DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 404

SURFACE WATER SUPPLY OF THE UNITED STATES

1915

PART IV. ST. LAWRENCE RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer

W. G. HOYT, A. H. HORTON, C. C. COVERT, and
C. H. PIERCE, District Engineers

Prepared in cooperation with
THE STATES OF MINNESOTA, WISCONSIN, NEW YORK, AND VERMONT

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SURFACE WATER SUPPLY OF ST. LAWRENCE RIVER BASIN, 1915.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1915.

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

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

The work was begun in 1888 in connection with special studies relating to irrigation in the arid west. Since the fiscal year ending June 30, 1895, successive sundry bills passed by Congress have carried the following item and appropriations:

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

Annual appropriations for the fiscal years ending June 30, 1895–1915.

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1915, inclusive	150,000

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgements for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on pages 12–13.

Measurements of stream flow have been made at about 3,800 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1915, 1,350 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to pre-

cipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

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

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

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

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

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

"Millions of cubic feet" is applied to quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms not in common use are here defined:

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

"Control," "controlling section," and "point of control"; terms used to designate the section or sections of the stream below the gage which determine the discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

The "point of zero flow" for a given gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.

CONVENIENT EQUIVALENTS.

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

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	0.03719	1.041	1.079	1.116	1.153
2.....	.07438	2.083	2.157	2.231	2.306
3.....	.11157	3.124	3.236	3.347	3.459
4.....	.14876	4.165	4.314	4.463	4.612
5.....	.18595	5.207	5.393	5.578	5.764
6.....	.22314	6.248	6.471	6.694	6.917
7.....	.26033	7.289	7.550	7.810	8.070
8.....	.29752	8.331	8.628	8.926	9.223
9.....	.33471	9.372	9.707	10.041	10.376

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

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

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	1.983	55.54	57.52	59.50	61.49
2.....	3.967	111.1	115.0	119.0	123.0
3.....	5.950	166.6	172.6	178.5	184.5
4.....	7.934	222.1	230.1	238.0	246.0
5.....	9.917	277.7	287.6	297.5	307.4
6.....	11.90	333.2	345.1	357.0	368.9
7.....	13.88	388.8	402.6	416.5	430.4
8.....	15.87	444.3	460.2	476.0	491.9
9.....	17.85	499.8	517.7	535.5	553.4

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

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

Discharge (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1.....	0.0864	2.419	2.506	2.592	2.678
2.....	.1728	4.838	5.012	5.184	5.356
3.....	.2592	7.257	7.518	7.776	8.034
4.....	.3456	9.676	10.02	10.37	10.71
5.....	.4320	12.10	12.53	12.96	13.39
6.....	.5184	14.51	15.04	15.55	16.07
7.....	.6048	16.93	17.54	18.14	18.75
8.....	.6912	19.35	20.05	20.74	21.42
9.....	.7776	21.77	22.55	23.33	24.10

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

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

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

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

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

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

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

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

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

Tens.	Units.									
	0	1	2	3	4	5	6	7	8	9
0	0.00	0.114	0.227	0.341	0.454	0.568	0.682	0.795	0.909	1.02
1	1.14	1.25	1.36	1.48	1.59	1.70	1.82	1.93	2.04	2.16
2	2.27	2.39	2.50	2.61	2.73	2.84	2.95	3.07	3.18	3.29
3	3.41	3.52	3.64	3.75	3.86	3.98	4.09	4.20	4.32	4.43
4	4.54	4.66	4.77	4.88	5.00	5.11	5.23	5.34	5.45	5.57
5	5.68	5.79	5.91	6.02	6.13	6.25	6.36	6.48	6.59	6.70
6	6.82	6.93	7.04	7.16	7.27	7.38	7.50	7.61	7.72	7.84
7	7.95	8.07	8.18	8.29	8.41	8.52	8.63	8.75	8.86	8.97
8	9.09	9.20	9.32	9.43	9.54	9.66	9.77	9.88	10.0	10.1
9	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.
1 second-foot for one year (365 days) covers 1 square mile 1.131 feet, or 13.572 inches deep.
1 second-foot for one year (365 days) equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one year (365 days) equals 724 acre-feet.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.
1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equals about 1 kilowatt.

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

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1914, and ending September 30, 1915. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

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

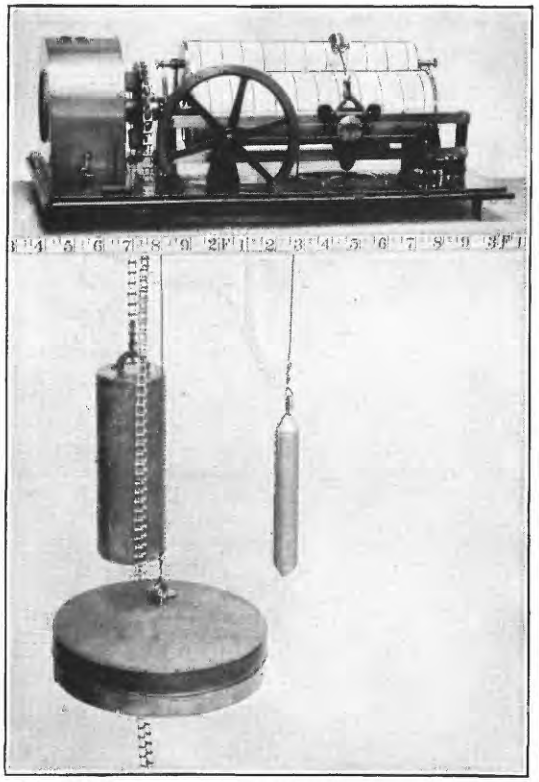
From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating tables, when applied to the gage heights, give the discharge from which the daily, monthly, and yearly mean discharge is determined.

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

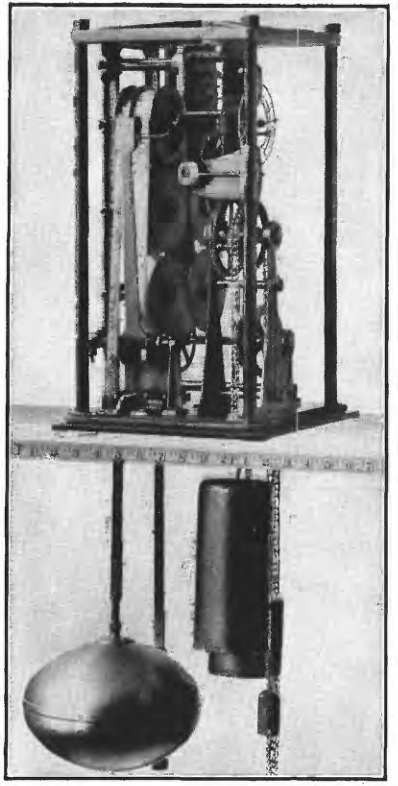
If the base data are insufficient to determine the daily discharge, tables giving daily gage heights and results of discharge measurements are published.

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

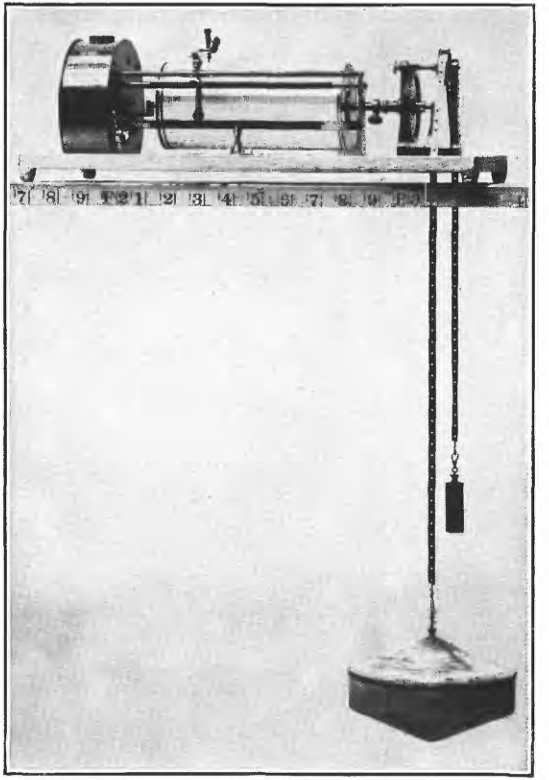
The table of daily discharge in general gives the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the



A. STEVENS.

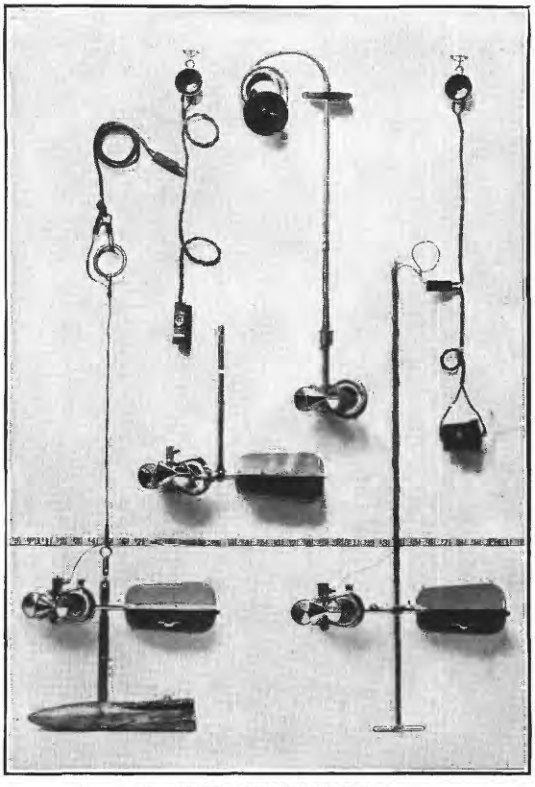


B. GURLEY PRINTING.

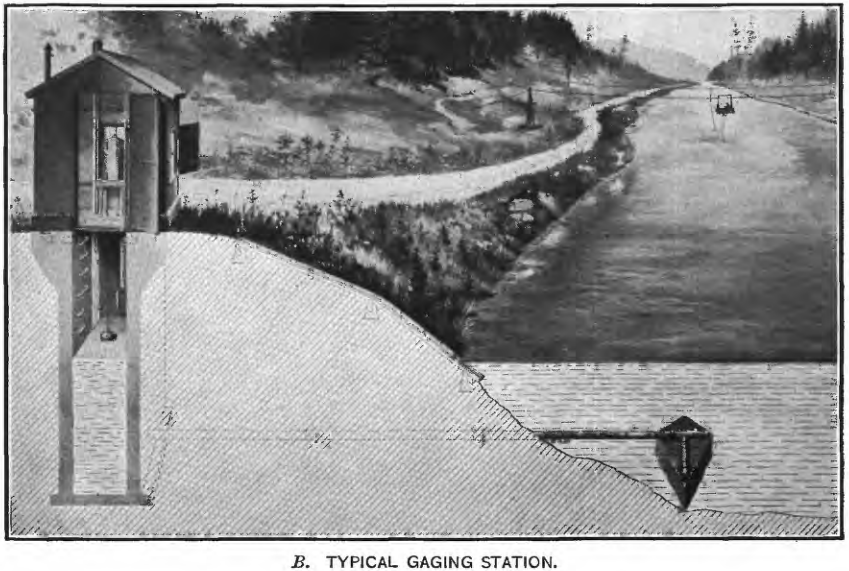


C. FRIEZ.

WATER-STAGE RECORDERS.



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.

mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by use of the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 6, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

Footnotes added to the daily discharge tables give information regarding 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 letter in the column headed "Accuracy," in the table showing monthly discharge, rates the accuracy of the monthly mean and not that of the estimate of maximum or minimum discharge or the discharge for any one day. The rating is determined by considering the accuracy of the rating curve, the probable reliability of the observer, the number of gage readings per day, the range of the fluctuation in stage, and 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.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by the inclusion of large noncontributing districts in the measured drainage area, by lack of

information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

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

COOPERATION.

The work in Minnesota during the year ending September 30, 1915, was done with State cooperation under terms of an act of the legislature of 1909 as embodied in joint resolution 19, which reads as follows:

Whereas the water supplies, water powers, navigation of our rivers, drainage of our lands, and the sanitary condition of our streams and their watersheds generally form one great asset and present one great problem: Therefore be it

Resolved by the house of representatives, the senate concurring, That the State Drainage Commission be, and is hereby, directed to investigate progress in other States toward the solution of said problem in such States, to investigate and determine the nature of said problem in this State.

The work was carried on in conjunction with the State Drainage Commission, E. V. Willard, acting State drainage engineer.

The work in Wisconsin during the year ending September 30, 1915, was done in cooperation with the Railroad Commission of Wisconsin, C. M. Larson, chief engineer.

The gaging stations on Wolf River in the Menominee Indian Reservation were maintained in cooperation with the Office of Indian Affairs.

The gaging station on Peshtigo River at High Falls, near Crivitz, Wis., was maintained in cooperation with the Wisconsin Public Service Co.

The gaging station on Escanaba River, near Escanaba, Mich., has been maintained in cooperation with the geological survey of the State of Michigan.

The station on Manistee River, near Sherman, Mich., was maintained in cooperation with William G. Fargo, Jackson, Mich.

Work in the State of New York has been conducted under cooperative agreements with John A. Bensel, State engineer and surveyor, and since July 1, 1911, with the division of inland waters of the State Conservation Commission as provided by an act of the State legislature.

Inspections of the water-stage recorder on Genesee River at Rochester, N. Y., were made by an employee of the Rochester Railway & Light Co.

Observations of stage on Orwell Brook, near Altmar, N. Y., were made by an employee of the Niagara, Lockport & Ontario Power Co., Niagara Falls, N. Y.

The work in Vermont during the year ending September 30, 1915, was done in cooperation with the State of Vermont, Charles W. Gates, governor.

The gaging station on Dog River at Northfield, Vt., has been maintained in cooperation with the department of civil engineering of Norwich University.

Charles T. Middlebrook, consulting engineer of Albany, N. Y., has furnished financial assistance in obtaining discharge measurements of the Green River at Garfield, Vt.

The Newport Electric Light Co. has cooperated in maintaining the station on the Clyde River at West Derby, Vt.

DIVISION OF WORK.

The data for stations in the Lake Superior drainage basin in Minnesota were collected and prepared for publication under the general direction of W. G. Hoyt, district engineer, Madison, Wis., and under the immediate supervision of S. B. Soulé, assisted by H. T. Critchlow.

Data for stations in the Lake Superior and Lake Michigan drainage basins in Wisconsin were collected and prepared for publication under the direction of W. G. Hoyt, district engineer, assisted by G. H. Canfield, H. C. Beckman, M. F. Rather, and J. O. Entringer.

For stations in the Lake Huron, Lake Michigan, and Lake Erie drainage basins in Michigan, data were collected and prepared for publication under the direction of A. H. Horton, district engineer, who was assisted by B. J. Peterson.

Data for stations in the St. Lawrence drainage basin in New York were collected and prepared for publication under the direction of C. C. Covert, district engineer, assisted by O. W. Hartwell, C. S. De Golyer, W. S. Easterly, E. D. Burchard, R. M. Adams, H. W. Fear, W. A. James, and Helen Kimmey.

Data for stations in Vermont were collected and prepared for publication under the direction of C. H. Pierce, district engineer, assisted by C. S. De Golyer, Hardin Thweatt, R. S. Barnes, and G. F. Adams.

The manuscript was assembled by B. J. Peterson.

GAGING-STATION RECORDS.

STREAMS TRIBUTARY TO LAKE SUPERIOR.

POPLAR RIVER AT LUTSEN, MINN.

LOCATION.—In sec. 34, T. 60 N., R. 3 W., near the post office of Lutsen, Cook County, about 800 feet above the mouth of the river, and about the same distance below the State highway bridge.

DRAINAGE AREA.—144 square miles.

RECORDS AVAILABLE.—August 22, 1912, to September 30, 1915; May 6, 1911, to November 4, 1911 (gage-height record only).

GAGE.—Staff gage bolted to the rock wall of the right bank of the stream, in a pool between two distinct falls; read twice daily, to quarter-tenths, by C. A. A. Nelson. The staff gage used from May 6 to November 4, 1911, was about 350 feet below the present gage and set at a different datum.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel in solid rock; crest of falls below gage constitutes the control; banks do not overflow. Point of zero flow is at gage height −0.35 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.95 feet at 6 p. m. June 13 (discharge, 412 second-feet); minimum stage recorded, 0.85 foot March 30 and 31 (discharge, 19 second-feet).

1912–1915: Maximum stage recorded, 3.75 feet August 11, 1914 (discharge, 692 second-feet); minimum stage, 0.80 foot January 4, February 8 and 13, 1913 (discharge, 18 second-feet).

WINTER FLOW.—Discharge relation not seriously affected by ice; open-channel rating curve assumed applicable.

REGULATION.—The flow of the river has in former years been controlled to some extent by two dams above the station, the nearest being that of the National Paper and Pulp Co., 2½ miles above the mouth of the river, but it is believed that the flow for the year ending September 30, 1915, was entirely natural.

ACCURACY.—Control permanent; mean daily gage height accurate; rating curve well defined for stages below 250 second-feet; results good.

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

Daily discharge, in second-fee , of Poplar River at Lutsen, Minn., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	130	71	65	20	20	22	20	71	94	190	48	33
2	129	71	65	20	20	22	20	65	85	190	44	30
3	122	89	59	20	20	22	20	65	78	190	39	28
4	116	97	58	20	20	22	20	75	73	215	42	26
5	114	92	54	20	20	22	20	86	93	240	50	25
6	116	85	54	22	20	22	24	92	190	228	54	24
7	119	83	50	22	20	22	30	202	215	190	53	22
8	116	80	48	22	21	21	38	252	202	168	48	22
9	114	78	48	22	21	21	48	215	228	148	47	24
10	106	71	46	22	21	20	62	179	215	136	43	23
11	134	67	44	22	21	20	86	150	265	141	39	22
12	136	65	42	22	21	20	73	139	295	179	37	22
13	119	61	39	22	21	20	54	134	395	168	34	25
14	110	65	37	22	21	20	49	124	378	168	34	31
15	108	67	34	22	21	20	58	116	325	159	33	43
16	102	65	32	22	21	20	61	141	280	146	32	37
17	100	62	30	22	22	20	62	190	240	129	33	34
18	94	61	28	22	22	20	62	190	252	114	30	34
19	93	60	26	22	22	20	78	190	295	110	29	34
20	92	61	24	22	22	20	78	179	310	102	27	36
21	89	72	24	22	22	20	71	168	295	99	26	35
22	86	79	24	22	22	20	61	202	342	92	25	34
23	92	75	23	22	22	20	62	190	325	92	25	32
24	94	75	23	22	22	20	65	168	325	92	30	30
25	87	75	23	22	22	20	73	150	342	83	29	55
26	83	72	22	22	22	20	75	143	325	73	28	146
27	80	71	22	22	22	20	79	134	280	70	26	141
28	79	67	21	21	22	20	85	126	252	65	25	99
29	75	65	21	21	.....	20	86	122	240	59	38	75
30	72	61	21	21	.....	19	78	118	215	55	42	70
31	72	.....	20	21	.....	19	.....	108	.....	50	37	.....

NOTE.—Discharge computed from a rating curve well defined below 250 second-feet.

Monthly discharge of Poplar River at Lutsen, Minn., for the year ending Sept. 30, 1915.

(Drainage area, 144 square miles.)

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	136	72	103	0.715	0.82	A.
November	97	60	72.1	.501	.56	A.
December	65	20	36.4	.253	.29	A.
January	22	20	21.5	.149	.17	B.
February	22	20	21.2	.147	.15	B.
March	22	19	20.5	.142	.16	A.
April	86	20	56.6	.393	.44	A.
May	252	65	145	1.01	1.16	A.
June	395	73	248	1.72	1.92	B.
July	240	50	134	.931	1.07	A.
August	54	25	36.4	.253	.29	A.
September	146	22	43.1	.299	.33	A.
The year	395	19	78.2	.543	7.36	

ST. LOUIS RIVER NEAR THOMSON, MINN.

LOCATION.—In sec. 11, T. 48 N., R. 16 W., in St. Louis County, Minn., just below the tailrace of the Great Northern power house, 3 miles east of Thomson.

RECORDS AVAILABLE.—October 5, 1909, to September 30, 1915.

DRAINAGE AREA.—3,420 square miles.

GAGE.—Chain gage, cantilever type, on left bank of river about 50 feet below the power plant of the Great Northern Power Co., read twice daily, to half-tenths, by employees of the company.

DISCHARGE MEASUREMENTS.—Made from a cable about 1,500 feet below gage.

CHANNEL AND CONTROL.—Bed of stream composed of rock and heavy gravel; control practically permanent. Right bank steep and high; never overflows; left bank slopes gradually up from the water's edge, so that the width of the channel varies considerably at different stages.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during the year, 11,000 second-feet June 16–17; minimum mean daily discharge, 470 second-feet September 4.

1909–1915: Maximum stage recorded, 7.45 feet June 9, 1914 (discharge, 14,400 second-feet); minimum mean daily discharge, 171 second-feet February 19, 1912.

WINTER FLOW.—Discharge relation seriously affected by ice; observations discontinued during winter.

REGULATION.—The flow at the station is to a certain extent regulated by reservoirs above. The dam at Thomson is designed to hold a 24-hour supply of water for the power plant, and logging dams control the discharge from a large part of the area above the station. The gage heights show considerable fluctuation caused by the operation of the turbine gates at the power plant, which is operated on a 24-hour schedule, although with a varying load. This fluctuation is the most marked during periods of low water, when practically all the flow passes through the turbines.

ACCURACY.—Gage-height record fragmentary; except for fluctuation, which probably introduces considerable error at times, conditions are favorable for excellent results.

COOPERATION.—Gage readings furnished by Great Northern Power Co.

No discharge measurements made at this station during the year.

Daily discharge, in second-feet, of St. Louis River near Thomson, Minn., for the year ending Sept. 30, 1915.

Day.	Apr.	May.	June.	Aug.	Sept.	Day.	Apr.	May.	June.	Aug.	Sept.
1	.....	2,480	2,200	.....	1,000	16	1,500	.....	11,000	1,500	865
2	.....	.....	2,620	.....	670	17	1,440	7,590	11,000	1,090	820
3	.....	2,760	2,760	.....	565	18	.....	8,110	10,400	910	820
4	.....	2,760	1,830	.....	470	19	1,340	7,850	10,200	910	740
5	.....	2,910	1,610	.....	.....	20	1,340	6,840	.....	1,000	670
6	.....	2,760	.....	.....	.....	21	1,390	6,600	8,370	865	820
7	.....	2,760	1,610	.....	635	22	1,390	6,370	7,850	910	820
8	.....	3,380	2,620	.....	530	23	1,610	.....	8,630	910	865
9	.....	.....	3,710	.....	705	24	.....	5,470	9,410	705	780
10	.....	3,380	4,640	.....	1,040	25	.....	5,050	9,150	705	740
11	.....	3,220	.....	.....	1,090	26	2,340	4,440	8,630	740	740
12	1,610	3,220	.....	.....	910	27	2,200	4,250	.....	865	955
13	1,500	3,220	.....	.....	740	28	2 760	3,880	.....	1,000	820
14	1,610	3,060	10,400	910	670	29	2,910	3,540	.....	820	820
15	1,610	3,060	10,700	780	740	30	2,620	.....	.....	910	670
						31	.....	2,760	.....	1,000	.....

NOTE.—Discharge determined from a rating curve well defined between 530 and 10,400 second-feet. Estimates in above table were obtained from gage heights which are the mean of two readings of the gage per day, and may be considerably in error because of fluctuations in stage (see "Regulation" in station description); estimates of monthly flow therefore not computed.

WHITEFACE RIVER BELOW MEADOWLANDS, MINN.

LOCATION.—In sec. 26, T. 53 N., R. 19 W., in St. Louis County, about half a mile below the beginning of a decided rapids, 1½ miles below the Duluth, Missabe & Northern Railway bridge, 2½ miles below the highway bridge on section line between secs. 14 and 23, T. 53 N., R. 19 W., at which the station on Whiteface at Meadowlands was located; 4 miles below mouth of the Little Whiteface, which enters from the left, and 8 miles above the confluence of Whiteface and St. Louis Rivers.

DRAINAGE AREA.—446 square miles.

RECORDS AVAILABLE.—April 28, 1912, to September 30, 1915. Records June 7, 1909, to November 9, 1912, collected at station at Meadowlands, 2½ miles upstream.

GAGE.—Chain gage attached to a horizontal timber fastened to two trees on left bank of river, near the residence of A. A. Jochim, used for all readings since November 8, 1914; read twice daily, morning and evening, to quarter-tenths, by A. A. Jochim. A chain gage attached to horizontal timber fastened to two trees on the same bank of the river, but 300 feet upstream from the present gage, was used from April 28, 1912, to November 7, 1914. The present gage was set so as to read to datum of former one, at the time of installation.

DISCHARGE MEASUREMENTS.—At high and medium stages made from the Duluth, Missabe & Northern Railway bridge; at low stage by wading in the vicinity of the gage.

CHANNEL AND CONTROL.—Bed of stream of heavy gravel and rock; practically permanent; right bank rather low, and overflows at extremely high stages; the left bank high, and does not overflow; a decided rapids a short distance below the gage constitutes the control. Another rapids above the gage is frequently obstructed by logs, but when there is water enough to carry them over this rapids, there is generally sufficient to carry them over the lower rapids, so that the control is seldom obstructed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.45 feet, at 6.40 a. m., June 17 (discharge, 3,040 second-feet); minimum stage recorded, 2.14 feet, September 6, 7, and 8 (discharge, 71 second-feet).

1909–1915: Maximum stage recorded, 7.45 feet at 6.40 a. m., June 17, 1915 (discharge, 3,040 second-feet); minimum discharge, 30 second-feet July 6 to 10, 1909 (from records for old station). Open-water records only; flow probably much lower at times during the winter.

WINTER FLOW.—Discharge relation seriously affected by ice; observations discontinued during winter months.

REGULATION.—The flow is controlled to a large extent by logging dams above the station. The operation of the gates to these dams cause a fluctuation in stage of several feet at the gaging station.

ACCURACY.—Results apparently good, and would be excellent, except for the uncertainty in mean daily gage height (obtained from two readings daily) at times when fluctuation is rapid.

Discharge measurements of Whiteface River below Meadowlands, Minn., during the year ending Sept. 30, 1915.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 7, 1914[a]	2.89	183	May 5, 1915	3.68	460

[a] Made from Duluth, Missabe and Northern Railway bridge about 1½ miles above gage.

Daily discharge, in second-feet, of Whiteface River below Meadowlands, Minn., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	250	156	.....	431	1,180	1,050	145	86
2	220	167	.....	872	519	932	136	86
3	180	156	.....	180	334	816	126	81
4	136	156	.....	712	282	816	110	81
5	110	180	.....	390	282	816	126	76
6	126	180	.....	250	565	872	110	72
7	126	180	.....	712	763	872	104	72
8	282	180	.....	613	872	763	110	72
9	206	167	.....	712	1,120	565	118	76
10	192	167	.....	1,050	1,120	712	110	92
11	192	156	.....	932	1,250	613	97	92
12	167	126	.....	872	1,320	519	86	97
13	167	136	.....	932	2,680	431	235	92
14	167	136	136	763	2,760	474	474	97
15	156	145	156	390	2,680	565	192	97
16	167	.....	110	1,600	2,920	613	145	110
17	156	.....	92	1,460	3,000	565	110	136
18	156	.....	118	1,820	2,760	519	104	126
19	167	.....	136	1,900	2,520	474	92	126
20	145	.....	97	1,530	2,120	431	92	118
21	145	.....	126	1,460	1,900	390	86	126
22	156	.....	156	1,180	1,750	390	81	110
23	156	.....	92	1,180	1,530	371	76	97
24	192	.....	266	816	1,390	390	76	92
25	316	.....	206	872	1,320	390	76	92
26	316	.....	220	763	1,320	352	81	97
27	299	.....	712	872	1,320	352	72	110
28	316	.....	431	1,050	1,600	352	76	126
29	266	.....	390	816	1,530	316	86	192
30	180	.....	613	662	1,250	220	92	206
31	180	.....	.....	613	.....	167	92	.....

NOTE.—Discharge computed from a rating curve well defined between 39 and 2,280 second-feet. Discharge estimated, because of ice, from climatic records and discharge of adjacent drainage areas as follows: Nov. 15–30, 125 second-feet; Apr. 1–13, 90 second feet.

Monthly discharge of Whiteface River below Meadowlands, Minn., for the year ending Sept. 30, 1915.

[Drainage area, 446 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	316	110	193	0.433	0.50	B.
November	180	.....	142	.318	.35	D.
April	712	.....	174	.390	.44	D.
May	1,900	180	916	2.05	2.36	B.
June	3,000	282	1,530	3.43	3.83	B.
July	1,050	167	552	1.24	1.43	B.
August	474	72	120	.269	.31	B.
September	206	72	104	.233	.26	B.

CLOQUET RIVER AT INDEPENDENCE, MINN.

LOCATION.—In sec. 26, T. 52 N., R. 17 W., in St. Louis County, at the highway bridge at Independence post office, just below a small tributary entering from the right.

DRAINAGE AREA.—698 square miles.

RECORDS AVAILABLE.—June 28, 1909, to September 30, 1915.

GAGE.—Vertical staff gage, attached to upstream end of an old log bulkhead, immediately under the bridge, and at the left bank of the river; read twice daily to quarter-tenths by Herbert Haakensen.

DISCHARGE MEASUREMENTS.—Made from bridge at all except extremely low stages, which are measured by wading about one-fourth of a mile below gage.

CHANNEL AND CONTROL.—Heavy gravel and rock; practically permanent; the banks do not overflow; the control frequently obstructed by logs, either intentionally held at the sides of the stream to facilitate log driving, or accidentally lodged on projecting rocks.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 8.61 feet at 6 p. m. July 12 (discharge, 3,280 second-feet), minimum stage recorded, 4.18 feet April 18 to 22 (discharge, 97 second-feet). Open-water records. The Great Northern Power Co. reported that there was no discharge from Fish Lake and Island Lake reservoirs April 6 to 20, probably minimum flow at Independence occurred about April 7, and was not over 10 second-feet.

1909–1915: Maximum discharge, 6,010 second-feet, June 1, 1911.

WINTER FLOW.—Discharge relation seriously affected by ice; observations discontinued during the winter.

REGULATION.—Cloquet River is used extensively for log driving, and the run-off from by far the greater part of the drainage area above Independence is controlled by logging dams. This control caused violent fluctuations in the gage heights during the day, amounting at times to several feet.

ACCURACY.—On account of the irregular fluctuation in gage height, the mean daily gage height is doubtless subject to rather large error a considerable part of the time. (See note on regulation.) The bulkhead to which the staff gage was attached became very unstable during 1915, and the proper corrections to apply to the gage readings was a matter of considerable uncertainty. For the above reasons results are subject to error.

The following discharge measurement was made by S. B. Soulé:

May 4, 1915: Gage height, 4.50 feet; discharge, 159 second-feet.

Daily discharge, in second-feet, of Cloquet River at Independence, Minn., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	532	330	.....	152	480	455	2,090	140
2	505	370	.....	152	455	588	1,900	224
3	505	370	.....	152	455	675	2,090	140
4	455	370	.....	165	432	708	2,280	129
5	410	370	.....	179	432	532	2,280	224
6	410	390	.....	193	410	1,530	1,900	615
7	410	390	.....	193	350	1,180	1,800	311
8	410	410	.....	193	274	1,180	2,040	129
9	410	410	.....	193	257	2,090	1,850	129
10	410	410	.....	224	330	2,280	1,530	129
11	410	390	.....	224	505	2,670	370	140
12	410	390	.....	240	645	3,070	292	193
13	311	390	.....	257	615	1,180	224	240
14	311	390	.....	224	588	1,900	118	274
15	292	410	.....	193	645	2,280	118	311
16	292	455	.....	257	772	740	118	311
17	292	505	.....	432	875	208	118	311
18	292	.....	100	615	2,000	165	118	311
19	292	.....	100	588	1,620	165	118	311
20	480	.....	100	560	1,180	152	118	292
21	455	.....	100	560	480	152	129	274
22	410	.....	100	560	505	152	224	274
23	410	.....	109	560	2,090	140	390	274
24	370	.....	129	675	2,180	140	532	274
25	311	.....	165	875	2,280	140	455	274
26	311	.....	224	1,020	2,280	140	675	292
27	311	.....	240	1,100	1,620	140	455	292
28	311	.....	224	805	1,020	1,020	129	292
29	311	.....	208	588	805	3,170	129	292
30	330	.....	179	532	455	2,670	129	292
31	330	.....	.....	505	.....	2,570	129	.....

NOTE.—Discharge Oct. 1 to Nov. 17 and Apr. 18 to Sept. 30 from a rating curve only fairly well defined between 63 and 1,700 second-feet. Discharge Nov. 18–30 and Apr. 1–17 estimated, because of ice, from climatic records, discharge records of streams in adjacent areas, and notes regarding regulation above Independence, as follows: Nov. 18–30, 300 second-feet; Apr. 1–17, 25 second-feet.

Monthly discharge of Cloquet River at Independence, Minn., for the year ending Sept. 30, 1915.

[Drainage area, 698 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	532	292	377	0.540	0.62	C.
November	505	.....	355	.509	.57	D.
April	240	.....	80.1	.115	.13	D.
May	1,100	152	425	.609	.70	C.
June	2,280	257	901	1.29	1.44	C.
July	3,170	140	1,100	1.58	1.82	C.
August	2,280	118	802	1.15	1.33	C.
September	615	129	256	.367	.41	C.

AMINICON RIVER NEAR AMINICON FALLS, WIS.

LOCATION.—Douglas County, sec. 29, T. 48 N., R. 12 W., at highway bridge, about 500 feet above the Northern Pacific Railway bridge, three-fourths of a mile east of the settlement of Aminicon Falls, and 7 miles above mouth of river.

DRAINAGE AREA.—102 square miles (measured on map published by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—March 17, 1914, to September 30, 1915.

GAGE.—Chain gage fastened to upstream side of highway bridge; read once daily, to half-tenths, by T. J. St. Onge.

DISCHARGE MEASUREMENTS.—Made from highway bridge or by wading near bridge section.

CHANNEL AND CONTROL.—Heavy gravel and small rock; water confined to one channel at all stages; zero flow will occur at stage of approximately 0.20 foot on the gage.

EXTREMES OF DISCHARGE.—1914–15: Maximum stage recorded during period, 3.5 feet April 8, 9, and May 16, 1915 (discharge, 716 second-feet); minimum stage recorded, 0.3 foot September 7, 1915 (discharge approximately 1 second-foot).

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

ACCURACY.—Rating curve well defined; no diurnal fluctuation; open-water records for 1915 excellent.

Discharge measurements of Aminicon River near Aminicon Falls, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	Sec.-ft.			Feet.	Sec.-ft.
Dec. 31	M. F. Rather	1.35	[a]15	Mar. 10[b]	H. C. Beckman	.63	9.7
Jan. 11[b]	G. H. Canfield	1.85	13	May 18	S. B. Soulé	2.95	535
11[b]	....do	2.30	14	Aug. 30	H. T. Critchlow	.48	5.3
Feb. 10[b]	H. C. Beckman	.73	5.6				

[a] Discharge estimated; measurement impossible on account of ice.
[b] Measurement made under complete ice cover.

Daily discharge, in second-feet, of Aminicon River near Aminicon Falls, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	42	28						205	107	205	15	3
2	42	23						192	90	157	15	3
3	42	32						326	74	136	15	3
4	37	42						295	60	116	12	3
5	32	37					405	233	54	98	12	2
6	32	32	20	14	6	9		248	54	82	12	2
7	32	32						205	42	74	10	1
8	32	32					716	205	67	67	10	2
9	32	32					716	205	82	54	10	3
10	32	28					550	233	116	48	10	3
11	54	28					390	264	157	54	10	4
12	60	23					342	233	180	54	8	8
13	54	32					295	180	390	48	6	10
14	48	37					295	326	326	42	6	10
15	48		18	12	6	23	264	518	326	42	6	8
16	54						264	716	454	37	6	6
17	48						233	583	518	37	4	6
18	48						233	550	583	32	4	8
19	42						219	518	616	32	3	8
20	42						205	486	518	28	3	6
21	42						205	422	486	23	3	6
22	37	25					205	374	486	23	3	6
23	37						192	326	486	23	6	6
24	37						180	264	374	23	6	8
25	42						180	233	358	23	4	10
26	37		16	8	7	84	168	219	326	23	3	10
27	32						219	205	233	19	3	10
28	32						192	192	233	15	3	12
29	32						219	168	264	15	4	15
30	32						205	146	264	15	3	19
31	28	.....					.....	126	.....	15	3	.....

NOTE.—Discharge computed as follows: Oct. 1 to Nov. 14, and Apr. 8 to Sept. 30, except May 26, from a rating curve well defined between 4 and 600 second-feet; May 26 interpolated, gage height for the day was evidently read 1 foot too low. Discharge Nov. 15 to Apr. 7, estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Aminicon River near Aminicon Falls, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	60	28	40.0	0.392	0.45	B.
November	42	.....	27.9	.274	.31	C.
December	.....	.....	17.9	.175	.20	D.
January	.....	.....	11.2	.110	.13	D.
February	.....	.....	6.29	.062	.06	C.
March	.....	.....	40.1	.393	.45	D.
April	716	168	317	3.11	3.47	B.
May	716	126	303	2.97	3.42	A.
June	616	42	277	2.72	3.04	A.
July	205	15	53.5	.525	.61	A.
August	15	3	7.03	.069	.08	B.
September	19	1	6.70	.066	.07	B.
The year	716	1	92.4	.906	12.29	

BRULE RIVER NEAR BRULE, WIS.

LOCATION.—About sec. 26, T. 48 N., R. 10 W., at the Brule Outing Club, about 4½ miles downstream from Brule, Douglas County, and 9 miles above mouth of river.

DRAINAGE AREA.—162 square miles (measured on map published by Wisconsin Geological and Natural History Survey, edition of 1911; scale 1 in.=6 miles).

RECORDS AVAILABLE.—March 19, 1914, to September 30, 1915.

GAGE.—Vertical staff; low-water section, 0 to 7.9 feet, fastened to downstream side of Brule Outing Club boat landing; high-water section, 8.0 to 9.9 feet, fastened to tree on shore end of landing; gage read twice daily, morning and evening, to quarter-tenths. Gage reader, H. A. Wilcox.

DISCHARGE MEASUREMENTS.—Made from a boat held in place by a wire across the river below gage, or, at low stages, by wading. All measurements made about 200 feet below gage section.

CHANNEL AND CONTROL.—Channel gravel; control formed by head of rapids below gage; river occupies one channel at all stages; banks wooded and do not overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.4 feet at 6 a. m., May 16 (discharge, 1,010 second-feet, determined from extension of rating curve), minimum stage recorded, 2.82 feet at 7 p. m., August 19 to 21 (discharge, 129 second-feet).

1914–15: Maximum stage recorded May 16, 1915; minimum stage recorded, 2.75 feet at 7 a. m., March 20, 1914 (discharge, 115 second-feet).

WINTER FLOW.—Discharge relation affected by ice; discharge determined from measurements made through the ice, observer's notes, and weather records.

REGULATION.—None except by natural storage in Lakes Minnesuing and Nebagamin.

ACCURACY.—The channel and control permanent; rating curve fairly well defined over a range covered by 97 per cent of the gage heights; records good.

Discharge measurements of Brule River near Brule, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 2[a]	M. F. Rather	3.55	150	Mar. 12[a]	H. C. Beckman	2.90	143
Feb. 11[a]	H. C. Beckman	4.09	143	May 18	S. B. Soulé	4.49	653

[a] Measurement made through complete ice cover.

Daily discharge, in second-feet, of Brule River near Brule, Wis., for the years ending Sept. 30, 1914–1915.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914.								
1	.....		250	475	295	475	158	208
2	.....		220	440	280	405	148	220
3	.....		208	440	250	340	145	195
4	.....		182	545	250	340	145	195
5	.....		195	510	280	310	145	182
6	.....		182	475	310	280	145	182
7	.....		195	440	280	250	145	170
8	.....		182	422	340	235	158	170
9	.....		170	388	340	220	195	170
10	.....	175	182	370	280	208	280	182
11	.....		182	340	250	195	220	195
12	.....		250	325	220	250	220	195
13	.....		208	310	220	280	220	195
14	.....		235	280	208	250	195	235
15	.....		250	280	195	250	195	220
16			265	265	195	235	295	208
17			265	265	182	220	235	208
18			295	250	195	208	220	195
19		160	475	235	220	195	195	195
20		158	355	235	195	182	195	182
21		148	475	250	195	182	182	195
22	155	145	475	235	220	170	182	220
23		145	440	235	220	195	208	208
24		150	440	220	250	182	208	195
25		220	545	220	250	170	195	195
26		280	475	250	220	170	195	182
27		220	440	220	615	170	195	170
28		170	545	220	690	165	195	170
29	.....	160	615	440	510	160	182	170
30	.....	235	545	340	405	158	182	170
31	.....	310	.....	310	.....	158	182	.....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	170	158	182			208	170	265	235	265	150	135
2	170	158	182			158	182	250	235	250	155	135
3	165	182	170			280	195	310	220	250	158	135
4	165	182	170			195	265	325	208	250	160	135
5	158	182	168			158	310	310	220	250	168	135
6	170	182	165			170	340	325	475	235	160	135
7	170	170	165			220	370	405	458	220	158	141
8	170	170	165	150		170	405	370	405	208	155	195
9	170	165	170			165	405	340	405	195	148	195
10	170	165				158	370	310	370	195	145	158
11	220	158				145	370	295	340	182	143	155
12	208	158			145	158	340	280	340	170	143	170
13	195	170				165	310	265	405	170	143	170
14	195	170				150	310	250	355	170	140	220
15	182	182				145	310	265	440	195	143	208
16	182	182				158	310	1,010	388	195	141	182
17	170	182				150	295	690	340	182	137	195
18	170					170	295	650	615	182	135	182
19	170					170	310	545	770	170	133	170
20	170		160			170	310	475	580	168	133	160
21	170					165	280	458	545	168	133	158
22	170					170	280	475	475	168	135	158
23	170	170		145		182	295	422	422	168	145	150
24	170				145	195	310	388	370	160	155	150
25	170				150	195	280	355	340	158	143	208
26	170				182	170	280	340	310	158	135	220
27	170				208	170	310	310	310	160	135	208
28	170				208	170	310	295	295	160	135	195
29	165	158			.....	158	295	280	280	158	165	195
30	165	165			.....	165	280	265	265	155	155	195
31	158	.....			.....	158	.....	250	.....	150	143	.....

NOTE.—Discharge, except as noted below, determined from a rating curve fairly well defined between 125 and 690 second-feet. Discharge Feb. 16 to Mar. 18, Nov. 18–28, 1914, and Dec. 10, 1914, to Feb. 23, 1915, estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Brule River near Brule, Wis., for 1914–15.

[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.		
1914.						
February 16–28	.....	.....	155	0.957	0.46	C.
March	310	.....	182	1.12	1.29	D.
April	615	170	325	2.01	2.24	B.
May	545	220	330	2.04	2.35	B.
June	690	182	285	1.76	1.96	B.
July	475	158	233	1.44	1.66	B.
August	295	145	192	1.19	1.37	B.
September	235	170	193	1.19	1.33	B.
1914–15.						
October	220	158	174	1.07	1.23	B.
November	.....	158	170	1.05	1.17	B.
December	182	.....	163	1.01	1.16	B.
January	.....	.....	147	.907	1.05	C.
February	208	.....	151	.932	.97	C.
March	280	145	173	1.07	1.23	B.
April	405	170	303	1.87	2.09	B.
May	1,010	250	380	2.35	2.71	B.
June	770	208	381	2.35	2.62	B.
July	265	150	189	1.16	1.34	B.
August	168	133	146	.901	1.04	B.
September	220	135	172	1.06	1.18	B.
The year	1,010	.....	212	1.31	17.79	

BAD RIVER NEAR ODANAH, WIS.

LOCATION.—In sec. 25, T. 47 N., R. 3 W., about 8 miles upstream from Odanah, Ashland County, 12 miles above the mouth. Potato River enters from the right about 8 miles above the station.

DRAINAGE AREA.—607 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—July 31, 1914, to September 30, 1915.

GAGE.—Gurley water-stage recorder over wooden well on left bank, just above the first falls in the river above the mouth; well connected with the river by a 4½-inch galvanized steel pipe.

DISCHARGE MEASUREMENTS.—Made from a cable about 700 feet upstream from gage.

CHANNEL AND CONTROL.—At gage and measuring section, sand and gravel; rock outcrops at the beginning of rapids about 200 feet below the gage form a permanent control. During log-driving period logs may collect on the outcrop and cause backwater at the gage. Right bank high and will not overflow; left bank of medium height and may overflow during extremely high water.

EXTREMES OF DISCHARGE.—1914–15: Maximum stage recorded during period, 3.77 feet at 9 a. m. April 11, 1915 (discharge, 3,450 second-feet). The recording gage was not in operation May 6 to 18, but a flow of 3,900 second-feet was estimated for May 16; minimum discharge recorded by measurement made January 9, 1915, 122 second-feet; that a mean of 105 second-feet occurred has been estimated for the period January 21 to February 10.

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

REGULATION.—A number of small reservoirs are operated during the early spring and summer as an aid to log driving. During such periods the stage fluctuates rapidly.

ACCURACY.—Rating curve well defined over a range in stage covered by the gage heights; channel apparently permanent; records for period when water-stage recorder was in operation believed excellent.

Discharge measurements of Bad River near Odanah, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 9 [a]	G. H Canfield	1.90	122	Apr.15 [b]	H. C. Beckman	3.51	2,930
Feb.12 [a]	do	1.95	123	May 18	do	3.52	3,030
Mar.13 [a]	do	2.02	176	Aug 10 [c]	H. T. Critchlow	1.41	418
Apr.15 [b]	H. C. Beckman	3.12	2,270				

[a] Measurement made under complete ice cover three-fourths mile below gage; control section frozen over.
[b] Many logs floating, but none lodged on control.
[c] Made by wading half mile below gage.

Daily discharge, in second-feet, of Bad River near Odanah, Wis., for the years ending Sept. 30, 1914–15.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1914.				1914—Con.				1914—Con.			
1	.....	198	311	11	.....	746	361	21	.....	.....	435
2	.....	188	634	12	.....	593	400	22	.....	361	522
3	.....	.....	895	13	.....	.....	374	23	.....	394	828
4	.....	.....	925	14	.....	.....	394	24	.....	500	857
5	.....	.....	800	15	.....	.....	407	25	.....	676	737
6	.....	.....	625	16	.....	.....	676	26	.....	428	876
7	.....	.....	561	17	.....	.....	530	27	.....	368	561
8	.....	.....	456	18	.....	.....	601	28	.....	335	500
9	.....	.....	601	19	.....	.....	553	29	.....	311	428
10	.....	.....	354	20	.....	.....	515	30	.....	275	387
								31	709	275	.....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	317	281						693	421	414	188	329
2	329	299						617	428	380	188	230
3	264	299					790	634	387	354	225	193
4	231	299						857	354	442	435	167
5	264	305										
			290	110	105	175		915	329	617	915	153
6	293	335							925	530	975	139
7	241	281					1,920		2,130	492	791	139
8	253	275					2,200		1,910	394	545	167
9	269	264					2,360		1,770	361	470	162
10	247	287					2,860		1,570	348	400	148
11	368	264					3,220		1,240	642	335	144
12	508	241					2,950	1,830	1,050	1,070	275	144
13	456	236					2,440		1,080	828	241	153
14	428	241					2,130		1,090	642	219	241
15	400	241					2,280		1,060	684	214	435
			150	130	140	195						
16	361						2,600		791	601	241	361
17	348						2,280		684	530	253	449
18	323	230					2,060	2,860	1,140	456	209	508
19	287						1,770	2,200	2,680	442	188	500
20	311						1,700	1,700	2,280	456	167	361
21	275						1,420	1,570	1,700	428	153	311
22	253						1,110	2,680	1,290	348	144	264
23	241						1,010	2,440	1,020	287	144	275
24	275						965	1,910	819	264	209	230
25	293						895	1,510	593	287	209	269
			270	110	105	170	430					
26	311						838	1,140	601	253	198	485
27	317						866	935	485	247	177	435
28	299						975	782	414	258	172	361
29	305						885	625	387	258	241	335
30	287						800	593	485	214	414	335
31	281							508	.....	198	361	.....

NOTE.—Discharge, except as noted below, determined from a rating curve well defined between 80 and 3,900 second-feet. Nov. 16 to Apr. 6 estimated because of ice; May 6 to 17 estimated because water-stage recorder was not running, from consideration of weather records and high-water mark referred to gage datum on May 18. Braced figures show mean discharge for period included. Dec. 6–8, 12–31, and Jan. 1–8, no gage height record; Jan. 9 to Mar. 12 and Mar. 20–31, one reading of slope gage every other day.

Monthly discharge of Bad River near Odanah, Wis., for the years ending Sept. 30, 1914–15.

[Drainage area, 607 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1914.						
September	925	311	570	0.939	1.05	B.
1914–15.						
October	508	241	312	.514	.59	A.
November	335	.....	267	.440	.49	C.
December	.....	.....	181	.298	.34	D.
January	.....	.....	115	.189	.22	C.
February	.....	.....	136	.224	.23	C.
March	.....	.....	272	.448	.52	D.
April	3,220	.....	1,580	2.60	2.90	B.
May	.....	508	1,520	2.50	2.88	C.
June	2,680	329	1,040	1.71	1.91	A.
July	1,070	198	443	.730	.84	A.
August	975	144	319	.526	.61	A.
September	508	139	281	.463	.52	A.
The year	.....	.....	539	.888	12.05	

STURGEON RIVER NEAR SIDNAW, MICH.

LOCATION.—Just above the old timber dam on the line between secs. 4 and 5, T. 48 N., R. 34 W., 3 miles north of Opal, Baraga County.

DRAINAGE AREA.—155 square miles.

RECORDS AVAILABLE.—September 27, 1912, to September 30, 1915.

GAGE.—Vertical staff fastened to downstream side of the old timber dam; read daily during open-water season, to hundredths; elevation of zero of gage, 1,206.94 feet.

DISCHARGE MEASUREMENTS.—At low water made by wading 1 mile below dam; at high water, from cable 200 yards upstream.

CHANNEL AND CONTROL.—Gravel and boulders; practically permanent.

WINTER FLOW.—Discharge relation affected by ice; flow determined by frequent current meter measurements made through the ice.

ACCURACY.—Conditions are favorable for good results.

COOPERATION.—Estimates of daily discharge furnished by Vielé, Blackwell & Buck, consulting engineers, New York City.

Daily discharge, in second-feet, of Sturgeon River near Sidnaw, Mich., for the years ending Sept. 30, 1913–1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	85	78	95	.....	.....	.....	470	710	275	175	70	25
2	87	78	215	.....	.....	.....	500	600	240	165	55	29
3	79	62	239	.....	37	.....	510	555	210	150	45	29
4	79	80	236	74	.....	40	495	510	175	210	40	37
5	70	87	234	.....	.....	.....	455	495	170	310	40	33
6	61	87	.....	.....	.....	.....	400	455	455	275	38	33
7	61	90	.....	.....	.....	.....	350	420	380	225	37	29
8	56	93	.....	.....	.....	.....	335	420	365	200	35	25
9	50	127	202	.....	48	.....	340	280	350	190	33	22
10	50	138	.....	.....	.....	.....	300	260	315	175	30	37
11	49	138	.....	78	.....	.....	280	240	245	150	30	38
12	120	144	.....	.....	.....	.....	300	325	190	175	29	37
13	236	130	.....	.....	.....	.....	310	210	175	210	29	33
14	227	130	.....	.....	.....	.....	335	200	190	280	25	29
15	205	105	.....	.....	.....	.....	480	120	240	240	29	23
16	178	112	.....	.....	45	44	840	240	225	200	33	23
17	155	105	128	.....	.....	.....	1,350	335	275	165	29	20
18	138	70	.....	.....	.....	.....	2,080	350	315	135	25	23
19	130	75	.....	59	.....	.....	2,000	365	320	120	23	29
20	130	78	.....	.....	.....	.....	1,840	365	380	115	20	88
21	112	90	.....	.....	.....	.....	1,840	380	335	110	23	258
22	112	87	.....	67	.....	.....	1,860	395	280	95	22	285
23	120	70	.....	.....	.....	102	2,518	400	240	95	25	275
24	120	62	100	.....	.....	.....	3,175	315	210	90	23	285
25	112	70	.....	.....	.....	.....	2,588	280	175	85	20	305
26	105	87	.....	.....	47	.....	2,000	240	140	120	18	315
27	100	87	.....	63	.....	.....	1,920	210	140	190	20	330
28	90	87	77	.....	.....	112	1,320	210	130	175	37	340
29	86	87	.....	.....	.....	315	1,070	210	150	120	33	360
30	82	80	.....	.....	.....	365	840	260	165	80	29	357
31	80	.....	.....	.....	.....	400	.....	280	.....	75	25	.....
1913–14.												
1	330	300	335	66	.....	.....	.....	1,930	165	250	60	74
2	325	270	300	.....	.....	.....	.....	1,570	147	210	52	120
3	315	258	285	.....	.....	.....	112	1,280	112	176	47	165
4	305	242	275	.....	.....	.....	.....	1,180	112	145	45	230
5	300	225	258	.....	.....	.....	.....	980	108	130	42	236
6	285	215	240	.....	.....	48	.....	875	95	80	36	213
7	295	200	213	.....	.....	.....	.....	800	88	75	34	186
8	270	258	185	72	.....	.....	.....	770	93	70	30	149
9	285	246	160	.....	.....	.....	.....	675	99	50	29	120
10	300	242	160	.....	.....	.....	.....	580	88	40	37	104
11	315	213	147	.....	.....	.....	.....	525	60	36	40	100
12	330	210	130	.....	.....	.....	.....	450	48	67	37	116
13	335	200	120	.....	.....	.....	.....	390	45	103	43	120
14	325	200	110	.....	.....	54	.....	350	42	170	42	108
15	300	190	106	.....	.....	.....	173	328	47	202	37	140
16	285	190	96	.....	.....	.....	340	283	125	60	36	191
17	275	175	.....	71	.....	.....	580	242	32	123	32	230
18	258	210	.....	.....	49	.....	950	218	29	93	30	218
19	246	258	.....	.....	.....	.....	2,280	195	29	80	29	202
20	213	238	.....	.....	.....	.....	2,250	185	29	75	26	160
21	160	240	.....	.....	.....	.....	1,875	180	29	60	37	135
22	147	280	.....	.....	.....	.....	1,600	360	30	47	36	112
23	135	335	.....	.....	.....	.....	1,440	360	36	112	51	93
24	155	420	.....	.....	.....	.....	1,340	330	43	145	96	85
25	213	510	.....	.....	.....	.....	1,410	300	52	112	104	90
26	375	520	.....	.....	.....	.....	1,530	295	60	75	93	77
27	420	475	.....	.....	53	.....	1,500	288	60	80	85	72
28	405	455	.....	.....	.....	74	1,250	270	170	115	74	60
29	385	440	.....	.....	.....	.....	3,050	242	283	120	65	52
30	360	400	.....	.....	.....	.....	2,520	227	295	103	51	50
31	335	.....	.....	.....	.....	.....	.....	190	.....	77	53	.....

Daily discharge, in second-feet, of Sturgeon River near Sidnaw, Mich., for the years ending Sept. 30, 1913–15—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	47	74	283	.....	.....	.....	56	590	212	287	47	29
2	45	65	360	.....	.....	.....	55	560	185	270	58	27
3	42	93	365	.....	.....	.....	55	510	165	241	92	26
4	40	130	315	.....	.....	.....	56	605	144	196	213	24
5	37	213	270	.....	.....	.....	65	540	122	226	270	23
6	37	242	218	.....	.....	.....	74	490	365	241	283	22
7	43	202	149	.....	.....	68	103	505	530	260	241	22
8	52	170	170	.....	.....	.....	165	680	550	213	213	21
9	85	160	160	89	.....	.....	283	660	610	150	180	20
10	93	149	170	.....	.....	.....	450	625	570	125	150	22
11	100	135	135	.....	.....	.....	625	550	520	112	115	24
12	130	125	149	.....	43	.....	525	605	450	185	99	27
13	135	116	116	.....	.....	.....	505	850	475	224	82	37
14	125	108	155	.....	.....	.....	690	825	440	213	66	45
15	112	125	.....	.....	.....	.....	1,000	790	380	241	58	99
16	92	136	.....	.....	.....	.....	1,300	710	350	213	52	190
17	77	180	.....	.....	.....	.....	1,410	680	290	191	49	185
18	71	190	.....	.....	.....	.....	1,370	615	250	169	47	159
19	68	185	.....	.....	67	.....	1,350	560	265	135	43	154
20	60	173	.....	86	.....	54	1,300	490	275	112	42	115
21	57	155	.....	.....	.....	.....	1,130	650	270	93	37	103
22	52	149	.....	.....	.....	.....	920	890	287	80	36	92
23	50	145	.....	.....	.....	.....	750	820	277	74	34	101
24	52	130	.....	.....	.....	.....	645	730	247	82	32	115
25	57	116	.....	.....	.....	.....	560	645	212	74	34	213
26	60	135	.....	.....	.....	.....	515	565	186	66	32	450
27	65	180	.....	.....	.....	.....	458	450	150	58	30	470
28	68	135	.....	.....	85	.....	450	385	135	72	29	458
29	77	140	.....	.....	.....	52	466	335	186	62	29	390
30	72	149	.....	.....	.....	.....	615	281	241	56	29	300
31	74	.....	64	.....	.....	.....	.....	260	.....	52	29	.....

NOTE.—Discharge determined from a rating curve based on 24 discharge measurements, 8 of which were made in 1912, 14 in 1913, and 1 each in 1914 and 1915.

Monthly discharge of Sturgeon River near Sidnaw, Mich., for the years ending Sept. 30, 1913–1915.

[Drainage area, 155 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1912–13.					
October	236	49	109	0.703	0.81
November	144	62	93.8	.605	.68
December	.....	.....	150	.968	1.12
January	.....	.....	70	.452	.52
February	.....	.....	45	.290	.30
March	400	.....	89	.574	.66
April	3,180	280	1,100	7.10	7.92
May	710	120	343	2.21	2.55
June	455	130	248	1.60	1.78
July	310	75	165	1.06	1.22
August	70	18	31.3	.202	.23
September	360	20	125	.806	.90
The year	3,180	18	214	1.38	18.69

Monthly discharge of Sturgeon River near Sidnaw, Mich., for the years ending Sept. 30, 1913–1915—Continued.

[Drainage area, 155 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1913–14.					
October	420	135	290	1.87	2.16
November	520	175	287	1.85	2.06
December	.....	.....	140	.903	1.04
January	.....	.....	a 68.5	a .415	.48
February	.....	.....	a 53.4	a .324	.34
March	.....	.....	a 59	a .358	.41
April	3,050	.....	883	5.70	6.36
May	1,930	180	543	3.50	4.04
June	295	29	88.4	.570	.64
July	250	36	106	.684	.79
August	104	26	48.7	.314	.36
September	236	50	134	.865	.97
The year	3,050	.....	160	.....	19.65
1914–15.					
October	135	37	70.2	.453	.52
November	242	65	147	.948	1.06
December	.....	.....	156	1.01	1.16
January	.....	.....	a 79.5	a .482	.56
February	.....	.....	a 62.0	a .376	.39
March	.....	.....	a 59.6	a .361	.42
April	1,410	55	598	3.86	4.31
May	890	260	595	3.84	4.43
June	610	122	311	2.01	2.24
July	287	52	154	.994	1.15
August	283	29	88.7	.572	.66
September	470	20	132	.852	.95
The year	1,410	.....	205	.....	17.85

a Records obtained about a mile below regular station; drainage area, 165 square miles.

NOTE.—Computed by engineers of the Geological Survey from records furnished by Vielé, Blackwell & Buck, consulting engineers, New York City.

PERCH RIVER NEAR SIDNAW, MICH.

LOCATION.—At the culvert of the Duluth, South Shore & Atlantic Railway, about 3 miles east of Sidnaw.

DRAINAGE AREA.—60 square miles.

RECORDS AVAILABLE.—September 28, 1912, to September 30, 1915.

GAGE.—Vertical staff nailed to a small tree 800 feet north of the Duluth, South Shore & Atlantic Railway culvert; read daily during open-water season to hundredths.

DISCHARGE MEASUREMENTS.—At low stages, made by wading; at high stages, from highway bridge at lower side of railroad culvert.

CONTROL.—Cobbles and boulders; practically permanent.

WINTER FLOW.—Discharge relation affected by ice; flow determined by frequent current-meter measurements made through the ice.

ACCURACY.—Conditions favorable for good results.

COOPERATION.—Estimates of daily discharge have been furnished by Vielé, Blackwell & Buck, consulting engineers, New York City.

Daily discharge, in second-feet, of Perch River near Sidnaw, Mich., for the years ending Sept. 30, 1913–1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	34	33	25	.....	15	.....	58	240	134	152	47	32
2	31	33	60	.....	.....	.....	71	225	123	134	41	29
3	32	30	95	.....	.....	.....	76	200	110	160	42	33
4	32	27	66	.....	.....	.....	74	195	95	162	41	37
5	32	27	60	.....	.....	.....	76	190	103	168	39	35
6	26	29	50	23	.....	.....	74	188	134	172	39	33
7	32	32	.....	.....	.....	.....	77	172	160	150	37	33
8	29	33	.....	.....	.....	.....	82	160	148	134	31	33
9	30	33	.....	.....	.....	15	82	148	150	120	39	32
10	28	39	.....	.....	16	.....	71	134	139	118	37	31
11	29	35	.....	.....	.....	.....	74	133	110	100	36	32
12	57	34	.....	22	.....	.....	100	122	103	110	33	30
13	75	40	.....	.....	.....	.....	123	118	105	118	33	29
14	70	39	.....	.....	.....	.....	168	118	118	108	31	28
15	65	34	30	.....	.....	.....	222	113	113	100	29	27
16	57	32	.....	.....	.....	.....	285	112	110	100	37	26
17	53	30	.....	.....	22	.....	378	113	95	100	51	26
18	50	29	.....	.....	.....	.....	380	140	148	82	76	25
19	45	28	.....	24	.....	.....	360	140	188	76	55	25
20	39	27	.....	.....	.....	.....	345	135	190	70	49	51
21	39	29	.....	.....	.....	.....	370	139	168	63	50	71
22	45	28	33	.....	24	25	420	137	149	68	47	71
23	43	27	.....	.....	.....	.....	490	135	133	63	45	95
24	43	23	.....	.....	.....	.....	500	130	99	56	44	103
25	39	30	.....	.....	.....	.....	500	122	100	57	31	105
26	38	29	.....	.....	.....	.....	440	100	110	60	33	95
27	35	36	.....	20	.....	.....	420	103	118	71	31	93
28	33	61	.....	.....	.....	.....	360	102	134	68	35	90
29	34	76	26	.....	.....	28	295	103	168	65	37	87
30	34	30	.....	.....	.....	.....	250	130	160	60	33	79
31	34	.....	.....	.....	.....	51	.....	134	.....	50	33	.....
1913–14.												
1	75	118	83	.....	.....	.....	28	440	100	87	52	69
2	71	113	76	.....	.....	.....	23	395	93	77	56	72
3	76	103	71	.....	.....	.....	21	345	82	65	44	113
4	75	95	68	36	.....	.....	26	310	78	63	46	110
5	70	87	63	.....	.....	.....	28	290	70	49	41	103
6	75	90	60	.....	.....	.....	29	272	69	44	33	98
7	79	95	57	.....	.....	.....	28	242	69	40	28	85
8	82	95	60	.....	.....	24	26	225	68	33	31	78
9	83	93	63	.....	.....	.....	28	223	54	31	32	69
10	108	.....	64	.....	.....	.....	41	220	49	29	36	72
11	133	.....	70	.....	.....	.....	32	195	48	33	37	70
12	134	.....	65	.....	.....	.....	33	188	42	95	42	64
13	130	.....	62	.....	.....	.....	46	168	38	113	43	63
14	118	.....	57	.....	.....	.....	50	153	37	103	41	56
15	103	.....	55	.....	.....	25	70	152	36	93	46	80
16	95	88	52	.....	.....	.....	110	135	33	87	52	98
17	90	87	49	.....	20	.....	152	134	31	63	42	123
18	82	87	44	30	.....	.....	225	132	29	56	32	133
19	75	95	48	.....	.....	.....	220	129	29	52	28	103
20	68	100	.....	.....	.....	.....	235	118	28	53	33	78
21	63	110	.....	.....	.....	.....	250	133	31	56	40	73
22	56	115	.....	.....	.....	.....	242	134	28	60	44	64
23	52	115	.....	.....	.....	.....	235	133	26	63	56	63
24	62	110	.....	.....	.....	.....	233	134	37	50	63	56
25	82	103	.....	.....	23	.....	252	133	38	46	78	53
26	103	95	.....	.....	.....	.....	272	129	36	44	78	52
27	108	87	.....	.....	.....	.....	375	123	39	56	78	49
28	123	82	32	.....	.....	.....	415	118	98	71	69	48
29	133	.....	.....	.....	.....	26	500	110	90	65	70	46
30	133	83	.....	.....	.....	.....	490	105	93	63	69	44
31	123	.....	.....	.....	.....	.....	.....	100	.....	63	65	.....

Daily discharge, in second-feet, of Perch River near Sidnaw, Mich., for the years ending Sept. 30, 1913–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	44	28	44	.....	.....	26	28	162	94	81	43	33
2	43	29	41	.....	.....	.....	29	156	89	83	55	34
3	41	34	46	.....	.....	.....	31	158	83	86	81	33
4	37	41	43	.....	.....	.....	34	166	80	89	113	33
5	36	40	49	.....	.....	.....	38	168	77	87	135	32
6	33	38	.....	.....	.....	.....	47	173	187	86	140	28
7	40	36	.....	.....	30	.....	78	180	199	81	128	29
8	46	40	.....	.....	.....	.....	92	191	210	78	111	29
9	40	43	.....	.....	.....	.....	98	187	212	78	98	29
10	40	41	.....	.....	.....	.....	154	178	217	62	94	32
11	37	40	.....	.....	.....	.....	155	166	200	66	79	36
12	36	38	.....	.....	.....	.....	148	178	200	79	66	37
13	33	36	.....	.....	.....	.....	152	191	189	89	55	40
14	32	43	.....	.....	.....	25	162	189	172	93	52	89
15	33	46	.....	.....	.....	.....	180	190	150	98	49	100
16	32	48	.....	.....	.....	.....	202	182	128	105	50	98
17	33	56	.....	.....	.....	.....	210	174	123	98	49	98
18	32	72	.....	.....	.....	.....	226	162	115	89	47	95
19	33	78	.....	.....	.....	.....	217	154	119	86	46	93
20	34	87	.....	.....	.....	.....	209	146	128	76	43	87
21	35	80	.....	.....	27	.....	198	144	135	73	40	82
22	34	75	.....	.....	.....	.....	188	200	127	71	40	76
23	37	62	.....	.....	.....	.....	174	196	124	66	40	68
24	38	63	.....	.....	.....	26	162	180	113	62	42	73
25	41	62	.....	.....	.....	.....	158	166	101	55	40	81
26	37	62	.....	.....	.....	.....	154	161	192	54	38	105
27	34	62	21	.....	.....	.....	156	130	89	53	40	110
28	33	53	.....	.....	.....	26	158	120	86	51	38	95
29	33	46	.....	.....	.....	.....	162	108	83	50	37	90
30	31	43	.....	.....	.....	.....	160	105	80	48	36	81
31	29	.....	.....	.....	.....	.....	.....	100	.....	44	36	.....

NOTE.—Discharge determined from a rating curve based on 18 discharge measurements, three of which were made in 1912, eleven in 1913, two in 1914, and two in 1915.

Monthly discharge of Perch River near Sidnaw, Mich., for the years ending Sept. 30, 1913–1915.

[Drainage area, 60 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1912–13.					
October	75	26	40.7	0.678	0.78
November	76	23	33.8	.563	.63
December	.....	.....	37.2	.620	.71
January	.....	.....	22	.367	.42
February	.....	.....	19	.317	.33
March	.....	.....	22	.367	.42
April	500	58	241	4.02	4.48
May	240	100	143	2.38	2.74
June	190	95	130	2.17	2.42
July	172	50	100	1.67	1.92
August	76	29	40.1	.668	.77
September	105	25	50.5	.842	.94
The year	500	.....	73.3	1.22	16.56
1913–14.					
October	134	52	92.3	1.54	1.78
November	.....	.....	95.7	1.60	1.78
December	.....	.....	51.9	.865	1.00
January	.....	.....	38.8	.647	.75
February	.....	.....	22.5	.375	.39
March	.....	.....	24.6	.410	.47
April	500	21	157	2.62	2.92
May	440	100	188	3.13	3.61
June	100	26	53.3	.888	.99
July	113	29	61.4	1.02	1.18
August	78	28	48.5	.808	.93
September	133	44	76.2	1.27	1.42
The year	500	.....	76.1	1.27	17.22
1914–15.					
October	46	29	36.0	.600	.69
November	87	28	50.7	.845	.94
December	.....	.....	39	.650	.75
January	.....	.....	30	.500	.58
February	.....	.....	28.7	.478	.50
March	.....	.....	25.8	.430	.50
April	226	28	139	2.32	2.59
May	200	100	163	2.72	3.14
June	217	77	133	2.22	2.48
July	105	44	74.7	1.24	1.43
August	140	36	63.3	1.06	1.22
September	110	28	64.9	1.08	1.20
The year	226	.....	70.8	1.18	16.02

NOTE.—Computed by engineers of the Geological Survey from records furnished by Vielé, Blackwell & Buck, consulting engineers, New York City.

STREAMS TRIBUTARY TO LAKE MICHIGAN.

ESCANABA RIVER NEAR ESCANABA, MICH.

LOCATION.—At quarter-section corner between secs. 24 and 25, T. 40 N., R. 23 W., at highway bridge between Escanaba and Gladstone, about 9 miles north of Escanaba and 4 miles above mouth of river.

DRAINAGE AREA.—800 square miles.

RECORDS AVAILABLE.—August 25, 1903, to March 31, 1909; June 1, 1909, to September 30, 1915. Discharge measurements only, April, May, and July, 1903.

GAGE.—Standard chain gage attached to bridge; read daily, in the morning, to tenths. Gage reader, Regis Beauchamp.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.5 feet April 17, 18, and July 1; minimum stage recorded, 2.0 feet September 3 to 5 and 9 to 11.

WINTER FLOW.—Discharge relation affected by ice, which sometimes remains for nearly four months.

ACCURACY.—Discharge relation during logging season may be affected by backwater from log jams. The station has not been visited since July 16, 1908, and gage heights as given in the following table may therefore be in error because of elongation of the gage chain or changes in the position of the gage.

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

Daily gage height, in feet, of Escanaba River near Escanaba, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.2	2.3	3.1	3.0	3.0	3.0	.....	3.7	2.7	4.5	2.4	2.2
2	2.2	2.3	3.1	3.0	.....	.....	.....	3.7	2.6	3.9	2.6	2.2
3	2.1	2.3	3.1	3.0	3.0	3.0	.....	3.7	2.6	3.8	3.6	2.0
4	2.1	2.3	3.0	3.0	.....	.....	3.0	3.7	2.6	3.9	3.4	2.0
5	2.1	2.3	2.9	3.0	.....	.....	3.0	3.6	2.5	3.9	3.6	2.0
6	2.1	2.4	2.9	3.0	3.0	3.0	3.1	3.6	3.0	3.8	3.8	2.1
7	2.1	2.5	2.8	3.0	.....	.....	3.1	3.6	3.6	3.8	3.7	2.1
8	2.2	2.5	2.9	3.0	3.0	3.0	3.3	3.5	3.6	3.6	3.8	2.1
9	2.2	2.5	2.9	3.0	.....	.....	3.5	3.7	3.7	3.5	3.7	2.0
10	2.2	2.5	3.0	.....	3.0	3.0	3.8	3.9	3.7	3.3	3.5	2.0
11	2.3	2.5	3.1	3.0	.....	.....	4.0	3.9	3.8	3.0	3.0	2.0
12	2.3	2.5	3.0	.....	.....	.....	4.2	3.9	3.9	3.5	2.9	2.2
13	2.2	2.5	3.0	3.0	3.0	3.0	4.2	4.0	4.0	3.4	2.7	2.6
14	2.2	2.5	3.2	.....	.....	.....	4.2	4.0	3.9	3.3	2.6	3.6
15	2.2	2.8	3.2	.....	3.0	3.0	4.2	4.0	3.8	3.1	2.6	3.9
16	2.2	2.8	3.2	3.0	.....	.....	4.4	3.7	3.6	3.1	2.8	4.0
17	2.2	2.8	3.2	.....	3.0	3.0	4.5	3.6	3.6	3.1	2.8	4.0
18	2.2	2.8	3.3	3.0	.....	.....	4.5	3.5	3.7	3.0	2.7	4.0
19	2.2	2.8	3.3	.....	.....	.....	4.4	3.4	3.7	2.8	2.6	3.8
20	2.1	2.8	3.3	3.0	3.0	3.0	4.3	3.2	4.0	2.7	2.4	3.5
21	2.1	2.8	3.3	.....	.....	.....	4.1	3.2	4.0	2.6	2.4	3.3
22	2.1	3.0	3.2	.....	3.0	3.0	4.0	3.4	3.9	2.4	2.4	3.0
23	2.1	3.0	3.2	3.0	.....	.....	4.0	3.6	3.9	2.4	2.4	2.8
24	2.1	3.0	3.2	.....	3.0	3.0	3.9	3.7	4.0	2.5	2.4	2.7
25	2.2	3.0	3.2	3.0	.....	.....	3.8	3.6	3.9	2.5	2.4	2.7
26	2.2	3.0	3.1	.....	.....	.....	3.8	3.5	3.8	2.5	2.4	2.7
27	2.2	3.0	3.1	3.0	3.0	3.0	3.8	3.3	3.8	2.4	2.3	2.7
28	2.2	3.0	3.1	.....	.....	.....	3.8	3.2	4.0	2.3	2.3	2.8
29	2.3	3.0	3.0	.....	.....	.....	3.8	3.2	4.2	2.3	2.5	2.9
30	2.3	3.1	3.0	3.0	.....	.....	3.8	3.0	4.4	2.3	2.5	3.0
31	2.3	.....	3.0	.....	.....	.....	.....	2.8	.....	2.3	2.4	.....

NOTE.—Discharge relation probably affected by ice Nov. 15 to Mar. 31.

MENOMINEE RIVER BELOW KOSS, MICH.

LOCATION.—In sec. 5, T. 33 N., R. 23 E., at "Grand Rapids," about 4 miles below Koss, Marinette County, Mich., and 3 miles west of Ingalls, Mich. Little Cedar River, draining an area entirely in Michigan, enters from the left about half a mile below the station.

DRAINAGE AREA.—3,790 square miles.

RECORDS AVAILABLE.—July 1, 1913, to September 30, 1915.

DISCHARGE.—The flow is computed by the Menominee & Marinette Light & Traction Co., of Menominee, Mich., as follows: Each hour the load on the generators is noted and gage heights read of the head and tail water to determine the head on the spillway of the dam and the acting head on the turbines. The flow through the turbines for each hour is taken from a table giving the discharge corresponding to load and head. The flow over the spillway is taken from a table computed from a

weir formula. When water is wasted through the gates the magnitude and duration of the gate openings are noted and the quantity wasted is determined from computed tables. The sum of the hourly flow through the turbines and over the spillway, plus the quantity wasted through the gates, divided by the number of seconds in 24 hours, gives the average discharge in second-feet for the day. No account is taken of the water passing through the exciter turbine nor of waste over the "trash gate" at the power house. This amount is, however, relatively small.

EXTREMES OF DISCHARGE.—Maximum daily discharge during year, 8,650 second-feet April 13; minimum daily discharge, 1,170 second-feet December 27, 1914.

1913–1915: Maximum daily discharge, 20,800 second-feet May 3, 1914; minimum daily discharge, 1,000 second-feet June 14, 1914.

ACCURACY.—No measurements have been made by the Survey engineers at this plant, but measurements made at Koss, Mich., during the year ending September 30, 1914, compare closely with the discharge determined at the power house.

COOPERATION.—Discharge records furnished by Edward Daniell, general manager of the Menominee & Marinette Light & Traction Co.

Daily discharge, in second-feet, of Menominee River below Koss, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,530	2,200	2,550	1,340	1,350	1,570	2,430	7,050	4,470	4,970	2,190	1,660
2	2,460	1,970	3,140	1,500	1,340	1,610	2,300	6,560	3,430	6,420	2,480	1,700
3	2,500	1,860	3,660	1,360	1,610	2,020	2,270	6,260	3,070	5,320	2,320	1,710
4	2,430	2,360	3,500	1,390	1,680	1,960	2,200	6,030	3,340	4,780	2,700	1,560
5	2,240	2,450	3,500	1,340	1,640	1,840	2,600	6,390	3,070	4,840	3,220	1,440
6	1,930	2,480	3,300	1,570	1,480	1,960	2,150	6,270	2,280	4,900	4,880	1,280
7	2,350	2,530	3,100	1,760	1,610	1,720	3,740	6,520	3,080	4,540	5,930	1,280
8	2,370	2,460	2,530	1,690	1,460	1,540	4,980	6,930	2,410	4,650	6,150	1,540
9	2,570	2,580	2,280	1,620	1,340	1,520	5,510	7,480	6,250	4,320	5,720	1,550
10	2,880	2,240	2,020	1,610	1,740	1,860	8,000	8,040	6,600	4,030	5,350	1,350
11	2,770	2,430	1,830	1,420	1,770	1,860	7,550	8,150	6,480	3,700	5,580	1,420
12	2,960	2,530	1,910	1,340	1,690	1,790	7,990	7,840	6,520	3,830	4,290	1,240
13	2,160	2,570	1,720	1,630	1,520	1,810	8,650	7,300	5,900	4,660	3,980	1,790
14	2,430	2,480	1,390	1,820	1,620	1,770	8,590	6,400	5,950	4 950	3,330	2,050
15	2,680	2,790	1,200	1,710	1,570	1,750	7,940	6,320	5,930	4,630	2,380	2,220
16	2,570	2,860	1,800	1,700	1,570	1,740	7,340	6,620	5,740	4,260	2,130	3,460
17	2,620	2,630	1,620	1,670	2,110	2,120	6,890	6,310	4,910	4,340	2,340	4,940
18	2,450	1,850	1,420	1,540	1,910	1,930	7,060	6,350	4,280	4,040	1,960	5,120
19	2,380	1,890	1,360	1,480	1,820	1,890	7,790	6,030	4,630	4,090	3,400	4,780
20	2,190	1,930	1,550	1,840	1,790	1,880	7,380	5,380	4,950	4,050	2,520	4,110
21	2,490	1,970	1,560	1,820	1,750	1,770	7,110	5,260	6,080	3,560	2,360	4,280
22	2,460	2,320	1,460	1,680	1,810	1,780	6,700	5,420	5,820	3,080	2,200	3,060
23	2,440	2,500	1,640	1,700	1,830	1,780	6,380	6,330	5,730	2,870	2,150	2,800
24	2,490	2,440	1,550	1,610	2,050	2,230	6,500	6,980	4,470	2,680	2,130	3,070
25	2,370	2,790	1,330	1,540	2,010	2,490	6,440	7,480	4,380	2,220	2,200	2,730
26	2,080	2,660	1,390	1,410	1,910	2,500	6,090	7,220	4,460	2,560	2,160	2,380
27	1,900	2,730	1,170	1,700	1,790	2,510	6,680	6,830	3,690	2,380	2,190	2,300
28	2,190	2,680	1,220	1,660	1,770	2,440	6,560	6,550	3,340	2,500	2,110	3,660
29	2,260	2,580	1,400	1,440	.....	2,280	7,000	5,940	2,950	2,450	1,940	3,560
30	2,330	2,460	1,820	1,550	.....	2,180	7,190	5,540	3,970	2,350	1,840	3,660
31	2,350	.....	1,460	1,620	.....	2,410	.....	4,640	.....	2,350	1,270	.....

NOTE.—Discharge computed by the Menominee & Marinette Light & Traction Co. See "Discharge" under station description. During October and November, and to some extent throughout the remainder of the low-water period of the year, and especially on Aug. 31, the flow past the station drops off, owing to holding back of water at dams upstream.

Monthly discharge of Menominee River below Koss, Mich., for the year ending Sept. 30, 1915.

[Drainage area, 3,790 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	2,960	1,900	2,410	0.636	0.73
November	2,860	1,850	2,410	.636	.71
December	3,660	1,170	1,980	.522	.60
January	1,840	1,340	1,580	.417	.48
February	2,110	1,340	1,700	.449	.47
March	2,510	1,520	1,950	.515	.59
April	8,650	2,150	6,000	1.58	1.76
May	8,150	4,640	6,530	1.72	1.98
June	6,600	2,280	4,610	1.22	1.36
July	6,420	2,220	3,880	1.02	1.18
August	6,150	1,270	3,080	.813	.94
September	5,120	1,240	2,590	.683	.76
The year	8,650	1,170	3,230	.852	11.56

NOTE.—Computed by engineers of the United States Geological Survey from records of daily discharge furnished by the Menominee & Marinette Light & Traction Co.

BRULE (MENOMINEE) RIVER NEAR FLORENCE, WIS.

LOCATION.—In sec. 10, T. 40 N., R. 18 E., at highway bridge near Washburn Farm, 3½ miles north of Florence, Florence County, 1 mile above the mouth of Paint Creek and 6 miles above the mouth of Michigamme River, both entering from the left.

DRAINAGE AREA.—344 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 24, 1914, to September 30, 1915.

GAGE.—Chain gage fastened to upstream side of highway bridge; read twice daily, morning and evening, to quarter-tenths, by R. N. Washburn.

DISCHARGE MEASUREMENTS.—At low stages, made by wading; at medium and high stages from highway bridge.

CHANNEL AND CONTROL.—Firm gravel, smooth; left bank high; right bank of medium height and may overflow at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year: 3.3 feet, April 1 (discharge, 908 second-feet); minimum discharge, 185 second-feet, recorded by discharge measurement made February 4.

1914–15: Maximum stage recorded, 4.6 feet at 1 p. m. May 1 and 3, 1914 (discharge, 1,730 second-feet), minimum discharge recorded by discharge measurement made February 4, 1915.

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

REGULATION.—Logging dams above the gage are so operated that during the spring large volumes of water are released to facilitate log driving; the flow during such periods fluctuates rapidly; flow for remainder of year probably natural. The natural flow may be increased somewhat throughout the year by discharge from mine pumpage.

ACCURACY.—Rating curve well defined; diurnal fluctuation apparently small; owing to some uncertainty in gage readings the records can not be considered better than fair.

Discharge measurements of Brule River near Florence, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 10	G. H. Canfield	2.16	284	Mar. 4[a]	M. F. Rather	3.40	251
Jan. 13[a]	do	3.40	222	Apr. 10	do	2.72	588
Feb. 4[a]	M. F. Rather	3.35	185	May 22	H. C. Beekman	2.75	607

[a] Measurement made under complete ice cover.

Daily discharge, in second-feet, of Brule River near Florence, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	305	351	328				908	480	376	506	262	284
2	351	351	305				878	453	351	506	351	262
3	328	351	305				848	534	376	506	453	262
4	305	305	305				788	506	401	506	617	241
5	305	328	284				788	534	453	453	673	220
				240	190	270						
6	284	305	305				788	673	506	401	617	220
7	212	284	305				788	730	506	506	561	220
8	241	284	305				788	730	480	453	480	241
9	220	328	305				788	848	534	480	453	220
10	305	328	305				788	645	506	730	401	328
11	376	305	305				848	376	480	453	351	284
12	305	351	284				848	401	506	589	305	284
13	305	351					730	328	401	506	305	328
14	328	305					730	401	401	480	284	480
15	401	328					673	351	453	453	351	702
				215	230	350						
16	351	305	270				673	453	480	561	351	519
17	328	328					617	401	453	480	305	617
18	305	305					617	351	427	401	305	589
19	328	305					589	351	480	401	284	589
20	284	305					561	376	427	401	262	506
21	305	305					561	351	401	376	262	351
22	351	305					506	351	427	351	284	328
23	328	305					506	351	453	351	262	351
24	305	305					453	328	480	328	284	328
25	305	351					480	351	561	305	241	401
			260	180	280	450						
26	305	305					480	328	534	328	262	427
27	284	328					506	351	427	305	284	453
28	328	305					534	351	506	284	262	401
29	305	351					506	305	534	262	305	427
30	305	328					506	351	506	305	328	401
31	328	.....					.....	328	.....	262	305	.....

NOTE.—Discharge determined as follows: Oct. 1 to Dec. 12 and Apr. 1 to Sept. 30 from a rating curve well defined between 262 and 968 second-feet; Apr. 2, interpolated; Dec. 13 to Mar. 31, estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Brule River near Florence, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 344 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	401	212	310	0.901	1.04	B.
November	351	284	320	.930	1.04	B.
December	328	.....	279	.811	.94	C.
January	.....	.....	211	.613	.71	D.
February	.....	.....	230	.669	.70	D.
March	.....	.....	360	1.05	1.21	D.
April	908	453	669	1.94	2.16	B.
May	848	305	441	1.28	1.48	B.
June	561	351	461	1.34	1.50	B.
July	730	262	427	1.24	1.43	B.
August	673	241	356	1.03	1.19	B.
September	702	220	375	1.09	1.22	B.
The year	908	.....	370	1.08	14.62	

PINE RIVER NEAR FLORENCE, WIS.

LOCATION.—In secs. 23, 26, T. 39 N., R. 17 E., at highway bridge, 8 miles southwest of Florence, Florence County, and 12 miles above mouth of the river. Popple River enters from the right about 200 feet above the station.

DRAINAGE AREA.—518 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 22, 1914, to September 30, 1915.

GAGE.—Standard chain gage fastened to guard rail on upstream side of bridge; read twice daily, morning and evening, to half-tenths by William Taft.

DISCHARGE MEASUREMENTS.—At medium and high stages made from upstream side of bridge; at low stages by wading.

CHANNEL AND CONTROL.—Coarse gravel and stones; left bank high and will not overflow; right bank low and may overflow around approach to bridge during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year when discharge relation was not affected by backwater, 4.4 feet August 6 and 7 (discharge, 1,050 second-feet); minimum recorded stage, 1.6 feet September 6 and 7 (discharge, 118 second-feet).

1914–15: Maximum stage when discharge relation was not affected by backwater, 5.2 feet August 24 and 25, 1914 (discharge, 1,370 second-feet); minimum stage recorded: September 6 and 7, 1915 (discharge, 118 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

REGULATION.—River used for log driving in spring; backwater at gage caused by closing of gates of a dam below; observations discontinued during such periods. Discharge as published believed to be nearly the natural flow.

ACCURACY.—Rating curve well defined; channel permanent; gage-height records not very reliable; results probably fair.

Discharge measurements of Pine River near Florence, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	G. H. Canfield	2.22	311	Mar. 4[a]	M. F. Rather	4.25	210
Jan. 13[a]	do	3.35	210	Apr. 10[b]	do	4.54	696
Feb. 4[a]	M. F. Rather	3.65	168	May 22	H. C. Beckman	3.88	853

[a] Measurement made under complete ice cover.
[b] Incomplete ice cover below bridge.

Daily discharge, in second-feet, of Pine River near Florence, Wis., for the years ending Sept. 30, 1914–15.

Day.	Jan.	Feb.	Mar.	Apr.	June.	July.	Aug.	Sept.
1914.								
1					607	1,120	710	641
2					575	1,000	483	675
3					575	889	454	710
4				240	641	745	425	675
5					641	675	354	607
6		185	180		543	607	354	543
7					543	498	368	607
8				260	520	440	396	675
9					498	354	368	607
10					440	340	368	498
11					425	257	368	483
12					368	675	340	528
13					340	963	410	889
14				310	287	1,040	454	852
15					262	926	483	780
16		170	200	745	262	889	454	745
17				815	262	745	607	675
18				926	242	675	675	607
19				1,160	232	396	745	543
20				1,200	214	368	963	543
21				1,120	274	354	1,040	513
22				1,040	382	326	1,080	483
23				.....	483	498	1,200	454
24				.....	513	454	1,370	425
25				.....	528	410	1,370	396
26	200	160	225	.....	543	675	1,280	368
27				.....	852	745	1,120	675
28				.....	1,280	889	1,040	675
29				.....	1,200	815	963	528
30				.....	1,160	780	675	483
31				.....	.....	745	543	.....

Daily discharge, in second feet, of Pine River near Florence, Wis., for the years ending Sept. 30, 1914–15—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	June.	July.	Aug.	Sept.
1914–15.											
1	410	326						725	552	225	156
2	368	340						690	518	256	143
3	368	354						655	484	319	143
4	312	368						620	418	690	143
5	312	382						552	385	941	143
6	287	368	360	220	170	220	555	586	385	1,050	118
7	340	340						586	352	1,050	118
8	368	340						620	319	977	143
9	396	340						620	303	905	169
10	396	326						690	303	761	256
11	396	326						655	552	690	287
12	368	326						655	586	586	287
13	340	368						620	620	484	319
14	287	340						552	586	451	319
15	262		265	200	205	260	1,080	552	552	385	352
16	300							586	552	368	385
17	312	340						586	586	352	451
18	340							620	352	287	518
19	312							620	352	272	518
20	312							552	319	225	484
21	326							518	319	225	484
22	340							484	319	196	484
23	340							451	319	196	451
24	354							418	352	191	518
25	312							352	319	182	552
26	312	400	230	170	230	340		287	287	196	620
27	312							319	287	182	552
28	312							319	272	169	552
29	312							352	256	169	518
30	312							352	225	169	484
31	312								225	156	

NOTE.—Discharge computed as follows: June 1 to Nov. 14, 1914, from a rating curve well defined between 287 and 1,280 second-feet; from June 1 to Sept. 30, 1915, from a rating curve well defined above 256 second-feet. June 8 and Oct. 10, 1914, interpolated. No discharge records available Apr. 23 to May 30, 1914, and Apr. 10 to May 30, 1915, because of backwater at gage (see regulation in station description). Discharge Jan. 22 to Apr. 15, 1914, and Nov. 15, 1914, to Apr. 7, 1915, estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Pine River near Florence, Wis., for the years ending Sept. 30, 1914–15.

[Drainage area, 518 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1914.						
January 22–31			200	0.386	0.14	C.
February			172	.332	.35	D.
March			202	.390	.45	D.
April 1–22			503	.971	.79	C.
June	1,280	214	523	1.01	1.13	B.
July	1,120	257	655	1.26	1.45	B.
August	1,370	340	692	1.34	1.54	B.
September	889	368	596	1.15	1.28	B.
1914–15.						
October	410	262	333	.643	.74	B.
November			363	.701	.78	C.
December			283	.546	.63	D.
January			196	.378	.44	C.
February			200	.386	.40	C.
March			275	.531	.61	C.
April 1–17			771	1.49	.94	
June	725	287	540	1.04	1.16	B.
July	620	225	395	.763	.88	B.
August	1,050	156	429	.828	.95	B.
September	620	118	356	.687	.77	B.

PIKE RIVER AT AMBERG, WIS.

LOCATION.—In sec. 15, T. 35 N, R. 21 E., at Chicago, Milwaukee & St. Paul Railway bridge half a mile south of Amberg, Marinette County, immediately below the junction of the two branches of the Pike River and about 11 miles above the mouth.

DRAINAGE AREA.—240 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—February 26, 1914, to September 30, 1915.

GAGE.—Chain gage fastened to guard rail on upstream side of bridge; read once daily, in the morning, to quarter-tenths, by Frank Bunce.

DISCHARGE MEASUREMENTS.—At medium and high stages made from a highway bridge quarter of a mile downstream from the bridge to which the gage is fastened; at extreme low water by wading.

CHANNEL AND CONTROL.—Solid rock and some loose granite bowlders; channel permanent but very rough at gage. Banks medium high, but do not overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.7 feet April 11 (discharge, 778 second-feet); minimum stage recorded, 1.55 feet September 7 (discharge, 109 second-feet).

1914–1915: Maximum stage recorded, 4.65 feet at 8.10 p. m. July 14, 1914 (discharge, 1,200 second-feet); minimum stage recorded, 1.55 feet September 7, 1915 (discharge, 109 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice; flow estimated from discharge measurements, observer's notes, and weather records.

ACCURACY.—Rating curve well defined; channel permanent; no diurnal fluctuation; records excellent.

Discharge measurements of Pike River at Amberg, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 8	G. H. Canfield	1.97	202	Mar. [a]5	M. F. Rather	2.45	145
Jan. [a]14	do	2.03	134	June 28	H. C. Beckman	2.02	211
Feb. [a]3	M. F. Rather	2.17	141				

[a] Measurement made with ice present at gage section and control.

Daily discharge, in second-feet, of Pike River at Amberg, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	217	185					192	437	244	318	148	122
2	204	192					204	364	244	318	148	122
3	204	204					204	348	230	364	180	128
4	204	217					303	380	217	348	318	128
5	199	217					364	380	204	364	444	114
6	192	204	170	135	140	145	582	364	258	348	493	114
7	217	204					658	396	348	318	582	109
8	288	199					698	620	412	303	582	128
9	318	192					738	582	396	258	493	148
10	288	185					738	510	364	217	396	158
11	273	185					778	461	364	230	333	138
12	258	185					738	412	348	318	258	158
13	230	169					658	396	333	333	230	169
14	230						582	364	318	303	217	204
15	217						510	333	288	244	192	258
16	217		135	135	160	150	510	318	258	244	204	273
17	217	160					510	348	230	258	199	230
18	204						476	333	204	230	192	217
19	204						476	318	380	217	158	169
20	204						444	318	582	204	142	230
21	199						428	303	582	180	148	192
22	199						396	428	510	176	148	176
23	199						364	510	412	169	142	158
24	217						396	476	348	192	169	158
25	230						412	396	318	217	142	138
26	217	200	130	135	150	175	396	396	244	204	148	128
27	204						380	412	230	230	154	148
28	204						444	364	217	192	134	180
29	204						582	348	230	169	142	138
30	192						510	318	348	158	142	118
31	199						.....	288	.....	148	138	.....

NOTE.—Discharge determined as follows: Oct. 1 to Nov. 13 qnd Apr. 1 to Sept. 30, from a rating curve well defined between 180 and 1,120 second-feet; Nov. 14 to Mar. 31, estimated, because of ice, from discharge measurements, observer's notes, and weather records; May 1 and 11, interpolated. Braced figures show mean discharge for period included.

Monthly discharge of Pike River at Amberg, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	318	192	221	0.921	1.06	A.
November	.....	.....	189	.788	.88	C.
December	.....	.....	145	.604	.70	D.
January	.....	.....	135	.562	.65	C.
February	.....	.....	150	.625	.65	C.
March	.....	.....	157	.654	.75	C.
April	778	192	489	2.04	2.28	A.
May	620	288	394	1.64	1.89	A.
June	582	204	322	1.34	1.50	A.
July	364	148	251	1.05	1.21	A.
August	582	134	242	1.01	1.16	A.
September	273	109	162	.675	.75	A.
The year	778	.....	238	.992	13.48	

PESHTIGO RIVER AT HIGH FALLS, NEAR CRIVITZ, WIS.

LOCATION.—In sec. 1, T. 32 N., R. 18 E., at High Falls, near Crivitz, Marinette County, about a quarter of a mile downstream from power house of the Wisconsin Public Service Co.; 1 mile upstream from Thunder River (coming in from the right), and 15 miles by road northwest of Crivitz.

DRAINAGE AREA.—585 square miles (measured on map by Wisconsin Geological and Natural History Survey, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—August 3, 1912, to September 30, 1915.

GAGE.—Barrett & Lawrence water-stage recorder, set over a wooden well about 15 feet from the left bank and quarter of a mile downstream from power house; well is protected from floating logs by a large boulder.

DISCHARGE MEASUREMENTS.—Made from cable, half a mile below the gage.

CHANNEL AND CONTROL.—Banks at control and measuring section are high and will not overflow. The control for the gage at low stages is a small gravel riffle about 50 feet downstream from the gage; at medium and high stages this control is apparently drowned out and is probably formed by some point farther downstream.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.82 feet at 6 p. m. April 12 (discharge, 1,410 second-feet); minimum stage recorded, 1.1 feet at 5 p. m. March 21 (discharge, 54 second-feet).

1912–1915: Maximum stage recorded, 6.0 feet at 1 p. m. May 24, 1914; (discharge, 2,740 second-feet); minimum recorded stage that of March 21, 1915. Owing to artificial regulation, extremes given do not represent the natural flow.

WINTER FLOW.—Because of the relatively warm water in the large service reservoir ice does not form on the river in the vicinity of the gage; open-water rating curve used throughout year.

DIVERSIONS.—About 2 second-feet of seepage water enters the river below the gage but above the cable and is included in the published estimates.

REGULATION.—Flow controlled by operation of the power plant. During log-driving seasons large and sudden fluctuations are caused by the operation of logging and sluice gates. The fluctuation due to changes in load are relatively small. The mean monthly flow does not represent the natural flow because of storage.

ACCURACY.—Rating curve very well defined between 145 and 3,980 second-feet, and all conditions at the station are favorable for the collection of excellent records. Owing, however, to possible errors in mean gage heights because of lag in recording mechanism of water-stage recorder, the estimates are rated "good."

COOPERATION.—Recording-gage records furnished by the Wisconsin Public Service Co.

Discharge measurements of Peshtigo River at High Falls, near Crivitz, Wis., in 1914.

[Made by G. H. Canfield.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Jan. 17	2.22	352
Nov. 7	2.47	489
Nov. 8	1.91	228

Daily discharge, in second-feet, of Peshtigo River at High Falls, near Crivitz, Wis., for the years ending Sept. 30, 1912–1915.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1912.			1912.			1912.		
1	.....	684	11	1,660	980	21	1,040	502
2	.....	1,110	12	1,880	1,080	22	990	592
3	422	1,280	13	1,770	1,040	23	963	550
4	269	1,280	14	1,530	850	24	560	560
5	340	1,220	15	1,250	850	25	540	512
6	350	1,210	16	1,200	850	26	615	490
7	355	986	17	655	850	27	550	526
8	523	938	18	955	533	28	530	508
9	885	928	19	1,100	460	29	520	470
10	1,130	928	20	1,140	464	30	581	480
						31	635	.....

Daily discharge, in second-feet, of Peshtigo River at High Falls, near Crivitz, Wis., for the years ending Sept. 30, 1912–1915.—Continued

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	450	340	340	382	318	320	445	1,180	1,340	565	615	250
2	395	385	540	440	255	280	514	1,150	1,520	585	676	263
3	395	356	590	460	280	315	1,060	930	1,250	518	705	338
4	396	445	675	435	290	315	1,390	920	1,100	403	530	485
5	395	370	681	386	282	315	1,410	1,130	1,180	485	380	501
6	390	380	800	416	295	300	1,350	1,100	1,120	650	442	512
7	470	370	742	398	306	328	1,280	1,100	1,020	585	445	510
8	470	388	536	400	292	325	1,280	1,100	1,050	590	486	540
9	435	397	478	400	306	300	1,390	1,100	690	660	416	488
10	430	397	465	396	330	403	1,340	1,180	710	640	385	387
11	396	450	560	370	310	595	1,240	1,120	805	451	494	375
12	340	495	534	305	338	1,010	1,220	950	750	710	520	350
13	450	522	530	345	316	980	1,020	950	624	675	506	340
14	650	510	495	330	316	970	1,080	1,010	720	640	400	299
15	692	386	404	302	330	940	1,240	990	230	775	315	310
16	692	376	424	346	275	645	1,390	850	683	828	345	341
17	570	356	442	360	302	425	1,480	760	708	706	446	330
18	518	413	463	360	304	510	1,930	850	709	574	452	319
19	495	552	486	330	314	535	2,200	1,010	750	578	455	316
20	520	420	490	350	334	580	2,330	1,000	732	670	455	410
21	550	295	490	352	343	650	2,480	1,000	765	574	395	680
22	560	325	390	350	373	612	1,810	1,060	775	295	398	650
23	554	345	405	355	255	516	2,150	1,270	790	464	378	805
24	388	295	392	352	300	542	2,050	1,460	770	480	255	1,040
25	300	432	368	354	310	552	1,900	1,670	442	458	290	855
26	455	360	425	312	310	548	1,890	1,590	442	456	310	906
27	520	338	460	330	308	500	1,710	1,360	642	700	344	938
28	380	222	445	330	306	472	1,750	1,180	766	798	350	652
29	312	266	380	330	.....	452	1,600	930	710	816	350	510
30	600	300	445	330	.....	405	1,350	975	582	912	292	660
31	480	.....	440	330	.....	422	.....	1,290	.....	788	250	.....
1913–14.												
1	445	582	502	270	307	330	340	1,820	555	1,570	898	900
2	490	445	521	343	276	330	342	2,070	392	1,090	650	800
3	430	556	500	342	362	330	335	1,870	750	1,180	710	770
4	534	590	490	268	370	346	338	1,690	653	1,250	536	835
5	616	543	476	320	378	360	245	1,330	389	1,150	585	770
6	580	479	480	310	370	345	305	1,280	1,080	1,080	503	625
7	648	390	380	332	372	360	327	1,180	415	890	501	630
8	638	422	352	359	309	258	332	1,100	1,000	800	479	724
9	521	435	362	362	350	314	340	1,060	805	420	437	586
10	542	505	363	357	350	336	360	935	698	496	494	547
11	679	415	352	275	350	340	343	1,000	710	490	483	700
12	705	378	335	340	350	350	242	850	740	487	387	585
13	624	438	355	364	366	377	260	850	548	930	390	463
14	629	459	278	335	370	350	325	1,080	290	1,280	422	607
15	635	458	345	362	302	256	390	605	600	1,340	425	753
16	645	398	369	371	326	309	360	530	599	1,270	454	871
17	648	554	415	370	352	330	330	476	1,180	847	617	778
18	638	548	377	268	355	343	280	534	750	724	898	835
19	596	452	376	350	342	352	250	572	696	690	935	850
20	626	457	350	373	340	350	340	561	302	630	1,010	825
21	485	442	262	354	355	350	426	932	214	490	1,170	672
22	368	454	345	370	270	360	1,160	462	275	492	1,100	530
23	342	481	370	366	314	360	1,350	465	276	467	1,000	528
24	344	612	355	370	310	370	1,200	1,240	140	550	1,330	550
25	347	680	270	300	325	370	1,200	493	618	640	1,230	554
26	384	610	330	333	308	385	1,200	480	1,020	650	1,150	454
27	575	472	368	350	325	368	1,200	628	1,080	650	1,290	394
28	625	514	288	375	325	332	1,190	630	1,580	700	1,040	660
29	590	542	324	388	.....	265	1,270	496	1,400	750	826	563
30	639	461	350	380	.....	312	1,550	480	1,600	800	978	420
31	629	.....	339	350	.....	335	.....	526	.....	865	1,000	.....

Daily discharge, in second-feet, of Peshtigo River at High Falls, near Crivitz, Wis., for the years ending Sept. 30, 1912–1915—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	437	255	442	282	270	326	459	900	701	473	241	503
2	427	373	461	364	250	419	391	860	625	560	325	467
3	425	428	448	311	260	440	382	830	557	651	362	458
4	300	442	462	412	270	400	272	681	525	515	357	458
5	374	477	455	446	270	492	409	728	439	453	586	296
6	408	475	270	454	255	496	466	585	261	611	1,190	253
7	390	461	391	478	114	300	505	782	427	617	1,250	398
8	431	275	447	390	198	378	558	899	479	530	1,200	443
9	483	363	450	372	241	444	629	822	485	483	1,160	502
10	518	413	456	223	242	463	815	1,060	425	450	769	536
11	414	432	478	300	257	452	954	1,140	346	294	670	534
12	487	425	466	359	261	459	1,310	994	418	417	725	324
13	486	374	286	344	255	453	1,150	871	620	526	492	417
14	431	419	397	351	111	288	1,090	815	590	544	423	506
15	438	270	451	371	257	396	991	740	590	448	283	500
16	436	362	466	360	300	464	779	587	441	566	415	488
17	433	417	471	218	298	478	737	487	454	491	462	545
18	302	433	449	213	290	397	560	728	560	386	461	549
19	404	457	447	265	279	267	854	857	760	630	474	350
20	405	444	294	258	290	275	852	1,140	749	724	507	482
21	432	441	410	261	210	98	742	640	1,060	640	463	542
22	441	279	467	229	340	270	770	543	1,020	706	321	668
23	437	375	466	229	399	303	800	650	623	490	450	535
24	443	432	462	120	404	320	740	690	700	451	499	515
25	284	433	251	202	430	320	753	682	555	316	530	527
26	392	328	296	240	445	284	988	694	476	447	564	339
27	416	417	239	267	435	292	1,040	770	336	525	540	451
28	440	472	363	270	266	238	943	683	506	517	523	534
29	427	291	455	270	.....	363	930	683	469	482	311	556
30	400	412	487	270	.....	433	915	590	465	448	428	555
31	408	.....	435	270	.....	438	.....	551	.....	389	475	.....

NOTE.—Discharge, except as noted below, computed from a rating curve well defined between 145 and 3,980 second-feet. Discharge estimated as follows: Jan. 28–31, May 6–9, 1913, Feb. 9–12, 27–28, Mar. 1–3, 20–23, Apr. 14, 17, 18, 24–26, May 15–24, July 26–30, Aug. 31, Sept. 1, 2, 1914, Jan. 29, Feb. 4, Apr. 30, and May 2, 1915; discharge on the following days determined from mean gage height for less than 24 hours: Feb. 26, Mar. 4, 26, Apr. 13, 15, 23, July 25, 1914, Apr. 29 and May 3, 1915.

Monthly discharge of Peshtigo River at High Falls, near Crivitz, Wis., for the years ending Sept. 30, 1912–1915.

Month.	Discharge in second-feet.			Accuracy.	Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
1912.					1913–14.				
August 3–31	1,880	269	860	B.	March	385	256	338	C.
September	1,280	460	790	B.	April	1,550	242	604	B.
1912–13.					May	2,070	462	910	C.
October	692	300	473	B.	June	1,600	140	712	B.
November	552	222	383	B.	July	1,570	420	828	B.
December	800	340	494	B.	August	1,330	387	772	B.
January	460	302	362	B.	September	900	394	659	B.
February	373	255	307	B.	The year	2,070	140	578	
March	1,010	280	518	B.					
April	2,480	445	1,510	B.	1914–15.				
May	1,670	760	1,100	B.	October	518	284	418	B.
June	1,520	230	812	B.	November	477	255	396	B.
July	912	295	614	B.	December	487	239	413	B.
August	705	250	422	B.	January	478	120	303	B.
September	1,040	250	512	B.	February	445	111	282	B.
The year	2,480	222	626		March	496	98	369	B.
					April	1,310	272	759	B.
1913–14.					May	1,140	487	764	B.
October	705	342	555	B.	June	1,060	261	555	B.
November	680	378	492	B.	July	724	294	509	B.
December	521	262	374	B.	August	1,250	241	563	B.
January	388	268	342	B.	September	668	253	474	B.
February	378	270	337	B.	The year	1,310	98	485	

OCONTO RIVER NEAR GILLETT, WIS.

LOCATION.—In sec. 34, T. 28 N., R. 18 E., at steel highway bridge 2½ miles southeast of Gillett, Oconto County, and about 27 miles above mouth of river.

DRAINAGE AREA.—678 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—June 7, 1906, to March 30, 1909; January 6, 1914, to September 30, 1915.

GAGE.—Chain gage attached to iron railing on upstream side of bridge; read once daily, to quarter-tenths, by Miss Nettie Gilbertson. Zero of gage used for January 16, 1914, to September 30, 1915, is 4 feet above that of gage used June 7, 1906, to March 31, 1909.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge to which gage is fastened.

CHANNEL AND CONTROL.—Gravel; fairly permanent; left bank of medium height and will not overflow; right bank may overflow during extreme flood stages and water flow around the end of the bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.4 feet April 14–16 and June 21 (discharge, 1,720 second-feet); minimum discharge, 344 second-feet recorded by discharge measurement made January 8.

1906–1909 and 1914–1915: Maximum discharge recorded, 2,630 second-feet May 1, 1908; minimum open-water discharge, 95 second-feet January 3 and 6, 1907.

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

REGULATION.—A dam above the station stores water to float logs during the spring; except when dam is operated, flow at the gage is natural.

ACCURACY.—Rating curve well defined; channel permanent; little, if any, diurnal fluctuation; records excellent.

Discharge measurements of Oconto River near Gillett, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 8[a]	H. C. Beckman	2.64	344	Mar. 8[a]	M. F. Rather	2.87	439
Feb. 6[a]	M. F. Rather	2.70	364	30[b]	do	1.93	732

[a] Measurement made through complete ice cover. [b] Small amount of ice along water edge.

Daily discharge, in second-feet, of Oconto River near Gillett, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	468	468	642				840	1,020	840	670	446	424
2	468	446	670				950	840	1,160	615	515	424
3	446	492	960				1,060	900	1,190	642	565	403
4	615	492	762				810	930	725	670	615	403
5	642	492	565				900	930	698	642	960	382
6	670	446	590	345	380	435	1,160	840	698	670	960	403
7	424	468	602				1,220	1,090	725	615	1,020	403
8	424	515	615				1,290	840	725	615	992	468
9	515	492	565				1,430	900	725	590	1,020	515
10	900	492	515				1,640	900	725	615	900	642
11	403	492	515				1,500	900	840	565	615	565
12	515	468	515				1,430	960	810	515	725	615
13	615	468	504				1,500	1,640	698	468	725	752
14	565	515	492				1,720	615	870	468	698	725
15	565	565					1,720	670	960	492	698	1,090
16	565			340	405	545	1,720	960	870	468	642	1,220
17	615		435				1,500	1,500	1,360	468	960	1,220
18	565						1,430	960	1,020	468	725	1,160
19	565						1,430	960	1,090	468	615	1,160
20	515						1,430	900	1,290	492	615	1,160
21	540	515					1,430	1,090	1,720	492	468	1,090
22	515						1,220	1,160	1,570	515	468	1,090
23	515						1,220	1,220	1,430	515	492	1,020
24	515						1,160	1,360	1,430	515	515	1,060
25	468						992	1,320	1,500	615	424	1,220
26	515	565	375	375	420	660	992	1,290	900	670	468	590
27	515	565					1,060	1,160	780	615	446	615
28	515	565					1,060	1,160	725	642	468	565
29	515	565					1,090	1,160	615	615	424	540
30	515	565					1,060	1,090	670	515	424	446
31	515	.....					.....	1,160	.....	515	424	.....

NOTE.—Discharge, except as noted below, determined from a rating curve well defined between 305 and 1,790 second-feet. Discharge Nov. 16–25 and Dec. 15 to Mar. 31, estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Oconto River near Gillett, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 678 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	900	424	539	0.795	0.92	A.
November	.....	446	520	.767	.86	B.
December	960	.....	492	.726	.84	C.
January	.....	.....	354	.522	.60	C.
February	.....	.....	400	.590	.61	C.
March	.....	.....	550	.811	.94	C.
April	1,720	810	1,270	1.87	2.09	B.
May	1,640	615	1,050	1.55	1.79	B.
June	1,720	615	979	1.44	1.61	A.
July	670	468	563	.830	.96	A.
August	1,020	424	646	.953	1.10	A.
September	1,220	382	746	1.10	1.23	A.
The year	1,720	.....	675	.996	13.55	

WOLF RIVER AT KESHENA, WIS.

LOCATION.—In sec. 26, T. 28 N., R. 15 E., at the highway bridge at Keshena, Shawano County, 3 miles below junction with West Branch of Wolf River (coming in from the right).

DRAINAGE AREA.—797 square miles.

RECORDS AVAILABLE.—May 9, 1907, to March 31, 1909; February 10, 1911, to September 30, 1915.

GAGE.—May 9, 1907, to November 29, 1914, vertical staff gage fastened to downstream abutment; December 9, 1914, to September 30, 1915, chain gage fastened to downstream side of new bridge, both gages at same datum; gage read twice daily, morning and evening, to quarter-tenths, by Ray Gauthier.

DISCHARGE MEASUREMENTS.—Made from the bridge.

CHANNEL AND CONTROL.—Gravel; smooth and practically permanent; banks of medium height, and will probably never overflow. During the last part of November and the first part of December, 1914, a new bridge was erected at the site of the old gage. Plotting of the discharge measurements made since the bridge was built indicates that the construction of the new piers apparently changed the discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet at 6 p. m. June 19 (discharge, 1,600 second-feet); minimum stage recorded, 1.2 feet at 6 p. m. September 4 (discharge, approximately 414 second-feet).

1907–1909 and 1911–1915: Maximum discharge recorded, 3,910 second-feet September 2, 1912; minimum open-water discharge, 275 second-feet September 26, 1908.

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

REGULATION.—The river and its main tributaries above Keshena are controlled to some extent by logging dams.

ACCURACY.—Rating curve fairly well defined; channel permanent; little, if any, diurnal fluctuation; records good.

Discharge measurements of Wolf River at Keshena, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 9 [a]	H. C. Beckman	1.75	601	Mar. 10 [b]	M. F. Rather	2.55	527
Jan. 6 [b]	do	2.26	474	31 [a]	do	1.77	552
Feb. 8 [b]	M. F. Rather	2.78	493				

[a] Partial ice cover on river below gage. [b] Measurements made through complete ice cover.

Daily discharge, in second-feet, of Wolf River at Keshena, Wis., for the year ending Sept 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	806	853					586	909	810	670	670	459
2	715	806					586	810	762	909	670	492
3	715	806					627	909	762	762	715	475
4	760	760					627	1,010	810	715	960	428
5	760	760					715	1,010	909	762	1,120	443
			630	510	520	540						
6	1,000	806					859	909	715	715	1,120	443
7	1,280	806					909	1,010	627	715	1,010	443
8	1,280	853					960	1,120	715	627	960	547
9	1,220	853					960	1,120	810	627	909	859
10	1,220	853					1,010	1,070	960	627	960	670
11	1,110	853					1,240	1,010	1,070	586	859	586
12	1,050	806					1,300	909	1,070	586	810	547
13	1,020	760					1,180	715	909	670	715	670
14	984	715					1,070	810	670	627	762	1,180
15	950	1,000					1,120	810	762	627	909	1,120
16	950	1,000	500	600	545	525	1,120	1,070	859	627	762	909
17	901	950					1,070	859	859	627	762	810
18	901	950					1,010	810	909	586	627	859
19	853						1,010	960	1,600	586	586	670
20	853						1,010	960	1,480	586	510	627
21	853						1,010	1,120	1,180	586	510	627
22	806						909	1,420	960	586	443	586
23	853						909	1,360	909	586	428	547
24	853	830					909	1,180	960	715	547	859
25	853						1,120	1,120	715	715	510	586
26	853		495	610	555	575	1,120	1,240	715	586	627	547
27	853						1,120	1,120	670	670	586	510
28	853						1,120	1,010	715	547	547	547
29	806						1,010	909	670	670	547	547
30	806						909	909	670	715	443	547
31	806	.....					.....	859	.....	670	443	.....

NOTE.—Discharge computed as follows: Oct. 1 to Nov. 18 from a rating curve well defined between 380 and 1,920 second-feet; Apr. 1 to Sept. 30 from a rating curve fairly well defined between 510 and 1,240 second-feet; Oct. 13 and 14 interpolated. Discharge Nov. 19 to Mar. 31 estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Wolf River at Keshena, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 797 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,280	715	920	1.15	1.33	A.
November	1,000	715	838	1.05	1.17	C.
December	.....	.....	540	.678	.78	D.
January	.....	.....	575	.721	.83	C.
February	.....	.....	539	.676	.70	C.
March	.....	.....	548	.688	.79	C.
April	1,300	586	970	1.22	1.36	B.
May	1,420	715	1,000	1.25	1.44	B.
June	1,600	627	874	1.10	1.23	B.
July	909	547	654	.821	.95	B.
August	1,120	428	711	.892	1.03	B.
September	1,180	428	638	.801	.89	B.
The year	1,600	428	735	.922	12.50	

WOLF RIVER AT NEW LONDON, WIS.

LOCATION.—In sec. 12, T. 22 N., R. 14 E., at Pearl Street highway bridge, New London, Waupaca County. Embarrass River enters from the right three-fourths of a mile above and Little Wolf River, also from the right, 5 miles below the station.

DRAINAGE AREA.—2,240 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles.)

RECORDS AVAILABLE.—Gage heights March 1, 1899, to September 30, 1915; daily discharge estimates October 1, 1913, to September 30, 1915.

GAGE.—Enameled steel gage, fastened to pile under downstream side of Pearl Street Bridge, read at noon to the nearest tenth; datum of the gage was raised 0.641 foot March 1, 1911, according to United States Army Engineers.

DISCHARGE MEASUREMENTS.—Made from the Shawano Street Bridge, two blocks below the gage.

CHANNEL AND CONTROL.—Sand, hard pan, and mud; not permanent; no well-defined control; both banks at the gage fairly high and will never overflow. It is reported that during extreme flood stages the water from Embarrass River will flow across the city of New London into the channel of the Wolf River below the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.6 feet March 27 (discharge, 4,260 second-feet); minimum discharge, 756 second-feet, recorded by discharge measurement made January 4.

1914–1915: Maximum stage recorded, 9.9 feet June 9 and 10, 1914 (discharge, 8,490 second-feet). Minimum for period by measurement January 4, 1915. United States Army Engineer office reports a stage of 11.6 feet on April 16, 1888.

WINTER FLOW.—Discharge relation seriously affected by ice; flow determined from discharge measurements, observer's notes, and weather records.

REGULATION.—Little, if any, diurnal fluctuation caused by power plants on the river above the station, has been observed at the gage; monthly record shows natural flow.

ACCURACY.—Rating curve fairly well defined over range in stage covered by gage heights; channel not absolutely permanent; records good.

COOPERATION.—Gage-height records are taken by an employee of the United States Army Engineers and furnished the Survey monthly.

Discharge measurements of Wolf River at New London, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16[a]	H. C. Beckman	3.42	1,500	Mar. 29	M. F. Rather	7.40	4,110
16[a]	do	3.48	1,510	May 27	H. C. Beckman	6.25	3,430
Jan. 4[b]	do	2.38	756	27	do	6.24	3,360
Feb. 9[b]	M. F. Rather	3.10	856	June 26	W. G. Hoyt	5.18	2,650
Mar. 11[b]	do	4.53	1,150	Aug. 18	H. C. Beckman	2.89	1,630

[a] Strong upstream wind during measurement.
[b] Measurement made under complete ice cover.

Daily discharge, in second-feet, of Wolf River at New London, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,460	1,270	1,380				3,700	2,490	2,810	1,950	1,410	1,100
2	1,460	1,270	1,500				3,560	2,490	2,690	1,870	1,450	1,060
3	1,380	1,230	1,540				3,350	2,400	2,540	1,790	1,450	1,020
4	1,310	1,270	1,570				3,220	2,440	2,310	1,750	1,480	980
5	1,310	1,270	1,570				3,160	2,440	2,080	1,710	1,520	980
6	1,270	1,270	1,570	755	820	1,580	3,160	2,490	2,040	1,640	1,710	980
7	1,270	1,230	1,610				3,160	2,540	1,990	1,710	1,710	940
8	1,350	1,230	1,500				3,220	2,590	1,990	1,710	1,790	900
9	1,420	1,230	1,380				3,280	2,590	1,990	1,670	1,790	940
10	1,540	1,200	1,310				3,350	2,640	2,040	1,640	1,790	1,020
11	1,610	1,200					3,490	2,640	2,040	1,560	1,750	1,180
12	1,650	1,090					3,560	2,640	2,080	1,480	1,670	1,450
13	1,650	1,160					3,630	2,540	2,170	1,450	1,640	1,480
14	1,690	1,200					3,700	2,490	2,260	1,450	1,560	1,750
15	1,690	1,350		1,070	810	1,210	3,700	2,350	2,310	1,370	1,520	2,040
16	1,730	1,610					3,700	2,310	2,260	1,370	1,480	2,310
17	1,730	1,460				1,760	3,700	2,260	2,170	1,370	1,520	2,540
18	1,690						3,700	2,350	2,080	1,370	1,640	2,690
19	1,690						3,630	2,400	2,220	1,300	1,670	2,750
20	1,650						3,560	2,440	2,400	1,300	1,670	2,810
21	1,610						3,420	2,590	2,490	1,300	1,520	2,750
22	1,540						3,350	2,750	2,640	1,330	1,410	2,690
23	1,420					3,560	3,280	2,920	2,640	1,330	1,330	2,540
24	1,350	1,400				3,700	3,160	3,160	2,690	1,300	1,140	2,400
25	1,350					4,010	2,980	3,220	2,690	1,370	1,140	2,220
26	1,350			855	850	1,860	4,010	2,860	3,220	2,640	1,410	1,180	2,080
27	1,350						4,260	2,810	3,220	2,540	1,480	1,220	1,990
28	1,310						4,170	2,750	3,220	2,490	1,520	1,220	1,830
29	1,310						4,170	2,640	3,160	2,350	1,520	1,220	1,750
30	1,270	1,380					3,930	2,590	3,100	2,080	1,450	1,220	1,670
31	1,270	.....					3,850	.....	2,980	.....	1,410	1,180	.....

NOTE.—Discharge computed as follows: Oct. 1 to Nov. 17 and Dec. 1–10, from a rating curve well defined between 986 and 8,820 second-feet; Mar. 23 to Oct. 30 from a rating curve well defined between 1,480 and 4,660 second-feet. Discharge Nov. 18–29 and Dec. 11 to Mar. 22 estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Wolf River at New London, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 2,240 square miles]

Month	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,730	1,270	1,470	0.656	0.76	B.
November	1,610	1,090	1,320	.589	.66	C.
December	1,610	.....	1,130	.504	.58	D.
January	.....	.....	806	.360	.42	D.
February	.....	.....	1,260	.562	.59	D.
March	4,260	.....	2,340	1.04	1.20	D.
April	3,700	2,590	3,310	1.48	1.65	A.
May	3,220	2,260	2,680	1.20	1.38	A.
June	2,810	1,990	2,320	1.04	1.16	A.
July	1,950	1,300	1,510	.674	.78	A.
August	1,790	1,140	1,480	.661	.76	A.
September	2,810	900	1,760	.786	.88	B.
The year	4,260	.....	1,780	.795	10.82	

WEST BRANCH OF WOLF RIVER AT NEOPIT, WIS.

LOCATION.—In sec. 20, T. 29 N., R. 14 E., at dam and power plant at Neopit, Shawano County, a station on the Wisconsin Northern Railroad, 20 miles north of Shawano; about 11 miles above confluence of Wolf River and West Branch.

DRAINAGE AREA.—108 square miles.

RECORDS AVAILABLE.—January 25, 1911, to September 30, 1915.

GAGE.—Vertical staff; head and tail race gages.

DETERMINATION OF FLOW.—Observations are taken at 6, 7, and 10 a. m., and at 3, 6, and 10 p. m., of the head of water flowing over the spillway, the head on the wheels, and the kilowatt output as measured at the switchboard. The flow at these times is determined by means of a curve developed by current-meter measurements, and the computed discharge is then weighted in accordance with the elapsed interval.

EXTREMES OF DISCHARGE.—Maximum mean daily discharge during year, 431 second-feet September 23; minimum mean daily discharge, 18 second-feet October 2. 1911–1915: Maximum mean daily discharge, 999 second-feet, July 24, 1912; minimum mean daily discharge, 17 second-feet, August 30, 1914.

ACCURACY.—Two discharge measurements made January 7 and one March 9 indicate that the records are being carefully taken, and that the method of computation gives results well within 10 per cent.

Daily discharge, in second-feet, of West Branch of Wolf River at Neopit, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	54	132	112	84	85	94	118	103	102	98	77	68
2	18	148	114	84	83	83	117	.....	89	106	75	67
3	25	144	113	69	87	84	107	.....	100	77	97	67
4	94	162	116	80	78	106	102	.....	98	127	100	70
5	178	107	118	85	98	83	143	.....	128	92	124	64
6	105	147	103	88	90	79	148	.....	93	103	166	75
7	124	159	113	87	76	118	123	.....	134	121	73	72
8	98	98	115	85	87	112	137	.....	97	72	43	106
9	82	133	111	85	86	79	158	126	104	95	130	89
10	41	79	79	73	89	102	203	131	140	80	122	75
11	111	102	83	88	98	95	156	95	112	64	85	80
12	102	105	79	90	110	85	163	114	145	115	68	104
13	104	103	65	95	98	115	142	133	135	67	83	100
14	91	120	83	93	129	78	155	85	112	72	221	137
15	85	112	77	86	188	115	136	126	89	79	91	130
16	185	82	80	70	184	71	135	130	128	101	49	115
17	73	77	80	94	96	90	138	107	80	70	49	135
18	62	94	80	91	85	76	107	131	182	.....	47	111
19	68	98	82	84	83	91	149	113	181	.....	49	61
20	70	95	94	87	86	77	127	139	112	.....	48	80
21	67	120	84	95	116	95	128	176	137	.....	53	86
22	69	104	85	93	108	85	112	210	108	.....	55	83
23	70	113	87	91	87	74	107	148	130	.....	70	431
24	69	108	89	75	104	105	128	137	91	.....	77	109
25	56	83	105	95	110	82	115	143	108	59	73	69
26	66	126	92	87	82	88	135	139	78	160	72	45
27	76	120	60	90	81	94	122	108	94	62	74	70
28	90	118	88	69	104	133	122	122	108	69	74	112
29	125	112	85	88	.....	65	110	139	95	84	68	126
30	131	120	80	93	.....	91	118	121	102	79	72	110
31	136	.....	83	76	.....	90	.....	75	.....	83	77	.....

NOTE.—See "Determination of flow" in station description for method used in computing the daily discharge. Weekly reports not received for periods May 2–8, and July 18–24; flow estimated as follows: May 2–8, 120 second feet; July 18–24, 65 second-feet.

Monthly discharge of West Branch of Wolf River at Neopit, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 108 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	185	18	87.9	0.814	0.94	B.
November	162	77	114	1.06	1.18	B.
December	118	60	91.5	.847	.98	B.
January	95	69	85.5	.792	.91	C.
February	188	76	100	.926	.96	C.
March	133	65	91.5	.847	.98	B.
April	203	102	132	1.22	1.36	B.
May	210	75	126	1.17	1.35	B.
June	182	78	114	1.06	1.18	B.
July	160	.....	83.5	.773	.89	B.
August	221	43	82.6	.765	.88	B.
September	431	45	102	.944	1.05	B.
The year	431	18	101	.935	12.66	

LITTLE WOLF RIVER AT ROYALTON, WIS.

LOCATION.—In sec. 1, T. 22 N., R. 13 E., at highway bridge in Royalton, Waupaca County, about 4 miles above mouth of river.

DRAINAGE AREA.—485 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—January 13, 1914, to September 30, 1915.

GAGE.—January 13, 1914, to August 20, 1915, chain gage fastened to upstream side of highway bridge; read twice daily, morning and evening, to half-tenths; August 21 to September 30, 1915, inclined gage on left bank of river, about 150 feet upstream from highway bridge. Datum of inclined gage 0.75 foot higher than that of chain gage; owing, however, to change in slope, there is no constant difference between readings on the two gages.

DISCHARGE MEASUREMENTS.—Made from a cable, about 500 feet upstream from chain gage.

CHANNEL AND CONTROL.—Channel at the gage section consists of heavy gravel and rock, and is permanent; at the measuring section, fine, smooth gravel. Neither bank overflows to any extent at flood stages; discharge relation is changed occasionally by the washing away of portions of the remains of an old dam a short distance below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.3 feet at 7.15 a. m., April 8; minimum stage, 1.05 feet at 7 p. m., August 22.

1914–15: Maximum stage recorded, 7.5 feet at 7.15 p. m., June 7, 1914 (discharge, 5,350 second-feet); minimum discharge, approximately 145 second-feet, August 22, 1914 (gage height, 1.05 feet).

WINTER FLOW.—Discharge relation affected by ice; flow estimated, from discharge measurements, observer's notes, and weather records.

REGULATION.—The few power plants above the station use little storage, and no diurnal fluctuation has been observed at the gage.

Because of changes in the discharge relation due to washing away of portion of an old dam below gage, estimates of discharge are withheld until additional data are obtained.

Discharge measurements of Little Wolf River at Royalton, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14	H. C. Beckman	1.68	280	June 27	W. G. Hoyt	1.53	301
Jan. 5[a]	do	1.75	181	27	do	1.57	311
Feb. 9[a]	M. F. Rather	2.40	269	Aug. 20	H. C. Beckman	[b] 1.40	236
Mar. 11	do	2.22	297				

[a] Made through complete ice. [b] Inclined gage read 1.46 feet.

Daily gage height, in feet, of Little Wolf River at Royalton, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.70	1.58	1.68	1.70	1.55	2.3	2.0	1.78	1.64	1.45	1.40	1.29
2	1.50	1.50	1.72	1.88	1.72	2.5	2.05	1.68	1.36	1.48	1.53	1.40
3	1.58	1.55	1.75	1.72	1.92	2.5	2.15	1.71	1.52	1.36	1.48	1.32
4	1.48	1.55	1.75	1.78	1.95	2.4	2.25	1.88	1.42	1.48	1.53	1.36
5	1.42	1.58	1.68	1.82	2.2	2.3	2.45	2.1	1.46	1.52	1.48	1.30
6	1.55	1.52	1.62	2.2	2.15	2.05	2.9	1.98	1.56	1.48	1.37	1.30
7	1.52	1.52	1.65	1.78	2.3	2.0	3.0	1.88	1.54	1.55	1.57	1.24
8	1.65	1.48	1.60	1.85	2.4	2.25	3.2	1.96	1.66	1.58	1.52	1.28
9	1.92	1.58	1.60	2.1	2.4	2.3	3.0	2.15	1.92	1.52	1.49	1.32
10	2.3	1.52	1.62	1.95	2.3	2.1	2.95	2.05	1.72	1.58	1.42	1.32
11	1.98	1.55	2.7	1.98	2.45	2.1	3.0	1.94	1.72	1.50	1.42	1.38
12	2.0	1.52	2.7	1.88	2.2	2.2	3.0	1.84	1.69	1.42	1.45	1.64
13	2.1	1.62	2.7	2.1	2.3	2.25	3.1	1.71	1.72	1.42	1.39	1.79
14	2.0	1.62	2.4	2.4	3.5	2.6	2.8	1.68	1.74	1.38	1.22	2.40
15	2.0	1.88	2.2	1.78	3.3	2.75	2.65	1.68	1.72	1.30	1.39	2.05
16	2.1	1.92	2.1	2.05	3.6	2.5	2.35	1.68	1.69	1.45	1.25	2.5
17	1.90	1.75	1.78	2.5	3.6	2.6	2.25	2.0	1.52	1.42	1.42	2.5
18	1.62	2.45	1.78	2.15	3.2	2.75	2.25	1.95	1.66	1.42	1.39	2.25
19	1.92	1.92	2.1	2.6	2.9	2.65	2.15	1.98	1.92	1.40	1.47	2.25
20	1.80	1.70	1.78	2.15	2.85	2.5	2.1	1.98	1.84	1.36	1.37	2.1
21	1.60	1.72	1.68	2.4	2.8	2.4	2.1	2.3	1.96	1.43	1.42	1.82
22	1.45	2.0	1.62	2.2	3.2	2.5	2.05	2.8	1.74	1.43	1.10	1.75
23	1.40	1.75	1.75	2.4	3.6	2.4	1.93	2.7	1.72	1.40	1.48	1.82
24	1.82	1.58	1.72	1.98	3.6	3.0	2.0	2.6	1.62	1.43	1.38	1.58
25	1.55	1.58	1.78	1.92	3.0	3.3	1.96	2.5	1.59	1.68	1.22	1.64
26	1.82	1.65	1.92	2.05	3.0	3.2	1.86	2.3	1.56	1.50	1.42	1.75
27	1.60	1.62	1.78	1.92	2.9	2.9	1.93	2.1	1.54	1.48	1.42	1.54
28	1.62	1.95	1.82	1.92	2.6	2.4	1.88	1.91	1.45	1.43	1.22	1.42
29	1.52	1.62	1.72	1.82	.....	2.2	1.80	1.74	1.45	1.46	1.35	1.51
30	1.52	1.60	1.72	1.80	.....	2.3	1.86	1.68	1.45	1.50	1.38	1.50
31	1.48	.....	1.75	1.72	.....	2.15	.....	1.68	.....	1.48	1.28	.....

NOTE.—Discharge relation affected by ice Nov. 14–30 and Dec. 11 to Mar. 27, Gage heights Aug. 21 to Sept. 30 refer to the inclined gage and are not comparable to gage heights prior to that period.

MILWAUKEE RIVER NEAR MILWAUKEE, WIS.

LOCATION.—In the NW. ¼ sec. 5, T. 7 N., R. 22. E., immediately above the remains of an old quarry near the north limits of Milwaukee, in Milwaukee County; about half a mile below the concrete highway bridge and 1 mile above Mineral Spring road; about 5½ miles above the confluence of the Milwaukee and Menominee rivers.

DRAINAGE AREA.—661 square miles (measured on Wisconsin Geological and Natural History Survey map, edition of 1911; scale, 1 inch=6 miles).

RECORDS AVAILABLE.—April 30, 1914, to September 30, 1915.

GAGE.—Chain gage fastened to cantilever arm supported by two trees on the left bank of the river, immediately back of the home of Johanna Liebl; read twice daily, morning and evening, to quarter-tenths, by Miss Johanna Liebl.

CHANNEL AND CONTROL.—Bed of channel at gage heavy gravel; about 200 feet below the gage is a rock outcrop with a 4-foot fall which forms the control and should be permanent. Below the control the river flows in an artificial channel which at one time was a quarry. Left bank above and below the control high and will never overflow; right bank above control of medium height; below control right bank is artificial and of such height that it will rarely overflow.

DISCHARGE MEASUREMENTS.—At low stages made by wading immediately above the gage; at medium and high stages from the lower members of a wooden railroad bridge about 700 feet below the gage; bridge crosses an abandoned quarry, and the channel beneath is artificial and affords a good measuring section.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.6 feet February 24 (discharge, approximately 5,310 second-feet); minimum discharge 92 second-feet, December 18 (recorded by discharge measurement).

1914–15: Maximum stage recorded, 5.6 feet Februrary 24, 1914 (discharge approximately 5,310 second-feet); minimum stage recorded, 0.58 foot August 10 to 15, 17, 18, 20, 21, 1914 (discharge, 58 second-feet).

REGULATION.—Operation of small plants above causes no diurnal fluctuation at the gage.

ACCURACY.—Rating curve well defined; control permanent; no diurnal fluctuation; records excellent.

Discharge measurements of Milwaukee River near Milwaukee, Wis., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	H. C. Beckman	3.22	2,050	Feb. 12[a]	M. F. Rather	2.35	279
Dec. 18[a]	do	1.20	92	Mar. 3	do	2.70	1,540
Jan. 15[a]	G. H. Canfield	1.67	1.28				

[a] Made through complete ice cover

Daily discharge, in second-feet, of Milwaukee River near Milwaukee, Wis., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	142	302				2,140	494	210	820	184	112	100
2	146	302				2,020	379	184	610	184	157	131
3	146	312				1,790	367	210	427	184	176	122
4	112	302				1,460	397	210	367	168	210	112
5	112	302				1,270	494	302	323	112	254	112
			175	105	160							
6	146	302				997	569	302	288	112	302	112
7	146	288				734	650	323	302	122	302	112
8	168	263				864	650	323	427	288	415	112
9	122	254				908	610	427	427	254	494	176
10	302	227				952	650	356	460	254	263	210
11	254	210				1,460	692	302	460	254	227	146
12	288	210				1,680	734	288	397	218	302	288
13	650	210				1,790	734	323	610	184	227	820
14	1,790					2,140	650	210	650	218	184	908
15	1,360					2,260	650	218	650	176	184	1,180
			105	175								
16	2,380				630	1,680	650	312	494	138	168	2 020
17	4,270					1,460	569	323	427	112	168	1,360
18	2,500					1,680	415	356	820	122	168	1,270
19	2,020	175				1,270	379	312	650	146	168	1,180
20	1,570					1,180	379	302	820	157	168	1,090
21	1,220					1,040	323	532	908	112	138	997
22	997				2,630	997	288	650	734	112	122	734
23	820				5,010	952	302	569	777	112	112	650
24	610				5,310	908	273	1,270	650	122	112	494
25	494				4,410	997	254	820	494	112	131	397
			80	190								
26	494	210			3,570	952	254	1,790	415	112	131	427
27	494	240			3,430	820	227	1,790	273	122	112	415
28	356	254			2,760	777	263	2,020	254	131	112	494
29	340	227			.....	650	227	3,570	254	122	122	440
30	312	220			.....	494	218	1,680	218	138	112	356
31	302	.....			.....	494	.....	1,180	.....	112	100	.....

NOTE.—Discharge determined from a rating curve well defined between 57 and 2,380 second-feet; discharge Nov. 14–25 and Nov. 30 to Feb. 21, estimated, because of ice, from discharge measurements, observer's notes, and weather records. Braced figures show mean discharge for period included.

Monthly discharge of Milwaukee River near Milwaukee, Wis., for the year ending Sept. 30, 1915.

[Drainage area, 661 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	4,270	112	808	1.22	1.41	B.
November	312	.....	224	.339	.38	C.
December	.....	.....	119	.180	.21	C.
January	.....	.....	158	.239	.28	C.
February	5,310	.....	1,270	1.92	2.00	C.
March	2,260	494	1,250	1.89	2.18	B.
April	734	218	458	.693	.77	B.
May	3,570	184	699	1.06	1.22	B.
June	908	218	514	.778	.87	B.
July	288	112	158	.239	.28	B.
August	494	100	192	.290	.33	B.
September	2,020	100	566	.856	.96	B.
The year	5,310	.....	530	.802	10.89	

GRAND RIVER AT GRAND RAPIDS, MICH.

LOCATION.—At Fulton Street Bridge, Grand Rapids.

DRAINAGE AREA.—4,900 square miles.

RECORDS AVAILABLE.—March 12, 1901, to September 30, 1915.

GAGE.—Staff, attached to bridge; read daily, morning and evening, to hundredths, by R. De Witt.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

EXTREMES OF STAGE.—Maximum stage recorded during year: 9.6 feet at 2 p. m., February 22; minimum stage recorded, −1.5 feet, August 17.

WINTER FLOW.—Discharge relation somewhat affected by ice.

REGULATION.—Operation of power plants above station may modify low-water flow.

ACCURACY.—The two or three measurements made since 1905 indicate that the rating curve used in 1905 was not applicable after that year.

COOPERATION.—Records furnished by city engineer of Grand Rapids.

No discharge measurements made during the year.

Daily gage height, in feet, of Grand River at Grand Rapids, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−0.98	.....	−1.02	.....	−0.35	6.55	−0.03	−1.00	−1.00	−1.00	.....	−1.10
2	−1.05	−1.00	−1.02	−0.70	− .30	5.52	− .38	.....	−1.00	−1.02	−1.50	−1.10
3	−1.10	− .98	−1.00	.....	− .15	4.50	− .55	−1.10	−1.00	−1.10	−1.35	−1.15
4	.....	− .90	−1.05	− .75	− .05	3.58	.....	−1.10	−1.00	.....	− .95	−1.15
5	−1.00	− .98	−1.02	− .65	− .30	2.80	− .78	−1.00	−1.10	.....	− .45	.....
6	−1.10	− .98	.....	− .55	− .30	1.95	− .60	−1.00	.....	−1.00	− .30	.....
7	−1.10	− .95	−1.05	− .55	.....	.....	− .50	−1.00	−1.20	−1.00	− .85	−1.05
8	−1.10	.....	−1.05	− .45	− .15	1.78	− .52	−1.00	−1.20	− .65	.....	− .55
9	−1.10	−1.10	−1.05	− .55	.55	1.78	− .48	.....	−1.18	− .72	− .88	.65
10	−1.02	−1.10	−1.02	.....	.55	1.50	− .30	−1.00	−1.12	− .58	− .70	1.80
11	.....	−1.10	−1.02	− .45	.70	1.82	.....	−1.00	−1.00	.....	− .90	4.48
12	− .90	−1.18	−1.02	− .52	1.38	2.05	− .15	−1.00	−1.05	− .98	− .90	.....
13	− .85	−1.05	.....	− .55	2.18	2.30	.82	−1.00	.....	.00	−1.00	5.90
14	− .85	−1.05	− .90	− .70	4.15	.....	.95	−1.00	−1.15	− .85	−1.00	6.52
15	− .85	.....	− .45	− .52	5.48	2.30	1.00	−1.00	−1.08	−1.00	.....	6.68
16	− .80	−1.10	− .75	− .60	6.08	2.60	.75	.....	−1.08	−1.00	−1.00	6.68
17	− .70	−1.12	− .75	.....	8.45	2.30	.65	−1.12	−1.05	−1.12	− .45	6.35
18	.....	−1.10	− .70	− .50	8.50	2.15	.....	−1.00	−1.12	.....	− .18	5.60
19	− .42	−1.05	− .60	− .40	8.40	2.00	− .20	−1.05	.....	−1.30	− .10	.....
20	− .22	−1.08	.....	− .30	7.82	1.75	− .05	−1.05	.....	−1.35	− .05	3.50
21	− .35	−1.05	− .30	− .30	.....	.....	− .35	−1.00	.....	−1.30	− .02	2.85
22	− .42	.....	− .40	.00	8.58	1.15	− .55	− .95	.05	−1.30	.....	2.68
23	− .65	−1.15	− .40	.45	8.18	1.12	− .78	.....	.50	−1.30	− .15	2.45
24	− .68	−1.12	− .50	.....	7.98	1.00	−1.00	−1.00	.00	−1.30	− .12	2.35
25	.....	−1.08	.....	.00	7.82	.85	.....	− .95	− .35	.....	− .12	2.00
26	− .85	.....	− .55	− .10	7.88	.55	−1.05	− .80	− .65	−1.42	.05	.....
27	−1.02	−1.00	.....	− .30	7.82	.50	−1.00	− .75	.....	−1.42	− .25	3.50
28	−1.02	−1.02	− .25	− .15	.....	.....	−1.00	− .90	−1.00	−1.40	− .55	3.78
29	−1.02	.....	− .50	− .30	.....	− .15	−1.00	− .90	−1.00	−1.35	.....	3.70
30	−1.02	−1.00	− .50	− .40	.....	− .08	− .95	.....	−1.00	−1.38	− .95	.....
31	−1.00	.....	− .45	.....	.....	− .20	.....	.....	.....	−1.40	−1.10	3.30

NOTE.—Discharge relation probably affected by ice Dec. 15 to Mar. 7.

MANISTEE RIVER NEAR SHERMAN, MICH.

LOCATION.—At North Bridge, 1 mile from Sherman, immediately above mouth of Wheeler Creek.

DRAINAGE AREA.—900 square miles.

RECORDS AVAILABLE.—July 10, 1903, to September 30, 1915.

GAGE.—Standard chain gage; read daily, morning and evening, to hundredths, by Eunice Munn.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year: 4.21 feet at 4.30 p. m., April 12 (discharge, 1,860 second-feet); minimum stage recorded, 1.40 feet at 8.45 a. m., December 16 (discharge, 697 second-feet).

WINTER FLOW.—Stream freezes over and special studies are necessary to determine the winter flow. The constancy of flow during year is remarkable and is due to the fact that the water is derived from springs and ground water. A fairly close estimate of the discharge for the periods during which ice is present can be made by using climatic data and the general records.

ACCURACY.—No discharge measurements were made at this station during the year and the accuracy of discharge estimates published in the following tables depends upon the constancy of the discharge relation subsequent to August 28, 1913, when the last discharge measurement was made and upon the constancy of the length of the gage chain and of the position of the gage.

Daily discharge, in second-feet, of Manistee River near Sherman, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	919	1,030	1,240	.....	.....	1,110	1,110	1,160	955	985	919	852
2	919	993	1,280	.....	.....	1,110	1,070	1,110	955	955	885	852
3	919	1,030	1,280	.....	.....	1,070	1,070	1,110	919	955	993	820
4	919	1,030	1,240	.....	.....	1,030	1,110	1,110	955	993	993	820
5	885	1,030	1,240	.....	.....	993	1,200	1,110	955	1,030	1,160	820
6	885	1,030	1,200	.....	.....	1,030	1,240	1,110	955	1,070	1,200	852
7	885	1,030	1,160	.....	.....	1,030	1,330	1,160	955	1,110	1,200	852
8	955	1,030	1,160	.....	.....	993	1,330	1,110	955	1,110	1,110	885
9	993	1,030	1,110	.....	.....	993	1,420	1,110	955	1,070	1,070	919
10	1,030	1,030	1,030	.....	.....	1,030	1,700	1,110	993	1,030	1,070	919
11	1,030	1,030	993	.....	.....	1,030	1,750	1,070	993	1,030	1,030	955
12	1,030	993	993	.....	1,070	1,030	1,850	1,070	1,030	993	993	993
13	1,030	1,030	955	.....	1,070	1,070	1,850	1,110	1,030	955	955	1,160
14	1,030	1,030	919	.....	1,110	1,070	1,750	1,110	993	955	955	1,110
15	1,030	1,070	820	.....	1,160	1,110	1,700	1,110	993	919	955	1,070
16	1,030	1,160	727	.....	1,160	1,160	1,600	1,110	993	919	955	1,160
17	1,070	1,200	.....	.....	1,160	1,110	1,560	1,070	993	919	919	1,280
18	1,200	1,110	.....	.....	1,110	1,110	1,460	1,070	993	919	955	1,420
19	1,240	1,160	.....	.....	1,110	1,070	1,460	1,070	1,110	885	919	1,370
20	1,240	1,110	.....	.....	1,110	1,070	1,420	1,070	1,070	885	919	1,280
21	1,200	1,110	.....	.....	1,070	1,110	1,420	1,070	1,070	885	885	1,200
22	1,200	1,110	.....	.....	1,110	1,160	1,370	1,070	1,070	885	885	1,110
23	1,110	1,110	.....	.....	1,110	1,160	1,370	1,070	1,030	885	885	1,070
24	1,110	1,110	.....	.....	1,160	1,200	1,330	1,070	993	885	885	1,070
25	1,070	1,110	.....	.....	1,160	1,240	1,280	1,030	955	955	885	1,070
26	1,070	1,160	.....	.....	1,160	1,240	1,330	1,030	955	993	885	1,110
27	1,070	1,240	.....	.....	1,160	1,200	1,280	1,030	955	993	852	1,110
28	1,030	1,240	.....	.....	1,160	1,160	1,240	993	919	993	852	1,110
29	1,030	1,200	.....	.....	.....	1,160	1,200	993	885	955	852	1,110
30	1,030	1,240	.....	.....	.....	1,140	1,200	993	885	955	852	1,070
31	1,030	.....	.....	.....	.....	1,130	.....	955	.....	955	852	.....

NOTE.—Discharge, except as noted below, determined from a rating curve well defined above 900 second-feet; discharge Dec. 17 to Feb. 11 estimated because of ice, as follows, and may be subject to error: Dec. 17–31, 800 second-feet; Jan. 1–31, 900 second-feet; Feb. 1–11, 900 second-feet; Mar. 30 and 31, interpolated.

Monthly discharge of Manistee River near Sherman, Mich., for the year ending Sept. 30, 1915.

[Drainage area, 900 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	1,240	885	1,040	1.16	1.34
November	1,240	993	1,090	1.21	1.35
December	1,280	.....	947	1.05	1.21
January	.....	.....	900	1.00	1.15
February	.....	.....	1,040	1.16	1.21
March	1,240	993	1,100	1.22	1.41
April	1,850	1,070	1,400	1.56	1.74
May	1,160	955	1,080	1.20	1.38
June	1,110	885	982	1.09	1.22
July	1,110	885	965	1.07	1.23
August	1,200	852	959	1.07	1.23
September	1,420	820	1,050	1.17	1.30
The year	1,850	.....	1,040	1.16	15.77

STREAMS TRIBUTARY TO LAKE HURON.

TITTABAWASSEE RIVER AT FREELAND, MICH.

LOCATION.—At highway bridge at Freeland.

DRAINAGE AREA.—2,530 square miles.

RECORDS AVAILABLE.—August 22, 1903, to August 3, 1906; October 28, 1906, to December 31, 1909; January 1, 1912, to September 30, 1915.

COOPERATION.—Estimates of daily discharge were made and furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

Daily discharge, in second-feet, of Tittabawassee River at Freeland, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,116	1,480	1,468	973	1,120	6,000	2,001	2,238	1,536	1,214	1,520	1,074
2	1,134	1,600	1,460	990	1,112	6,000	1,480	2,190	1,480	1,270	1,450	1,080
3	1,110	1,002	1,438	1,004	1,096	6,156	1,450	2,001	1,450	1,316	1,910	1,062
4	1,092	1,600	1,410	1,020	1,102	5,530	2,001	1,865	1,418	1,340	2,245	1,056
5	1,074	1,418	1,410	1,020	1,165	5,275	2,578	1,945	1,390	1,300	2,580	1,056
6	1,086	1,270	1,380	1,044	1,320	6,167	3,055	2,166	1,384	1,270	3,120	1,050
7	1,110	1,182	1,290	1,065	1,665	4,950	3,150	2,400	.....	1,235	3,204	1,050
8	1,122	1,140	1,000	1,083	1,626	4,670	3,285	2,520	.....	1,176	3,159	1,062
9	1,134	1,170	840	1,097	1,655	4,460	3,760	2,578	.....	1,170	2,835	1,080
10	1,116	1,200	435	1,097	1,665	4,250	4,070	2,570	.....	1,158	2,400	1,098
11	1,182	1,249	288	1,105	1,673	4,570	4,350	2,440	.....	1,140	2,400	1,080
12	1,390	1,235	293	1,112	1,760	4,750	6,750	2,238	.....	1,158	2,270	1,600
13	1,410	1,249	306	1,130	1,910	5,275	8,890	2,065	.....	1,170	2,105	2,835
14	1,377	1,384	318	1,150	2,330	5,829	7,886	1,921	.....	1,158	1,993	6,860
15	1,316	1,462	344	1,173	3,692	6,480	6,360	1,753	.....	1,140	1,905	8,040
16	1,263	1,945	372	1,188	4,700	6,700	4,950	1,635	.....	1,140	1,921	7,020
17	1,480	2,920	420	1,206	4,890	6,167	4,250	1,600	.....	1,122	1,945	6,602
18	1,985	3,150	417	1,248	4,500	5,125	3,810	1,600	.....	1,140	1,993	6,360
19	1,841	3,760	415	1,300	4,095	5,000	3,580	1,480	.....	1,140	1,985	5,865
20	1,705	3,240	415	1,432	4,155	4,300	3,285	1,600	2,071	1,122	1,953	5,325
21	1,600	3,380	452	1,470	4,205	3,910	2,965	1,785	2,065	1,110	1,182	4,800
22	1,536	3,570	480	1,522	4,107	3,860	2,496	1,913	2,065	1,110	1,170	4,250
23	1,488	3,240	610	1,534	4,700	3,760	2,570	2,081	1,945	1,110	1,140	3,790
24	1,474	3,055	700	1,500	5,000	3,770	2,594	2,065	1,841	1,110	1,140	3,285
25	1,450	3,015	755	1,482	5,000	3,710	2,570	2,001	1,705	1,110	1,110	3,031
26	1,410	2,965	804	1,455	5,000	3,570	2,520	1,945	1,462	1,100	1,098	2,673
27	1,377	1,985	825	1,432	5,500	3,520	2,400	2,089	1,308	1,080	1,080	2,520
28	1,340	1,520	839	1,357	5,500	3,285	2,440	1,753	1,182	1,100	1,062	2,400
29	1,316	1,300	862	1,300	.....	2,965	2,400	1,705	1,170	1,600	1,080	2,270
30	1,300	1,450	910	1,234	.....	2,700	2,331	1,600	1,176	1,825	1,062	2,081
31	1,249	.....	930	1,112	.....	2,400	.....	1,568	.....	1,560	1,080	.....

Monthly discharge of Tittabawassee River at Freeland, Mich., for the year ending Sept. 30, 1915.

[Drainage area, 2,530 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	1,980	1,070	1,340	0.530	0.61
November	3,760	1,000	2,000	.791	.88
December	1,470	288	771	.305	.35
January	1,530	973	1,220	.482	.56
February	5,500	1,100	3,080	1.22	1.27
March	6,700	2,400	4,680	1.85	2.13
April	8,890	1,450	3,540	1.40	1.56
May	2,580	1,480	1,980	.783	.90
July	1,820	1,080	1,220	.482	.56
August	3,200	1,060	1,840	.727	.84
September	8,040	1,050	3,110	1.23	1.37

NOTE.—Computed by engineers of the United States Geological Survey from records of daily discharge furnished by G. S. Williams, Ann Arbor, Mich.

STREAMS TRIBUTARY TO LAKE ERIE.

HURON RIVER AT DEXTER, MICH.

LOCATION.—At the highway bridge at Dexter, one-fourth mile below mouth of Mill Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 1, 1904, to September 30, 1915.

GAGE.—Standard chain attached to bridge; read daily, morning and evening, to half-tenths; gage reader, D. M. Litchfield.

DISCHARGE MEASUREMENTS.—Made from a boat several hundred feet below gage or from bridge.

CHANNEL AND CONTROL.—The high water that carried out the gage on March 12, 1908, caused permanent change in bed of river; a small headrace runs to an abandoned mill on left bank; at ordinary stages little or no water flows into this headrace but at high stages a small quantity of water may pass through it around the gage.

EXTREMES OF STAGE.—Maximum stage recorded during year: 3.0 feet, at 5 p. m., February 13; minimum stage recorded, −0.1 foot, October 2 to 5, 8, and July 25.

WINTER FLOW.—Little ice forms at this section; current swift.

COOPERATION.—Gage-height record furnished by Eastern Michigan Edison Co., Washtenaw division, Ann Arbor.

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

Daily gage height, in feet, of Huron River at Dexter, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−0.08	0.00	0.00	0.6	1.2	1.6	0.30	0.02	0.30	0.22	0.18	0.28
2	− .10	.00	.12	.5	1.2	1.5	.32	.00	.22	.30	.15	.25
3	− .10	− .02	.12	.8	1.2	1.4	.32	.02	.20	.28	.18	.20
4	− .10	− .02	.05	.65	1.2	1.3	.30	.15	.20	.25	.22	.20
5	− .10	.00	.00	.28	1.2	1.2	.30	.30	.20	.20	.22	.22
6	− .05	.00	.00	.28	1.3	1.2	.28	.28	.10	.20	.20	.42
7	− .08	.00	.00	.42	1.4	.9	.30	.30	.10	.20	.20	.5
8	− .10	.00	.00	.40	1.45	.8	.30	.30	.12	.40	.20	.7
9	− .05	.00	.18	.48	1.6	.8	.32	.35	.10	.40	.20	.7
10	− .02	.00	.18	.48	1.5	.8	.32	.32	.00	.38	.18	.7
11	.20	.00	.12	.42	1.45	.8	.35	.30	.00	.32	.18	.8
12	.12	.00	.15	.42	2.0	.8	.42	.30	.00	.28	.22	1.05
13	.10	.00	.10	.38	2.8	.8	.45	.25	.00	.22	.30	1.2
14	.10	.00	.00	.38	2.8	.8	.42	.18	.02	.22	.32	1.3
15	.10	.00	.28	.38	2.7	.8	.40	.10	.08	.35	.40	1.25
16	.18	.00	.32	.38	2.2	.8	.32	.22	.20	.42	.38	1.15
17	.35	.00	.38	.48	2.2	.7	.30	.28	.32	.35	.40	1.2
18	.40	.00	.38	.48	2.1	.7	.30	.25	.5	.28	.48	1.3
19	.32	.00	.00	.48	2.0	.7	.30	.22	.7	.20	.5	1.5
20	.28	−.02	.00	.5	2.0	.6	.28	.20	.7	.12	.6	1.5
21	.22	−.02	.00	.5	2.0	.6	.25	.22	.6	.05	.7	1.6
22	.20	.00	.38	.6	2.0	.6	.20	.28	.6	−.02	.8	1.5
23	.20	−.08	.45	.95	2.2	.6	.20	.25	.5	−.05	.8	1.5
24	.20	−.08	.65	1.8	2.4	.6	.20	.22	.48	−.08	.75	1.35
25	.20	−.05	.95	1.3	2.2	.6	.20	.22	.38	−.10	.7	1.3
26	.20	.00	1.1	1.0	2.0	.5	.20	.32	.28	−.02	.7	1.3
27	.12	.00	1.45	1.0	2.0	.5	.12	.30	.20	−.08	.6	1.4
28	.10	.00	.75	.95	1.9	.48	.10	.30	.18	.00	.55	1.3
29	.10	.00	.30	1.05	.....	.42	.08	.38	.18	.08	.5	1.3
30	.10	.00	.30	1.15	.....	.40	.00	.42	.15	.15	.48	1.2
31	.10	.....	.45	1.2	.....	.35	.....	.35	.....	.18	.38	.....

HURON RIVER AT BARTON, MICH.

LOCATION.—At dam and power plant of the Eastern Michigan Edison Co. at Barton, near Ann Arbor, 4 miles above the station at Geddes.

DRAINAGE AREA.—723 square miles (reported by G. S. Williams).

RECORDS AVAILABLE.—January 1 to September 30, 1915.

DETERMINATION OF DISCHARGE.—Flow computed from records of operation of power plant, the flow through under-sluices during floods, and the depth of flow over dam. The flow through the power house is determined from a calibration of the turbines by means of a specially constructed weir, the crest of which was formed by a ¼-inch by 5-inch milled plate, the discharge over the weir being computed by Bazin's formula for free overflow. The greater part of the flood water passes through under-sluices in the power-house foundations, and this flow is determined from a weir calibration of the sluices. Water flows over crest of dam only a few days during the year.

COOPERATION.—Estimates of daily discharge made and furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

Daily discharge, in second-feet, of Huron River at Barton, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	274	290	437	243	374	1,286	434	254	344	344	323	441
2	233	298	418	294	383	1,099	430	246	370	420	336	413
3	245	300	371	292	407	1,046	416	270	337	400	359	397
4	226	321	314	323	452	986	422	304	312	405	353	315
5	230	301	188	273	500	905	421	362	353	407	383	421
6	238	288	291	283	499	871	440	339	256	397	338	442
7	233	321	346	336	571	833	452	402	326	312	373	540
8	231	281	347	328	612	773	417	439	280	488	365	534
9	266	330	347	357	621	721	416	446	318	475	357	593
10	280	284	366	355	578	776	432	426	282	460	342	682
11	336	283	339	380	586	798	439	406	257	472	324	697
12	311	289	321	369	823	749	460	406	222	406	364	753
13	325	293	275	356	1,172	765	478	360	241	410	405	863
14	312	272	330	367	1,668	693	492	315	274	330	416	883
15	318	282	203	352	2,052	747	475	300	298	412	482	869
16	352	299	288	369	1,525	723	458	353	338	443	440	860
17	467	297	242	379	1,339	688	455	397	422	420	434	825
18	504	311	261	437	1,352	676	424	376	544	470	466	821
19	451	285	269	423	1,376	613	416	371	666	322	482	911
20	444	217	244	406	1,432	636	396	354	639	310	522	932
21	471	299	270	365	1,412	574	371	375	608	205	558	913
22	449	285	241	356	1,393	613	358	372	573	306	657	919
23	421	268	240	352	1,568	585	371	367	535	200	655	911
24	387	275	234	384	1,699	578	366	379	479	251	642	865
25	398	261	217	391	1,734	555	355	346	464	193	592	896
26	399	242	227	375	1,359	548	348	329	429	222	570	856
27	385	288	228	327	1,239	512	316	367	354	229	565	862
28	322	252	246	351	1,371	507	316	394	330	249	538	891
29	308	308	292	313	.....	483	293	435	351	294	482	921
30	319	331	248	308	.....	455	251	449	337	327	524	711
31	291	.....	285	367	.....	445	.....	458	.....	339	441	.....

Monthly discharge of Huron River at Barton, Mich., for the year ending Sept. 30, 1915.

[Drainage area, 723 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	504	226	336	0.465	0.54
November	331	217	288	.398	.44
December	437	188	288	.398	.46
January	437	243	349	.483	.56
February	2,050	374	1,070	1.48	1.54
March	1,290	445	717	.992	1.14
April	492	251	404	.559	.62
May	458	246	368	.509	.59
June	666	222	385	.533	.59
July	488	193	352	.487	.56
August	657	323	454	.628	.72
September	932	315	731	1.01	1.13
The year	2,050	188	474	.656	8.89

NOTE.—Computed by engineers of the United States Geological Survey from records of daily discharge furnished by G. S. Williams, Ann Arbor, Mich.

HURON RIVER AT GEDDES, MICH.

LOCATION.—At dam and power plant of the Eastern Michigan Edison Co., at Geddes, half a mile above mouth of Fleming Creek.

DRAINAGE AREA.—757 square miles.

RECORDS AVAILABLE.—February 1, 1904, to December 31, 1914, when station was discontinued.

DETERMINATION OF DISCHARGE.—Flow of the river at station computed from records of the operation of the power plant and records of depth of flow over dam. The turbines have not been rated in place and the flow through them is computed from a Holyoke test of the type mounted. The dam is a rock-filled timber-cribbed structure with a broad and somewhat uneven crest. It is subject to leakage which was not feasible of measurement.

ACCURACY.—As the turbines have not been rated in place, and on account of leakage and irregularities in the dam, estimates of flow as computed from the available data may be somewhat in error.

COOPERATION.—Estimates of daily discharge were made and furnished by G. S. Williams, consulting engineer, Ann Arbor, Mich.

Daily discharge, in second-feet, of Huron River at Geddes, Mich., for the period Oct. 1 to Dec. 31, 1914.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	243	409	385	11	400	282	326	21	418	272	260
2	249	314	517	12	327	294	311	22	396	297	246
3	232	302	339	13	410	309	322	23	401	268	299
4	249	314	355	14	329	264	270	24	364	251	249
5	204	374	196	15	394	272	162	25	359	243	250
6	302	272	202	16	445	323	234	26	351	247	284
7	247	296	311	17	501	293	266	27	366	249	247
8	253	302	414	18	514	281	197	28	327	263	315
9	333	314	343	19	476	279	282	29	312	283	333
10	341	283	376	20	442	302	266	30	351	305	315
								31	325	.....	311

Monthly discharge of Huron River at Geddes, Mich., for the period Oct. 1 to Dec. 31, 1914.

[Drainage area, 757 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	514	204	350	0.462	0.53
November	409	243	292	.386	.43
December	517	162	296	.391	.45

NOTE.—Computed by engineers of the United States Geological Survey from records of daily discharge furnished by G. S. Williams, Ann Arbor, Mich.

HURON RIVER AT FLAT ROCK, MICH.

LOCATION.—At the highway bridge at Flat Rock, 2,000 feet below the crossing of Detroit, Toledo & Ironton Railway.

DRAINAGE AREA.—1,000 square miles.

RECORDS AVAILABLE.—August 6, 1904, to September 30, 1915.

GAGE.—Staff; read daily, morning and evening, to tenths, by C. L. Metler.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Probably permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 9.0 feet, at 5 p. m. February 16; minimum stage recorded, 0.9 foot, at 7 a. m. July 29.

WINTER FLOW.—Ice jams form below the station and cause backwater at the gage; in general the section above the station is kept open by the power plant.

REGULATION.—At ordinary stages flow of the river is controlled by a dam and power plant immediately above station, but operation of this plant is assumed to have little effect on diurnal fluctuations of stage.

COOPERATION.—Gage-height record furnished by Eastern Michigan Edison Co., Washtenaw division, Ann Arbor, Mich.

Daily gage height, in feet, of Huron River at Flat Rock, Mich., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.9	2.0	2.1	2.6	3.0	5.55	2.5	1.9	2.7	2.3	1.8	2.75
2	2.0	2.1	2.0	2.7	4.5	5.4	2.5	1.3	2.55	2.05	1.75	2.5
3	1.7	2.2	2.8	3.0	3.75	5.0	2.4	1.25	2.45	2.25	2.4	2.55
4	1.8	2.05	2.55	2.45	3.6	4.75	2.6	2.1	2.35	2.5	2.55	2.45
5	1.8	2.0	2.2	2.85	4.15	4.55	2.25	1.95	2.1	2.5	2.55	2.5
6	1.95	2.05	1.9	2.7	4.7	4.45	2.5	2.15	1.9	2.55	2.45	2.5
7	1.55	2.1	1.45	2.8	5.0	4.35	2.7	2.25	1.45	2.8	2.45	2.65
8	1.55	2.0	2.15	2.75	4.95	4.4	2.6	2.4	2.4	3.35	2.0	3.4
9	1.75	2.0	2.55	2.95	4.95	4.05	2.7	2.5	2.25	2.95	2.0	3.65
10	2.1	2.2	2.45	3.3	4.9	4.1	2.45	2.4	2.05	3.6	2.35	3.6
11	2.4	1.95	2.25	2.8	4.75	4.3	2.5	2.5	1.95	3.1	2.2	3.75
12	2.4	2.05	2.4	3.1	5.3	4.4	2.2	2.5	1.7	2.8	2.75	4.2
13	2.3	2.0	2.3	3.1	6.0	4.1	2.8	2.35	1.0	3.15	2.8	5.25
14	2.35	2.1	1.9	3.1	7.05	3.9	2.8	2.25	1.6	2.6	2.8	5.45
15	2.2	2.0	2.0	3.1	7.85	3.95	2.8	2.2	2.0	2.4	2.7	4.8
16	2.4	2.0	2.4	3.05	8.7	4.0	2.65	2.0	1.75	2.8	2.7	4.7
17	2.7	1.95	2.3	2.9	8.75	3.8	2.75	1.95	2.15	3.15	2.9	4.5
18	2.9	2.1	2.45	3.15	8.08	3.8	2.4	2.75	2.65	2.5	2.65	4.4
19	2.8	2.15	2.5	3.7	7.68	3.6	2.4	2.2	3.4	2.3	2.6	4.5
20	2.85	2.05	2.6	3.75	7.42	3.5	2.4	2.05	3.6	3.1	2.9	4.45
21	2.8	1.75	2.7	3.5	7.15	3.2	2.4	2.35	3.7	2.0	2.95	4.8
22	2.65	1.7	2.55	3.25	6.82	3.5	2.2	2.05	3.4	1.8	.....	4.75
23	2.65	1.8	2.5	3.25	6.65	3.35	2.2	2.3	3.05	1.75	3.6	4.7
24	2.5	2.15	2.35	3.0	6.95	3.3	2.0	2.25	2.9	1.75	3.55	4.75
25	2.5	2.1	2.4	2.9	7.15	3.35	1.9	2.35	2.7	2.0	3.5	4.55
26	2.1	1.9	2.4	3.4	6.8	3.3	1.95	2.4	2.6	1.75	3.05	4.4
27	2.55	1.8	2.4	3.45	5.85	3.2	2.4	2.3	.....	1.85	3.2	4.5
28	2.3	1.8	2.55	3.3	6.1	2.2	2.4	2.2	2.3	1.8	2.95	4.6
29	2.25	1.9	2.5	3.2	.....	2.5	2.4	2.3	2.35	1.3	3.0	4.4
30	2.3	1.9	2.7	3.1	.....	2.75	1.8	2.65	2.3	2.3	2.8	4.3
31	2.15	.....	2.55	3.0	.....	2.7	.....	2.6	.....	2.15	2.9	.....

NOTE.—Discharge relation probably affected by ice during the greater part of the period Dec. 1 to Mar. 31.

CATTARAUGUS CREEK AT VERSAILLES, N. Y.

LOCATION.—On a three-span highway bridge in the village of Versailles, Cattaraugas County, about 6 miles below Gowanda, 2¼ miles above the mouth of Clear Creek (coming in from the right) and about 8 miles above the mouth of the stream.

DRAINAGE AREA.—467 square miles (measured on Post Route Map).

RECORDS AVAILABLE.—September 23, 1910, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Chain fastened to the upstream side of the first span from the right-hand end of the bridge; read twice daily to quarter-tenths by James Palmer.

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

CHANNEL AND CONTROL.—Rock and gravel; occasionally shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.6 feet at 9 a. m. January 7 (discharge, 9,050 second-feet); minimum stage recorded, 4.80 feet from 4 p. m., December 16 to 4 p. m. December 17, and 5 p. m. December 18 (discharge, 90 second-feet).

1910–1915: Maximum stage recorded, 11.6 feet at 5.40 p. m. March 25, 1913 (discharge, approximately 30,000 second-feet); minimum stage recorded, 4.65 feet August 21 and September 6 and 7, 1913 (discharge, 55 fecond-feet).

WINTER FLOW.—Discharge relation affected by ice.

ACCURACY.—Rating curve well defined; estimates as published fairly good.

Discharge measurements of Cattaraugus Creek at Versailles, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 7	C. S. DeGolyer	6.29	1,580	May 22	C. C. Covert	5.54	554
7	do	6.19	1,430	Sept. 1	C. S. DeGolyer	5.15	237

Daily discharge, in second-feet, of Cattaraugus Creek at Versailles, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	108	179	1,180	.....	3,260	760	381	286	207	238	541	238
2	116	179	3,090	.....	1,810	702	402	253	207	1,610	253	207
3	116	179	2,110	.....	1,270	515	402	253	253	2,470	268	207
4	108	235	1,070	.....	820	468	340	304	207	648	790	182
5	108	265	614	.....	760	515	468	402	170	445	568	182
6	116	250	561	.....	915	541	850	340	157	286	322	182
7	116	265	460	8,650	820	541	1,430	304	157	207	253	170
8	155	332	435	2,980	648	492	1,020	1,430	157	1,430	422	157
9	192	392	392	2,720	468	422	1,120	648	157	980	541	170
10	315	332	414	760	468	445	1,120	422	157	648	360	182
11	250	371	371	648	594	445	1,270	340	170	422	268	182
12	206	700	350	594	4,520	402	2,470	286	157	1,050	253	147
13	206	510	280	445	2,240	360	1,200	286	157	492	194	222
14	179	561	250	445	2,360	492	790	253	157	340	322	182
15	145	510	135	468	5,940	594	594	238	222	268	222	157
16	155	435	99	360	2,720	648	568	253	304	422	182	182
17	165	510	90	594	1,520	541	568	268	222	1,610	182	182
18	265	614	.....	1,120	1,020	445	445	304	138	702	182	182
19	435	614	.....	4,190	702	422	445	268	147	515	157	238
20	280	561	.....	1,610	730	422	340	268	207	402	138	268
21	206	535	.....	1,050	915	445	360	268	157	340	147	182
22	179	510	.....	594	1,120	402	322	568	157	286	253	170
23	165	435	.....	594	2,020	422	340	360	157	253	492	182
24	155	485	.....	541	5,210	675	340	322	182	222	304	157
25	155	588	.....	541	3,870	915	340	402	147	194	1,710	147
26	165	640	.....	515	2,020	1,120	304	445	147	194	850	286
27	165	1,420	.....	541	915	568	286	402	138	194	468	980
28	179	1,030	.....	445	760	541	286	322	128	182	322	402
29	165	614	.....	381	.....	541	286	268	110	207	360	286
30	179	510	.....	322	.....	492	268	238	110	207	402	207
31	165	.....	.....	360	.....	402	.....	207	.....	207	304	.....

NOTE.—Discharge relation affected by ice Dec. 18 to Jan. 6, inclusive; new rating curve used from Jan. 7, to Sept. 30, 1915; discharge estimated, because of ice, by comparison with records of flow of streams in adjacent areas as follows: Dec. 18–31, 444 second-feet; Jan. 1–6, 469 second-feet.

Monthly discharge of Cattaraugus Creek at Versailles, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 467 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	435	108	181	0.388	0.45	B.
November	1,420	179	491	1.05	1.17	B.
December	3,090	90	584	1.25	1.44	C.
January	8,650	.....	1,110	2.37	2.73	C.
February	5,940	468	1,800	3.85	4.01	C.
March	1,120	360	539	1.16	1.34	B.
April	2,470	268	645	1.38	1.54	A.
May	1,430	207	362	.775	.89	A.
June	304	110	171	.366	.41	B.
July	2,470	182	570	1.22	1.41	B.
August	1,710	138	388	.831	.96	B.
September	980	147	227	.486	.54	B.
The year	8,650	90	598	1.28	16.89	

STREAMS TRIBUTARY TO LAKE ONTARIO.

LITTLE TONAWANDA CREEK AT LINDEN, N. Y.

LOCATION.—At the stone-arch highway bridge in the village of Linden, Genesee County, 600 feet northeast of Erie Railroad station, and 3 miles above junction with Tonawanda Creek.

DRAINAGE AREA.—22 square miles (measured on topographic maps.)

RECORDS AVAILABLE.—July 8, 1912, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Vertical staff on right-hand upstream abutment of bridge; lower 2 feet of enameled iron graduated to hundredths of a foot; upper 4 feet of bronze graduated to half-tenths; read daily, morning and evening, to half-tenths, by C. L. Schenck.

DISCHARGE MEASUREMENTS.—High-water measurements made from a cable 1,000 feet above weir; low-water measurements made by wading above weir.

CHANNEL AND CONTROL.—A standard Francis weir, 2.01 feet long and 8 inches high, has been constructed under the upstream side of the bridge; when the water overtops this weir it flows over a 2-inch plank about 13 feet long, including the 2 feet of weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet at 5.20 p. m. February 24 (discharge, 452 second-feet); minimum stage recorded, 0.34 foot at 8.30 a. m. and 5.20 p. m. September 25 (discharge, 1.17 second-feet).

1912–1915: Maximum stage recorded, 8.08 feet with the weir in a damaged condition at noon, March 25, 1913 (discharge, 1,300 second-feet); minimum stage recorded, 0.18 foot, August 20 and 21, September 14 to 16, inclusive, and October 8, 1913 (discharge, 0.43 second foot).

ACCURACY.—At gage height 0.69 or below flow is confined to weir; for such stages the accuracy of the data corresponds to that of a properly constructed Francis weir; for stages above gage height 0.69 foot weir has been rated with a current meter and data should also be excellent.

Discharge measurements of Little Tonawanda Creek at Linden, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 7[a]	R. M. Adams	4.35	300	July 14	C. C. Covert	0.845	6.0
7[a]	do	3.94	264	15	do	.828	7.4
May 17	C. S. DeGolyer	.985	11.4				

[a] Made under complete ice cover; ice jammed against bridge abutments 1 foot upstream from crest of weir.

Daily discharge, in second-feet, of Little Tonawanda Creek at Linden, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.87	3.07	12	19	51	28	17	6.6	3.7	9.0	4.1	2.12
2	1.74	2.79	43	16	51	24	20	6.6	3.36	5.1	4.1	1.93
3	1.62	2.79	21	13	41	20	18	6.6	3.28	22	4.9	1.81
4	1.62	2.79	15	14	29	17	16	6.1	3.07	17	10.0	1.74
5	1.51	2.58	11	13	27	15	23	9.0	2.93	14	11.8	1.74
6	1.56	2.51	9.0	13	32	17	59	6.6	2.65	9.7	6.4	1.74
7	1.51	2.45	6.6	274	28	16	55	6.4	2.51	6.9	5.1	1.62
8	1.74	2.65	6.4	79	22	15	47	22	2.45	75	4.6	1.51
9	1.62	3.21	6.9	38	20	14	51	11.1	2.38	35	6.1	1.39
10	2.25	2.93	6.6	24	17	15	47	8.7	2.25	14	4.6	1.39
11	2.12	2.93	6.9	19	18	15	41	6.6	2.25	9.0	3.9	1.34
12	1.87	3.9	5.6	17	261	12	104	6.1	2.12	13	3.6	1.51
13	1.74	3.6	6.1	16	144	12	51	8.4	2.12	9.0	3.6	1.81
14	1.74	4.9	5.3	14	154	16	30	7.2	2.51	7.2	3.21	1.51
15	1.68	4.1	4.6	14	420	22	22	5.6	3.21	6.1	3.14	1.39
16	2.12	6.4	6.1	13	122	25	22	6.1	4.2	5.6	2.79	1.39
17	2 12	5.1	5.9	24	71	16	21	10.7	2.93	5.1	2.51	1.39
18	3.07	3.6	5.9	63	59	14	17	8.4	2.38	4.4	2.25	1.39
19	13	3.9	6.1	135	47	14	14	6.6	2.86	3.9	2.25	1.51
20	6.1	4.2	6.6	67	41	17	13	6.1	3.36	3.9	2.12	1.39
21	4.4	3.9	6.4	43	47	17	10.4	6.6	2.51	3.6	2.38	1.39
22	3.6	3.9	5.6	32	63	15	9.7	19	3.6	7.2	3.6	1.28
23	3.21	3.9	6.6	28	135	17	10.0	10.7	7.2	5.6	3.28	1.28
24	2.93	3.7	6.1	29	360	29	9.7	8.4	5.1	3.9	2.79	1.23
25	2.79	4.2	6.1	21	164	41	8.4	6.6	3.6	3.36	3.6	1.17
26	2.93	11	6.4	19	59	39	7.5	6.6	2.93	15	3.07	2.25
27	3.07	12	6.1	18	43	29	7.2	6.6	2.51	6.1	2.38	5.1
28	2.79	6.1	6.4	17	38	26	7.2	5.6	2.25	7.8	2.25	2.65
29	2.65	6.1	6.6	14	.....	20	7.2	5.1	2.12	8.4	2.79	2.18
30	2.86	6.1	20	13	.....	17	6.4	4.2	32	5.3	2.93	1.74
31	3.21	.....	22	13	.....	19	.....	4.2	.....	4.4	2.51	.....

NOTE.—Discharge relation not affected by ice; discharge below 3.5 second-feet determined by Francis formula; above 3.5 second-feet from a well-defined rating curve. See "Accuracyl n station description"

Monthly discharge of Little Tonawanda Creek at Linden, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 22.0 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	13	1.51	2.81	0.128	0.15	A.
November	12	2.45	4.38	.199	.22	A.
December	43	4.6	9.51	.432	.50	A.
January	274	13	36.5	1.66	1.91	A.
February	420	17	91.6	4.16	4.33	A.
March	41	12	19.8	.900	1.04	A.
April	104	6.4	25.7	1.17	1.30	A.
May	22	4.2	7.91	.360	.42	A.
June	32	2.12	4.01	.182	.20	A.
July	75	3.36	11.1	.505	.58	A.
August	11.8	2.12	3.96	.180	.21	A.
September	5.1	1.17	1.73	.079	.09	A.
The year	420	1.17	17.8	.809	10.95	

GENESEE RIVER AT ST. HELENA, N. Y.

LOCATION.—At the steel highway bridge in the hamlet of St. Helena, Wyoming County, about 6 miles above the mouth of Silver Lake outlet, 9½ miles above Canaseraga Creek and 5½ miles below the village of Portageville and the site of the proposed storage dam of the State of New York Conservation Commission.

DRAINAGE AREA.—1,030 square miles.

RECORDS AVAILABLE.—August 14, 1908, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Gurley water-stage recorder installed August 24, 1911. Prior to this date, a chain, fastened to the upstream side of the bridge, middle span; read daily to hundredths. Datum same for both gages, but slope of water surface makes readings different. Gage heights from water-stage recorder used to hundredths. Gage inspected by Herman Piper.

DISCHARGE MEASUREMENTS.—At high stages made from the bridge; at low and medium stages made either by wading or from the bridge.

CHANNEL AND CONTROL.—Gravel and rocks; occasionally shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.5 feet at 5 p. m. February 15 (discharge, 20,200 second-feet); minimum stage recorded, 1.70 feet from 12 noon to 2 p. m. October 7 (discharge, approximately 25 second-feet).

1908–1915: Maximum stage recorded 12.0 feet at 8 a. m. March 26, 1913 (discharge, approximately 37,800 second-feet); minimum stage recorded, 1.70 feet at 5 p. m. October 5, and 8 a. m., October 17, 1913 (discharge, approximately 18 second-feet).

WINTER FLOW.—Discharge relation usually but slightly affected by ice; determination of winter discharge considered good when frequent discharge measurements are made.

ACCURACY.—Rating curve well defined; conditions for meter measurements good; mean daily gage heights determined from record of water-stage recorder eliminate error from diurnal fluctuations in flow due to operation of mill above the station.

Discharge measurements of Genesee River at St. Helena, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	C. S. De Golyer	2.28	125	Mar. 30	C. S. De Golyer	3.45	848
Dec. 22[a]	R. M. Adams	2.96	409	July 9	do	6.39	6,490
Jan. 8	do	7.01	9,050	14	C. C. Covert	4.00	1,530
8	do	6.52	7,430	17	C. S. De Golyer	6.94	8,880
Feb. 3[b]	do	4.80	2,360				

[a] Partial ice cover. [b] Complete ice cover.

Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	115	108	508	.....	.....	1,870	765	500	285	350	2,490	568
2	110	150	860	.....	.....	1,650	688	522	257	688	2,280	443
3	110	138	1,250	.....	.....	1,190	656	515	238	1,330	2,000	376
4	108	138	850	.....	.....	1,020	592	492	238	2,390	2,350	334
5	104	154	640	.....	.....	960	720	632	206	1,540	2,450	300
6	100	112	515	.....	.....	960	1,280	747	176	1,150	1,240	295
7	61	130	492	19,600	.....	860	3,900	648	183	765	870	295
8	120	120	408	8,550	.....	770	3,220	774	183	2,240	998	290
9	135	173	396	3,710	.....	725	3,900	1,050	170	7,880	1,850	295
10	98	166	402	2,100	.....	558	4,260	756	156	3,290	1,060	260
11	125	180	408	1,650	770	725	4,760	632	130	1,820	680	228
12	144	195	266	1,580	1,190	595	6,250	545	153	5,070	530	215
13	128	260	317	770	4,670	558	3,440	500	122	2,710	464	236
14	106	389	385	860	3,280	638	2,200	437	153	1,480	429	290
15	122	415	280	1,070	18,500	770	1,620	379	133	1,040	356	236
16	128	747	266	860	10,000	960	1,350	450	225	830	350	206
17	115	998	.....	815	4,670	860	1,310	450	210	5,970	402	198
18	112	712	.....	1,440	3,080	738	1,100	595	170	3,220	339	219
19	173	592	.....	4,180	2,180	688	932	450	150	1,560	290	270
20	206	522	.....	3,490	2,020	774	810	398	183	1,240	250	396
21	202	485	.....	2,520	2,020	810	712	362	229	880	245	312
22	188	389	.....	1,510	2,520	712	624	1,070	234	729	3,810	270
23	141	328	.....	.....	4,920	680	568	960	221	729	2,870	250
24	147	317	.....	.....	12,100	1,150	552	680	159	592	1,580	224
25	102	350	.....	.....	14,900	1,600	522	770	173	443	2,920	195
26	154	389	.....	.....	5,450	2,490	485	680	190	382	1,620	219
27	118	1,330	.....	.....	3,280	1,360	436	960	114	2,940	987	471
28	135	932	.....	.....	2,350	1,120	464	638	159	1,150	747	328
29	92	592	.....	.....	.....	1,090	632	485	163	756	783	255
30	141	485	.....	.....	.....	890	568	385	139	860	1,020	215
31	132	.....	.....	.....	.....	810	.....	339	.....	2,130	738	.....

NOTE.—Mean daily gage heights used in the determination of discharge obtained from the records of the water-stage recorder except for the periods Dec. 12 to Mar. 6 and May 14 to July 1, when they were determined from two readings of chain gage each day. Discharge estimated, because of ice, as follows: Dec. 17–31, 471 second-feet; Jan. 1–6, 789 second-feet; Jan. 23–31, 758 second-feet; Feb. 1–10, 1,460 second-feet.

Monthly discharge of Genesee River at St. Helena, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 1,030 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	206	61	128	0.124	0.14	A.
November	1,330	108	400	.388	.43	A.
December	.....	266	491	.477	.55	C.
January	19,600	.....	2,140	2.08	2.40	C.
February	18,500	.....	4,020	3.90	4.06	B.
March	2,490	558	986	.957	1.10	B.
April	6,260	436	1,640	1.59	1.77	A.
May	1,070	339	607	.589	.68	A.
June	285	114	183	.178	.20	B.
July	7,880	350	1,880	1.83	2.11	B.
August	3,810	245	1,260	1.22	1.41	A.
September	568	195	290	.282	.31	A.
The year	19,600	61	1,150	1.12	15.16	

GENESEE RIVER AT JONES BRIDGE, NEAR MOUNT MORRIS, N. Y.

LOCATION.—At highway bridge known as Jones Bridge, about 5 miles below the village of Mount Morris, Livingston County, 6 miles by river above the village of Geneseo, 1½ miles below the inflow of Canaseraga Creek, and about 1¾ miles above the mouth of Beads Creek.

DRAINAGE AREA.—1,410 square miles.

RECORDS AVAILABLE.—May 22, 1903, to April 30, 1906; August 12, 1908, to December 31, 1913; July 12 to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Gurley 7-day water-stage recorder installed September 11, 1915, on the right bank about 60 feet downstream from the bridge. Prior to 1915 a chain gage fastened to upsteam side of highway bridge was used. Datum of water-stage recorder is 2.73 feet higher than that for former chain gage. Gage inspected by T. S. Trewer.

DISCHARGE MEASUREMENTS.—Made from footbridge erected on the outriggers of the bridge.

CHANNEL AND CONTROL.—Sandy clay; likely to shift, but, as shown by measurements, fairly permanent in recent years.

EXTREMES OF DISCHARGE.—1903–1915: Maximum stage recorded, 27.6 feet at 10.30 a. m. March 26, 1913 (discharge, 19,300 second-feet); minimum stage recorded, 2.7 feet at 6 p. m. August 29, 1909 (discharge, approximately 18 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice. Flow determined chiefly by comparison with records of flow of the Genesee at Rochester and at St. Helena.

Discharge measurements of Genesee River at Jones Bridge, near Mount Morris, N. Y., during the year ending Sept. 30, 1915.

[Made by E. D. Burchard.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
July 9	14.95	9,610
July 12	10.06	5,740
July 28	6.81	1,710
August 5	8.86	2,990

Daily discharge, in second-feet, of Genesee River at Jones Bridge, near Mount Morris, N. Y., for the year ending Sept. 30, 1915.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	2,030	755	11	.....	900	353	21	1,000	375	508
2	.....	2,400	657	12	5,600	725	314	22	850	3,070	409
3	.....	1,850	531	13	3,110	608	371	23	850	3,400	386
4	.....	2,270	478	14	1,820	562	386	24	750	1,940	353
5	.....	2,830	437	15	1,280	495	394	25	608	2,420	332
6	.....	1,500	437	16	1,030	474	336	26	508	2,060	287
7	.....	1,000	437	17	4,810	540	311	27	2,800	1,220	478
8	.....	825	405	18	3,750	495	311	28	1,470	900	536
9	.....	2,480	453	19	1,610	433	343	29	900	825	409
10	.....	1,420	413	20	1,360	394	482	30	875	1,280	357
								31	2,450	960	.....

NOTE.—Gage heights, used in determination of above discharge, were obtained as follows: July 12 to Sept. 10, the mean of two observations per day from temporary chain gage; Sept. 11–30 determined from record of water-stage recorder.

Monthly discharge of Genesee River at Jones Bridge near Mount Morris, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 1,410 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	5,600	508	1,870	1.33	0.99	A.
August	3,400	375	1,380	.978	1.13	A.
September	755	287	422	.299	.33	B.

GENESEE RIVER AT ROCHESTER, N. Y.

LOCATION.—At the Elmwood Avenue Bridge, at the north end of South Park, 3½ miles above the center of the city of Rochester, Monroe County, 3½ miles below the mouth of Black Creek, and 7½ miles above the mouth of the river.

DRAINAGE AREA.—2,360 square miles.

RECORDS AVAILABLE.—February 9, 1904, to September 30, 1915. Fragmentary records before this period published in Water-Supply Papers 24, 65, and 97. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Gurley water-stage recorder installed December, 1910, in the pump house immediately below the bridge on the right-hand bank. Prior to December, 1910, a staff gage bolted to the downstream end of the first pier from the right-hand abutment was read once daily. Elevation of zero of gage, 506.848 Barge canal datum and 245.591 Rochester city datum. Datum unchanged since installation of the station. Gage inspected by G. A. Bailey.

DISCHARGE MEASUREMENTS.—Made from bridge to which staff gage is attached; prior to 1904 measurements and elevations of water surface taken in conjunction with the water flowing over and around Johnson-Seymour Dam in the city of Rochester.

CHANNEL AND CONTROL.—Gravel, smooth; considered permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 8.85 feet from 5 p. m. to 6 p. m. February 26 (discharge, 20,000 second-feet); minimum stage from water-stage recorder, 0.97 foot from 10 a. m. to 1 p. m. and 3. p. m., October 3 (discharge, 299 second-feet).

1904–1915: Maximum stage, 15.02 feet during the afternoon of March 28, 1913 (determined by leveling from a flood height marked by gage observer; discharge, approximately 42,000 second-feet); minimum stage, 0.71 foot from 10 p. m. September 30 to 4 a. m. October 1, 1913 (discharge, 154 second-feet).

WINTER FLOW.—Discharge relation affected by ice for short periods, although as a rule the channel is open.

ACCURACY.—Rating curve well defined for all stages; published data considered good for open-water periods.

Discharge measurements of Genesee River at Rochester, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 21	R. M. Adams	1.38	508	Feb. 1	R. M. Adams	1.85	1,020
Jan. 6	do	1.75	1,000	May 19	C. C. Covert		1,060

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	414	370	860	1,650	1,030	6,160	1,730	1,150	768	414	2,260	1,150
2	396	378	1,490	2,460	1,790	4,280	1,650	1,040	705	387	2,820	914
3	313	370	1,070	2,030	3,850	4,080	1,580	984	644	680	2,820	755
4	344	344	846	1,710	5,380	3,280	1,500	1,030	598	1,790	2,460	656
5	336	344	755	1,340	4,460	2,640	1,400	1,030	576	2,820	3,000	587
6	344	320	833	1,040	3,130	2,550	1,380	1,040	564	2,150	3,000	500
7	344	344	1,550	1,320	2,860	2,440	1,710	1,270	521	1,580	1,910	532
8	353	344	1,600	6,420	2,960	2,350	3,870	1,270	521	1,830	1,380	521
9	344	344	1,180	9,240	2,780	2,190	4,500	1,290	470	8,680	1,550	500
10	336	344	820	8,130	2,440	2,070	4,500	1,630	442	8,130	2,730	500
11	396	353	780	5,310	2,020	2,070	4,960	1,360	442	4,280	1,860	510
12	362	362	730	3,570	1,900	1,960	5,550	1,170	423	2,820	1,270	470
13	362	320	668	2,640	4,370	1,760	7,590	1,060	396	5,310	984	470
14	378	353	633	2,370	6,980	1,700	6,160	1,000	362	3,670	846	576
15	387	405	833	1,440	11,000	1,740	3,970	956	414	2,550	742	564
16	414	405	705	1,680	13,600	1,950	2,910	874	414	1,860	668	542
17	405	405	510	1,620	14,700	2,140	2,460	846	442	1,470	633	500
18	387	378	480	1,760	15,100	1,980	2,190	928	480	6,540	610	470
19	387	423	500	2,750	14,400	1,710	1,930	1,080	460	3,970	610	432
20	405	610	470	5,550	9,210	1,600	1,730	1,030	432	2,080	564	414
21	432	768	500	6,670	5,690	1,660	1,530	914	423	1,660	510	564
22	451	1,170	542	5,070	5,170	1,740	1,380	900	451	1,290	510	644
23	442	900	644	3,380	6,260	1,700	1,260	1,470	442	1,100	3,480	564
24	432	768	564	3,000	11,600	1,730	1,170	1,710	460	1,080	3,570	554
25	405	692	554	2,730	17,800	2,350	1,100	1,320	470	1,000	2,280	532
26	344	742	576	2,460	19,800	3,000	1,040	1,290	451	846	3,000	521
27	353	521	554	2,190	17,500	3,670	1,000	1,240	432	794	2,330	470
28	387	521	480	2,190	10,400	3,100	942	1,440	396	2,730	1,490	576
29	396	521	532	2,100	.....	2,300	914	1,210	378	1,810	1,140	718
30	396	490	622	1,630	.....	2,100	1,150	970	396	1,180	1,010	598
31	378	.....	692	1,660	.....	1,900	.....	833	.....	1,200	1,380	.....

NOTE.—Discharge, except as noted below, determined from a rating curve well defined below 12,000 second-feet. Oct. 29–31, estimated; Dec. 19 to Feb. 23, estimated, because of ice, from gage heights, discharge measurements, and climatic records, and may be subject to error.

Monthly discharge of Genesee River at Rochester, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 2,360 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	451	313	381	0.161	0.19	A.
November	1,170	320	487	.206	.23	A.
December	1,600	.....	760	.322	.37	B.
January	.....	.....	3,130	1.33	1.53	B.
February	19,800	.....	7,790	3.30	3.44	B.
March	6,160	1,600	2,450	1.04	1.20	A.
April	7,590	914	2,490	1.06	1.18	A.
May	1,710	833	1,140	.483	.56	A.
June	768	362	479	.203	.23	B.
July	8,680	387	2,510	1.06	1.22	A.
August	3,570	510	1,720	.729	.84	A.
September	1,150	414	577	.244	.27	B.
The year	19,800	313	1,960	.830	11.26	

CANASERAGA CREEK NEAR DANSVILLE, N. Y.

LOCATION.—At the highway bridge 1 mile west of the village of Dansville, Livingston County, about 2,200 feet below the mouth of Mill brook, and about 22 miles above the mouth of the creek.

DRAINAGE AREA.—167 square miles (measured by engineers of State of New York Conservation Commission).

RECORDS AVAILABLE.—July 21, 1910, to December 31, 1912; and July 10 to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Vertical staff, bolted to downstream side of the left abutment; read twice daily by Floyd Harter; datum lowered 4.77 feet on July 10, 1915.

DISCHARGE MEASUREMENTS.—Made from the bridge at high stages and by wading at low stages.

CHANNEL AND CONTROL.—Sand and gravel; likely to shift during high water.

WINTER FLOW.—Discharge relation affected by ice.

Data insufficient for estimates of discharge.

Discharge measurements of Canaseraga Creek near Dansville, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 12	C. C. Covert	5.74	31.1
July 10	E. D. Burchard	6.15	101
Aug. 9	do	6.75	339

Daily discharge, in second-feet, of Canaseraga Creek near Dansville, N. Y., for the year ending Sept. 30, 1915.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	53	65	11	.....	71	44	21	44	37	37
2	.....	62	49	12	.....	101	46	22	62	470	45
3	.....	162	44	13	114	71	35	23	58	216	30
4	.....	216	37	14	71	58	30	24	37	111	27
5	.....	120	37	15	65	58	30	25	30	252	27
6	.....	78	35	16	53	49	33	26	30	135	40
7	.....	65	35	17	505	58	44	27	62	101	44
8	.....	242	35	18	86	49	37	28	49	71	35
9	.....	350	93	19	71	46	65	29	39	176	27
10	101	141	49	20	58	37	46	30	135	129	25
								31	78	101	.....

Monthly discharge of Canaseraga Creek near Dansville, N. Y., for the year ending Sept. 30, 1915.

[Drainage area 167 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	505	30	86.6	0.519	0.37	B.
August	470	37	125	.749	.86	B.
September	93	25	40.5	.243	.27	B.

CANASERAGA CREEK AT GROVELAND STATION, N. Y.

LOCATION.—About 400 feet above the highway bridge at Groveland station, Livingston County. The creek is flowing through the improved channel at this point.

DRAINAGE AREA.—195 square miles (measured by engineers of State of New York Conservation Commission).

RECORDS AVAILABLE.—August 5 to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Sloping staff gage on right bank, graduated from 6.0 to 19.0 feet; read twice daily by E. R. Stoner.

DISCHARGE MEASUREMENTS.—Made from highway bridge at medium and high stages and by wading opposite gage at low stages.

CHANNEL AND CONTROL.—Gravel and clay; likely to shift.

WINTER FLOW.—Discharge relation probably affected by ice.

Data insufficient for estimates of discharge.

The following discharge measurement was made by E. D. Burchard:

July 10, 1915: Gage height, 0.67 foot (distance from reference point to water surface); discharge, 125 second-feet.

Daily gage height, in feet, of Canaseraga Creek at Groveland station, N. Y., for the year ending Sept. 30, 1915.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	7.00	11	7.44	6.74	21	6.82	6.75
2	.....	6.88	12	7.18	6.72	22	10.40	6.71
3	.....	6.85	13	7.12	6.81	23	8.32	6.66
4	.....	6.82	14	7.02	6.72	24	7.58	6.64
5	7.46	6.86	15	6.96	6.66	25	7.77	6.62
6	7.20	6.86	16	6.90	6.66	26	7.43	6.68
7	6.98	6.78	17	6.98	6.68	27	7.18	6.82
8	8.18	6.71	18	6.94	6.66	28	7.07	6.74
9	9.58	7.09	19	6.84	6.92	29	7.65	6.70
10	7.82	6.82	20	6.78	6.84	30	7.35	6.65
						31	7.09	.....

CANASERAGA CREEK AT SHAKERS CROSSING, N. Y.

LOCATION.—At highway bridge at Shakers Crossing, about a mile above mouth and 1½ miles northeast of Mount Morris, Livingston County.

DRAINAGE AREA.—347 square miles (measured by engineers of State of New York Conservation Commission).

RECORDS AVAILABLE.—Occasional discharge measurements 1904–1915; continuous record July 13 to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Gurley seven-day water-stage recorder on the left bank just below the bridge; auxiliary staff gage was installed at this gage, graduated from about 7.4 to 29.2 feet; datum of gage same as that for gage established on Genesee River at Jones Bridge near Mount Morris, July 12, 1915. Gage inspected by Mrs. William Russell.

DISCHARGE MEASUREMENTS.—Made from the highway bridge during medium and high stages and by wading during low stages.

CHANNEL AND CONTROL.—Firm gravel not likely to shift; subject to backwater from Genesee River.

WINTER FLOW.—Discharge relation probably affected by ice.

Data insufficient for estimates of discharge.

Discharge measurements of Canaseraga Creek at Shakers Crossing, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 9	O. W. Hartwell	18.27	732
14	E. D. Burchard	9.83	325

Daily gage height, in feet, of Canaseraga Creek at Shakers Crossing, N. Y., for the year ending Sept. 30, 1915.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	10.26	9.10	11	.....	9.51	8.95	21	9.18	9.09	9.21
2	.....	10.05	9.06	12	.....	9.36	8.77	22	9.19	11.22	9.18
3	.....	9.62	9.01	13	11.91	9.42	9.02	23	9.34	11.52	9.13
4	.....	10.58	9.05	14	10.01	9.36	9.15	24	9.22	9.95	9.12
5	.....	10.56	8.78	15	9.40	9.16	9.11	25	8.88	10.52	9.17
6	.....	9.58	8.89	16	9.35	9.20	9.05	26	9.18	10.01	8.86
7	.....	9.30	8.93	17	11.53	9.22	8.97	27	10.01	9.37	9.28
8	.....	9.06	8.90	18	12.06	9.34	9.09	28	9.42	9.18	9.32
9	.....	11.68	9.05	19	9.97	9.20	8.86	29	9.26	9.11	9.21
10	.....	10.03	9.01	20	9.30	9.18	9.20	30	9.23	9.41	9.19
								31	10.34	9.25	.....

NOTE.—Gage height July 13 to Aug. 23 is mean of two readings a day on temporary staff gage; gage height Aug. 24 to Sept. 30, determined by integrating record of water-stage recorder.

KESHEQUA CREEK NEAR SONYEA, N. Y.

LOCATION.—About 400 feet above the Delaware, Lackawanna & Western Railroad bridge and half a mile below gaging station formerly maintained at Sonyea, Livingston County.

DRAINAGE AREA.—74 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 22, 1910, to December 31, 1912, at station at Sonyea; August 29 to September 30, 1915, at present station.

GAGE.—Staff in two sections; sloping section graduated from 3.0 to 6.0 feet; vertical section, graduated from 6.0 to 17.0 feet; read twice daily by Fred Mott.

DISCHARGE MEASUREMENTS.—Made from footbridge at gage at high stages and by wading at low stages.

CHANNEL AND CONTROL.—Gravel; probably fairly permanent.

WINTER FLOW.—Discharge relation probably affected by ice.

Data insufficient for estimates of discharge.

The following discharge measurement was made by E. D. Burchard:

July 10, 1915: Gage height, 4.55 feet; discharge, 36.8 second-feet.

Daily discharge, in second-feet, of Keshequa Creek near Sonyea, N. Y., for the year ending Sept. 30, 1915.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	6.6	11	.....	3.0	21	.....	4.5
2	.....	4.5	12	.....	6.6	22	.....	4.5
3	.....	4.5	13	.....	4.5	23	.....	4.5
4	.....	3.0	14	.....	6.6	24	.....	3.0
5	.....	1.5	15	.....	6.6	25	.....	1.5
6	.....	3.0	16	.....	1.5	26	.....	4.5
7	.....	4.5	17	.....	1.5	27	.....	4.5
8	.....	1.5	18	.....	1.5	28	.....	6.6
9	.....	3.0	19	.....	3.0	29	6.6	1.5
10	.....	8.7	20	.....	8.7	30	8.7	3.0
						31	6.6	.....

Monthly discharge of Keshequa Creek, near Sonyea, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 74 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
September	8.7	1.5	4.08	0.055	0.06	C.

CANADICE OUTLET NEAR HEMLOCK, N. Y.

LOCATION.—In outlet at foot of Canadice Lake, Livingston County. The outlet flows into Genesee River through Hemlock Lake outlet and Honeoye Creek.

DRAINAGE AREA.—12.6 square miles of which 1.0 square mile is lake surface.

RECORDS AVAILABLE.—April, 1903, to September 30, 1915. Records published also in reports of New York State engineer and surveyor, State of New York Conservation Commission, and city engineer of Rochester.

GAGE.—Hook gage in channel above weir.

CHANNEL AND CONTROL.—Outflow is measured over a standard thin-edged weir with a 5-foot crest and two end contractions; so arranged with needle timbers at the ends that the length may be increased to 14.96 feet. No end contractions during high water. The weir crest stands 3.14 feet above the stream channel which is artificial with plank bottom and vertical sides. The crest is never submerged by backwater. Two additional rectangular gates, each a foot square, with three complete contractions and a fourth partial contraction at the bottom, afford by-passes during low water. Depth of water on weir is read each morning to hundredths of a foot, and each change of the gates is also noted. Corrections are made for velocity of approach for the higher stages and discharge is computed by the Francis formula.

WINTER FLOW.—Discharge relation not affected by ice as the pool above the weir is free from ice throughout the winter.

DIVERSION.—No water is diverted from Canadice Lake above the station.

REGULATION.—Outflow of lake is regulated by bulkhead and gates at dam above weir.

ACCURACY.—Observations and computations are made with care and the results should be very good.

COOPERATION.—Data collected and furnished for publication by the city engineer of Rochester.

Monthly discharge of Canadice Outlet near Hemlock, N. Y., for the year ending Sept. 30, 1915.

Month.	Mean discharge in second-feet.	Mean elevation of lake above low-water mark in feet.	Month.	Mean discharge in second-feet.	Mean elevation of lake above low-water mark in feet.
October	4.576	2.115	May	7.494	2.609
November	5.940	1.601	June	6.256	2.313
December	6.644	1.288	July	5.979	2.276
January	17.916	1.705	August	5.393	1.933
February	31.633	2.475	September	5.387	1.493
March	25.792	1.566			
April	8.119	1.752	The year	10.927	1.927

NOTE.—Terminal water surface for year was 1.06 feet lower than for the previous year, corresponding to a draft on storage of 31,881,900 cubic feet or a discharge of 1.011 second-feet for the year.

OWASCO OUTLET NEAR AUBURN, N. Y.

LOCATION.—On the farm of George Ridley, 3¾ miles below the State dam at the outlet of Owasco Lake, 2 miles below the center of the city of Auburn, Cayuga County.

DRAINAGE AREA.—206 square miles (measured on topographic maps).

RECORDS AVAILABLE.—November 17, 1912, to September 30, 1915.

GAGE.—Gurley water-stage recorder installed over a concrete well connected with the river by a 4-inch cast-iron pipe.

DISCHARGE MEASUREMENTS.—Made by wading directly opposite the gage in low water and from a cable and car at the same section in high water.

CHANNEL AND CONTROL.—Control is formed by a low concrete weir a short distance below the gage; crest of weir is 1 foot wide and the slopes of both upstream and downstream faces are ½:1; a small horizontal apron, built on a level with bed of stream, extends downstream 2½ feet from toe of dam. Mean elevation of the left-hand end of the dam for a distance of 50 feet is gage height 1.28 feet; the remaining 50 feet of the crest of the dam is at gage height 2.12 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.63 feet at 4 p. m. February 26 (discharge, 1,260 second-feet); minimum stage from water-stage recorder: 1.44 feet from 8 to 9 p. m. December 7 and at 7 p. m. December 14 (discharge, 7.8 second-feet).

1912–1915: Maximum stage, 4.6 feet during period March 25–30, 1913 (determined by leveling from flood marks; discharge, 2,750 second-feet); minimum stage from water-stage recorder, 1.41 feet at 1 a. m. October 15, 1913 (discharge, 5.6 second-feet).

WINTER FLOW.—Discharge relation not affected by ice except during extremely cold weather.

DIVERSIONS.—An average flow of about 10 second-feet is pumped from Owasco Lake for the municipal water supply of the city of Auburn. Proportion returning to stream above the gaging station not known.

Discharge measurements of Owasco Outlet near Auburn, N. Y., during the year ending Sept. 30, 1915.

[Made by O. W. Hartwell.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 20	2.60	349
July 6	2.55	322

Daily discharge, in second-feet, of Owasco Outlet near Auburn, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	192	60.0	117	84.0	475	1,010	182	172	167	127	132	251
2	183	150	117	81.4	475	954	181	167	154	148	156	248
3	201	158	118	91.0	480	871	171	189	153	150	198	248
4	69.6	149	107	114	473	821	174	159	159	126	252	203
5	170	160	108	83.3	447	833	180	175	170	179	291	136
6	149	157	111	57.2	490	693	177	170	105	265	322	142
7	148	153	117	157	468	617	165	171	190	330	336	158
8	159	59.9	124	158	401	524	174	176	170	350	338	166
9	175	142	121	206	234	444	170	191	147	340	405	269
10	158	143	115	314	250	417	167	247	196	320	481	154
11	126	153	117	316	235	447	163	238	192	299	505	142
12	179	113	108	315	256	467	184	219	178	326	528	128
13	166	133	112	383	236	437	212	180	162	480	517	565
14	161	149	125	390	241	339	275	165	179	577	460	602
15	167	57.3	99.0	373	570	334	276	158	182	561	438	645
16	152	128	106	421	843	301	277	158	154	535	399	580
17	162	134	108	408	869	334	269	167	117	447	383	573
18	86.2	144	111	430	820	306	245	163	119	325	370	595
19	167	151	93.5	486	700	269	245	162	124	361	310	542
20	162	135	104	520	620	259	201	160	79.3	352	275	520
21	153	127	107	558	590	232	172	165	145	308	283	513
22	148	127	110	558	605	288	164	176	139	252	286	471
23	141	135	100	539	625	324	166	192	124	255	294	456
24	137	132	96.0	465	861	312	171	219	125	258	316	420
25	68.5	136	86.1	536	1,080	255	172	227	129	191	318	331
26	143	119	118	522	1,170	179	176	224	125	178	304	318
27	149	132	116	502	1,160	183	177	219	76.4	146	300	323
28	140	118	80.8	491	1,060	168	176	218	122	154	286	431
29	137	118	84.3	492	.....	184	176	216	137	133	293	429
30	152	127	98.5	504	.....	179	175	205	137	145	296	411
31	169	.....	105	491	.....	184	.....	178	.....	154	292	.....

NOTE.—Discharge is mean of 24 hourly determination for each day; discharge Feb. 18–21, estimated.

Monthly discharge of Owasco Outlet near Auburn, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 206 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	201	a 68.5	151	0.733	0.85	A.
November	160	a 57.3	130	.631	.70	A.
December	125	80.8	108	.524	.60	A.
January	558	57.2	356	1.73	1.99	A.
February	1,170	234	598	2.90	3.02	A.
March	1,010	a 168	425	2.06	2.38	A.
April	277	a 163	194	.942	1.05	A.
May	247	a 158	188	.913	1.05	A.
June	196	a 76.4	145	.704	.78	A.
July	577	a 126	283	1.37	1.58	A.
August	528	a 132	334	1.62	1.87	A.
September	645	a 128	366	1.78	1.99	A.
The year	1,170	57.2	271	1.32	17.86	A.

a Sunday.

NOTE.—Figures indicate the flow as regulated at the State dam and mills in Auburn.

ORWELL BROOK NEAR ALTMAR, N. Y.

LOCATION.—At highway bridge 1½ miles by road northwest of Altmar, Oswego County, and one-eighth mile above confluence of Orwell Brook with Salmon River.

DRAINAGE AREA.—22.1 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 23, 1911, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Standard chain, attached to downstream side of bridge; read twice daily by Mrs. A. G. White.

DISCHARGE MEASUREMENTS.—Made by wading at low stages; from bridge at high stages.

CHANNEL AND CONTROL.—Composed of small stone and gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.7 feet at 4.30 p. m. January 7, probably affected by backwater from ice; maximum discharge probably represented by gage height 4.55 feet at 8.30 a. m. February 25 (discharge, 400 second-feet); minimum stage recorded, 1.75 feet July 24 and 25, August 1, 2, 3, 15, 16, 20, and 21, September 2–8, 12, and 17–25 (discharge, 8 second-feet).

1911–1915: Maximum stage recorded, 5.5 feet at 6 p. m. April 7, 1912 (discharge, 610 second-feet); minimum stage recorded, 1.65 feet August 6, 7, 14, 22, 23, and 24, and September 5, 1911 (discharge, 5 second-feet).

WINTER FLOW.—Discharge relation probably affected by ice.

ACCURACY.—Rating curve well defined; estimates good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Orwell Brook near Altmar, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	13	15	173	.....	91	47	34	13	9	8	9
2	11	20	307	.....	66	47	38	13	9	8	8
3	9	17	173	.....	61	47	34	12	12	8	8
4	9	17	108	.....	56	42	30	11	24	13	8
5	9	22	91	.....	52	42	26	11	20	11	8
6	9	22	76	.....	47	68	23	11	23	13	8
7	9	17	66	.....	47	81	23	13	23	17	8
8	9	17	56	.....	47	91	38	13	30	14	11
9	9	23	47	.....	47	126	38	11	26	13	13
10	12	17	38	.....	47	173	34	11	16	11	11
11	13	23	30	.....	47	269	30	13	15	11	9
12	13	23	30	.....	42	327	26	13	13	11	8
13	11	30	30	.....	38	269	26	11	11	9	15
14	9	30	.....	.....	34	215	23	11	11	9	14
15	9	38	.....	.....	30	116	23	23	9	8	11
16	11	76	.....	.....	30	91	26	29	10	8	9
17	24	52	.....	.....	34	72	23	18	13	9	8
18	18	47	.....	.....	38	66	20	13	11	9	8
19	15	52	.....	.....	38	66	23	14	11	9	8
20	15	47	.....	.....	38	61	23	17	11	8	8
21	13	52	.....	.....	38	56	23	15	11	12	8
22	13	47	.....	.....	38	52	32	13	9	30	8
23	11	40	.....	.....	40	47	23	11	9	36	8
24	11	42	.....	241	47	47	20	11	8	24	8
25	11	47	.....	368	47	42	17	11	8	18	8
26	11	52	.....	198	56	38	17	11	13	13	26
27	11	72	.....	149	56	38	15	9	11	11	18
28	11	78	.....	112	52	34	15	9	11	11	15
29	14	66	.....	.....	52	34	13	9	9	9	13
30	16	56	.....	.....	47	34	13	12	9	9	11
31	15	.....	.....	.....	47	.....	13	.....	9	9	.....

NOTE.—Discharge relation affected by ice from Dec. 14, to Feb. 23. Discharge, Dec. 14–31, estimated by comparison with record of flow of near-by streams, at 32.2 second-feet.

Monthly discharge of Orwell Brook near Altmar, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 22.1 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	24	9	12.1	0.548	0.63	A.
November	78	15	38.6	1.75	1.95	A.
December	307	.....	58.2	2.63	3.03	C.
February	368	.....	.....	.....	.....	
March	91	30	46.8	2.12	2.44	A.
April	327	34	91.3	4.13	4.61	A.
May	38	13	24.6	1.11	1.28	A.
June	29	9	13.1	.593	.66	B.
July	30	8	13.4	.606	.70	B.
August	36	8	12.5	.565	.65	B.
September	26	8	10.4	.471	.53	B.
The year	368	8	.....	.....	.....	

BLACK RIVER NEAR BOONVILLE, N. Y.

LOCATION.—At highway bridge, about 2 miles northeast of Boonville, Oneida County, 2 miles by river downstream from Hawkinsville, and about 1 mile above the mouth of Sugar River, a small tributary from the left.

DRAINAGE AREA.—303 square miles (measured on topographic maps).

RECORDS AVAILABLE.—February 16, 1911, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Standard chain fastened to the downstream side of the bridge; staff gage (graduated from 6 to 13 feet) fastened to the downstream right-hand abutment, is used for high-water readings; read twice daily by W. D. Charbonneau.

DISCHARGE MEASUREMENTS.—At high stages, made from a cable about half a mile above the gage; at low stages, by wading at a section near the cable.

CHANNEL AND CONTROL.—Rough and full of bowlders; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.96 feet at 4 p. m. April 12 (discharge, 4,090 second-feet); minimum stage recorded, 3.0 feet at 8 a. m. October 8 (discharge, 27 second-feet),

1911–1915: Maximum stage recorded, approximately 12.5 feet during the night of March 28, 1913 (determined by leveling from flood mark); discharge, approximately 10,000 second-feet); minimum stage recorded, 3.0 feet at 8 a. m. September 29 and November 8, 1913, and October 8, 1914 (discharge, 27 second-feet).

WINTER FLOW.—Discharge relation affected by ice. Flow determined by frequent discharge measurements and climatic records.

REGULATION AND DIVERSION.—The State dam at Forestport, about 8 miles upstream, provides a storage reservoir with a capacity of about 2,000,000,000 cubic feet. Water is diverted from this reservoir during the navigation season through the Forestport feeder flowing west to a basin in Boonville. The Black River Canal flows north from this basin, entering the Black River at the foot of Lyon Falls. A spillway from the basin overflows into Mill Creek, a tributary of Black River. Water flowing through these two channels returns to the river below the gaging station, thus passing around it. The Black River Canal also flows south from Boonville, passing out of the Black River drainage basin and entering the

summit level of the Erie Canal at Rome. Occasional discharge measurements are made at three points to indicate the distribution of the diverted water. The water entering Boonville through the Forestport feeder is measured at the highway bridge near Sperry Hill, about a mile northeast of Boonville. The water flowing north from the basin through the Black River Canal is measured at the highway bridge just below the lock into this canal near the railroad stations. The water flowing south from the basin has been measured at a private farm bridge about 1 mile southeast of Boonville, and during September, 1915, two water-stage recorders were installed on this canal to obtain a continuous record of the flow. This is published as a separate station, Black River Canal (flowing south), near Boonville, N. Y.

ACCURACY.—Rating curve well defined; estimates as published good.

Discharge measurements of Black River near Boonville, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	C. S. De Golyer	3.55	69.0	Mar. 17	E. D. Burchard	4.83	348
22	do	3.55	71.3	June 14	do	3.32	50.9

Discharge measurements of Forestport feeder at Boonville, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	C. S. De Golyer	[a] 0.77	272	July 30	O. W. Hartwell	1.86	251
June 15	E. D. Burchard	.....	231	Aug. 30	do	1.94	250
29	O. W. Hartwell	1.82	278	Sept. 17	do	1.91	255
July 25	C. C. Covert	1.82	285				

[a] Distance from reference point to water surface.

NOTE.—Gage height of measurements indicates elevation of water surface at measuring section above datum of gages installed October, 1915.

Discharge measurements of Black River canal flowing north near Boonville, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
Oct. 23	C. S. De Golyer	4.30	32.0
June 30	O. W. Hartwell	4.19	46.4

[a] Distance from reference point to water surface.

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	50	53	558	.....	490	1,140	238	1,060	111	335	59	290
2	49	62	1,140	.....	490	1,060	262	1,210	90	275	46	250
3	38	53	1,060	.....	558	1,060	262	1,210	84	370	59	194
4	42	60	1,140	.....	558	1,060	275	1,140	84	795	49	127
5	38	72	795	.....	630	855	305	1,060	97	795	39	97
6	36	97	630	.....	735	680	410	990	97	795	48	78
7	31	90	490	.....	680	605	680	920	90	1,140	63	55
8	28	97	535	.....	630	580	1,060	920	70	1,540	78	50
9	36	90	470	1,740	630	535	1,210	795	70	1,840	84	53
10	42	97	370	1,370	630	558	1,940	630	59	1,460	90	60
11	38	84	250	1,210	605	535	2,860	580	50	1,140	78	51
12	40	90	305	990	535	535	3,880	512	60	855	70	49
13	49	84	335	795	490	390	3,880	410	47	558	63	59
14	53	97	290	735	512	305	3,880	430	46	370	72	49
15	49	90	238	795	580	370	3,880	390	54	335	72	44
16	44	97	.....	735	920	352	3,620	290	49	275	78	46
17	59	145	.....	535	855	305	3,240	262	56	305	97	40
18	84	535	.....	580	680	320	2,500	320	63	275	111	37
19	111	470	.....	735	630	305	1,640	305	63	290	90	42
20	119	410	.....	680	680	305	1,540	410	59	262	111	46
21	111	370	.....	605	680	320	1,540	370	56	238	174	53
22	72	305	.....	680	680	352	1,370	352	42	205	275	52
23	52	84	.....	735	795	335	1,140	370	46	174	370	50
24	53	84	.....	630	1,210	335	795	335	40	127	735	59
25	60	795	.....	630	3,490	290	680	290	46	97	680	54
26	53	680	.....	605	3,360	335	680	305	55	104	605	65
27	55	535	.....	630	1,640	370	630	335	63	90	558	127
28	53	490	.....	680	1,540	290	795	352	57	66	490	184
29	59	535	.....	630	.....	320	920	320	56	60	390	238
30	49	512	.....	558	.....	320	920	275	84	70	390	227
31	51	.....	.....	490	.....	250	.....	262	.....	72	352	.....

NOTE.—Discharge estimated, because of ice, as follows: Dec. 16–31, 257 second-feet; Jan. 1–8, 485 second feet. Figures in the above table do not include diversions through the Forestport Feeder into Black River canal flowing south. See "Regulation and diversion" in station description.

Monthly discharge of Black River near Boonville, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 303 square miles.]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	119	28	55.0	B.
November	795	53	242	B.
December	1,140	.....	410	D.
January	1,740	.....	698	C.
February	3,490	490	925	B.
March	1,140	250	496	A.
April	3,880	238	1,570	A.
May	1,210	262	562	A.
June	111	40	64.8	B.
July	1,840	60	494	A.
August	735	39	209	A.
September	290	37	94.2	A.
The year	3,880	28	481	

NOTE.—See "Regulation and diversion" in station description.

BLACK RIVER CANAL (FLOWING SOUTH) NEAR BOONVILLE, N. Y.

LOCATION.—At summit level of Black River Canal near Boonville.

RECORDS AVAILABLE.—Occasional discharge measurements, 1900 and 1905 to 1915, published under Black River near Boonville, N. Y.; continuous record, September 16 to 30, 1915.

GAGES.—Two seven-day Gurley water-stage recorders with natural scale for gage heights. The float wells are 1½ by 2 feet inside dimensions, the bottoms of which are about 1½ feet below the normal elevation of water surface in the canal. They are 1.81 miles apart.

Gage No. 1 is on the right bank (opposite tow path) about 50 feet downstream from the collector's office in Boonville, N. Y.

Gage No.-2 is on the right bank (opposite tow path), about 300 yards above lock 70, and about 50 yards above the spillway from the canal into Lansingkill.

DISCHARGE MEASUREMENTS.—Made from a private farm bridge about 1 mile below the village of Boonville and about one-half mile below gage No. 1.

REGULATION.—Flow in the canal is regulated by the operation of the spillway and sluice gates at lock 70, and also by the discharge of Forestport Feeder into the basin at Boonville.

WINTER FLOW.—The water is drawn out of the canal during the frozen season.

Discharge measurements of Black River canal (flowing south) near Boonville, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	C. S. De Golyer	[a] 0.91	204	July 30	O. W. Hartwell	1.42	209
June 15	E. D. Burchard	.....	153	Aug. 30	.....do.....	1.38	193
29	O. W. Hartwell	1.49	205	Sept. 18	.....do.....	1.37	213
July 25	C. C. Covert	1.47	220	18	.....do.....	1.34	202

[a] Distance from reference point to water surface.

NOTE.—Gage height corresponding to measurements indicates elevation of water surface at measuring section above datum of gage installed September, 1915.

Daily discharge, in second-feet, of Black River Canal (flowing south) near Boonville, N. Y., for the year ending Sept. 30, 1915.

Day.	Sept.	Day.	Sept.	Day.	Sept.
18	200	23	183	28	186
19	198	24	178	29	192
20	195	25	169	30	196
21	187	26	176		
22	184	27	186		

MOOSE RIVER AT MOOSE RIVER, N. Y.

LOCATION.—In the village of Moose River, Lewis County, about 3 miles downstream from McKeever station on the Adirondack division of the New York Central & Hudson River Railroad, 5 miles below the mouth of South Branch of Moose River, and nearly 20 miles above the junction of Black and Moose rivers at Lyons Falls.

DRAINAGE AREA.—370 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 5, 1900, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Staff, in two sections, fastened to the left bank a short distance above cable; read twice daily by Chris Hannan. Gage datum lowered 0.17 foot on February 28, 1903, and again 5.00 feet on January 1, 1913.

DISCHARGE MEASUREMENTS.—Made from a cable a short distance below gage.

CHANNEL AND CONTROL.—Composed of cobble and boulders; fairly permanent; current smooth; depth comparatively uniform. Just above the station is a small island on which ice and log jams occasionally form. Velocity from dam at McKeever to the station relatively slow; below the station velocity very high.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.1 feet at 5 p. m. April 12 (discharge, 5,470 second-feet); minimum stage recorded, 4.9 feet at 8 a. m. December 20 (discharge, 37 second-feet).

1900–1915: Maximum stage 16.3 feet during afternoon of March 27, 1913 (determined by leveling from flood marks); discharge, approximately 15,500 second-feet); minimum stage recorded, 4.94 feet, July 21, 23, 25, 26, and 27, 1913 (discharge, 42 second-feet).

WINTER FLOW.—Discharge relation affected by ice.

REGULATION.—A timber dam at McKeever is used for power and for the regulation of flow for log driving. During portions of the year, therefore, two gage readings a day may not give a representative mean. Seasonal distribution of flow affected by operation of State dam at Old Forge.

ACCURACY.—Open-channel rating curve fairly accurate and published data considered good.

Discharge measurements of Moose River at Moose River, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 29	R. M. Adams	6.43	407	Jan. 25[a]	C. S. De Golyer	7.59	661
30	do	7.06	682	Feb. 15[a]	do	7.88	722
Dec. 16[a]	do	6.77	361	Mar. 16[a]	E. D. Burchard	7.18	471
Jan. 5[a]	C. S. De Golyer	7.60	597	Apr. 8	do	6.46	399
23[a]	do	8.09	990	8	do	6.23	346
24[a]	do	6.24	175	June 14	do	6.35	392

[a] Partial ice cover.

Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for the year ending Sept. 30, 1915.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	316	126	855	710	476	1,150	393	1,150	362	316	126	442
2	301	331	1,360	625	442	1,080	545	1,940	346	625	346	346
3	362	409	2,120	426	545	855	393	1,360	316	585	316	346
4	124	377	1,590	585	545	805	103	1,150	316	377	377	316
5	257	476	1,290	585	545	805	442	910	229	545	377	141
6	301	393	805	625	545	805	409	910	151	545	377	316
7	301	377	910	855	442	625	442	710	243	585	346	286
8	301	229	710	2,030	755	625	442	910	176	710	164	286
9	316	301	.....	1,510	710	625	585	625	257	1,850	346	331
10	229	362	.....	910	710	625	1,020	910	229	1,290	393	346
11	76	362	.....	910	665	545	3,060	665	202	805	545	316
12	164	316	.....	855	625	476	5,320	625	202	710	442	121
13	476	301	.....	625	625	510	3,500	585	58	585	426	316
14	442	272	.....	545	665	476	2,660	510	442	755	476	316
15	393	257	.....	585	805	476	2,390	585	377	910	189	301
16	409	665	334	545	1,150	476	2,300	510	545	585	316	301
17	545	1,590	301	121	1,360	476	2,300	442	805	510	346	286
18	83	1,510	272	710	1,150	476	2,300	510	665	362	393	257
19	426	1,150	316	1,150	1,020	426	2,120	545	710	625	377	99
20	910	855	44	1,940	855	426	2,570	476	585	510	286	257
21	545	665	426	1,590	625	.....	2,300	409	585	585	346	257
22	393	393	393	1,150	625	.....	2,300	409	545	442	229	272
23	625	346	426	910	625	.....	1,850	331	409	442	3,060	229
24	393	362	409	710	910	.....	1,360	409	409	346	1,940	301
25	164	393	50	665	2,570	.....	1,020	362	409	148	1,290	377
26	393	409	331	665	2,300	.....	1,050	393	393	442	1,020	476
27	442	625	189	625	2,030	.....	1,290	393	176	510	855	442
28	362	1,020	409	545	1,150	.....	910	393	377	442	710	510
29	316	476	346	545	.....	.....	1,020	442	346	442	442	442
30	377	665	286	426	.....	.....	1,150	331	331	331	510	442
31	257	.....	493	243	.....	.....	.....	409	.....	316	476	.....

NOTE.—Discharge relation affected by ice from about Dec. 9 to Mar. 31, inclusive; estimates subject to error; discharge, Dec. 9–15, estimated at 315 second-feet, and Mar. 21–31, 327 second-feet.

Monthly discharge of Moose River at Moose River, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 370 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	910	[a] 76	355	0.959	1.11	B.
November	1,590	[a] 126	534	1.44	1.61	B.
December	2,120	.....	544	1.47	1.69	C.
January	2,030	[a] 121	804	2.17	2.50	B.
February	2,570	[a] 442	910	2.46	2.56	B.
March	1,150	.....	528	1.43	1.65	C.
April	5,320	[a] 103	1,590	4.30	4.80	B.
May	1,940	[a] 331	655	1.77	2.04	B.
June	805	[a] 58	373	1.01	1.13	B.
July	1,850	[a] 148	588	1.59	1.83	B.
August	3,060	[a] 126	576	1.56	1.80	B.
September	510	[a] 99	316	.854	.95	B.
The year	5,320	[a] 58	645	1.74	23.67	

[a] Sunday.

NOTE.—Table shows flow as regulated in Fulton chain lakes at the Old Forge dam.

MIDDLE BRANCH OF MOOSE RIVER AT OLD FORGE, N. Y.

LOCATION.—About 300 feet below the highway bridge in Old Forge, Herkimer County, and about 400 feet below the dam.

DRAINAGE AREA.—51.5 square miles (measured on topographic maps).

RECORDS AVAILABLE.—November 9, 1911, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Vertical staff on left bank 300 feet below highway bridge; read twice daily by Jacob Edick.

DISCHARGE MEASUREMENTS.—Made by wading at low and medium stages and from the highway bridge at high stages.

CHANNEL AND CONTROL.—Rock ledge about 200 feet below the gage; channel fairly straight and uniform from dam to this point.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.9 feet at 5 p. m. October 9 (discharge, 274 second-feet); minimum stage occurs when gates at dam are closed, discharge being due to leakage and discharge through the fish hatchery; minimum gage height during the past year, 0.29 foot (discharge, 1.9 second-feet).

1911–1915: Maximum stage recorded, 6.3 feet (back water from Moose River) on March 28, 1913; discharge computed from records at dam, 760 second-feet.

WINTER FLOW.—Discharge relation not affected by ice.

REGULATION.—Flow controlled at the dam.

ACCURACY.—Rating curve well defined; estimates good.

Discharge measurements of Middle Branch of Moose River at Old Forge, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 27	R. M. Adams	0.32	2.0	Apr. 10	E. D. Burchard	1.92	113
Apr. 8	E. D. Burchard	1.08	31.2	10	do	2.22	153
9	do	.82	17.5	21	O. W. Hartwell	2.13	142
9	do	.30	2.2	June 12	E. D. Burchard	.55	5.0
9	do	1.30	46.2	12	do	1.87	104
9	do	1.68	84.4	12	do	2.41	184
9	do	1.92	111	12	do	2.60	213
9	do	2.11	133	12	do	2.74	238
10	do	.70	66.9	12	do	2.86	261
10	do	.57	12.0	13	do	1.46	59.7
10	do	1.50	6.9				

Daily discharge, in second-feet, of Middle Branch of Moose River at Old Forge, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	158	173	2.0	232	10	181	223	9.6	62	62	59	110
2	158	181	2.1	232	10	181	206	34	62	62	33	104
3	158	173	2.1	232	10	181	206	116	62	62	33	104
4	158	165	4.1	223	11	181	206	123	62	62	33	56
5	158	165	4.8	223	11	173	116	150	24	62	33	56
6	158	70	5.0	223	80	173	55	150	5	65	33	56
7	158	10	5.0	116	206	173	42	143	5	65	33	56
8	158	10	5.0	6.5	206	173	1.9	104	5	92	34	58
9	214	10	3.2	6.5	206	173	2.0	70	5	123	34	58
10	265	10	2.0	6.5	197	173	2.0	62	5	123	36	58
11	260	10	2.0	6.5	197	158	2.1	65	5	123	38	58
12	255	10	2.0	6.5	197	98	2.0	60	40	116	60	58
13	250	10	2.0	6.5	197	98	2.0	60	3.6	116	59	58
14	250	10	2.2	6.5	189	98	2.0	62	3.6	116	59	58
15	250	10	2.2	6.5	189	98	2.0	62	45	116	59	57
16	250	10	2.2	6.5	189	98	2.0	62	158	86	59	58
17	250	4.3	2.2	6.8	189	98	2.0	62	197	64	60	33
18	250	2.0	2.2	8.0	189	98	2.0	62	223	63	58	33
19	250	2.0	2.2	9.6	189	98	2.0	62	223	86	58	32
20	250	2.0	2.2	12	189	98	2.0	62	223	110	57	32
21	250	2.0	2.2	14	189	98	2.0	62	104	110	58	32
22	241	2.0	2.2	8.8	181	92	2.0	61	61	110	60	86
23	232	2.0	2.2	8.8	181	92	2.0	62	62	110	189	165
24	232	2.0	2.2	8.8	181	92	2.0	62	62	104	250	158
25	223	2.0	2.2	9.6	181	65	2.0	62	62	104	250	158
26	214	2.0	2.2	10	181	52	2.0	62	62	104	250	158
27	214	2.0	2.2	10	181	52	2.0	62	62	104	250	158
28	197	2.0	2.2	10	181	52	2.0	62	62	80	197	158
29	197	2.0	32	10	.....	52	2.0	62	62	60	150	158
30	197	2.0	197	10	.....	52	2.0	62	62	60	150	158
31	197	.....	232	10	.....	86	.....	62	.....	59	123	.....

NOTE.—Discharge rating changed Oct. 10–12; discharge computed from records at Old Forge dam; new rating curve used after Oct. 13. Discharge computed from records at Old Forge for the following periods: Nov. 18–27, because water surface was below gage (gage extended downward on Nov. 28); Apr. 12–30 and June 5–11 because discharge relation was affected by backwater from dam at McKeever.

Monthly discharge of Middle Branch of Moose River at Old Forge, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 51.5 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	265	158	215	4.17	4.81	A.
November	181	2.0	35.2	.683	.76	C.
December	232	2.0	17.3	.336	.39	C.
January	232	6.5	54.4	1.06	1.22	C.
February	206	10	154	2.99	3.11	B.
March	181	52	116	2.25	2.59	A.
April	223	1.9	36.7	.713	.80	C.
May	150	9.6	73.0	1.42	1.64	A.
June	223	3.6	69.3	1.35	1.51	B.
July	123	59	89.5	1.74	2.01	A.
August	250	33	92.1	1.79	2.06	A.
September	165	32	86.1	1.67	1.86	A.
The year	265	1.9	86.3	1.67	22.76	

NOTE.—Table shows flow as regulated at Old Forge dam.

STREAMS TRIBUTARY TO ST. LAWRENCE RIVER.

EAST BRANCH OF OSWEGATCHIE RIVER AT NEWTON FALLS, N. Y.

LOCATION.—600 feet below the lower dam of the Newton Falls Paper Co. in the village of Newton Falls, St. Lawrence County; 4 miles above the mouth of the Little River and 10 miles below outlet of Cranberry Lake.

DRAINAGE AREA.—166 square miles (measured by engineers of the State of New York Conservation Commission).

RECORDS AVAILABLE.—October 6, 1912, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New Conservation Commission.

GAGE.—Vertical staff gage read twice daily by C. H. Corp.

DISCHARGE MEASUREMENTS.—Made by wading at low stages and from a cable 30 feet above the gage during high water.

CHANNEL AND CONTROL.—Bottom consists of small bowlders and gravel covered with waste from the pulp mill.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.9 feet at 7.15 a. m., April 12 (discharge, 900 second-feet); minimum stage is reached every Sunday during a large part of the year, when the paper mill is shut down; gage height, 0.0 (discharge, 22 second-feet, represents leakage).

1912–1915: Maximum stage recorded, 6.1 feet at 5.15 p. m. March 28, 1913 (discharge, approximately 2,000 second-feet).

WINTER FLOW.—Effect of ice on discharge relation is diminished by the disturbance of the water at the paper mill.

REGULATION.—The dams of the paper mill cause some daily fluctuation, probably not enough to affect the accuracy of the records. Seasonal flow is largely controlled by dam at Cranberry Lake.

ACCURACY.—Rating curve well defined for ordinary stages; no high-water measurements yet made; estimates good.

Discharge measurements of East Branch of Oswegatchie River at Newton Falls, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 19	R. M. Adams	2.19	377	Mar. 19	E. D. Burchard	1.20	173
Feb. 6	C. S. De Golyer	2.23	345	19	do	1.25	186
Mar. 18	E. D. Burchard	.94	114	July 25	O. W. Hartwell	1.30	177

Daily discharge, in second-feet, of East Branch of Oswegatchie River at Newton Falls, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	304	81	402	304	402	350	205	262	262	262	75	376
2	304	196	402	304	376	376	282	75	223	262	171	326
3	304	304	460	148	326	376	282	188	223	180	262	304
4	81	304	580	262	304	376	99	282	223	49	262	304
5	188	304	490	350	304	350	242	282	223	28	262	81
6	304	304	304	326	350	350	304	282	58	171	304	188
7	304	196	402	350	155	155	304	282	70	262	326	304
8	304	28	402	350	282	262	262	282	205	262	155	304
9	304	223	402	402	350	304	304	75	262	262	350	304
10	304	304	402	350	304	304	350	188	180	262	460	304
11	81	304	402	402	304	304	550	262	22	70	402	304
12	188	304	402	376	304	350	820	262	22	171	402	75
13	304	304	93	376	304	376	610	242	126	242	376	188
14	304	304	223	376	148	163	402	171	242	242	376	304
15	304	81	350	376	326	242	376	171	242	242	223	304
16	304	205	376	376	402	262	430	52	242	262	350	304
17	304	326	376	223	376	262	376	180	242	242	376	282
18	99	326	376	430	350	112	350	282	242	64	376	282
19	350	326	350	490	350	155	350	282	242	171	326	70
20	350	350	87	460	350	223	304	196	70	262	304	188
21	350	376	223	402	196	133	282	196	112	262	304	304
22	376	93	350	376	402	188	262	282	223	262	81	304
23	376	205	350	376	430	223	282	75	282	262	350	282
24	402	326	223	304	376	223	282	188	262	262	460	282
25	148	326	99	430	376	223	75	282	262	155	402	282
26	376	326	99	376	376	205	188	304	133	262	402	81
27	350	350	99	376	376	205	282	304	39	262	376	205
28	304	350	262	376	188	205	262	282	22	262	350	304
29	304	87	376	376	.....	205	262	196	155	262	180	304
30	304	242	376	350	.....	205	262	50	242	262	304	282
31	304	.....	326	262	.....	205	.....	155	.....	262	376	.....

NOTE.—Discharge determined from mean daily gage height computed from two observations daily, weighted according to the time of changing wheels and gates at the paper mill. Discharge relation not seriously affected by ice.

Monthly discharge of East Branch of Oswegatchie River at Newton Falls, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 166 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	402	a 81	287	1.73	1.99	A.
November	376	a 28	258	1.55	1.73	A.
December	580	a 87	325	1.96	2.26	A.
January	490	a 148	356	2.14	2.47	A.
February	430	a 148	325	1.96	2.04	A.
March	376	112	254	1.53	1.76	A.
April	820	a 75	321	1.93	2.15	A.
May	304	a 50	213	1.28	1.48	A.
June	282	22	178	1.07	1.19	A.
July	262	28	218	1.31	1.51	A.
August	460	a 75	314	1.89	2.18	A.
September	376	a 70	258	1.55	1.73	A.
The year	820	22	275	1.66	22.49	

a Sunday.

NOTE.—Table shows run-off as regulated at Cranberry Lake and by the paper mills at Newton Falls.

OSWEGATCHIE RIVER NEAR OGDENSBURG, N. Y.

LOCATION.—At the steel highway bridge known locally as Eel Weir Bridge, about 1 mile below the mouth of the outlet of Black Lake and 5½ miles above city of Ogdensburg, St. Lawrence County, and mouth of river.

DRAINAGE AREA.—1,580 square miles.

RECORDS AVAILABLE.—April 22, 1903, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Chain, fastened to the upstream side of the bridge; read twice daily by J. H. La Rue.

DISCHARGE MEASUREMENTS.—Usually made from the bridge.

CHANNEL AND CONTROL.—Channel permanent; rock and partly artificial, the rock having been removed underneath the bridge by blasting to increase the bridge opening.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.5 feet at 8 a. m. March 1 (discharge, 6,650 second-feet); minimum stage recorded, 4.5 feet at 8 a. m. and 5 p. m. October 6, and from 8 a. m. June 9 to 5 p. m. June 10 (discharge, 295 second-feet).

1903–1915: Maximum stage recorded 9.9 feet on March 31, 1913 (discharge, 18,000 second-feet; minimum stage recorded, 4.5 feet from 8 a. m. June 9 to 5 p. m. June 10, 1915 (discharge, 295 second-feet).

WINTER FLOW.—Discharge relation not affected by ice.

REGULATION.—Two dams in the vicinity of the gage; one at Heuvelton, about 5 miles above, and one at Rensselaer Falls, 10 miles above.

ACCURACY.—Rating curve fairly well developed; open-water curve used throughout the year.

Discharge measurements of Oswegatchie River near Ogdensburg, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 17	C. S. De Golyer	4.60	456
Feb. 8	....do	5.44	1,600
July 27	C. C. Covert	5.03	930

Daily discharge, in second-feet, of Oswegatchie River near Ogdensburg, N. Y., for the year ending Sept. 30, 1915.

Date.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	478	920	1,380	750	2,200	6,360	2,100	1,360	560	620	890	2,310
2	590	718	1,480	886	2,100	6,080	2,000	1,530	478	620	1,040	2,100
3	590	590	1,480	1,200	2,100	5,520	1,710	1,360	500	620	1,040	1,900
4	562	590	1,580	1,290	2,000	4,980	1,800	1,360	500	620	1,200	1,800
5	450	520	1,670	1,100	1,800	4,460	2,100	1,440	500	1,040	1,200	1,620
6	330	562	2,280	1,100	1,710	3,700	2,100	1,360	500	685	1,200	1,360
7	450	562	2,280	1,580	1,620	3,700	2,000	1,280	500	560	1,280	1,360
8	520	562	2,280	2,810	1,530	3,460	1,900	1,360	445	596	1,360	1,360
9	520	562	1,290	3,600	1,530	3,220	2,420	1,710	343	685	1,200	1,200
10	478	590	2,180	4,100	1,620	2,750	2,750	1,280	295	750	1,200	1,200
11	886	750	2,070	4,360	1,710	2,100	3,220	965	390	820	1,360	1,120
12	590	670	1,970	4,620	1,710	2,100	4,200	890	390	820	1,280	965
13	590	1,010	1,670	4,360	1,710	2,100	3,950	890	478	890	1,530	1,040
14	426	670	1,670	4,360	1,710	2,000	4,720	890	390	750	1,530	1,040
15	450	670	1,480	4,100	2,100	1,710	5,250	890	412	820	1,530	890
16	450	1,380	1,380	3,840	2,980	1,530	5,800	820	500	890	1,360	890
17	450	1,200	1,290	3,600	4,200	1,530	5,520	820	500	890	1,360	890
18	1,200	835	1,290	3,140	5,250	1,530	5,250	750	560	890	1,280	890
19	478	1,010	1,100	3,600	5,250	1,530	4,720	820	685	1,040	1,280	820
20	520	1,100	956	4,100	5,250	1,360	4,200	750	620	1,040	1,280	750
21	520	1,010	920	4,620	4,980	1,360	3,950	685	596	1,040	1,280	750
22	478	1,100	1,100	4,620	4,720	1,360	3,700	890	620	1,040	1,440	750
23	520	1,100	956	4,620	4,460	1,360	3,700	750	620	1,040	1,900	646
24	562	1,100	920	4,720	4,200	1,360	3,220	685	778	1,040	2,310	620
25	718	1,200	920	4,200	4,720	1,440	2,980	620	750	890	2,980	620
26	784	1,100	920	4,200	5,250	1,800	2,640	500	646	890	3,220	620
27	750	1,010	835	3,700	5,800	2,000	2,310	524	620	890	2,980	524
28	1,010	1,100	835	3,220	6,080	2,200	2,000	620	724	890	2,980	560
29	590	1,100	835	2,980	.....	2,100	1,800	685	724	890	2,980	560
30	622	1,290	835	2,750	.....	2,310	1,360	620	724	890	2,640	560
31	750	.....	750	2,530	.....	2,100	.....	596	.....	890	2,420	.....

NOTE.—Discharge relation probably not affected by ice; new rating curve used Jan. 24 to Sept. 30.

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 1,580 square miles.]

Month	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,200	330	591	0.374	0.43	C.
November	1,380	520	886	.561	.62	C.
December	2,280	750	1,370	.867	1.00	C.
January	4,720	750	3,250	2.06	2.38	B.
February	6,080	1,530	3,220	2.04	2.12	B.
March	6,360	1,360	2,620	1.67	1.92	B.
April	5,800	1,360	3,180	2.01	2.24	B.
May	1,710	500	958	.606	.70	B.
June	778	295	545	.345	.38	C.
July	1,040	560	840	.532	.61	C.
August	3,220	890	1,690	1.07	1.23	B.
September	2,310	524	1,060	.671	.75	B.
The year	6,360	295	1,670	1.06	14.38	

NOTE.—Table shows run-off as regulated at Cranberry Lake and by numerous mills above the station.

RAQUETTE RIVER AT PIERCEFIELD, N. Y.

LOCATION.—Half a mile below dam of International Paper Co. at Piercefield, St. Lawrence County, and about three-fourths of a mile above head of Black Rapids.

DRAINAGE AREA.—723 square miles (all but 16 square miles measured on topographic maps).

RECORDS AVAILABLE.—August 20, 1908, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Water-stage recorder in a galvanized sheet-iron house over a concrete well connected with the river by a 4-inch, cast-iron pipe. Prior to January 1, 1913; the following gages were used: August 20, 1908, to September 3, 1910, vertical staff fastened to a large pine stump; September 4 to December 31, 1910, chain gage fastened to same stump and having the same datum. January 1, 1911, datum of chain gage was lowered 2 feet; water-stage recorder was set at this datum. Water-stage recorder inspected by Frank Bedard.

DISCHARGE MEASUREMENTS.—Made from a cable just above Black Rapids.

CHANNEL AND CONTROL.—Channel opposite gage is a deep pond with no perceptible velocity; control of pond is at head of Black Rapids.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 8.73 feet at 7 p. m. April 21 (discharge, 3,760 second-feet); minimum stage from water-stage recorder, 1.63 feet from 3 to 4 p. m. October 25 (discharge, 59 second-feet).

1908–1915: Maximum stage from water-stage recorder, 11.68 feet at 3 a. m. April 1, 1913 (discharge, 7,100 second-feet); minimum stage from water-stage recorder, 0.85 foot at 11 a. m. September 2, 1913 (discharge, approximately 10 second-feet).

WINTER FLOW.—Rapids that form control rarely freeze, and measurements made when ice was present indicate that the discharge relation is little if any affected by ice.

REGULATION.—Low-water flow controlled by dam of International Paper Co. Numerous lakes in the upper part of the drainage basin afford considerable storage, most of which is controlled.

ACCURACY.—Rating curve well defined. Estimates very good, fluctuation due to regulation being ascertained by water-stage recorder.

Discharge measurements of Raquette River at Piercefield, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	C. S. De Golyer	4.18	520	Dec. 16	C. S. De Golyer	5.64	1,240
Nov. 8	do	2.11	77.5	Feb. 11	do	5.48	1,080
15	do	2.40	121	Mar. 20	E. D. Burchard	5.49	1,020
15	do	2.30	127				

Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	504	80	791	845	1,040	1,240	729	2,990	1,200	584	500	778
2	522	202	806	822	1,040	1,320	530	2,740	1,100	573	780	893
3	500	365	956	309	1,060	1,260	732	3,060	1,000	572	780	1,120
4	212	350	975	508	1,070	1,230	349	3,010	854	210	771	968
5	316	398	1,010	842	1,070	1,230	580	2,920	723	118	767	283
6	486	382	624	764	1,090	1,250	821	2,780	243	487	759	311
7	436	378	1,010	846	651	1,020	656	2,820	368	573	897	790
8	364	204	1,090	866	1,040	1,350	512	2,780	512	594	378	931
9	330	334	1,060	856	1,090	1,370	648	2,400	533	590	523	756
10	348	422	1,060	428	1,070	1,350	798	2,700	426	572	762	756
11	179	396	1,070	780	1,000	1,360	592	2,750	317	209	714	862
12	239	386	1,030	872	846	1,300	1,330	2,640	322	409	748	477
13	334	379	598	855	1,000	1,030	1,700	2,510	175	639	715	505
14	345	396	936	844	527	785	2,100	2,400	242	925	850	733
15	340	199	1,050	984	947	1,220	2,440	2,260	424	1,060	364	775
16	180	285	1,040	1,080	971	1,280	2,610	1,840	510	1,040	484	750
17	164	416	1,110	624	859	1,280	2,830	2,120	520	1,070	576	754
18	121	413	1,030	954	866	1,120	2,960	1,920	521	558	654	786
19	262	410	1,030	1,110	878	1,040	3,440	1,860	524	905	682	436
20	447	444	792	1,110	902	950	3,600	1,800	238	1,000	686	486
21	454	698	796	1,060	400	360	3,590	1,680	325	974	668	779
22	470	318	1,070	743	764	849	3,610	1,600	502	965	253	765
23	494	526	1,030	1,220	815	1,020	3,590	1,120	502	811	511	758
24	210	718	815	738	983	866	3,510	1,500	511	952	734	728
25	68	700	375	1,200	1,110	842	3,230	1,490	506	418	716	696
26	262	693	400	1,340	1,200	856	3,400	1,470	485	885	727	296
27	450	771	450	1,330	1,310	999	3,280	1,500	238	967	721	400
28	480	651	988	1,290	710	421	3,170	1,410	368	974	837	564
29	453	235	943	1,170	.....	593	3,140	1,340	606	976	419	547
30	386	561	866	750	.....	852	3,000	456	580	955	495	530
31	308	.....	883	1,000	.....	858	.....	1,050	.....	920	772	.....

NOTE.—Discharge, Oct. 1 to Feb. 11, determined by discharge integration and from Feb. 12 to Sept. 30 from the average of hourly discharge. Discharge Dec. 26, 27, Jan. 30, 31, Feb. 1, 2, July 30, 31, Aug. 1–3, and Sept. 28–30. estimated from study of hydrograph.

Monthly discharge of Raquette River at Piercefield, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 723 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	522	[a] 68	344	0.476	0.55
November	771	[a] 80	424	0.586	0.65
December	1,110	375	893	1.24	1.43
January	1,340	[a] 309	908	1.26	1.45
February	1,310	[a] 527	939	1.30	1.35
March	1,370	[a] 360	1,050	1.45	1.67
April	3,610	[a] 349	2,120	2.93	3.27
May	3,060	[a] 456	2,090	2.89	3.33
June	1,200	[a] 175	512	0.708	0.79
July	1,070	118	725	1.00	1.15
August	897	[a] 253	653	0.903	1.04
September	1,120	[a] 283	674	0.932	1.04
The year	3,610	[a] 68	945	1.31	17.72

[a] Sunday.

NOTE.—Table shows run-off as regulated at the paper milldam.

RAQUETTE RIVER AT MASSENA SPRINGS, N. Y.

LOCATION.—At concrete highway bridge at Massena Springs, St. Lawrence County, 8 miles below Raymondville and 10 miles above the mouth of the stream.

DRAINAGE AREA.—1,200 square miles (measured by engineers of State of New York Conservation Commission; probably more accurate than area given in previous reports).

RECORDS AVAILABLE.—September 21 to October 17, 1903, and April 9, 1904, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Chain gage attached to concrete highway bridge February 2, 1912. Original gage was a vertical staff fastened to a stone wall on the left bank about 50 feet upstream from the present bridge. On August 16, 1906, it was replaced by a standard chain gage, fastened to an old highway bridge just above the present bridge. The datum of the chain gage was set 1.00 foot lower than that of the staff gage to avoid negative gage readings. The present chain gage was reset at such a datum that readings should be comparable with those at the former location. Gage read twice daily by Vivian McDonald.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed of river, coarse gravel and small boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.02 feet at 8.30 a. m. April 13 (discharge, 5,270 second-feet); minimum stage recorded, 0.6 foot at 11 a. m. October 26 (discharge, approximately 115 second-feet).

1903–1915: Maximum stage recorded, 14.2 feet, between 9 and 11 a. m. March 31 1913 (discharge, 16,500 second-feet); minimum stage recorded, 0.8 foot at 8.30 a. m. September 21, 1913 (discharge, approximately 50 second-feet).

WINTER FLOW.—Discharge relation affected by ice; gage observations suspended during period when ice is present.

REGULATION.—The operation of a number of power plants above station has marked effect on the low-water discharge of the stream. These plants are usually run for 24-hour power, but are closed on Sundays. The effect of this closing on the flow is noticeable for several days.

ACCURACY.—Discharge estimates for low-water periods may be considerably in error as a result of regulation of flow.

Discharge measurements of Raquette River at Massena Springs, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 16	C. S. De Golyer	1.78	436
July 28	O. W. Hartwell	3.17	1,350

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	630	325	785	.....	2,760	3,160	920	660	1,520	920
2	990	245	1,280	.....	3,060	3,470	785	990	1,680	720
3	385	785	785	.....	1,520	3,680	1,210	1,210	1,600	690
4	308	572	850	.....	2,290	3,360	920	405	1,600	630
5	450	720	1,060	.....	1,850	3,470	920	472	1,360	850
6	920	450	.....	.....	2,020	2,860	290	920	1,360	660
7	572	325	.....	.....	2,960	3,160	1,060	1,060	1,360	1,440
8	920	600	.....	.....	3,360	3,360	660	1,210	1,210	920
9	630	155	.....	.....	2,660	3,260	450	920	1,520	720
10	1,600	920	.....	.....	3,260	2,860	345	660	1,760	660
11	990	290	.....	.....	1,680	3,680	545	545	1,680	752
12	520	785	.....	.....	4,250	3,160	385	1,140	1,210	920
13	630	365	.....	.....	4,140	2,760	205	850	1,060	785
14	428	520	.....	.....	4,980	3,160	920	1,060	1,520	720
15	365	660	.....	.....	4,020	2,480	1,440	1,210	1,440	850
16	545	1,140	.....	.....	4,490	2,480	1,440	850	1,210	920
17	405	785	.....	.....	3,800	3,160	1,280	1,140	1,440	1,060
18	385	990	.....	.....	3,360	3,360	1,140	1,060	1,440	1,440
19	345	850	.....	.....	4,140	3,360	920	1,280	1,680	1,060
20	365	1,060	.....	.....	4,490	2,110	920	2,480	1,680	920
21	345	990	.....	.....	4,140	3,260	785	2,020	1,440	920
22	365	785	.....	.....	4,370	2,960	920	2,020	1,440	785
23	660	600	.....	.....	4,250	2,860	920	1,850	1,520	1,060
24	450	600	.....	.....	4,250	3,160	850	1,680	1,680	920
25	990	1,520	.....	.....	3,800	3,160	1,210	1,940	1,680	1,140
26	308	920	.....	.....	3,800	2,570	450	2,110	1,600	1,680
27	630	660	.....	.....	2,860	2,960	850	1,850	1,440	1,060
28	785	850	.....	2,570	3,260	1,940	690	1,940	1,760	920
29	405	572	.....	2,290	3,470	1,600	920	1,520	1,440	850
30	495	325	.....	1,760	3,680	1,360	1,280	1,210	1,600	1,140
31	545	.....	.....	1,760	.....	1,940	.....	1,360	1,210	.....

NOTE.—Discharge for low stages may be somewhat in error because of diurnal fluctuation in stage caused by mills above the station. Discharge relation affected by ice Dec. 6 to Mar. 27; no gage-height record Dec. 27 to Mar. 27; discharge, Dec. 6-31, estimated at 1,480 second-feet.

Monthly discharge of Raquette River at Massena Springs, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 1,200 square miles.[a]]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,600	308	592	0.493	0.57	C.
November	1,520	155	679	.566	.63	C.
December	.....	.....	1,390	1.16	1.34	D.
April	4,980	1,520	3,430	2.86	3.19	B.
May	3,680	1,360	2,910	2.42	2.79	B.
June	1,440	205	854	.712	.79	C.
July	2,480	405	1,280	1.07	1.23	B.
August	1,760	1,060	1,490	1.24	1.43	B.
September	1,680	630	939	.782	.87	C.

[a] Revised since last published.

NOTE.—Table shows run-off as regulated in lakes above Piercefield.

ST. REGIS RIVER AT BRASHER CENTER, N. Y.

LOCATION.—At the steel highway bridge in the village of Brasher Center, St. Lawrence County, 5 miles downstream from Brasher Falls, 6¼ miles below junction of east and west branches of St. Regis River, and about 12 miles above the mouth.

DRAINAGE AREA.—621 square miles (measured on Post Route map).

RECORDS AVAILABLE.—August 22, 1910, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and the State of New York Conservation Commission.

GAGE.—Chain, fastened to downstream side of bridge; read twice daily by Joseph Vanier.

DISCHARGE MEASUREMENTS.—At low stages made by wading; at high stages from the bridge.

CHANNEL AND CONTROL.—Channel very rough; composed of gravel and large bowlders. Control fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.7 feet at 7 a. m. and 4 p. m. April 12 (discharge, 5,650 second-feet); minimum stage recorded, 3.8 feet at 7 a. m October 5 (discharge, 120 second-feet).

1910–1915: Maximum stage recorded, 9.1 feet at 7 a. m. March 27, 1913 (discharge, 16,200 second-feet); minimum stage recorded, 3.75 feet at 5 p. m. August 9, 7 a. m and 5 p. m. August 10, and 7 a. m. August 12, 1914 (discharge, 105 second-feet).

WINTER FLOW.—Discharge relation affected by ice; discharge determined from frequent discharge measurements and climatic records.

ACCURACY.—Rating curve well defined; estimates good.

Discharge measurements of St. Regis River at Brasher Center, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 14	C. S. De Golyer	3.97	200	Jan. 6[b]	C. S. DeGolyer	5.04	450
16	do	4.09	255	26[a]	do	5.74	668
Nov. 16	do	4.48	575	Feb. 9[a]	do	6.04	708
17	do	4.84	990	Mar. 22	E. D. Burchard	4.31	486
Dec. 18[a]	R. M. Adams	5.66	346				

[a] Partial ice cover. [b] Complete ice cover.

Daily discharge, in second-feet, of St. Regis River at Brasher Center, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	283	482	600	.....	570	1,390	494	330	625	494
2	258	410	655	.....	570	1,480	390	330	494	458
3	258	446	820	.....	551	1,390	458	315	390	390
4	200	550	820	.....	522	1,480	330	282	407	375
5	128	500	1,070	.....	680	1,480	315	239	458	362
6	152	428	520	.....	930	1,570	282	330	475	302
7	140	395	710	.....	1,220	1,140	268	740	475	302
8	128	395	940	.....	1,480	1,390	375	592	475	375
9	170	482	940	.....	1,860	2,080	315	592	468	522
10	350	820	655	.....	2,190	1,220	302	680	740	658
11	350	372	500	.....	4,440	1,300	302	658	800	551
12	200	350	600	.....	6,250	1,220	475	494	658	458
13	185	322	372	.....	3,110	1,070	800	407	551	390
14	152	395	395	.....	4,770	658	930	407	475	458
15	190	500	.....	432	5,470	522	930	390	375	458
16	240	600	.....	680	3,080	740	1,000	494	352	352
17	309	940	.....	432	2,420	658	800	475	658	315
18	410	710	.....	522	2,190	551	625	625	1,000	330
19	446	1,070	.....	625	1,970	352	592	1,860	930	315
20	1,220	600	.....	432	1,660	390	494	1,660	680	250
21	940	520	.....	390	1,970	458	494	1,390	592	315
22	464	655	.....	475	1,760	800	458	1,140	1,000	263
23	410	600	.....	625	1,300	625	407	800	2,080	282
24	380	580	.....	1,070	1,140	458	458	551	2,080	250
25	520	395	.....	1,220	522	458	551	352	1,760	263
26	380	580	.....	1,300	432	680	570	282	1,390	263
27	296	710	.....	1,220	1,140	680	458	475	1,000	352
28	335	820	.....	592	1,480	680	390	458	740	592
29	410	600	.....	625	1,140	494	390	592	570	658
30	580	600	.....	625	1,300	432	375	680	494	551
31	520	.....	.....	625	.....	475	.....	800	522	.....

NOTE.—Mean daily gage height, Oct. 15 to Nov. 4, determined from record of a portable water-stage recorder; discharge for other periods determined from the mean of two readings of the gage per day. Discharge, estimated because of ice, as follows: Dec. 15–31, 457 second-feet; Jan. 1–10, 602 second-feet; Jan. 11–20, 592 second-feet; Jan. 21–31, 893 second-feet; Feb. 1–10, 1,250 second-feet; Feb. 11–28, 1,880 second-feet; Mar. 1–14, 849 second-feet.

Monthly discharge of St. Regis River at Brasher Center, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 621 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,220	128	355	0.572	0.66	B.
November	1,070	322	561	.903	1.01	B.
December	1,070	.....	560	.902	1.04	B.
January	.....	.....	705	1.14	1.31	D.
February	.....	.....	1,670	2.69	2.80	D.
March	.....	390	787	1.27	1.46	C.
April	6,250	432	2,000	3.22	3.59	B.
May	2,080	352	914	1.47	1.70	A.
June	1,000	263	501	.807	.90	B.
July	1,860	239	626	1.01	1.16	A.
August	2,080	352	765	1.23	1.42	A.
September	658	250	395	.636	.71	B.
The year	6,250	128	813	1.31	17.76	

DEER RIVER AT BRASHER IRON WORKS, N. Y.

LOCATION.—About 1,000 feet below steel highway bridge in the village of Brasher Iron Works, St. Lawrence County, and 2 miles above the confluence of Deer River with St. Regis River in Helena. No important tributaries enter between gage and mouth of river. A small creek enters from the left about 1 mile above station.

DRAINAGE AREA.—206 square miles (measured on Post Route map).

RECORDS AVAILABLE.—July 25, 1912, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Sloping staff gage, 32 feet long, graduated from 0.5 to 11.0 feet; read morning and evening. Gage read twice daily by Alex. Barlow.

DISCHARGE MEASUREMENTS.—During medium and high stages made from the bridge; at low stages by wading a short distance above bridge.

CHANNEL AND CONTROL.—Stream bed at bridge, solid rock; smooth. Control, about 300 feet below gage, consists of gravel and is fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.0 feet at 6 a. m. April 13 (discharge, 1,050 second-feet); minimum stage recorded, 0.95 foot at 7 p. m. September 7 (discharge, 30 second-feet).

1912–1915: Maximum stage recorded, 9.3 feet at 4 p. m. January 17, 1913 (discharge, approximately 9,700 second-feet); minimum stage recorded, 0.80 foot at 6 a. m. August 20 and 7 a. m. September 14, 1913 (discharge, 17 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice. Gage observations suspended during period when ice is present.

ACCURACY.—Rating curve fairly well defined.

Discharge measurements of Deer River at Brasher Iron Works, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 22	E. D. Burchard	1.69	137
July 29	C. C. Covert	1.27	68.4

Daily discharge, in second-feet, of Deer River at Brasher Iron Works, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	56	133	124	294	212	88	64	64	64
2	56	115	175	309	279	82	68	59	61
3	71	115	294	325	279	56	56	52	78
4	56	124	225	294	251	52	44	53	71
5	44	115	199	309	225	58	44	63	51
6	35	107	175	465	199	58	48	58	46
7	44	115	175	704	175	48	68	68	37
8	48	115	133	656	199	52	92	61	58
9	48	115	115	704	212	48	119	58	85
10	56	99	99	704	199	61	107	72	74
11	66	92	99	864	175	74	96	175	78
12	56	92	99	920	175	107	58	153	71
13	44	115	71	920	153	82	71	294	46
14	66	153	.....	656	133	115	61	71	59
15	61	124	.....	484	115	133	52	68	74
16	74	153	.....	392	99	164	44	56	52
17	107	124	.....	99	99	153	52	99	68
18	124	153	.....	175	115	115	48	175	63
19	133	175	.....	279	107	99	96	133	70
20	153	133	.....	251	88	85	133	143	44
21	143	153	.....	225	92	92	107	187	40
22	115	133	.....	199	99	115	85	309	52
23	99	175	.....	175	99	93	82	410	52
24	88	133	.....	175	85	92	115	279	48
25	88	115	.....	164	96	85	68	225	46
26	78	153	.....	153	99	74	48	175	48
27	85	212	.....	143	133	68	52	143	56
28	71	153	.....	115	133	61	56	115	85
29	82	133	.....	133	115	64	68	115	96
30	96	115	.....	143	96	64	82	99	71
31	115	.....	.....	.....	71	.....	63	107	.....

NOTE.—Discharge relation affected by ice Dec. 14 to Mar. 31; observations suspended Feb. 1 to Mar. 31. Discharge Dec. 14–31, estimated by comparison with records of flow of streams in adjacent areas, 109 second-feet.

Monthly discharge of Deer River at Brasher Iron Works, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 206 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	153	35	79.3	0.385	0.44	B.
November	212	92	131	.636	.71	B.
December	294	.....	128	.621	.72	C.
April	920	99	381	1.85	2.06	B.
May	279	71	149	.723	.83	A.
June	164	48	84.6	.411	.46	A.
July	133	44	72.5	.352	.41	A.
August	410	52	134	.650	.75	A.
September	96	37	61.5	.299	.33	A.

RICHELIEU RIVER AT FORT MONTGOMERY, ROUSES POINT, N. Y.

LOCATION.—Inside the fort, 1 mile northeast of village of Rouses Point, Clinton County, three-eighths mile south of the international boundary, and about half a mile from head of Richelieu River, the outlet of Lake Champlain.

DRAINAGE AREA.—7,870 square miles, including 436 square miles of water surface (from annual report of New York State engineer and surveyor).

RECORDS AVAILABLE.—1875 to 1915. Data published also in the report of the Deep Waterways Survey and annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGE.—Staff, read once daily to half-tenths by Thomas Bourke. Elevation of gage zero at Fort Montgomery, 92.50 feet above mean sea level.

EXTREMES OF STAGE.—Maximum stage recorded during year, 96.15 feet at 10 a. m. April 22; minimum stage recorded, 92.6 feet at 10 a. m. November 20 and 21.

1869–1915: Maximum stage recorded, 103.28 feet;[1] minimum stage recorded, 91.9 feet, November 13, 1908.

Daily gage height, in feet, of Richelieu River at Fort Montgomery, Rouses Point, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.6	0.55	0.7	0.6	1.1	3.4	2.8	3.2	2.2	1.3	1.5	1.2
2	.65	.4	.65	.7	1.2	3.4	2.7	3.1	2.0	1.3	1.3	1.25
3	.7	.3	.7	.5	1.15	3.3	2.6	3.0	1.9	1.2	1.3	1.1
4	.6	.6	.6	.5	1.2	3.45	2.5	3.0	2.0	1.3	1.4	1.0
5	.65	.3	.5	.6	1.2	3.4	2.6	2.9	1.9	1.3	1.3	1.0
6	.4	.25	.6	.6	1.3	3.45	2.6	3.0	1.8	1.3	1.3	1.0
7	.6	.4	.6	.6	1.3	3.4	2.6	3.1	1.9	1.25	1.4	1.1
8	.5	.4	.6	.6	1.35	3.3	2.5	3.0	1.5	1.2	1.4	1.0
9	.5	.3	.55	.65	1.25	3.3	2.6	2.95	1.7	1.3	1.3	1.1
10	.6	.35	.7	.7	1.3	3.3	2.7	2.9	1.7	1.4	1.25	1.0
11	.7	.5	.8	.8	1.4	3.25	2.7	2.9	1.8	1.45	1.3	.9
12	.4	.3	.8	.7	1.3	3.2	3.0	3.0	1.8	1.5	1.35	.9
13	.4	.4	.85	.7	1.3	3.15	3.2	2.7	2.0	1.55	1.3	.85
14	.4	.3	.8	.8	1.4	3.0	3.4	2.7	1.7	1.6	1.3	1.0
15	.6	.8	.7	.7	1.4	3.0	3.7	2.7	1.7	1.4	1.35	1.0
16	.45	.4	.7	.75	1.4	3.0	3.5	2.6	1.8	1.5	1.35	.85
17	.6	.4	.75	.85	1.5	2.9	3.45	2.7	1.8	1.5	1.2	.9
18	.5	.4	.75	.7	1.6	2.9	3.5	2.6	1.5	1.4	1.1	.8
19	.5	.8	.95	.85	1.6	2.9	3.5	2.4	.....	1.6	1.2	.85
20	.6	.1	.6	.95	1.7	2.85	3.4	2.5	1.7	1.5	1.3	.75
21	.7	.1	.9	1.0	1.7	2.8	3.35	2.5	1.65	1.5	1.3	.8
22	.6	.9	.7	1.1	1.6	2.7	3.65	2.6	1.6	1.55	1.3	.5
23	.7	.55	.7	1.2	1.7	2.8	3.3	2.5	1.4	1.6	1.3	.8
24	.2	.6	.6	1.1	1.8	2.75	3.3	2.3	1.4	1.7	1.35	.75
25	.6	.6	.6	1.1	2.2	2.75	3.2	2.3	1.4	1.5	1.3	.7
26	.65	.75	.6	1.15	2.7	2.7	3.3	2.0	1.3	1.45	1.25	1.2
27	.35	.4	.8	1.1	3.0	2.7	3.2	2.2	1.4	1.5	1.2	.35
28	.55	.5	.6	1.15	3.3	2.7	3.2	2.1	1.4	1.5	1.3	.4
29	.4	.8	.6	1.1	.....	2.7	3.4	2.1	1.4	1.4	1.3	.4
30	.4	.7	.6	1.1	.....	2.75	3.2	2.2	1.3	1.5	1.4	.5
31	.35	.....	.6	1.2	.....	2.7	.....	2.2	.....	1.4	1.15	.....

[1] Hoyt, J. C., Stream measurements, 1903, North Atlantic, St. Lawrence River, and Great Lakes drainage: U. S. Geol. Survey Water-Supply Paper 97, p. 340.

SARANAC RIVER NEAR PLATTSBURG, N. Y.

LOCATION.—At the Indian Rapids power plant (formerly known as Lozier Dam) of the Plattsburg Gas & Electric Co., about 6 miles above the mouth of the river at Plattsburg, Clinton County.

DRAINAGE AREA.—607 square miles (measured on topographic maps.)

RECORDS AVAILABLE.—March 27, 1903, to September 30, 1915. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

GAGES.—Crest gage, a vertical staff in the angle of the wing wall at the end of the intake racks; datum raised 0.76 foot August 20, 1906. Tailrace gage, a vertical staff spiked to timber crib dike between tailrace and river and about 50 feet below power house. Datum has changed slightly by settling of cribwork. An inclined staff gage at the cable station has been used to determine a discharge rating at that point. Records of kilowatt output are obtained from readings of watt meter on switchboard at half-hour intervals.

DISCHARGE MEASUREMENTS.—Made from cable at head of Indian Rapids one-fourth mile below the dam; low-water measurements made by wading under cable or in tailrace.

DISCHARGE RATING.—Records include flow over a concrete spillway 171.25 feet in crest length, a rating for which has been prepared by the use of coefficients [1] derived from experiments made in the hydraulic laboratory of Cornell University on a model section of the dam; the discharge through two power units equipped with 300 kilowatt generators which have been rated by current-meter measurements; and the discharge through two 5-foot waste gates when open.

EXTREMES OF DISCHARGE.—Maximum daily discharge during year, 3,600 second-feet April 12; minimum daily discharge, 114 second-feet, November 8.

1908–1915: Maximum daily discharge recorded, 6,410 second-feet, April 20, 1914; minimum daily discharge recorded, 90 second-feet, September 28, 1914.

REGULATION.—The lakes and ponds on the main stream and tributaries above the station comprise a water surface area of about 25.5 square miles. The natural storage afforded by these reservoirs has been largely increased by the State dam at Lower Saranac Lake, the operation of which affects the distribution of flow throughout the year.

ACCURACY.—At low stages there is considerable fluctuation in discharge from the operation of automatic governors on the wheel gates. Errors due to this cause are largely compensated by the use of 48 observations a day. A comparison made in July, 1914, of the discharge at the cable station, as determined by a portable water-stage recorder, and the discharge as computed by the power plant ratings showed a very close agreement for the daily means.

COOPERATION.—Gage-height records and watt-meter readings furnished by Plattsburg Gas & Electric Co., Herbert A. Stutchbury, superintendent.

The following discharge measurement was made by O. W. Hartwell:

May 12, 1915: Gage height, 2.45 feet; discharge, 845 second-feet.

[1] Horton, R. E., Weir experiments, coefficients, and formulas: U. S. Geol. Survey Water-Supply Paper 200, pp. 98–100, 1907.

Daily discharge, in second-feet, of Saranac River near Plattsburg, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	370	210	280	560	480	980	520	1,400	520	450	380	410
2	390	300	410	620	360	920	600	1,350	490	430	780	420
3	350	290	640	300	360	840	450	1,450	480	420	620	390
4	130	280	520	520	380	720	450	1,400	470	450	540	420
5	310	260	470	270	410	740	580	1,300	460	480	410	300
6	300	245	225	270	460	660	680	1,180	245	720	450	330
7	280	240	290	310	340	700	660	1,140	520	640	420	300
8	330	114	400	580	470	660	920	1,120	400	600	380	340
9	410	280	260	480	220	620	420	1,120	400	680	560	420
10	310	225	230	340	330	640	1,550	1,080	360	720	920	550
11	235	225	290	360	380	640	2,900	1,180	290	660	720	400
12	350	195	270	340	300	620	3,600	960	360	800	640	270
13	300	400	170	470	490	410	3,200	900	520	700	600	490
14	280	480	340	500	480	540	2,500	860	660	640	640	340
15	290	390	270	450	540	600	1,950	800	680	700	540	300
16	370	480	280	390	520	490	1,650	620	840	700	640	350
17	490	440	280	310	600	490	1,350	820	740	720	660	360
18	400	330	300	350	600	380	1,250	680	780	1,300	720	360
19	470	290	300	320	540	420	1,200	620	740	1,300	740	235
20	300	450	215	540	600	560	1,180	640	620	1,250	680	370
21	290	430	340	540	430	460	1,140	580	640	1,040	620	360
22	290	340	290	440	640	540	900	640	560	880	520	260
23	330	620	300	370	540	480	900	370	500	800	1,040	350
24	410	270	280	340	740	640	900	680	460	720	980	280
25	200	350	250	540	1,750	740	860	640	540	600	780	340
26	360	490	480	460	1,650	720	860	580	580	660	660	280
27	280	700	320	470	1,200	560	940	620	400	580	600	460
28	280	600	360	520	1,040	520	900	660	540	620	560	440
29	310	330	280	520	.....	620	1,300	620	460	580	420	430
30	310	500	300	420	.....	520	1,650	330	470	600	540	430
31	310	.....	600	280	.....	470	.....	680	.....	700	440	.....

NOTE.—See "Discharge rating" in station description.

Monthly discharge of Saranac River near Plattsburg, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 607 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	490	[a] 130	324	0.534	0.62
November	700	[a] 114	357	.588	.66
December	640	[a] 170	330	.544	.63
January	620	270	425	.700	.81
February	1,750	220	602	.992	1.03
March	980	380	610	1.01	1.16
April	3,600	420	1,260	2.08	2.32
May	1,450	[a] 330	872	1.44	1.66
June	840	[a] 245	524	.863	.96
July	1,300	420	714	1.18	1.36
August	1,040	[a] 380	620	1.02	1.18
September	550	[a] 235	366	.603	.67
The year	3,600	[a] 114	583	.960	13.06

[a] Sunday.

NOTE.—Table shows the flow as regulated by the reservoirs above station.

AUSABLE RIVER AT AUSABLE FORKS, N. Y.

LOCATION.—In the village of Ausable Forks, Clinton County, immediately below the junction of the east and west branches and about 15 miles above mouth of river.

DRAINAGE AREA.—444 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 17, 1910, to September 30, 1915. Data published also in the annual reports of the New York State engineer and surveyor and the State of New York Conservation Commission.

GAGE.—Chain, on left bank, about 1,000 feet below junction of east and west branches of Ausable River; read twice daily by A. S. Baker.

DISCHARGE MEASUREMENTS.—Made from a cable about 1½ miles below gage, at which place river flows in one channel.

CHANNEL AND CONTROL.—Bed consists of sand and gravel; likely to shift. Channel divided by an island.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.6 feet at 7.30 a. m. April 12 (discharge, 6,190 second-feet); minimum stage recorded, 3.40 feet at 8 a. m. September 5 (discharge, 75 second-feet).

1910–1915: Maximum stage recorded, 10.2 feet in the evening of March 27, 1913 (discharge, approximately 25,000 second-feet); minimum stage recorded, 3.0 feet at 7 a. m. July 21, 1912 (discharge, practically zero).

SPECIAL STUDY.—A portable water-stage recorder was installed at this station and a continuous gage-height record obtained July 11 to September 30, 1914, which showed a continual small fluctuation in stage. It was found that monthly mean discharge estimates based on semidaily gage heights were in error as follows: July 11 to 31, 3.5 per cent; August, 4.1 per cent; September, 0.5 per cent. Some of the daily discharges showed larger errors, but these were compensating.

WINTER FLOW.—Discharge relation slightly affected by ice. Flow determined from discharge measurements and climatic records.

ACCURACY.—Conditions at measuring section favorable; results good.

Discharge measurements of Ausable River at Ausable Forks, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 13	C. S. De Golyer	3.58	159	Jan. 7 [b]	C. S. De Golyer	3.90	393
13	do	3.56	150	27 [b]	do	3.62	203
Dec. 19 [a]	do	3.63	194	May 11	O. W. Hartwell	3.92	445

[a] Partial ice cover.

[b] Complete ice cover.

Daily discharge, in second-feet, of Ausable River at Ausable Forks, N. Y., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	161	125	374	230	.....	716	161	1,040	238	204	278	192
2	230	146	926	192	.....	574	224	1,160	217	238	374	204
3	161	230	1,140	166	.....	.....	135	1,080	211	217	365	179
4	156	217	766	230	.....	.....	146	1,020	179	230	246	146
5	204	204	680	204	.....	.....	211	954	172	347	217	83
6	156	204	230	185	179	365	230	870	146	766	198	115
7	156	217	484	740	246	356	224	766	156	384	179	115
8	125	179	384	1,320	294	302	550	792	135	1,240	151	111
9	125	211	310	870	302	278	574	844	130	2,380	620	135
10	130	185	179	792	286	310	1,240	668	166	1,320	716	146
11	166	179	166	402	262	230	5,600	692	217	597	574	125
12	192	198	135	286	246	204	5,030	620	1,160	940	402	151
13	130	166	125	302	262	179	2,380	527	632	328	328	146
14	179	204	161	365	166	204	1,490	433	504	319	262	192
15	172	161	179	238	644	246	1,130	302	393	319	230	125
16	156	172	156	246	818	179	1,100	527	740	294	270	135
17	166	753	230	192	.....	161	1,040	294	766	356	356	135
18	224	453	204	262	.....	161	954	328	680	870	328	146
19	238	328	198	338	.....	156	1,160	422	463	668	262	125
20	246	278	198	818	.....	146	1,760	422	898	692	204	125
21	262	278	166	562	.....	166	1,400	384	494	1,240	156	146
22	217	262	.....	.....	.....	204	982	384	356	443	310	156
23	217	230	.....	.....	.....	179	1,010	347	270	422	2,720	204
24	204	230	.....	.....	550	224	1,490	356	402	347	1,400	172
25	146	246	.....	.....	6,190	230	2,160	328	393	278	805	156
26	185	286	.....	.....	2,720	262	1,760	319	338	286	620	156
27	140	347	.....	.....	1,160	246	1,580	692	217	365	422	294
28	135	347	.....	.....	898	217	1,240	620	230	338	365	310
29	156	294	.....	.....	.....	217	1,580	365	254	668	294	217
30	166	347	.....	.....	.....	166	1,160	310	246	818	246	192
31	135	.....	246	.....	.....	161	.....	310	.....	393	230	.....

NOTE.—Discharge estimated because of ice as follows: Dec. 22–30, 165 second-feet; Jan. 22–31, 247 second-feet; Feb. 1–5, 181 second-feet; Feb. 17–23, 418 second-feet; Mar. 3–5, 439 second-feet.

Monthly discharge of Ausable River at Ausable Forks, N. Y., for the year ending Sept. 30, 1915.

[Drainage area, 444 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	262	125	175	0.394	0.45	A.
November	753	125	256	.577	.64	A.
December	1,140	.....	294	.662	.76	B.
January	1,320	.....	368	.829	.96	B.
February	6,190	.....	681	1.53	1.59	B.
March	716	146	269	.606	.70	B.
April	5,600	135	1,320	2.97	3.31	A.
May	1,160	310	586	1.32	1.52	A.
June	1,160	130	380	.856	.96	B.
July	2,380	204	591	1.33	1.53	B.
August	2,720	151	456	1.03	1.19	B.
September	310	83	161	.363	.40	B.
The year	6,190	83	459	1.03	14.01	

LAKE GEORGE AT ROGERS ROCK, N. Y.

For the purpose of determining the rate of change and the range in elevation of the water surface of the lake, gages were established on Lake George in July, 1913, at three points—Lake George, Sagamore (Bolton Landing), and Rogers Rock.

All three gages were read until June 30, 1914. Comparison of the records up to this date showed that one gage would indicate the mean elevation of the lake, and the observations at Lake George and Sagamore were discontinued July 1, 1914.

At Rogers Rock the gage is a vertical staff fastened to a pile in the back end of a covered boat house. The boat house is in a bay on the north side of the steamboat landing. The gage is read once each day to the nearest half-tenth, and the force and direction of the wind are recorded. The observer is George O. Cook.

The results of the observations are presented in the following tables:

Daily gage height, in feet, of Lake George at Rogers Rock, N. Y., for the year ending Sept. 30, 1915.

Day.	October.			November.			December.			January.			February.			March.		
	Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.	
		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]
1	2.42	N.	M.	1.85	S.	L.	1.58	S.	M.	1.42	S.	M.	1.85	NW.	H.	3.02	NW.	L.
2	2.45	N.	L.	1.82	SW.	M.	1.55	S.	L.	1.4	S.	M.	1.88	N.	H.	3.05	W.	M.
3	2.42	Calm.	....	1.75	N.	M.	1.58	SE.	L.	1.4	N.	L.	1.9	N.	H.	3.0	N.	H.
4	2.42	S.	M.	1.9	S.	H.	1.48	N.	H.	1.4	Calm.	....	1.9	Calm.	....	3.0	N.	M.
5	2.40	Calm.	....	1.7	SW.	M.	1.5	N.	H.	1.4	SW.	M.	1.92	S.	M.	2.95	N.	M.
6	2.30	N.	H.	1.68	N.	L.	1.48	N.	M.	1.42	S.	L.	1.95	SW.	L.	3.0	NE.	L.
7	2.32	S.	M.	1.68	SE.	M.	1.4	N.	H.	1.45	SW.	M.	1.98	SW.	L.	2.98	N.	H.
8	2.30	S.	L.	1.65	N.	L.	1.38	NW.	H.	1.5	W.	H.	2.0	Calm.	....	2.98	N.	H.
9	2.30	S.	M.	1.62	N.	M.	1.4	NE.	L.	1.5	NE.	L.	2.0	NE.	L.	2.95	N.	M.
10	2.30	S.	M.	1.6	N.	L.	1.4	N.	L.	1.5	N.	M.	1.98	N.	L.	2.95	N.	M.
11	2.28	SW.	H.	1.65	S.	H.	1.45	Calm.	....	1.55	S.	M.	1.98	S.	M.	2.9	N.	H.
12	2.25	W.	M.	1.6	S.	M.	1.42	Calm.	....	1.52	NW.	H.	1.95	SW.	M.	2.92	NW.	L.
13	2.15	N.	H.	1.58	E.	M.	1.45	S.	M.	1.52	NE.	M.	1.92	Calm.	....	2.95	Calm.	....
14	2.20	Calm.	....	1.52	N.	L.	1.6	SW.	H.	1.55	S.	M.	1.92	S.	M.	2.9	N.	H.
15	2.15	S.	M.	1.6	S.	M.	1.6	S.	H.	1.58	Calm.	....	1.98	S.	M.	2.88	S.	L.
16	2.08	N.	M.	1.65	S.	H.	1.55	S.	M.	1.55	S.	L.	2.02	S.	H.	2.88	N.	M.
17	2.10	Calm.	....	1.7	S.	H.	1.5	S.	M.	1.58	SW.	M.	2.1	NW.	M.	2.9	N.	M.
18	2.12	N.	L.	1.6	S.	H.	1.48	S.	M.	1.6	Calm.	....	2.05	N.	H.	2.85	N.	L.
19	2.15	Calm.	....	1.52	SW.	M.	1.45	S.	H.	1.75	SW.	H.	2.08	N.	M.	2.88	NE.	M.
20	2.15	S.	M.	1.62	N.	H.	1.5	W.	L.	1.8	S.	H.	2.05	Calm.	....	2.85	SW.	M.
21	2.12	S.	M.	1.72	S.	H.	1.6	S.	M.	1.8	N.	M.	2.05	N.	L.	2.8	N.	L.
22	2.0	N.	H.	1.7	SW.	H.	1.6	SW.	H.	1.8	N.	M.	2.08	S.	L.	2.8	NW.	M.
23	2.1	S.	L.	1.68	SW.	M.	1.45	NE.	L.	1.82	S.	M.	2.1	Calm.	....	2.8	NW.	L.
24	2.02	SW.	M.	1.65	S.	M.	1.45	S.	L.	1.85	S.	M.	2.12	Calm.	....	2.8	NW.	L.
25	2.02	S.	L.	1.65	S.	H.	1.45	N.	L.	1.9	S.	M.	2.6	N.	L.	2.75	Calm.	....
26	2.0	S.	H.	1.68	S.	M.	1.48	N.	M.	1.9	E.	L.	2.85	Calm.	....	2.8	NW.	H.
27	1.95	N.	H.	1.6	N.	M.	1.42	S.	L.	1.88	Calm.	....	2.92	N.	M.	2.78	NW.	H.
28	1.95	S.	H.	1.58	Calm.	....	1.45	S.	M.	1.88	N.	L.	2.98	N.	L.	2.75	S.	M.
29	1.9	S.	L.	1.55	S.	M.	1.42	S.	M.	1.9	SW.	M.	....	.....	....	2.72	W.	M.
30	1.88	S.	M.	1.58	S.	L.	1.5	S.	H.	1.88	S.	L.	....	.....	....	2.78	SW.	H.
31	1.85	S.	M.	.....	.....	....	1.4	Calm.	....	1.88	SW.	M.	....	.....	....	2.72	N.	M.

[a] L, light; H, heavy; M, moderate.

Daily gage height, in feet, of Lake George at Rogers Rock, N. Y., for the year ending Sept. 30, 1915—Continued.

Day.	April.			May.			June.			July.			August.			September.		
	Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.		Gage height.	Wind.	
		Direction.	Force.		Direction.	Force.		Direction.	Force.		Direction.	Force.		Direction.	Force.		Direction.	Force.
1	2.7	NW.	L.	2.78	Calm.	....	2.45	Calm.	....	2.42	S.	L.	2.7	Calm.	....	2.72	(a)	L.
2	2.68	N.	L.	2.75	N.	M.	2.42	N.	M.	2.45	NE.	L.	2.7	N.	M.	2.72	S.	M.
3	2.65	N.	H.	2.8	N.	M.	2.4	S.	L.	2.48	S.	M.	2.78	S.	M.	2.7	Calm.	....
4	2.62	N.	H.	2.75	N.	M.	2.4	Calm.	....	2.5	S.	M.	2.7	SE.	H.	2.68	S.	L.
5	2.7	S.	M.	2.75	Calm.	....	2.38	S.	L.	2.58	S.	M.	2.72	Calm.	....	2.78	Calm.	....
6	2.68	Calm.	....	2.72	Calm.	....	2.38	S.	L.	2.55	S.	H.	2.7	Calm.	....	2.78	S.	M.
7	2.65	NW.	M.	2.7	S.	L.	2.38	S.	L.	2.5	S.	M.	2.75	S.	M.	2.7	Calm.	....
8	2.7	S.	L.	2.7	S.	M.	2.35	N.	M.	2.58	N.	H.	2.72	S.	M.	2.7	S.	M.
9	2.65	W.	M.	2.72	SW.	H.	2.35	N.	L.	2.68	Calm.	....	2.68	N.	M.	2.65	S.	L.
10	2.75	S.	L.	2.75	SW.	H.	2.3	N.	M.	2.7	NE.	L.	2.68	S.	L.	2.65	S.	L.
11	2.85	S.	L.	2.7	N.	L.	2.4	Calm.	....	2.7	S.	M.	2.8	Calm.	....	2.62	SW.	M.
12	3.0	S.	H.	2.68	S.	H.	2.4	S.	L.	2.72	S.	L.	2.8	S.	M.	2.6	NW.	L.
13	2.9	N.	H.	2.55	N.	H.	2.4	S.	H.	2.75	S.	M.	2.8	S.	M.	2.6	Calm.	....
14	2.9	N.	H.	2.52	N.	H.	2.38	N.	M.	2.75	Calm.	....	2.78	S.	L.	2.62	S.	M.
15	2.92	Calm.	....	2.55	N.	M.	2.35	S.	M.	2.78	S.	M.	2.8	S.	M.	2.6	S.	M.
16	2.9	N.	M.	2.55	N.	L.	2.38	Calm.	....	2.78	Calm.	....	2.78	S.	M.	2.6	S.	M.
17	2.85	N.	H.	2.58	SW.	M.	2.4	Calm.	....	2.8	SW.	H.	2.7	N.	H.	2.62	SW.	M.
18	2.85	N.	H.	2.6	S.	M.	2.4	N.	M.	2.75	N.	M.	2.7	N.	L.	2.55	Calm.	....
19	2.92	Calm.	....	2.62	S.	L.	2.5	S.	L.	2.75	N.	M.	2.7	Calm.	....	2.55	S.	H.
20	2.95	W.	M.	2.52	N.	M.	2.4	N.	M.	2.72	N.	L.	2.7	S.	L.	2.5	NE.	L.
21	2.85	N.	H.	2.5	S.	M.	2.4	N.	M.	2.7	N.	M.	2.65	S.	L.	2.58	SW.	H.
22	2.95	S.	H.	2.6	S.	H.	2.42	S.	L.	2.7	SW.	M.	2.62	S.	M.	2.5	N.	H.
23	2.88	S.	L.	2.55	S.	M.	2.3	N.	H.	2.72	S.	M.	2.82	S.	M.	2.55	S.	M.
24	2.85	Calm.	....	2.52	S.	L.	2.35	NW.	L.	2.7	S.	M.	2.85	S.	M.	2.52	S.	M.
25	2.82	N.	L.	2.5	Calm.	....	2.35	(a)	M.	2.72	S.	H.	2.9	S.	M.	2.42	N.	M.
26	2.82	S.	L.	2.48	N.	H.	2.3	S.	L.	2.72	Calm.	....	2.85	S.	M.	2.6	S.	H.
27	2.8	N.	L.	2.5	N.	M.	2.3	N.	H.	2.7	N.	M.	2.8	NE.	L.	2.38	N.	M.
28	2.82	S.	M.	2.52	(a)	M.	2.32	Calm.	....	2.75	S.	M.	2.8	Calm.	....	2.3	NW.	M.
29	2.85	S.	M.	2.42	N.	M.	2.32	S.	L.	2.8	Calm.	....	2.75	Calm.	....	2.3	NE.	L.
30	2.8	NE.	M.	2.45	S.	L.	2.3	S.	M.	2.75	Calm.	....	2.8	S.	M.	2.3	N.	L.
31	.....	.....	....	2.45	N.	M.	.....	.....	....	2.72	SW.	L.	2.75	N.	M.	.....	.....	....

a Changeable.

LAKE CHAMPLAIN AT BURLINGTON, VT.

LOCATION.—On south side of roadway leading to dock of Champlain Transportation Co., at foot of King Street, Burlington.

RECORDS AVAILABLE.—May, 1907, to September 30, 1915.

GAGE.—Staff; read once daily. Comparisons of gage readings indicate that zero of gage at Burlington is at practically the same elevation as that of gage at Fort Montgomery—92.50 feet above mean sea level.

EXTREMES OF STAGE.—Maximum stage recorded during year, 3.7 feet April 20; minimum stage recorded, 0.5 foot at various times in November, 1914.

1907–1915: Maximum stage recorded, 8.20 feet April 7, 1913; minimum stage recorded, 0.25 foot December 4, 1908.

COOPERATION.—Gage-height record furnished through courtesy of Mr. D. A. Loomis, general manager of the Champlain Transportation Co.

Daily gage height, in feet, of Lake Champlain at Burlington, Vt., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.82	.....	0.85	0.87	.....	.....	2.85	3.35	2.28	1.49	.....	1.25
2	.82	0.57	.87	.....	.....	.....	2.80	.....	2.25	1.47	1.59	1.25
3	.82	.57	.88	.....	.....	.....	2.78	3.32	2.23	1.43	1.57	1.25
4	.....	.56	.90	.83	.....	.....	.....	3.30	2.19	.....	1.55	1.25
5	.80	.56	.90	.....	.....	.....	2.75	3.26	2.11	1.41	1.54	.....
6	.80	.56	.....	.....	.....	.....	2.72	3.20	.....	1.40	1.52	1.18
7	.79	.56	1.00	.79	.....	.....	2.72	3.18	2.03	1.40	1.51	1.15
8	.79	.55	1.00	.79	1.35	3.40	2.74	3.12	1.95	1.38	.....	1.12
9	.76	.55	1.02	.79	.....	.....	2.75	.....	1.90	1.54	1.48	1.11
10	.75	.54	1.02	.....	.....	.....	2.80	3.06	1.85	1.59	1.47	1.10
11	.....	.54	1.04	.80	.....	.....	.....	3.04	1.82	.....	1.47	1.10
12	.70	.52	1.04	.83	.....	.....	3.18	3.01	1.82	1.68	1.45	.....
13	.67	.53	.....	.84	.....	.....	3.45	2.95	.....	1.70	1.45	1.09
14	.67	.52	1.08	.84	.....	.....	3.63	2.91	1.80	1.70	1.45	1.09
15	.65	.....	1.10	.87	.....	3.45	3.64	2.87	1.80	1.70	.....	1.09
16	.65	.50	1.10	.87	.....	.....	3.65	.....	1.78	1.68	1.43	.....
17	.63	.50	1.08	.....	1.70	.....	3.65	2.80	1.78	1.66	1.43	1.09
18	.....	.50	1.05	.93	.....	.....	.....	2.73	1.75	.....	1.43	1.09
19	.68	.55	1.04	1.18	.....	.....	3.68	2.69	1.74	1.71	1.42	.....
20	.70	.57	.....	.....	.....	.....	3.70	2.64	.....	1.74	1.42	1.10
21	.70	.63	1.02	.....	.....	.....	3.64	2.60	1.72	1.78	1.40	1.10
22	.72	.....	1.00	.....	.....	.....	3.60	2.56	1.70	1.76	.....	1.10
23	.72	.70	1.00	.....	1.88	2.90	3.58	.....	1.70	1.72	1.38	1.10
24	.72	.78	.97	.....	1.98	.....	3.55	2.50	1.69	1.70	1.35	1.10
25	.....	.78	.....	.....	2.28	.....	.....	2.50	1.68	.....	1.35	1.10
26	.67	.78	.94	.....	.....	2.96	3.50	2.50	1.65	1.66	1.33	.....
27	.66	.78	.....	.....	.....	.....	3.46	2.43	.....	1.65	1.32	.98
28	.64	.83	.89	.....	.....	.....	3.40	2.38	1.56	1.61	1.30	.92
29	.60	.....	.88	.....	.....	.....	3.38	2.36	1.52	1.66	.....	.86
30	.58	.85	.87	.....	.....	.....	3.38	.....	1.45	1.64	1.27	.83
31	.....	.....	.87	.....	.....	.....	.....	2.30	.....	1.63	1.25	.....

NOTE.—Feb. 4, lake apparently frozen over, but heavy south wind Feb. 5 broke up ice; Feb. 19, lake frozen over; Feb. 23, ice 9.5 inches thick 100 feet from dock; Mar. 2, ice 7.5 inches thick 100 feet from dock; Mar. 8, ice 8 inches thick 100 feet from dock; readings taken to top of ice Feb. 8 and 17; lake clear of ice Apr. 14.

WINOOSKI RIVER AT MONTPELIER, VT.

LOCATION.—One mile downstream from the Central Vermont Railway station in Montpelier, about three-eighths mile above mouth of Dog River and 1¼ miles below mouth of Worcester Branch; from May 19, 1909, to June 30, 1914, at the highway bridge just above the Central Vermont Railway station.

DRAINAGE AREA.—420 square miles (measured from post-route map, 1915 edition).

RECORDS AVAILABLE.—May 19, 1909, to September 30, 1915.

GAGE.—Gurley seven-day water-stage recorder installed July 4, 1914, on right bank; gage heights referred to gage datum by means of a hook gage inside the well; an outside staff gage is used for auxiliary readings; records June 16 to July 3, 1914, obtained from the staff gage. A chain gage was maintained at the highway bridge from May 19, 1909, to June 30, 1914.

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

CHANNEL AND CONTROL.—Channel deep and of fairly uniform section at the gage; control is formed by a sharply defined rock outcrop about 500 feet below the gage.

EXTREMES OF DISCHARGE.—Maximum open-water stage during year from water-stage recorder, 9.8 feet at 3 a. m. April 12, 1915 (approximate discharge, determined from extension of rating curve, 9,000 second-feet); it is probable that somewhat higher stages occurred January 7–8 and February 25–26 owing to ice in the river, but no records were obtained; minimum stage from water-stage recorder, 2.78 feet at 4 to 5 a. m. October 11 (discharge, 18 second-feet).

Maximum stage determined by leveling from flood marks preserved on building near present gage, 17.31 feet, April 7, 1912 (discharge not determined); minimum stage from water-stage recorder 1914–15, 2.77 feet, August 13, 1914 (discharge, 17 second-feet).

WINTER FLOW.—Discharge relation seriously affected by ice during the winter months. Discharge estimated from gage heights, discharge measurements, observer's notes, and climatic records.

DIVERSIONS.—The water supplies for the cities of Montpelier and Barre are obtained from tributaries of the river. The sewer systems of both cities, however, discharge into the river above the gage.

REGULATION.—The operation of power plants on the main stream and tributaries above the station cause large diurnal fluctuations in stage (see fig. 30, p. 139, Water-Supply Paper 375).

ACCURACY.—By the use of continuous gage-height records good results are obtained during open-water periods.

Discharge measurements of Winooski River at Montpelier, Vt., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	C. H. Pierce	3.68	216	Mar. 25	C. H. Pierce	4.85	823
Nov. 25	C. S. De Golyer	3.83	255	May 3	C. S. Barnes	4.74	754
Dec. 22	do	[a] 4.14	248	3	do	4.72	738
Jan. 9	C. H. Pierce	[a] 4.98	394	June 6	C. H. Pierce	2.905	34.6
Feb. 11	R. S. Barnes	[a] 4.66	254	6	do	3.34	117
Mar. 16	C. H. Pierce	3.84	254				

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	198	68	240	108	[a] 90	930	445	790	195	204	120	180
2	189	136	445	120	[a] 108	825	470	970	155	345	320	155
3	201	131	482	66	[a] 131	620	380	741	168	260	350	141
4	64	131	345	86	155	578	355	584	143	225	222	150
5	131	120	240	86	168	620	488	512	120	288	204	72
6	120	[a] 132	168	108	155	590	518	460	86	292	198	122
7	108	143	180	2,230	175	518	488	400	131	210	178	155
8	115	115	113	2,890	240	530	825	720	120	958	150	[a] 150
9	131	186	133	375	240	470	1,380	685	126	2,570	410	[a] 140
10	66	180	97	260	195	420	1,780	494	131	860	470	[a] 130
11	22	180	90	195	153	420	3,570	415	108	470	316	[a] 125
12	86	143	97	180	160	376	5,230	360	560	320	234	[a] 120
13	97	143	21	143	150	345	2,050	345	288	260	210	[a] 115
14	86	168	58	131	120	320	1,280	[a] 315	210	272	195	106
15	86	150	72	86	155	320	1,060	[a] 285	180	231	163	108
16	86	580	70	86	370	320	916	256	168	195	207	99
17	131	530	78	49	602	240	860	272	395	195	450	95
18	268	300	66	131	355	234	720	300	470	335	320	86
19	225	225	49	1,580	231	225	678	292	300	296	228	54
20	219	210	34	1,380	180	260	664	292	435	390	195	108
21	195	195	74	430	175	210	572	248	288	260	170	122
22	175	204	95	231	192	222	500	260	216	260	124	201
23	168	260	97	201	201	288	455	240	210	560	626	201
24	126	180	86	189	225	560	445	225	168	320	460	136
25	86	210	42	204	[a] 1,000	720	530	219	143	234	590	133
26	143	143	[a] 28	175	[a] 1,500	1,010	790	225	143	225	445	66
27	155	460	[a] 28	150	1,780	560	685	470	115	240	863	155
28	131	590	[a] 42	150	1,140	518	536	320	180	225	222	198
29	131	312	[a] 86	117	.....	435	500	225	143	210	170	145
30	108	280	120	[a] 86	.....	300	560	198	155	225	204	113
31	120	.....	120	[a] 86	.....	[a] 372	.....	192	.....	168	178	.....

[a] Automatic gage out of order; discharge estimated.

NOTE.—Discharge determined from a rating curve well defined between 30 and 1,000 second-feet. Discharge relation affected by ice Dec. 7 to Feb. 26; estimates for this period based on gage heights corrected for backwater determined by means of three discharge measurements and climatic data.

Monthly discharge of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1915.

[Drainage area, 420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	268	22	134	0.319	0.37	A.
November	590	68	225	.536	.60	A.
December	482	21	126	.300	.35	C.
January	2,890	49	397	.945	1.09	C.
February	1,780	90	370	.881	.92	C.
March	1,010	210	463	1.10	1.27	A.
April	5,230	355	991	2.36	2.63	B.
May	970	192	397	.945	1.09	A.
June	560	86	208	.495	.55	A.
July	2,570	168	390	.929	1.07	A.
August	853	120	296	.705	.81	A.
September	201	54	129	.307	.34	B.
The year	5,230	21	343	.817	11.09	

DOG RIVER AT NORTHFIELD, VT.

LOCATION.—At highway bridge near Norwich University campus in Northfield Union Brook joins Dog River a short distance below the station.

DRAINAGE AREA.—47[1] square miles (from surveys made by Norwich University students).

RECORDS AVAILABLE.—May 14, 1909, to September 30, 1915, records May 14, 1909, to August 23, 1910, at lower highway bridge; August 23, 1910, to date at present site.

GAGE.—Gurley seven-day water-stage register installed October 8, 1914. Gage heights referred to gage datum by means of a hook gage inside the well, outside staff gage used for auxiliary readings. Records prior to October 8, 1914, based on two readings a day of staff gage.

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

CHANNEL AND CONTROL.—Channel is composed of gravel, sand, and clay and is subject to slight shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.15 feet at 4 p. m., February 25 (approximate discharge, determined from extension of rating curve, 2,900 second-feet); minimum stage recorded, 0.80 foot at various times in October, 1914 (discharge, 5.0 second-feet).

1909–1915: Maximum stage recorded, 8.5 feet, March 25, 1913 (discharge, 3,400 second feet); minimum stage recorded, 0.60 foot September 10–11, 1913 (discharge, 3.0 second-feet).

WINTER FLOW.—Discharge relation not seriously affected by ice during winter of 1915; open-water rating curve used throughout the winter.

REGULATION.—Operation of a small power plant above the station affects the distribution of flow throughout the day, but as the amount of storage is small, the fluctuations are not great.

ACCURACY.—Results good except for periods when water-stage recorder was not in operation.

[1] Revised since published in previous reports.

Discharge measurements of Dog River at Northfield, Vt., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	C. H. Pierce	0.94	7.6	Feb. 13	E. L. Magee	1.72	50.3
Nov. 21	C. S. De Golyer	1.46	26.2	20	G. F. Adams	1.98	65.6
21	G. F. Adams	1.43	27.7	25	do	6.90	2,590
Dec. 5	E. L. Magee	1.76	46.7	27	do	4.00	458
5	G. F. Adams	1.74	46.4	Mar. 6	do	2.27	107
Jan. 16	do	1.53	38.2	May 4	R. S. Barnes	1.97	68.3
Feb. 6	do	1.50	35.2	June 8	C. H. Pierce	1.10	14.6

Daily discharge, in second-feet, of Dog River at Northfield, Vt., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	12	12	42	22	26	178	75	71	22	53	48	22
2	14	13	74	25	27	149	80	90	20	80	125	20
3	9.6	13	64	25	29	112	69	78	19	58	61	20
4	8.1	13	45	30	32	110	72	69	19	67	49	18
5	9.1	14	35	40	37	103	91	62	17	58	66	18
6	8.1	14	26	30	42	96	93	58	14	49	51	17
7	8.6	14	27	70	45	86	100	54	14	35	45	18
8	31	15	30	225	38	81	206	83	16	190	45	20
9	8.8	20	27	125	34	78	213	71	14	265	78	18
10	9.3	17	26	75	34	70	505	58	12	118	56	18
11	9.1	16	23	50	33	70	695	51	16	79	44	16
12	13	17	18	35	42	58	630	47	36	61	38	12
13	14	17	23	35	38	58	308	59	26	82	41	12
14	12	26	23	30	31	58	215	56	21	115	36	13
15	9.3	22	20	30	141	51	185	46	18	81	33	13
16	14	149	23	29	110	51	a 166	42	25	59	30	12
17	23	75	20	26	78	47	146	45	62	54	45	12
18	23	30	19	83	56	42	128	48	53	58	34	11
19	23	26	19	182	53	38	121	44	38	54	29	12
20	19	27	18	141	51	41	106	40	47	64	25	14
21	17	26	20	72	45	47	87	37	31	48	22	23
22	15	25	22	47	45	44	81	37	25	51	34	25
23	14	20	22	48	45	51	75	34	21	51	79	17
24	14	18	20	53	110	74	80	31	20	43	42	16
25	14	24	18	49	1,450	99	74	29	20	a 41	53	14
26	15	35	18	47	490	125	78	36	16	39	40	15
27	15	90	18	43	286	81	69	42	18	36	31	20
28	15	52	19	41	204	80	62	35	24	30	25	15
29	14	38	18	33	.....	70	61	a 30	17	42	24	14
30	15	37	25	28	.....	53	64	26	16	31	25	13
31	12	.....	25	26	.....	62	.....	24	.....	27	26	.....

a Discharge interpolated.

NOTE.—Discharge determined from two rating curves, each fairly well defined below 500 second-feet. Discharge relation not seriously affected by ice during the year, but ice in gage well Dec. 20 to Jan. 15 and Jan. 30 to Feb. 5 prevented water-stage recorder from working properly, and discharge for these periods was estimated by comparison with record of Winooski River at Montpelier.

Monthly discharge of Dog River at Northfield, Vt., for the year ending Sept. 30, 1915.

[Drainage area, 47 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	31	8.1	14.1	0.300	0.35	C.
November	149	12	30.5	.649	.72	C.
December	74	a 18	26.7	.568	.65	C.
January	a 225	a 22	57.9	1.23	1.42	C.
February	1,450	a 26	130	2.77	2.88	B.
March	178	38	76.2	1.62	1.87	A.
April	695	61	164	3.49	3.89	A.
May	90	24	49.5	1.05	1.21	A.
June	62	12	23.9	.509	.57	A.
July	265	27	68.4	1.46	1.68	A.
August	125	22	44.5	.947	1.09	A.
September	25	11	16.3	.347	.39	A.
The year	1,450	8.1	58.0	1.23	16.72	

a Estimated. (See footnote to table of daily discharge.)

LAMOILLE RIVER AT CADYS FALLS, VT.

LOCATION.—About one-fourth mile below power plant of Morrisville Electric Light & Power Co., at what was formerly known as Cadys Falls, and 2 miles downstream from village of Morrisville.

DRAINAGE AREA.—280 square miles (measured on post-route map, edition of 1915).

RECORDS AVAILABLE.—September 4, 1913, to September 30, 1915. A station maintained at the highway bridge near the power plant at Cadys Falls from July 28, 1909, to July 13, 1910, was replaced by a station at Johnson, July 14, 1910. (See Water-Supply Paper 284, pp. 110–111.)

GAGE.—Gurley water-stage recorder in gage house on right bank one-fourth mile below highway bridge at Cadys Falls. From July 28, 1909, to July 13, 1910, chain gage on highway bridge.

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

CHANNEL AND CONTROL.—Channel smooth gravel; well defined gravel control 500 feet downstream from gage.

EXTREMES OF DISCHARGE.—Maximum stage during year approximately 10 feet February 25 and April 11 (approximate discharge, 6,500 second-feet); minimum stage from water-stage recorder: 1.86 feet at 10 a. m. December 13 (discharge, 54 second-feet).

1913–1915: Maximum stage recorded, 10.53 feet April 20, 1914 (discharge, 7,250 second-feet); minimum stage recorded, 1.82 feet August 17, 1914 (discharge, 50 second-feet).

WINTER FLOW.—Discharge relation affected by ice for short periods during extremely cold weather.

DIVERSIONS.—None except for domestic use.

REGULATION.—The large amount of storage in the pond above the power plant at Cadys Falls, together with the fluctuations in discharge caused by the operation of the plant, affect the flow of the river at this point.

ACCURACY.—Results good except for periods when water-stage recorder was not in operation.

Discharge measurements of Lamoille River at Cadys Falls, Vt., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 10	C. H. Pierce	2.06	101	Feb. 10	R. S. Barnes	[a] 2.36	151
Dec. 21	C. S. De Golyer	2.16	127	Apr. 23	do	2.75	328
Jan. 8	C. H. Pierce	3.09	472	July 30	G. F. Adams	3.03	460

[a] Discharge relation affected by ice.

Daily discharge, in second-feet, of Lamoille River at Cadys Falls, Vt., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	220	135	298	121	100	628	244	450	141	[a] 126	182	138
2	204	163	458	126	95	560	294	493	147	[a] 126	172	135
3	147	198	493	118	90	462	272	441	141	126	204	138
4	107	191	375	135	90	428	198	367	126	112	169	135
5	112	191	254	126	90	408	336	309	124	109	141	124
6	126	224	178	126	90	515	424	112	96	147	141	107
7	124	204	172	254	90	290	328	204	98	129	138	115
8	126	156	172	542	120	305	672	367	112	436	141	115
9	135	178	147	367	145	290	1,060	484	118	1,450	204	191
10	126	188	147	254	130	265	1,380	351	129	672	551	237
11	107	166	118	230	145	251	[b] 5,620	290	144	347	328	166
12	112	166	112	188	145	279	[b] 3,820	251	237	244	224	126
13	135	166	90	182	130	220	1,520	220	135	[b] 204	188	132
14	126	185	118	178	105	166	945	220	121	[b] 144	188	144
15	132	141	121	166	110	182	745	194	141	156	169	141
16	132	408	118	150	195	204	542	182	156	[a] 165	169	144
17	328	428	115	115	210	198	628	188	198	170	204	156
18	317	237	121	141	185	185	502	227	290	[a] 180	254	144
19	248	204	124	387	190	198	475	230	204	[a] 190	198	118
20	272	220	129	720	170	188	450	248	182	[a] 200	168	115
21	217	230	132	347	125	144	403	224	175	204	153	135
22	188	204	135	251	135	166	359	204	144	204	118	129
23	172	175	138	220	130	188	328	194	121	538	299	129
24	175	178	138	188	309	272	302	178	107	328	408	150
25	129	214	132	150	[b] 4,700	416	471	163	115	220	371	156
26	166	309	141	145	[b] 3,600	538	820	169	107	[a] 240	328	118
27	172	745	[a] 139	140	1,250	309	[b] 695	367	98	[a] 265	240	240
28	166	450	[a] 137	140	820	220	[b] 515	290	112	290	194	230
29	166	276	135	125	.....	272	416	204	[a] 120	[a] 300	141	172
30	172	262	135	120	.....	227	379	166	126	510	147	138
31	172	.....	135	110	.....	220	.....	150	.....	[a] 300	144	.....

[a] Estimated.

[b] Automatic gage not recording correctly; discharge based on gage heights partially estimated by comparative hydrographs.

NOTE.—Discharge relation affected by ice Jan. 25 to Feb. 23. Estimates for this period based on gage heights corrected for backwater by means of 1 discharge measurement and climatic data. Discharge based on 1 reading a day by observer June 30, July 17, 28, 30, and Aug. 1–5; a correction being applied to reduce to mean for day.

Monthly discharge of Lamoille River at Cadys Falls, Vt., for the year ending Sept. 30, 1915.

[Drainage area, 280 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	328	107	169	0.604	0.70	A.
November	745	135	240	.857	.96	A.
December	493	90	173	.618	.71	A
January	720	a 110	212	.757	.87	B.
February	a 4,700	a 90	489	1.75	1.82	C.
March	628	144	297	1.06	1.22	A.
April	a 5,620	198	838	2.99	3.34	A.
May	493	112	262	.936	1.08	A.
June	290	96	142	.507	.57	A.
July	1,450	109	285	1.02	1.18	C.
August	551	118	215	.768	.89	A.
September	240	107	147	.525	.59	A.
The year	a 5,620	90	287	1.02	13.93	

a See footnote to table of daily discharge.

GREEN RIVER AT GARFIELD, VT.

LOCATION.—At site of old dam just above highway bridge at Garfield. Green River enters Lamoille River about 2 miles below the station.

DRAINAGE AREA.—20 square miles (approximate).

RECORDS AVAILABLE.—Janaury 3 to September 30, 1915.

GAGE.—Inclined staff on left bank in pool back of weir; read to hundredths of a foot twice daily by P. M. Trescott.[1]

DISCHARGE MEASUREMENTS.—Standard sharp-crested weir of compound section; length of crest at gage height 0.00 is 9.0 feet; at gage height 0.83 foot, 11.17 feet additional length of crest becomes available. Current-meter measurements made by wading about half a mile downstream from weir.

CHANNEL AND CONTROL.—A pool of considerable size is formed in the old mill pond back of the weir; at ordinary stages the velocity of approach to the weir is very small; some water leaks around the weir in the old tailrace on left bank.

EXTREMES OF DISCHARGE.—Maximum stage recorded January 3 to September 30, 1915, 3.6 feet at 9 a. m., April 12 (discharge, 436 second-feet); minimum stage recorded 0.35 foot at 9 a. m., February 5 (discharge, 7.2 second-feet).

WINTER FLOW.—Discharge relation not affected by ice.

DIVERSIONS.—None.

REGULATION.—An old timber dam about 2 miles upstream affects flow to some extent. The dam leaks by an amount somewhat greater than the low-water flow. During prolonged low stages the surface of water in pond (103 acres) falls below crest of dam; subsequent increased flow into pond is retained therein until water again flows over crest, when the increased flow is apparent at gaging station.

ACCURACY.—Except for some uncertainty in regard to leakage through old tailrace results are considered very good below 120 second-feet; at higher stages the weir is flooded and results somewhat uncertain.

COOPERATION.—Gage-height records furnished by C. T. Middlebrook, consulting engineer, Albany, N. Y.

[1] Gage read but once a day from Jan. 3 to Feb. 21.

Discharge measurements of Green River at Garfield, Vt., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 15[a]	C. H. Pierce	0.88	31.0	Apr. 22[b]	R. S. Barnes	.92	28.7
15[b]	do	.80	23.9	July 30[b]	Pierce and Adams	.64	19.3
Apr. 22[b]	R. S. Barnes	.94	28.8				

[a] Measurement made about one-fourth mile below weir.
[b] Measurement made about one-half mile below weir.

NOTE.—Additional discharge measurements obtained subsequent to Sept. 30, 1915, at a section one-half mile above weir indicate that the inflow between the weir and this section is approximately the same as that between the weir and the measuring sections below the weir and that the variation of the current-meter measurements from the weir rating curve as corrected for leakage is due to this inflow.

Daily discharge, in second-feet, of Green River at Garfield, Vt., for the year ending Sept. 30, 1915.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	10	68	16	31	13	11	15	15
2	.....	10	53	16	32	13	10	19	14
3	8.0	10	43	17	30	13	10	14	13
4	8.0	9.6	34	16	27	13	10	13	13
5	8.3	7.2	32	20	24	11	10	12	12
6	8.8	9.8	34	19	22	11	10	11	12
7	10	9.8	28	21	20	11	9.8	12	11
8	14	9.6	24	38	32	11	23	12	11
9	11	9.1	26	51	36	10	81	13	14
10	10	9.1	21	116	28	11	60	13	12
11	10	9.6	21	301	24	15	29	13	11
12	10	9.6	22	394	20	17	23	13	11
13	10	9.8	18	178	18	16	18	13	11
14	10	9.1	19	114	17	15	15	14	11
15	10	9.1	20	86	15	15	14	14	10
16	11	13	20	76	14	17	13	13	10
17	11	11	18	70	16	18	43	17	11
18	12	8.8	18	53	18	17	159	16	10
19	14	8.8	20	45	21	16	70	15	9.8
20	16	9.3	19	41	25	16	35	15	9.8
21	13	12	15	32	23	15	25	15	18
22	12	12	13	29	23	13	22	14	12
23	12	15	13	25	21	13	19	19	11
24	19	14	15	25	19	12	18	17	11
25	15	61	17	41	16	11	19	24	11
26	14	134	20	66	21	11	18	23	15
27	12	105	17	55	29	10	15	21	13
28	12	81	19	39	25	9.8	13	19	12
29	9.6	.....	19	33	21	9.8	26	17	11
30	9.6	.....	21	31	17	9.6	17	16	11
31	10	.....	17	.....	15	.....	15	15	.....

NOTE.—Discharge computed from weir formula: $Q=3.33\ LH^{3/2}$, with logarithmic extension above gage height 1.90 feet, to which has been added 1.0 second-foot on account of leakage.

Monthly discharge of Green River at Garfield, Vt., for the year ending Sept. 30, 1915.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
January 3-31	19	8.0	11.4	A.
February	134	7.2	22.4	A.
March	68	13	24.0	A.
April	394	16	68.8	A.
May	36	14	22.6	A.
June	18	9.6	13.1	A.
July	159	9.8	27.8	A.
August	24	11	15.4	A.
September	15	9.8	11.9	A.

MISSISQUOI RIVER NEAR RICHFORD, VT.

LOCATION.—About 3 miles downstream from Richford, 3 miles below the mouth of North Branch and 2 miles above mouth of Trout River.

DRAINAGE AREA.—445 square miles (measured on Carte Regionale No. 5 of Quebec, edition of 1916, scale 1 to 253,440, and United States Post Route maps, edition of 1915; drainage area previously published is in error).

RECORDS AVAILABLE.—May 22, 1909, to September 30, 1915.

GAGE.—Barrett & Lawrence water-stage recorder in gage house on left bank about one-fourth mile above highway bridge, installed August 1, 1915. June 26, 1911, to July 31, 1915, chain gage on highway bridge. May 22, 1909, to December 31, 1910, the gage was just below the plant of the Sweat-Comings Co., in Richford.

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

CHANNEL AND CONTROL.—Channel deep; banks not subject to overflow; stream bed composed of gravel, bowlders, and ledge rock. Control at new site is sharply defined by rock outcrop about 100 feet below gage; control for chain gage is a poorly defined riffle about half a mile below the highway bridge, and at high stages probably at dam at Enosburg Falls.

EXTREMES OF DISCHARGE.—Maximim stage recorded during year, 16.0 feet at 8 a. m. and 4 p. m., February 26 (probably back water from ice); highest open-water stage, 11.95 feet at 4.30 p. m., April 13 (discharge, 5,500 second-feet); minimum stage recorded, 2.00 feet on September 7, 8, 14, 16, and 19 (discharge, 16 second-feet).

1909–1915: Maximum stage recorded, 16.7 feet at 8.30 a. m., March 26, 1913, (approximate discharge, computed from extension of rating curve, 10,200 second-feet); flow past gage at the old station practically zero at various times, owing to water being held back by the mills.

WINTER FLOW.—Discharge relation seriously affected by ice; flow estimated from gage heights corrected for back water by means of discharge measurements, observer's notes, and records of precipitation and temperature.

DIVERSIONS.—None, except for domestic use.

REGULATION.—Considerable daily fluctuation at low stages, caused by operation of power plants at Richford.

ACCURACY.—Results from automatic gage records are excellent. A comparative study of results from readings of chain gage twice a day and the automatic gage records shows that, although the values for individual days as obtained from two readings a day may be seriously in error, the monthly means are fairly good.

Discharge measurements of Missisquoi River near Richford, Vt., during the year Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 18	C. S. De Golyer	[a] 6.63	768	Aug. 3	G. F. Adams	4.94	114
18	do	6.58	760	4	do	[b] 5.00	144
Apr. 24	R. S. Barnes	6.21	638	Sept. 20	do	[c] 4.62	46
24	do	6.17	605	20	do	[d] 4.76	81
July 11	C. H. Pierce	5.88	487				

[a] Discharge relation affected by ice.
[b] Gage height by hook gage at automatic-gage station=2.65.
[c] Gage height by hook gage at automatic-gage station=2.25.
[d] Gage height by hook gage at automatic-gage station=2.44.

Twice daily discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1915.

[By chain gage.]

Day.	October.		November.		December.		March.	
	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.
1	170	157	[a] 330	298	782	985	2,460	2,120
2	146	146	258	298	1,240	1,620	1,880	1,800
3	114	[b] 100	330	372	1,990	1,780	1,640	1,640
4	[a] 86	69	330	330	1,540	1,380	1,480	1,440
5	69	86	298	275	950	[c] 820	1,120	1,020
6	104	124	330	395	[a] 685	620	930	[c] 870
7	114	114	530	[c] 545	445	395	[a] 810	780
8	104	104	[a] 560	530	445	445	690	690
9	86	86	530	472	500	445	635	635
10	95	[c] 90	472	420	560	685	608	580
11	[a] 86	77	420	372	880	1,020	580	525
12	69	69	330	298	1,020	[b] 1,020	500	475
13	69	77	258	258	.....	.....	475	[c] 430
14	86	69	225	[c] 241	.....	.....	[a] 380	380
15	77	170	[a] 258	298	.....	.....	340	300
16	372	530	[b] 350	[b] 395	.....	.....	340	300
17	848	[c] 916	[b] 440	[b] 495	.....	.....	260	260
18	[a] 985	1,060	[b] 530	815	.....	.....	300	300
19	1,200	1,120	620	620	.....	.....	300	360
20	1,060	985	500	445	.....	.....	380	[c] 425
21	848	590	395	[c] 372	.....	.....	[a] 475	475
22	330	258	[a] 350	350	.....	.....	580	635
23	275	275	310	330	.....	.....	635	690
24	225	[c] 110	350	350	.....	.....	870	1,050
25	[a] 196	196	420	560	.....	.....	1,400	1,800
26	182	196	[b] 1,140	[b] 1,940	.....	.....	2,280	2,200
27	225	210	2,960	2,680	.....	.....	2,080	[c] 1,900
28	210	196	2,370	[c] 1,730	.....	.....	[a] 1,720	1,480
29	196	182	[a] 1,090	1,020	.....	.....	1,050	870
30	210	258	880	685	.....	.....	635	525
31	372	[c] 351	.....	.....	.....	.....	425	380

[a] Sunday.
[b] Discharge interpolated.
[c] Gage read in morning only; afternoon discharge taken as mean of discharge for preceding and following mornings.

Twice daily discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1915—Continued.

Day.	April.		May.		June.		July.		August.		September.	
	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.
1	340	525	930	c900	320	320	66	66	a192	177	87	110
2	475	690	a870	870	300	280	66	87	148	148	87	c82
3	652	c590	810	780	260	260	110	b102	122	135	76	37
4	a525	580	750	690	225	225	a b95	87	122	c110	87	c87
5	580	690	690	720	192	c177	66	66	98	c98	a 87	12
6	690	840	690	652	a162	162	66	87	98	87	76	87
7	930	1,120	635	635	148	135	98	87	98	c72	12	46
8	1,260	1,480	652	c644	135	162	110	162	a46	110	12	76
9	1,640	1,880	a635	608	192	192	690	990	87	148	12	87
10	2,370	c2,600	635	652	192	192	1,260	b974	320	340	37	110
11	a2,820	3,450	750	720	192	208	a b688	402	380	c303	110	c93
12	4,450	5,050	608	580	242	c117	300	260	225	c186	a76	66
13	5,400	5,500	580	525	a192	177	242	208	148	148	76	76
14	5,150	5,150	500	475	162	192	208	192	225	c252	20	46
15	4,750	4,550	425	c402	260	340	162	155	a280	300	12	66
16	4,170	3,900	a380	360	425	450	148	122	225	177	b80	b95
17	3,360	c2,580	340	380	425	380	110	c292	208	192	110	98
18	a1,800	1,480	475	475	360	340	a475	900	260	280	12	c12
19	1,120	1,050	450	475	320	c290	720	572	280	208	a12	c39
20	930	990	635	608	a260	260	425	380	148	c135	66	c66
21	900	870	580	608	225	225	340	280	122	c110	66	192
22	750	780	580	c605	208	192	280	242	a98	110	225	225
23	690	780	a635	c580	192	192	225	c208	87	122	260	208
24	b910	b1,050	525	475	162	177	192	c177	300	340	162	177
25	a1,190	1,560	425	402	162	148	a162	c136	260	208	110	c98
26	2,120	2,280	340	425	148	c142	110	148	208	c216	a87	162
27	1,960	1,800	635	635	a135	122	148	148	225	208	340	525
28	1,480	1,400	580	552	98	98	135	122	177	c177	690	525
29	1,190	1,330	500	c462	87	98	162	380	a177	148	340	225
30	1,120	1,050	a425	425	87	76	662	525	98	110	208	177
31	.....	.....	380	360	.....	.....	340	c266	12	135	.....	.....

a Sunday.
b Discharge interpolated.
c Gage read in morning only; afternoon discharge taken as mean of discharge for preceding and following mornings.

NOTE.—Morning and afternoon discharge determined from readings of the chain gage and were based on a rating curve well defined below 1,000 second-feet, the higher portion of the curve being determined by one discharge measurement made in 1913; morning and afternoon discharge based on chain gage readings are given to permit comparison of results obtained by two readings a day with those obtained by means of the water-stage recorder. Discharge relation affected by ice from Dec. 13, 1914, to Feb. 28, 1915.

Daily discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1915.

[By water-stage recorder.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	226	98	11	379	101	21	136	79
2	176	70	12	246	88	22	101	262
3	126	70	13	148	81	23	112	266
4	132	70	14	254	51	24	398	193
5	115	54	15	331	58	25	292	132
6	101	72	16	226	44	26	279	120
7	84	49	17	219	66	27	246	403
8	64	51	18	336	51	28	223	700
9	118	56	19	296	36	29	142	429
10	350	62	20	179	62	30	139	274
						31	86	.....

NOTE.—Discharge determined from records of the water-stage recorder and were computed from a rating curve fairly well defined below 1,000 second-feet, two discharges measurements made after Sept. 30, 1915, being used to determine the curve.

Monthly discharge of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1915.

[Drainage area, 445 [a] square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	.....	.....	293	0.658	0.76	C.
November	.....	.....	606	1.36	1.52	C.
December	.....	.....	450	1.01	1.16	D.
January	.....	.....	550	1.24	1.43	D.
February	.....	.....	700	1.57	1.64	D.
March	.....	.....	897	2.02	2.33	C.
April	.....	.....	1,890	4.25	4.74	C.
May	.....	.....	576	1.29	1.49	C.
June	.....	.....	213	.479	.53	C.
July	.....	.....	285	.640	.74	C.
August	398	64	202	.454	.52	A.
September	700	36	138	.310	.35	A.
The year	.....	.....	564	1.27	17.21	

[a] Revised since last published.

NOTE.—Discharge, Dec. 13, 1914, to Feb. 28, 1915, estimated by comparison with records of streams in nearby drainage basins.

CLYDE RIVER AT WEST DERBY, VT.

LOCATION.—Just below the plant of the Newport Electric Light Co., at West Derby; about a mile above mouth of river.

DRAINAGE AREA.—150 square miles (measured on post-route map, edition of 1915).

RECORDS AVAILABLE.—May 25, 1909, to September 30, 1915.

GAGE.—Chain gage read twice daily by E. C. Rogers. Barrett & Lawrence water-stage recorder installed September 21, 1915, in gage house on right bank; gage heights referred to datum of chain gage.

DISCHARGE MEASUREMENTS.—Made by wading near the gage or from highway bridge one-half mile downstream.

CHANNEL AND CONTROL.—Stream bed rough and irregular; covered with bowlders and rock ledge; fall of river rapid for some distance below the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.35 feet at 6.10 p. m., April 14 (discharge, 825 second-feet); minimum stage recorded, 1.62 feet at 5.10 p. m., October 10 (discharge, 19 second-feet).

1909–1915: High water of March 25–30, 1913, reached maximum stage of 5.8 feet (determined by engineers of Geological Survey from high-water marks; discharge approximately 6,300 second-feet); minimum stage recorded, 1.60 feet at 5.45 p. m. August 25, 1913, and 7.30 p. m., July 30 and 4.50 p. m. August 17, 1914 (discharge, 17 second-feet).

WINTER FLOW.—Discharge relation affected by ice for short periods; station temporarily discontinued from December 20, 1914, to February 20, 1915.

DIVERSIONS.—None, except for municipal use.

REGULATION.—The flow at ordinary stages is very fully controlled by the two dams at West Derby, but the operation of the power plant is such that the fluctuations in stage are not large. The distribution of flow is also affected by several dams above West Derby. Seymour Lake and several smaller ponds in the basin afford a large amount of natural storage, but at the present time there is little if any artificial regulation at these ponds.

ACCURACY.—A comparative study of automatic and chain gage records for two months subsequent to the installation of the automatic gage indicates that the results obtained from the reading the chain gage twice daily are very good. A fairly good rating curve has been developed.

Discharge measurements of Clyde River at West Derby, Vt., during the year ending Sept. 30, 1915.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 19	C. S. De Solyer	2.02	83	Sept. 21	G. F. Adams	1.95	76
19	do	2.02	81	22	do	1.94	80
Apr. 25	R. S. Barnes	2.74	342				

Daily discharge, in second-feet, of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1915.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	82	63	113		285	102	435	164	100	232	112
2	87	68	129		545	110	442	152	86	243	100
3	78	74	132		449	118	387	135	86	218	95
4	78	68	151		370	110	364	125	86	188	90
5	80	74	154		331	118	342	120	90	170	86
6	78	59	160		284	120	311	108	100	164	86
7	76	87	151		239	143	298	100	88	155	80
8	70	82	137		232	158	311	100	128	135	78
9	63	89	121		200	207	293	90	173	128	100
10	36	91	110		185	302	280	95	207	135	92
11	61	82	105		176	381	275	102	259	135	118
12	67	78	96		176	505	271	110	311	140	120
13	63	82	82		176	675	267	95	342	146	132
14	56	80	78		164	825	255	102	311	164	120
15	57	76	78		173	875	232	110	267	138	102
16	70	82	82		146	675	218	112	218	140	88
17	78	80	74		152	545	214	115	185	135	82
18	80	74	78		140	491	194	125	197	125	80
19	80	78	68		130	429	197	146	204	125	72
20	87	118			135	405	194	176	232	130	72
21	96	129		128	128	364	182	188	243	138	76
22	96	113		140	128	348	185	194	239	128	70
23	96	116		138	128	342	182	185	228	115	76
24	89	103		158	152	331	182	176	214	118	90
25	82	105		505	155	381	170	170	197	125	102
26	78	100		775	173	429	158	140	188	146	105
27	76	132		775	143	435	185	130	164	149	92
28	70	116		725	118	463	176	115	173	140	98
29	70	110			108	498	176	120	204	138	118
30	68	103			102	470	176	102	232	135	128
31	67				95		179		232	118	

NOTE.—Discharge computed from a fairly well-defined rating curve. Discharge prior to Sept. 20 based on mean of two readings of chain gage per day; Sept. 21–30 water-stage recorder used.

Monthly discharge of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1915.

[Drainage area, 150 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	96	36	74.7	0.498	0.57	B.
November	132	59	90.4	.603	.67	B.
December	.....	.....	93	.620	.71	C.
January	.....	.....	105	.700	.81	D.
February	.....	.....	185	1.23	1.28	C.
March	585	95	207	1.38	1.59	A.
April	875	102	378	2.52	2.81	A.
May	442	158	249	1.66	1.91	A.
June	194	90	130	.867	.97	B.
July	342	86	193	1.29	1.49	B.
August	243	115	148	.987	1.14	B.
September	132	70	95.3	.635	.71	B.
The year	.....	.....	162	1.08	14.66	

BEAVER RIVER AT STATE DAM, N. Y.

Discharge measurements of Beaver River at State dam, N. Y., during the year ending Sept. 30, 1915.

Date.	Made by—	Gate.		Lake elevation.	Discharge.
		No.	Opening.		
			Inches.	*Feet.*	*Sec.-ft.*
June 10	E. D. Burchard	3	24	17.10	172
10	.....do	3	36	17.10	234
10	.....do	3	12	17.10	85.7
10	O. W. Hartwell	1	24	17.10	171
10	.....do	2	12	17.10	86.1
10	E. D. Burchard	4	12	17 10	82.7
11	.....do	4	36	17.10	236
11	.....do	1	44½	17.10	279

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART IV. ST. LAWRENCE RIVER BASIN

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

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

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

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

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

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

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish list giving prices.

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

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

Boston, Mass., Customhouse.
Albany, N. Y., Room 19, Federal Building.
Atlanta, Ga., Post Office Building.
Chicago, Ill., 802 Federal Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
St. Paul, Minn, Old Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 3,800 points in the United States, and the data obtained have been published in the reports tabulated on page v.

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

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

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to September, 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332	do	1912.
WS 351 to 362	do	1913.
WS 381 to 394	do	1914.
WS 401 to 414	do	1915.

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

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1915. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1915, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, and 401, which contain records for the New England streams from 1903 to 1915. Results of miscellaneous measurements are published by drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899–1915.

Year.	I North Atlantic slope (St. John River to York River).	II South Atlantic and eastern Gulf of Mexico (James River to the Mississippi).	III Ohio River	IV St. Lawrence River and Great Lakes.	V Hudson Bay and upper Mississippi River.	VI Missouri River.	VII Lower Mississippi River.	VIII Western Gulf of Mexico.	IX Colorado River.	X Great Basin.	XI Pacific slope in California.	XII North Pacific slope basins.		
												Pacific slope in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope in Oregon.
1899[a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900[g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[k]98, 99, [m]100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 179, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332A	332B	332C
1913	351	352	353	354	355	356	357	358	359	360	361	362A	362B	362C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414

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

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

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

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PART IV. ST. LAWRENCE RIVER BASIN.

PRINCIPAL STREAMS.

The St. Lawrence River basin includes streams which drain into the Great Lakes and St. Lawrence River. The principal streams flowing directly or indirectly into Lake Superior from the United States are St. Louis, Ontonagon, Dead, and Carp rivers; streams flowing into Lake Michigan are Escanaba, Menominee, Peshtigo, Oconto, Fox, St. Joseph, and Grand rivers; into Lake Huron flow Thunder Bay, Au Sable, Rifle, and Saginaw rivers; into Lake Erie flow Huron, Maumee, Sandusky, Black, and Cuyahoga rivers. Streams flowing into Lake Ontario are Genesee, Oswego, Salmon, and Black rivers. The St. Lawrence receives Oswegatchie and Raquette rivers, Richelieu River (the outlet of Lake Champlain), and St. Francis River, whose principal tributary, Clyde River, reaches it through Lake Memphremagog. The streams of this basin drain wholly or in part the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin.

In addition to the list of gaging stations and annotated list of publications relating specifically to the section, this part contains a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See pp. XIX.)

GAGING STATIONS.

NOTE.—Dash following a date indicates that station was being maintained September 30, 1915. Period after date indicates discontinuance.

Streams tributary to Lake Superior:
- Brule River at mouth, Minn., 1911.
- Devil Track River at mouth, Minn., 1911.
- Cascade River at mouth, Minn., 1911.
- Poplar River at Lutsen, Minn., 1911–
- Beaver Bay River at Beaver Bay, Minn, 1911–1914.
- St. Louis River near Cloquet, Minn., 1903.
- St. Louis River near Thomson, Minn., 1909–
  - Whiteface River at Meadowlands, Minn., 1909–1912.
  - Whiteface River below Meadowlands, Minn., 1912–
  - Cloquet River at Independence, Minn., 1909–
- Aminicon River near Aminicon Falls, Wis., 1914–
- Brule River near Brule, Wis., 1914–
- Bad River near Odanah, Wis., 1914–
- Ontonagon River near Rockland, Mich., 1903.
- Sturgeon River near Sidnaw, Mich., 1912–1915.

Streams tributary to Lake Huron—Continued.
Shiawassee River (head of Saginaw River):
Flint River at Flint, Mich., 1903–4.
Cass River at Frankenmuth, Mich., 1908–9.
Cass River at Bridgeport, Mich., 1908.
Tittabawassee River at Freeland, Mich., 1903–1909; 1912–
Streams tributary to Lake Erie:
Huron River at Dover, Mich., 1904.
Huron River at Dexter, Mich., 1904–
Huron River at Barton, Mich., 1914–
Huron River at Geddes, Mich., 1904–1914.
Huron River at French Landing, Mich., 1904–5.
Huron River at Flat Rock, Mich., 1904–
Maumee River near Sherwood, Ohio, 1903–1906.
Maumee River near Waterville, Ohio, 1898–1901.
St. Marys River at Fort Wayne, Ind., 1905–6.
St. Joseph River at Fort Wayne, Ind., 1905–6.
Tiffin River near Defiance, Ohio, 1903–1906.
Auglaize River near Defiance, Ohio, 1903.
Ottawa River at Lima, Ohio, 1902–3.
Blanchard River at Ottawa, Ohio, 1902–3.
Sandusky River near Mexico, Ohio, 1898–1900.
Sandusky River at Fremont, Ohio, 1898–1901.
Black River near Elyria, Ohio, 1903–1906.
Cuyahoga River at Independence, Ohio, 1903–1906.
Cuyahoga River at Cleveland, Ohio, 1903.
Cattaraugus Creek at Versailles, N. Y., 1910–
Streams tributary to Lake Ontario:
Niagara River:
Tonawanda Creek:
Little Tonawanda Creek near Linden, N. Y., 1912–
Genesee River at St. Helena, N. Y., 1908–
Genesee River at Mount Morris, N. Y., 1905–1909.
Genesee River at Jones Bridge, near Mount Morris, N. Y., 1903–1906; 1908–
Genesee River at Rochester, N. Y., 1904–
Canaseraga Creek near Dansville, N. Y., 1910–1912; 1915–
Canaseraga Creek at Groveland station, N. Y., 1915–
Canaseraga Creek at Shakers Crossing, N. Y., 1915–
Keshequa Creek at Sonyea, N. Y., 1910–1912.
Keshequa Creek near Sonyea, N. Y., 1915–
Hemlock Lake at Hemlock, N. Y., 1894–1902.
Canadice Outlet near Hemlock, N. Y., 1903–
Honeoye Creek at East Rush, N. Y., 1903–1906.
Seneca River (head of Oswego River) at Baldwinsville, N. Y., 1898–1908.
Oswego River at Fulton, N. Y., 1900; 1902.
Oswego River at Battle Island, above Minetto, N. Y., 1900–1906.
Oswego River at high dam, near Oswego, N. Y., 1897–1901.
Seneca Lake at Geneva, N. Y., 1905–6.
Cayuga Lake at Ithaca, N. Y., 1905–1908.
Fall Creek near Ithaca, N. Y., 1908–9.
Owasco Outlet near Auburn, N. Y., 1912–
Skaneateles Lake at Skaneateles, N. Y., 1890–91.
Skaneateles Lake outlet at Willow Glen, N. Y., 1892–1908.
Skaneateles Lake outlet at Jordan, N. Y., 1890–1892.

Streams tributary to Lake Ontario—Continued.
Oswego River tributaries—Continued.
Onondaga Lake outlet at Long Branch, N. Y., 1904.
Fish Creek, East Branch (through Oneida Lake, head of Oneida River), at Point Rock, N. Y., 1898–99.
Oneida River at Brewerton, N. Y., 1899.
Oneida River at Oak Orchard, near Euclid, N. Y., 1902–1909.
Oneida River at Caughdenoy, N. Y., 1910–1913.
Fish Creek:
West Branch of Fish Creek at McConnellsville, N. Y., 1898–1901.
Oneida Creek at Kenwood, N. Y., 1898–1900.
Chittenango Creek at Chittenango, N. Y., 1901–1906.
Chittenango Creek at Bridgeport, N. Y., 1898–1901.
Salmon River at Stillwater Bridge, near Redfield, N. Y., 1911–1913.
Salmon River near Pulaski, N. Y., 1900–1908; 1910–1914.
Orwell Brook near Altmar, N. Y., 1911–
Black River near Booneville, N. Y., 1911–
Black River near Felts Mills, N. Y., 1902–1913.
Black River at Huntingtonville dam, near Watertown, N. Y., 1897–1901.
Black River canal flowing south near Boonville, N. Y., 1915–
Moose River at Moose River, N. Y., 1900–
Middle Branch of Moose River at Old Forge, N. Y., 1911–
Beaver River at Croghan, N. Y., 1901–1903.
Streams tributary to the St. Lawrence:
Oswegatchie River, East Branch (head of Oswegatchie River), at Newton Falls, N. Y., 1912—
Oswegatchie River near Ogdensburg, N. Y., 1903–
Raquette River at Raquette Falls, near Coreys, N. Y., 1908–1912.
Raquette River at Piercefield, N. Y., 1908–
Raquette River at South Colton, N. Y., 1904.
Raquette River at Massena Springs, N. Y., 1903–
Bog River near Tupper Lake, N. Y., 1908–1912.
St. Regis River at Brasher Center, N. Y., 1910–
Deer River at Brasher Iron Works (railroad station), Ironton, N. Y., 1912–
Chateaugay River near Chateaugay, N. Y., 1908.
Richelieu River at Fort Montgomery, N. Y., 1875–
Lake Champlain at Burlington, Vt., 1907–
Big Chazy River at Moors, N. Y., 1908.
Saranac River at Saranac Lake, N. Y., 1902–3.
Saranac River near Plattsburg, N. Y., 1903–
Ausable River at Ausable Forks, N. Y., 1910–
Ausable River at Keeseville, N. Y., 1904 and 1908.
Boquet River at Willsboro, N. Y., 1904 and 1908.
Lake George, N. Y., 1913–
Lake George outlet at Ticonderoga, N. Y., 1904–5.
Poultney River at Fairhaven, Vt., 1908.
Mettawee River at Whitehall, N. Y., 1908.
Otter Creek at Middlebury, Vt., 1903–1907.
East Creek near Rutland, Vt., 1911–1913.
Winooski River above Stevens Branch near Montpelier, Vt., 1909–1914.
Winooski River at Montpelier, Vt., 1909–
Winooski River at Richmond, Vt., 1903–1907; 1910.

Streams tributary to the St. Lawrence—Continued.
Richelieu River tributaries—Continued.
Lake Champlain at Burlington, Vt., 1907—Continued.
Winooski River near Winooski, Vt., 1903.
Worcester Branch of Winooski River at Montpelier, Vt., 1909–1914.
Dog River at Northfield, Vt., 1909–
Dog River near Montpelier Junction, Vt., 1910.
Mad River at Moretown, Vt., 1910.
Little River near Waterbury, Vt., 1910.
Huntington River at Jonesville, Vt., 1910.
Lamoille River at Morrisville, Vt., 1909–10.
Lamoille River at Cadys Falls, near Morrisville, Vt., 1913–
Lamoille River at Johnson, Vt., 1910–1913.
Lamoille River at West Milton, Vt., 1903.
Green River at Garfield, Vt., 1915–
Missisquoi River at Richford, Vt., 1909–1910.
Missisquoi River near Richford, Vt., 1911–
Missisquoi River at Swanton, Vt., 1903.
St. Francis River:
Clyde River at West Derby, Vt., 1909–

REPORTS ON WATER RESOURCES OF THE ST. LAWRENCE RIVER BASIN.[1]

PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

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

*21. Wells of northern Indiana, by Frank Leverett. 1899. 82 pp., 2 pls. (Continued in No. 26.)

Discusses, by counties, the glacial deposits and the sources of well water; gives many well sections.

*24. Water resources of the State of New York, Part I, by G. W. Rafter. 1899. 99 pp., 13 pls. 15c.

*25. Water resources of the State of New York, Part II, by G. W. Rafter. 1899. 100 pp., 12 pls. 15c.

No. 24 contains descriptions of the principal rivers of New York and their more important tributaries, and data on temperature, precipitation, evaporation, and stream flow.

No. 25 contains discussion of water storage projects on Genesee and Hudson Rivers, power development at Niagara Falls, descriptions and early history of State canals, and a chapter on the use and value of the water powers of the streams and canals; also brief discussion of the water yield of sand areas of Long Island.

*26. Wells of southern Indiana (continuation of No. 21), by Frank Leverett. 1899. 64 pp. 5c.

Discusses, by counties, the glacial deposits and the sources of well water; contains many well sections.

*30. Water resources of the Lower Peninsula of Michigan, by A. C. Lane. 1899. 97 pp., 7 pls.

Describes lake and river transportation and navigation, water powers and domestic water supplies; discusses climate, topography, geology, and well waters; compares quality and quantity of waters.

[1] For stream-measurement reports, see tables on pp. IV, V, VI.

31. Lower Michigan mineral waters, by A. C. Lane. 1899. 97 pp., 4 pls. 10c.

Treats of economic value of mineral waters and discussion and classification of analyses; contains analyses of waters of Lake Superior and of smaller lakes and rivers and of well waters from various geologic formations; also sanitary condition of drinking waters.

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

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

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

91. The natural features and economic development of the Sandusky, Maumee, Muskingum, and Miami drainage areas in Ohio, by B. H. and M. S. Flynn. 1904. 130 pp. 10c.

Describes the topography, geology, and soils of the areas, and discusses stream flow, dams, water powers, and public water supplies.

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

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

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

Contains brief reports as follows:

Minnesota, by C. W. Hall; Wisconsin district, by Alfred R. Schultz; Lower Michigan; Illinois, by Frank Leverett; Indiana, by Frank Leverett; New York, by F. B. Weeks; Ohio, by Frank Leverett.

Each of these reports describes briefly the topography of the area, the relation of the geology to the water supplies, and gives list of pertinent publications; lists also principal mineral springs.

121. Preliminary report on the pollution of Lake Champlain, by M. O. Leighton. 1905. 119 pp., 13 pls. 20c.

Describes the lake and principal inflowing streams and discusses the characteristics of the water and the wastes resulting from the manufacturing processes by which the waters are polluted. Discusses also the effect of mill waste on algæ, bacteria, and fish.

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

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

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

Contains three brief reports pertaining chiefly to areas in the St. Lawrence River basin:

Two unusual types of artesian flow, by Myron L. Fuller. Describes (1) artesian flows from uniform, unconfined sand on Long Island, N. Y., and in Michigan; and (2) flow from jointed upper portion of limestone and other rocks in southeastern Michigan.

Water resources of the Catatonk area, New York, by E. M. Kindle. Describes topography and geology of areas southeast of Finger Lake region, N. Y., including part of city of Ithaca; discusses briefly the artesian wells of Ithaca, the quality of the spring water at several small towns, and of the streams used for municipal supplies and for power.

A ground-water problem in southeastern Michigan, by Myron L. Fuller. Discusses causes of failure of wells in certain areas in southeastern Michigan in 1904 and the application of the conclusions to other regions.

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

Describes flood on Grand River, Mich. (from report of R. E. Horton), discussing streams, precipitation, and temperature, discharge, damage, and prevention of future damage.

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

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

*156. Water powers of northern Wisconsin, by L. S. Smith. 1906. 145 pp., 5 pls. 25c.

Describes, by river systems, the drainage, geology, topography, rainfall, and run-off, water powers and dams.

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

Contains brief report entitled Flowing well districts in the eastern part of the northern peninsula of Michigan, by Frank Leverett.

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

Contains accounts of floods on Sixmile Creek and Cayuga Inlet, N. Y. (in 1857, 1901, and 1905), and on Grand River, Michigan, and estimate of flood discharge and frequency for Genesee River; gives index to literature on floods in American streams.

*182. Flowing wells and municipal water supplies in the southern portion of the southern peninsula of Michigan, by Frank Leverett and others. 1906. 292 pp., 5 pls. 50c.

*183. Flowing wells and municipal water supplies in the middle and northern portions of the southern peninsula of Michigan, by Frank Leverett and others. 1907. 393 pp., 5 pls. 50c.

Nos. 182 and 183 describe in general the geographic features, water-bearing formations, drainage, quality of water, and subterranean-water temperature, and give details concerning water supplies by counties. The reports contain many analyses.

*193. The quality of surface waters in Minnesota, by R. B. Dole and F. F. Wesbrook. 1907. 171 pp., 7 pls. 25c.

Describes by river basins the topography, geology, and soils, the industrial and municipal pollution of the streams, and gives notes on the municipalities; contains many analyses.

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

Scope indicated by amplification of title.

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

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results; gives results of analyses of waters of Lake Superior and Lake Michigan, Kalamazoo and Grand rivers, Lake Huron, Lake Erie, Maumee River, and St. Lawrence and Oswegatchie rivers.

239. The quality of the surface waters of Illinois, by W. D. Collins. 1910. 94 pp., 3 pls. 10c.

Discusses the natural and economic features that determine the character of the streams, describes the larger drainage basins and the methods of collecting and analyzing the samples of water, and discusses each river in detail with reference to its source, course, and quality of water; includes short chapters on municipal supplies and industrial uses.

254. The underground waters of north-central Indiana, by S. R. Capps, with a chapter on the chemical character of the waters, by R. B. Dole. 1910. 279 pp., 7 pls. 40c.

Describes relief, drainage, vegetation, soils and crops, industrial development, geologic formations; sources, movements, occurrence, and volume of ground water; methods of well construction and lifting devices; discusses in detail, for each county, surface features and drainage, geology, and ground water, city, village, and rural supplies, and gives record of wells and analyses of waters. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, and medicinal uses, methods of purification and chemical composition; many analyses and field assays.

417. Profile surveys of rivers in Wisconsin, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 16 pp., 32 pls. 45c.

ANNUAL REPORTS.

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

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

Annual reports 1 to 26 are royal octavo; later reports are octavo.

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

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

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

*The water resources of Illinois, by Frank Leverett, pp. 695–849, pls. 108 to 113. Describes the physical features of the State, and the drainage basins, including Illinois, Des Plaines, Kankakee, Fox, Illinois-Vermilion, Spoon, Mackinaw, and Sangamon rivers, Macoupin Creek, Rock River, tributaries of the Mississippi in western Illinois, Kaskaskia, Big Muddy, and tributaries of the Wabash; discusses the rainfall and run-off, navigable waters and water powers, the wells supplying water for rural districts, and artesian wells; contains tabulated artesian-well data and water analyses.

Eighteenth Annual Report, United States Geological Survey, 1896–97, Charles D. Walcott, Director. 1897. 5 parts in 6 volumes. *Pt. IV, Hydrography, x, 756 pp., 102 pls. $1.75. Contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419–560, pls. 33 to 37. Describes Wabash, Whitewater, Great Miami, Little Miami, Scioto, Hocking, Muskingum, and Beaver rivers and lesser tributaries of the Ohio in Indiana and Ohio, the streams discharging into Lake Erie and Lake Michigan, and streams flowing to the Upper Mississippi through the Illinois; discusses shallow and drift wells, the flowing wells from the drift and deeper artesian wells, and gives records of wells at many of the cities; describe the mineral springs and gives analyses of the waters; contains also tabulated lists of cities using surface waters for water-works, and of cities and villages using shallow and deep well waters; discusses the source and quality of the city and village supplies, and gives precipitation tables for various points.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 volumes and separate case for maps with Pt. V. *Pt. IV, Hydrography. $1.85. Contains:

* The rock waters of Ohio, by Edward Orton, pp. 633–717, pls. 71 to 73. Describes the principal geologic formations of Ohio and the waters from the different strata; discusses the flowing wells at various points and the artesian wells of the deep preglacial channels in Allen, Auglaize, and Mercer counties; discusses city and village supplies; gives analyses of waters from various formations.

MONOGRAPHS.

Monographs are of quarto size. They are not distributed free, but may be obtained from the Geological Survey or from the Superintendent of Documents at the prices given. An asterisk (*) indicates that the Survey's stock of the paper is exhausted.

XLI. Glacial formations and drainage features of the Erie and Ohio basins, by Frank Leverett. 1902. 802 pp., 26 pls. $1.75.

Treats of an area extending westward from Genesee Valley in New York across northwestern Pennsylvania and Ohio, central and southern Indiana, and southward from Lakes Ontario and Erie to Allegheny and Ohio rivers.

BULLETINS.

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

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

Discusses the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin, and detailed records of wells in Onondaga County, N. Y., and Hancock and Wood counties, Ohio. These wells were selected because they give definite stratigraphic information.

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

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, and Wisconsin, and detailed records of wells in Cook County, Ill.; Erie County, N. Y.; Ottawa, Sandusky, and Summit counties, Ohio; and Manitowoc County, Wis. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

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

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

Folios 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are pub-

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

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

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

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

*81. Chicago, Ill.-Ind.

Describes an area embracing not only the immediate site of the city but adjacent parts of Cook, Dupage, and Will counties Ill.; gives an account of the water power, discusses the quality of the waters, and gives analyses of waters from artesian wells; gives also a list of papers relating to the geology and paleontology of the area.

140. Milwaukee, Wis. 5c.

Gives analyses of spring waters and of artesian water in Milwaukee; also tabulated data concerning wells.

155. Ann Arbor, Mich. 25c.

Discusses the present lakes, the lakes of the glacial period, and, under "Economic geology," the water resources, including the use of the rivers for power and of the underground waters, shallow and artesian, for city and village supplies; discusses the quality of the waters, and gives details by townships.

*169. Watkins Glen-Catatonk, N. Y.

Includes discussion of water supply at Ithaca.

190. Niagara, N. Y. 50c. either edition.

Gives analyses of mineral water from well at Akron; discusses briefly the municipal supplies of Buffalo, Niagara Falls, Tonawanda, La Salle, and Youngstown, and the use of Niagara River for power development.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of the various sections of the country. Notable among those pertaining to the St. Lawrence River basin are the reports of the Chief of Engineers, United States Army, the State Geological Survey of Illinois, the Illinois Water-Supply Commission, the Rivers and Lakes Commission of Illinois, the New York State Conservation Commission and State Water-Supply Commission, and the water-power report of the Tenth Census (vol. 16). The following reports deserve special mention:

The mineral content of Illinois waters, by Edward Bartow, J. A. Udden, S. W. Parr, and George T. Palmer: Illinois State Geol. Survey Bull. 10, 1909.

Chemical and biological survey of waters of Illinois, by Edward Bartow: Univ. Illinois Pubs. 3, 6, 7, 1906–1909.

Chemical survey of the waters of Illinois, report for the years 1897–1902, by A. W. Palmer, with report on geology of Illinois as related to its water supply, by Charles W. Rolfe: Univ. Illinois Pub.

Diversion of the waters of the Great Lakes by way of the Sanitary and Ship Canal of Chicago: A brief of the facts and issues, by Lyman E. Cooley, Chicago, 1913.

The State of Missouri *v.* the State of Illinois and the Sanitary district of Chicago, before Frank S. Bright, commissioner of the Supreme Court of the United States. 1904.

The mineral waters of Indiana, their location, origin, and character, by W. S. Blatchley: Indiana Dept. Geology and Nat. Res. Twenty-sixth Ann. Rept., 1901.

Reports of the water resources investigation of Minnesota, by the State Drainage Commission, 1909–1912.

Water powers of Wisconsin, by L. S. Smith: Wisconsin Geol. and Nat. Hist. Survey Bull. 20, 1908.

Report of the Railroad Commission of Wisconsin to the legislature on water powers. 1915.

Hydrology of the State of New York, by George W. Rafter: New York State Mus. Bull. 85, 1905.

Many of these reports can be obtained from the various commissions, and probably all can be consulted in the public libraries of the larger cities.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

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

WATER-SUPPLY PAPERS.

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

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

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

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

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

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

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

Discusses efficiency of pumps and water lifts of various types.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

79. Normal and polluted waters in northeastern United States, by M. O. Leighton. 1903. 192 pp. 10c.

Defines essential qualities of water for various uses, the impurities in rain, surface, and underground waters, the meaning and importance of sanitary analyses, and the principal sources of pollution; chiefly "a review of the more readily available records" of examination of water supplies derived from streams in the Merrimack, Connecticut, Housatonic, Delaware, and Ohio River basins; contains many analyses.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Notes on the hydrology of Cuba, by M. L. Fuller.

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

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

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

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

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

Scope indicated by title.

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

Scope indicated by title.

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

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

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

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

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

Scope indicated by title.

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

Contains brief reports of general interest as follows:

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

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

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

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

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

Proposed State code of water laws, by Morris Bien.

Power engineering applied to irrigation problems, by O. H. Ensign.

Estimates on tunneling in irrigation projects, by A. L. Fellows.

Collection of stream-gaging data, by N. C. Grover.

Diamond-drill methods, by G. A. Hammond.

Mean-velocity and area curves, by F. W. Hanna.

Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.

Effect of aquatic vegetation on stream flow, by R. E. Horton.

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

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

Alkali soils, by Thos. H. Means.

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

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

Silting of reservoirs, by W. M. Reed.

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

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

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

147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.

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

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

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

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

Scope indicated by title.

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

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

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

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

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

Significance of the term "artesian," by Myron L. Fuller.

Representation of wells and springs on maps, by Myron L. Fuller.

Total amount of free water in the earth's crust, by Myron L. Fuller.

Use of fluorescein in the study of underground waters, by R. B. Dole.

Problems of water contamination, by Isaiah Bowman.

Instances of improvement of water in wells, by Myron L. Fuller.

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

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

Scope indicated by title.

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

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

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

Scope indicated by title.

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

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

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

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

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

Scope indicated by title.

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

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

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

Scope indicated by amplification of title.

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

Scope indicated by title.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

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

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

Scope indicated by title.

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

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

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

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

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

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

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

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

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

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

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

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

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

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

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

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

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

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

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

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

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

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

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

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

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

Scope indicated by title.

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

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

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

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

*375. Contributions to the hydrology of the United States, 1915. N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls.

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

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

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

Three papers presented at the conference of engineers of the water-resources branch in December, 1914.

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

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

(c) The measurement of silt-laden streams, by Raymond C. Pierce, pp. 39–51.

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

ANNUAL REPORTS.

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

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173, Pl. 21. Scope indicated by title.

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

*Irrigation in India, by H. M. Wilson, pp. 375–561, pls. 107 to 146. See Water-Supply Paper 87.

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

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. 111 to 145. Discusses the economic aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping and subirrigation.

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

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

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, papers chiefly of a theoretic nature, v, 958 pp., 127 pls. $2.65. Contains:

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

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

PROFESSIONAL PAPERS.

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

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

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

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

A highly technical report.

BULLETINS.

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

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

*319. Summary of the controlling factors of artesian flows, by Myron L. Fuller, 1908. 44 p. 10c.

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

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

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

INDEX BY AREAS AND SUBJECTS.

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

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

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

INDEX OF STREAMS.