DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

WATER-SUPPLY PAPER 384

SURFACE WATER SUPPLY OF THE UNITED STATES
1914

PART IV. ST. LAWRENCE RIVER BASIN

Prepared under the direction of

NATHAN C. GROVER, Chief Hydraulic Engineer

by

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

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

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10 CENTS PER COPY

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SURFACE WATER SUPPLY OF ST. LAWRENCE RIVER BASIN, 1914.

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, 1914.

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. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 12.

Measurements of stream flow have been made at about 3,400 points in the United States [1] and also at many points in Alaska and the Hawaiian Islands. In July, 1914, 1,480 gaging stations were being

[1] Stream-gaging stations and publications relating to water resources, 1885–1913; U. S. Geol. Survey Water-Supply Paper 340, 1916.

maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report (pp. I–XXIX).

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. 7–8).

"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 1 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 1 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 1 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 1 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, 1913, and ending September 30, 1914. At the 1st 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 text books on the measurement of river discharge. (See Pls. I and 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.

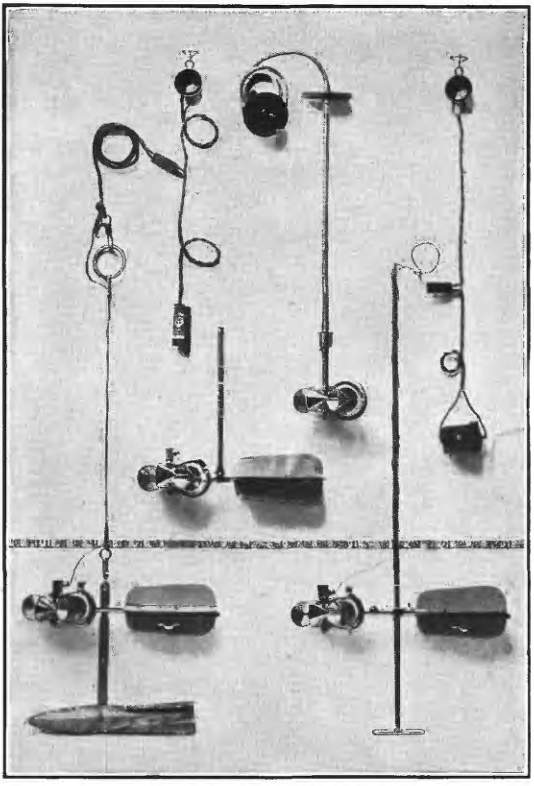
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

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

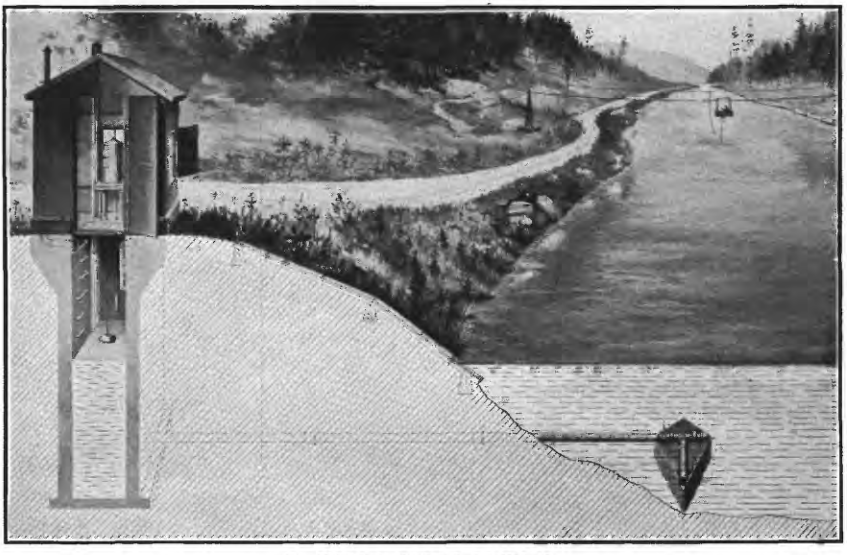
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the constancy of the discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of channel, 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 automatic gages the true mean daily discharge may be obtained by weighting discharge for parts of the day.

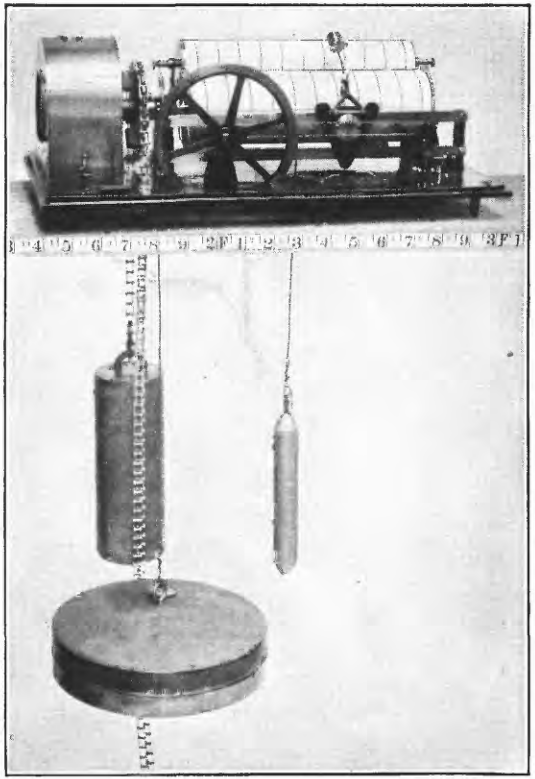
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently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



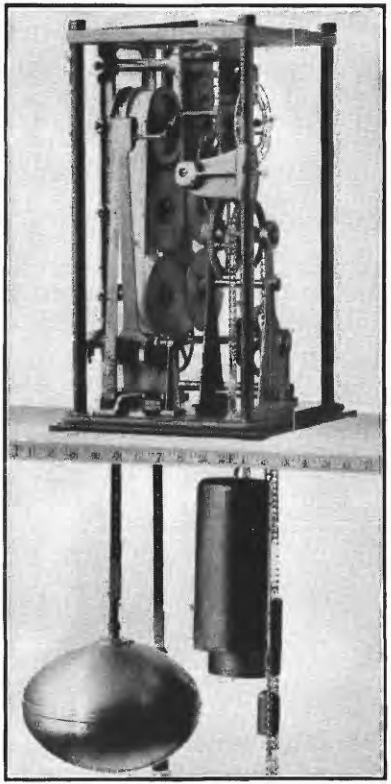
A. PRICE CURRENT METERS.



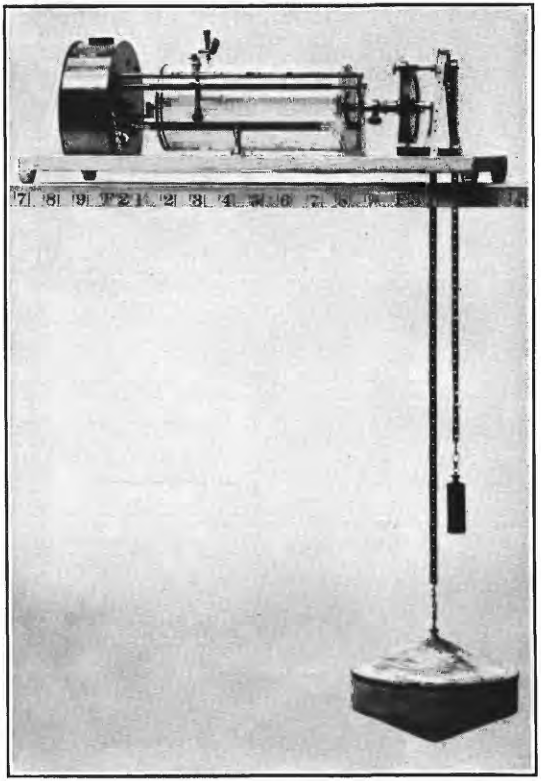
B. TYPICAL GAGING STATIONS.



A. STEVENS.



B. GURLEY PRINTING.



C. FRIEZ.

AUTOMATIC GAGES.

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 non-contributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off (depth in inches)" are therefore not computed if such errors appear probable. The computations are also omitted for 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, 1914, 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 soil problem in this State.

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

Assistance has been rendered by the Oliver Iron Mining Co., which paid the salary of the observer on Menominee River near Iron Mountain, Mich.

The work in Wisconsin during the year ending September 30, 1914, 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 Escanaba River near Escanaba, Mich., has been maintained in cooperation with the Geological Survey of the State of Michigan.

The stations on Manistee River near Sherman, Mich., and Au Sable River near Lovells, Mich., were 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.

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, 1914, was done in cooperation with the State of Vermont, Allen M. Fletcher, governor.

The gaging station on Dog River at Northfield, Vt., has been maintained in cooperation with Norwich University.

Observations of stage on Clyde River at West Derby, Vt., were made by an employee of the Newport Electric Light Co.

DIVISION OF WORK.

The data for stations in the Lake Superior drainage basin and the Lake Michigan drainage basin in Wisconsin were collected and prepared for publication under the direction of W. G. Hoyt, district engineer, who was assisted by S. B. Soulé, G. H. Canfield, J. B. Stewart, H. C. Beckman, M. F. Rather, O. A. Stellar, W. C. Muehlstein, Joe Entringer, and B. J. Peterson.

For stations in the Lake Huron and the Lake Michigan drainage basins in Michigan and the Lake Erie basin in Ohio, 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. In Vermont the work was supervised by C. H. Pierce. The assistants in both States were O. W. Hartwell, G. H. Canfield, C. S. De Golyer, R. S. Barnes, W. S. Easterly, E. D. Burchard, H. W. Fear, and W. A. James.

GAGING-STATION RECORDS.

STREAMS TRIBUTARY TO LAKE SUPERIOR.

POPLAR RIVER AT LUTSEN, MINN.

Location.—In sec. 34, T. 60 N., R. 3 W., about 800 feet above the mouth of river in the town of Lutsen.

Drainage area.—144 square miles.

Records available.—May 6 to November 4, 1911; August 22, 1912, to September 30, 1914.

Gage.—Staff bolted to rock wall on right bank about 800 feet above the mouth and in a pool between two distinct falls; read daily, morning and evening, to quarter-tenths. Gage reader, C. A. A. Nelson. From May 6 to November 4, 1911, the gage was located about 200 feet above mouth of river.

Discharge measurements.—Made by wading.

Channel and control.—Channel, solid rock; control point, crest of the falls below.

Extremes of discharge.—Maximum stage recorded during year: 3.75 feet, August 11; discharge, 692 second-feet. Minimum stage recorded: 0.90 foot, January 26 and March 23 to 29; discharge, 20 second-feet.

Maximum stage recorded August 22, 1912, to September 30, 1914: 3.75 feet, August 11, 1914; discharge, 692 second-feet. Minimum stage recorded: 0.8 foot, January 4, February 8 and 13, 1913; discharge, 9 second-feet.

Winter flow.—Discharge relation affected to a limited extent by ice.

Regulation.—Flow controlled to some extent by two dams above station, the nearest being that of the National Paper and Pulp Co., 2½ miles above mouth of river.

Accuracy.—Gage so located that, except for ice at control and temporary lodging of drift on rapids below, records should be reliable.

Discharge measurements of Poplar River at Lutsen, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	S. B. Soulé	2.20	189
July 7	J. B. Stewart	1.70	104

Daily discharge, in second-feet, of Poplar River at Lutsen, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	33	78	99	34	22	22	22	360	395	228	38	168
2	34	73	97	32	23	21	22	378	310	190	130	168
3	32	71	92	32	22	21	22	482	252	168	168	168
4	39	67	72	32	21	21	22	570	228	146	139	146
5	280	66	67	32	22	21	22	570	202	124	114	129
6	360	70	66	34	21	21	22	535	179	110	97	130
7	325	70	62	30	21	21	22	535	190	100	83	130
8	295	66	60	30	21	21	22	500	240	92	79	122
9	265	66	60	30	21	21	22	430	265	85	150	110
10	240	66	58	29	21	21	23	378	295	78	500	103
11	310	62	58	29	21	21	23	360	265	87	675	99
12	280	60	54	27	21	21	22	310	240	159	570	92
13	215	60	50	27	21	21	23	265	215	179	465	102
14	168	58	50	27	21	21	27	252	168	150	378	465
15	150	55	49	27	21	21	35	228	150	130	325	605
16	136	50	48	27	21	21	55	215	143	122	265	535
17	118	48	47	23	21	21	72	215	126	118	240	448
18	106	48	46	23	21	21	126	202	118	106	240	378
19	99	49	42	22	21	21	143	190	106	97	215	295
20	99	55	40	22	21	21	136	179	100	85	190	240
21	85	61	39	21	21	21	129	190	97	83	168	228
22	80	71	38	22	21	21	122	202	100	85	168	215
23	78	80	36	22	21	20	126	202	97	85	215	215
24	72	50	32	21	21	20	134	179	92	72	228	215
25	78	71	27	21	21	20	159	190	85	62	202	202
26	102	62	31	20	21	20	215	215	78	55	190	179
27	113	55	34	23	21	20	265	202	132	53	190	168
28	99	49	34	25	22	20	482	202	395	47	190	159
29	89	72	37	23	.....	20	518	448	378	44	168	148
30	83	89	37	22	.....	22	430	535	310	40	168	139
31	80	.....	35	21	.....	22	.....	465	.....	40	168	.....

NOTE.—Daily discharge determined from a rating curve well defined between 20 and 265 second-feet. Above 265 second-feet the rating curve is merely an extension. Discharge Dec. 22, 1913, and Jan. 12–15, 1914, estimated because of ice.

Monthly discharge of Poplar River at Lutsen, Minn., for the year ending Sept. 30, 1914.

[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	360	32	147	1.02	1.18	B.
November	89	48	63.3	.440	.49	B.
December	99	27	51.5	.358	.41	B.
January	34	20	26.1	.181	.21	B.
February	23	21	21.2	.147	.15	B.
March	22	20	20.9	.145	.17	B.
April	518	22	115	.799	.89	B.
May	570	179	329	2.28	2.63	C.
June	395	78	198	1.38	1.54	B.
July	228	40	104	.722	.83	B.
August	675	38	230	1.60	1.84	B.
September	605	92	217	1.51	1.68	B.
The year	675	20	127	.882	12.02	

BEAVER BAY RIVER AT BEAVER BAY, MINN.

Location.—Steel highway bridge at Beaver Bay, a few hundred yards above mouth of river.

Drainage area.—120 square miles.

Records available.—July 26, 1911, to September 30, 1914, when station was discontinued.

Gage.—Chain fastened to highway bridge; read daily, in the afternoon, to quarter-tenths; gage reader, Louis Lorntson. Prior to April 10, 1912, readings were taken from a vertical staff gage attached to a rock wall beneath bridge. Both gages set at same datum.

Discharge measurements.—During low water, made by wading; during high water, from boat.

Channel and control.—Solid rock; banks high and rocky.

Winter flow.—Discharge relation affected by ice.

Extremes of discharge.—Maximum stage recorded during year: 6.8 feet, April 28; discharge, 1,940 second-feet. Minimum stage recorded: 0.77 foot, March 30; discharge, 14 second-feet.

Maximum stage recorded July 26, 1911, to September 30, 1914: 7.0 feet, April 17, 1913; discharge, 2,020 second-feet. Minimum stage recorded: 0.3 foot, July 30, 1912; discharge, 3 second-feet.

These data are for open-water periods only; flow probably nearly zero in exceedingly cold weather; discharge of 2.1 second-feet was measured January 14, 1913.

Regulation.—None.

Accuracy.—At times of exceptionally high seas on Lake Superior, a bar is formed which causes backwater at the gage, which lasts as long as the high sea is running. When the lake becomes normal, the water washes through the bar and the regular rating curve applies.

Discharge measurements of Beaver Bay River at Beaver Bay, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 19	S. B. Soulé	2.30	129
July 5	J. B. Stewart	2.10	90

NOTE.—Measurements made by wading.

Daily discharge, in second-feet, of Beaver Bay River at Beaver Bay, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	39	84	132	.....	17	1,300	315	230	8	124
2	40	65	124	.....	17	1,120	230	160	9	87
3	42	61	110	.....	20	1,220	150	124	12	77
4	350	57	87	.....	21	1,580	124	110	15	72
5	945	74	77	.....	18	1,120	104	98	18	67
6	765	65	74	.....	18	945	85	87	23	63
7	675	61	69	.....	21	855	765	75	22	59
8	630	79	205	.....	18	675	900	63	51	51
9	545	61	150	.....	20	545	765	44	59	38
10	1,300	79	57	.....	23	445	425	41	87	48
11	1,080	117	53	.....	26	385	192	37	79	132
12	810	59	45	.....	36	285	180	160	98	87
13	630	49	36	.....	160	242	160	300	59	132
14	465	39	34	.....	385	205	124	230	59	855
15	385	34	32	.....	332	170	98	170	38	675
16	255	34	30	.....	945	160	82	104	51	505
17	160	36	28	.....	900	150	59	72	53	385
18	110	39	26	.....	945	140	55	51	41	350
19	82	42	28	.....	1,040	124	48	44	38	230
20	87	53	39	.....	945	160	44	38	29	160
21	92	69	79	16	945	218	38	33	25	230
22	82	79	69	16	900	180	36	31	33	160
23	77	92	39	15	675	160	41	29	77	160
24	77	84	30	16	585	140	31	25	87	180
25	77	87	20	17	765	205	33	18	98	140
26	160	79	.....	17	810	192	36	15	98	104
27	124	74	.....	17	855	160	855	15	110	92
28	82	65	.....	17	1,940	170	1,080	14	67	72
29	104	69	.....	16	1,710	1,080	765	14	132	79
30	87	84	.....	14	1,480	1,040	315	14	140	69
31	63	.....	.....	16	.....	675	.....	10	110	.....

NOTE.—Daily discharge determined from a rating curve well defined below 285 second-feet. Above 285 second-feet the rating curve is only an extension. Discharge estimated, because of ice, as follows: Dec. 26–31, 1913, 20 second-feet; Jan. 1–31, 1914, 10 second-feet; Feb. 1-28, 4 second-feet; Mar. 1–20, 6 second-feet.

Monthly discharge of Beaver Bay River at Beaver Bay, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 120 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,300	39	336	2.80	3.23	B.
November	117	34	65.7	.548	.61	A.
December	205	.....	57.8	.482	.56	B.
January	.....	.....	10	.083	.10	D.
February	.....	.....	4	.033	.03	D.
March	.....	.....	9.58	.080	.09	D.
April	1,940	17	552	4.60	5.13	C.
May	1,580	124	518	4.32	4.98	C.
June	1,080	31	271	2.26	2.52	B.
July	300	10	79.2	.660	.76	B.
August	140	8	58.9	.491	.57	B.
September	855	38	183	1.52	1.70	B.
The year	1,940	.....	179	1.49	20.28	

ST. LOUIS RIVER NEAR THOMSON, MINN.

Location.—In sec. 11, T. 48 N., R. 16 W., just below tailrace of Great Northern power house, 3 miles east of Thomson.

Drainage area.—3,420 square miles.

Records available.—October 5, 1909, to September 30, 1914.

Gage.—Chain gage; read daily (except Sunday) at 8 and 11 a. m. and 2 and 5 p. m.; average of four readings taken as mean for day. Gage reader, R. A. Giddings.

Discharge measurements.—Made from a cable 1,500 feet below gage.

Channel and control.—Rock and gravel; practically permanent.

Extremes of discharge.—Maximum stage recorded during year: 7.45 feet, June 9; discharge, 14,400 second-feet. Minimum mean daily discharge computed during year: January 23, 424 second-feet.

Maximum stage recorded October 5, 1909, to September 30, 1914: 7.45 feet, June 9, 1914; discharge, 14,400 second-feet. Minimum mean daily discharge computed: 171 second-feet, February 19, 1912.

Winter flow.—Discharge relation affected by ice during January, February, and March; estimates based on quantity of water passing through turbines of Great Northern Power Co.

Regulation.—Flow at station regulated to a certain extent by reservoirs above. The dam at Thomson is designed to hold 24 hours' supply of water for the power plant, and logging dams control the discharge from a large part of the area above the station. 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 though with varying load.

Accuracy.—Open-water estimates subject to errors due to fluctuation in stage caused by operation of power plant. Daily range in stage is not great, however, and it is believed that errors will compensate for a month so that the monthly averages should be accurate within 10 per cent. Accuracy of records furnished by power company not known.

Cooperation.—Gage heights throughout year and records of flow when ice affects the discharge relation furnished through courtesy of Great Northern Power Co., Duluth.

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

May 9, 1914: Gage height, 6.13 feet; discharge, 10,700 second-feet.

Daily discharge, in second-feet, of St. Louis River near Thomson, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,720	1,830	1,720	609	539	584	579	10,400	10,200	9,100	1,390	2,480
2	1,500	1,950	1,720	545	508	570	763	11,600	10,700	8,540	1,360	2,620
3	1,610	2,200	1,830	522	509	602	787	12,000	9,410	7,970	1,340	2,620
4	1,500	2,340	1,720	493	503	593	706	12,700	8,890	7,410	1,340	2,910
5	3,060	2,200	1,830	501	485	580	717	12,600	7,850	6,840	1,180	2,910
6	4,260	2,070	1,610	516	537	567	711	12,200	6,600	5,910	1,180	.....
7	5,470	1,950	1,610	511	521	555	724	11,700	6,840	5,690	1,040	.....
8	5,910	2,070	1,090	525	568	627	691	11,300	8,630	4,840	1,090	.....
9	7,080	1,830	1,090	522	529	606	628	9,920	14,000	4,250	1,130	.....
10	7,080	1,720	1,090	515	552	575	617	8,590	14,000	3,880	1,180	.....
11	7,590	1,830	1,340	455	531	574	563	8,570	12,900	3,540	1,000	.....
12	7,080	1,610	1,230	488	525	568	627	8,330	11,500	5,470	1,000	.....
13	6,370	1,500	1,230	473	525	578	653	7,220	10,300	8,110	955	.....
14	6,600	1,440	1,140	442	526	599	780	7,210	9,070	10,200	1,000	.....
15	5,690	1,830	1,090	448	547	691	868	6,360	7,850	9,410	1,140	.....
16	5,260	1,500	1,090	508	494	726	1,130	5,240	7,080	9,410	1,380	.....
17	5,260	1,500	955	517	513	718	1,340	4,440	5,910	8,110	1,610	.....
18	4,250	1,340	820	534	506	722	1,780	3,880	4,840	7,080	1,280	.....
19	3,880	1,610	780	488	530	675	2,150	4,060	4,440	6,380	1,280	.....
20	3,220	1,390	670	487	555	588	2,350	3,880	3,880	5,690	1,390	.....
21	3,060	1,440	530	460	550	583	2,450	4,060	3,710	4,640	1,610	.....
22	2,620	1,390	670	427	553	550	2,940	4,060	3,540	4,060	1,610	.....
23	2,340	1,830	705	424	525	556	3,520	4,840	3,540	3,540	1,780	.....
24	2,620	1,830	670	448	520	536	3,480	4,250	3,540	3,220	1,950	.....
25	2,480	1,830	530	511	479	571	3,530	5,690	3,540	2,910	2,340	.....
26	2,620	1,610	530	499	529	512	3,810	4,250	3,220	2,630	3,060	.....
27	2,620	1,830	500	503	537	523	3,690	3,380	3,540	2,350	2,910	.....
28	2,620	1,610	550	494	529	519	5,220	3,880	6,970	2,070	2,910	.....
29	2,480	1,720	600	499	.....	496	9,270	6,840	10,400	1,950	2,720	.....
30	2,480	1,720	670	479	.....	455	9,540	10,400	9,670	1,950	2,530	.....
31	1,830	.....	670	538	.....	551	.....	10,300	.....	1,830	2,340	.....

NOTE.—Daily discharge, except as noted below, determined from a rating curve well defined between 530 and 10,400 second-feet. Daily discharge Jan. 1 to May 16 obtained from records of flow through the turbines, furnished by the Great Northern Power Co. Daily discharge when the gage was not read, estimated for the following days: Oct. 6, Dec. 9 and 28, 1913; May 31, June 13, 14, 21, and 28, July 1–4, 19, 26, and 27, Aug. 2, 8, 9, 16, 23, 29, and 30, 1914.

Monthly discharge of St. Louis River near Thomson, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 3,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	7,590	1,500	3,940	1.15	1.33
November	2,340	1,340	1,750	.512	.57
December	1,830	500	1,040	.304	.35
January	609	424	496	.145	.17
February	568	479	526	.154	.16
March	726	455	585	.171	.20
April	9,540	563	2,220	.649	.72
May	12,700	3,880	7,550	2.21	2.55
June	14,000	3,220	7,550	2.21	2.47
July	10,200	1,830	5,450	1.59	1.83
August	3,060	955	1,610	.471	.54
September	.....	.....	.....	.....	.....

WHITEFACE RIVER BELOW MEADOWLANDS, MINN.

Location.—About 2½ miles below Meadowlands, half a mile below the beginning of decided rapids, and about 10 miles above confluence of Whiteface and St. Louis rivers.

Drainage area.—446 square miles.

Records available.—April 28, 1912, to September 30, 1914. Records June 7, 1909, to November 9, 1912, collected at station at Meadowlands about 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; read daily, morning and evening, to quarter-tenths. Gage reader, A. A. Jochim.

Discharge measurements.—Made by wading or from Duluth, Missabe & Northern Railway bridge about 5,000 feet above gage.

Channel and control.—Heavy gravel and rock; probably permanent.

Winter flow.—Discharge relation affected by ice. Observations discontinued.

Extremes of discharge.—Maximum stage recorded during year: 6.82 feet at 7.10 a. m., April 29; discharge, 2,540 second-feet. Minimum stage recorded: 1.7 feet at 5 p. m., April 11; discharge, 39 second-feet.

Maximum discharge computed June 7, 1909, to September 30, 1914: 3,400 second-feet, August 11, 1909. Minimum discharge computed: 30 second-feet, July 6–10, 1909.

These data are for open-water periods only; minimum probably much lower during exceedingly cold weather.

Regulation.—Flow controlled to a large extent by logging dams. The operation of these gates causes fluctuations of several feet in gage heights. Few logs below station and backwater is seldom present.

Accuracy.—Estimates good except for periods when ice is present.

Discharge measurements of Whiteface River below Meadowlands, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 7	S. B. Soulé	6.10	1,970	Aug. 17	J. B. Stewart	2.45	104
July 3	J. B. Stewart	4.75	1,080				

Daily discharge, in second-feet, of Whiteface River below Meadowlands, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	266	474	220	.....	2,440	1,750	1,680	126	390
2	266	334	220	.....	2,120	1,680	1,320	118	519
3	266	316	235	.....	2,360	1,750	1,050	104	519
4	431	282	235	.....	2,360	1,460	932	92	519
5	816	266	220	.....	2,360	872	712	81	474
6	1,120	282	206	.....	1,820	662	613	81	431
7	1,250	282	192	.....	1,820	613	613	76	431
8	1,320	266	.....	.....	1,600	1,600	519	72	390
9	1,250	220	.....	.....	1,320	2,360	474	76	334
10	1,320	282	.....	.....	1,050	2,200	390	86	334
11	1,530	390	.....	39	1,180	1,900	371	86	282
12	1,390	316	.....	42	763	1,750	1,680	86	316
13	1,250	266	.....	59	1,250	1,530	2,050	86	316
14	1,180	250	.....	59	1,050	1,250	1,900	81	390
15	1,050	235	.....	72	763	932	1,600	81	565
16	872	167	.....	81	662	712	1,460	104	662
17	763	167	.....	67	816	565	1,250	126	712
18	662	167	.....	76	763	474	1,050	145	763
19	565	192	.....	126	192	431	565	220	712
20	519	282	.....	192	266	431	474	282	613
21	431	206	.....	250	316	352	519	250	519
22	390	250	.....	712	316	371	474	220	474
23	390	206	.....	763	474	334	352	250	431
24	352	167	.....	712	613	352	299	565	371
25	334	206	.....	1,120	519	316	266	1,050	316
26	371	250	.....	712	250	299	235	613	299
27	431	220	.....	932	712	613	156	474	299
28	390	192	.....	816	474	1,120	167	390	266
29	352	206	.....	2,440	1,050	1,250	167	352	282
30	371	220	.....	2,280	1,460	1,250	156	334	299
31	431	.....	.....	.....	1,600	.....	145	352	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge Dec. 9–31, 1913, estimated at 200 second-feet by comparison with records for St. Louis River near Thomson, Minn.

Monthly discharge of Whiteface River below Meadowlands, Minn., for the year ending Sept. 30, 1914.

[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	1,530	266	720	1.61	1.86	B.
November	474	167	252	.565	.63	B.
December	.....	.....	204	.457	.53	B.
April 11–30	2,440	39	578	1.30	.97	B.
May	2,440	192	1,120	2.51	2.89	B.
June	2,360	299	1,040	2.33	2.60	B.
July	2,050	145	763	1.71	1.97	B.
August	1,050	72	228	.511	.59	B.
September	763	266	441	.989	1.10	B.

CLOQUET RIVER AT INDEPENDENCE, MINN.

Location.—In sec. 26, T. 52 N., R. 17 W., at the highway bridge at Independence post office, just below a small tributary entering from the north.

Drainage area.—698 square miles.

Records available.—June 28, 1909, to September 30, 1914.

Gage.—Vertical staff; read three times daily to quarter-tenths. Gage reader, Herbert Haakensen.

Discharge measurements.—Made from bridge.

Channel and control.—Heavy gravel and rock; practically permanent.

Extremes of discharge.—Maximum stage recorded during year: 8.95 feet at noon, June 2; discharge, 3,620 second-feet. Minimum discharge probably below 10 second-feet January 1 to 11, 1914, as Great Northern Power Co. reported no flow from Fish Lake and Island Lake reservoirs during that period.

Maximum mean daily discharge computed June 28, 1909, to September 30, 1914: 6,010 second-feet, June 1, 1911.

Winter flow.—Discharge relation affected by ice.

Regulation.—River used extensively for log driving; run-off from greater part of drainage area above Independence controlled by logging dams.

Accuracy.—Open-water records approximate; operation of logging dams causes violent diurnal fluctuations in the gage height amounting at times to several feet; mean daily gage height derived from three readings, taken morning, noon, and night, only approximate. Discharge relation also somewhat affected by backwater from logs lodged in the channel throughout the open-water period.

Cooperation.—Records of flow from the logging reservoirs were furnished by Great Northern Power Co., Duluth, January 1 to March 14, 1914.

Discharge measurements of Cloquet River at Independence, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 6	S. B. Soulé	7.88	[a] 2,870	Aug. 18	J. B. Stewart	5.45	508
July 3	J. B. Stewart	7.40	2,090				

[a] Few logs lodged in channel.

Daily discharge, in second-feet, of Cloquet River at Independence, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	165	410	311	.....	1,640	3,270	1,530	330	740
2	179	505	208	.....	2,080	3,570	2,090	292	740
3	193	560	140	.....	2,650	3,470	2,090	292	740
4	240	560	370	.....	2,760	2,770	2,000	274	740
5	330	455	330	.....	2,880	2,380	1,900	274	772
6	505	410	292	.....	2,880	1,620	1,350	257	772
7	1,600	350	292	.....	2,760	1,620	1,260	240	772
8	900	480	274	.....	2,760	1,800	805	240	805
9	2,390	1,080	390	.....	2,300	1,800	645	240	805
10	2,390	1,370	505	.....	1,960	2,180	455	257	805
11	2,250	390	410	.....	2,540	2,180	505	274	708
12	2,250	165	505	.....	2,080	2,180	1,350	311	615
13	2,250	165	620	.....	1,860	2,000	1,530	410	615
14	2,110	165	505	.....	2,760	2,090	1,900	455	740
15	1,720	165	505	208	2,540	2,180	1,800	505	805
16	1,850	193	455	208	1,160	2,090	1,440	560	1,020
17	1,720	193	410	208	410	2,180	1,020	505	1,020
18	1,850	193	330	224	410	1,800	1,020	505	1,180
19	755	208	330	311	900	1,100	1,100	455	1,180
20	720	224	311	208	1,060	875	1,020	455	1,260
21	620	292	.....	193	1,240	772	875	588	1,260
22	620	292	.....	208	1,860	675	805	675	1,020
23	620	330	.....	224	2,190	675	675	708	1,020
24	685	330	.....	208	2,670	675	560	708	1,020
25	755	330	.....	208	1,180	772	560	645	708
26	790	257	.....	224	532	1,020	505	560	708
27	825	224	.....	257	390	1,020	505	615	675
28	685	224	.....	370	1,260	1,100	455	675	675
29	560	292	.....	790	2,000	1,350	330	740	675
30	410	292	.....	620	2,770	1,530	330	708	675
31	410	.....	.....	.....	2,770	.....	330	740	.....

NOTE.—Daily discharge determined from poorly defined rating curves; discharge relation affected by backwater from logs Apr. 15 to Sept. 30, 1914; discharge estimated, because of ice, as follows: Dec. 21–31, 300 second-feet; Jan. 1–31, 85 second-feet; Feb. 1–28, 220 second-feet; Mar. 1–14, 270 second-feet. No record Mar. 15 to Apr. 14.

Monthly discharge of Cloquet River at Independence, Minn., for the year ending Sept. 30, 1914.

[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	2,390	165	1,080	1.55	1.79	A.
November	1,370	165	370	.530	.59	A.
December	.....	140	348	.499	.58	B.
January	.....	.....	85	.122	.14	
February	.....	.....	220	.315	.33	
March 1–14	.....	.....	270	.387	.20	
April 15–30	790	193	292	.418	.25	C.
May	2,880	390	1,910	2.74	3.16	C.
June	3,570	675	1,760	2.52	2.81	C.
July	2,090	330	1,060	1.52	1.75	C.
August	740	240	468	.670	.77	C.
September	1,260	615	842	1.21	1.35	C.

NOTE.—Mean monthly discharge Dec. 21, 1913, to Mar. 14, 1914, estimated from discharge at outlet of Fish Lake Reservoir on Cloquet River in sec. 15, T. 52 N., R. 15 W., and from the flow from Island Lake Reservoir on Beaver River in sec. 29, T. 52 N., R. 15 W., plus 10 second-feet; no record Mar. 15 to Apr. 14.

AMINICON RIVER NEAR AMINICON FALLS, WIS.

Location.—At highway bridge about three-fourths of a mile east of Aminicon Falls, 500 feet above Northern Pacific Railway bridge, and 7 miles above mouth of river.

Drainage area.—102 square miles.

Records available.—March 17 to September 30, 1914.

Gage.—Chain gage fastened to upstream side of highway bridge; read once daily to half-tenths. Gage reader, F. J. St. Onge.

Discharge measurements.—Made from highway bridge or at low stages by wading.

Channel and control.—Heavy gravel and small rock; probably permanent.

Winter flow.—Discharge relation affected by ice; flow determined from discharge measurements made through the ice.

Extremes of discharge.—Maximum stage recorded March 17 to September 30, 1914: 3.1 feet at 7.30 a. m., April 29; discharge, 583 second-feet. Minimum stage recorded: 0.7 foot, August 6 to 8; discharge, 15 second-feet.

These data are for open-water period only. Minimum discharge measured during extremely cold weather: 6.6 second-feet by current-meter February 19, but flow is probably less at times.

Accuracy.—Records good. Estimates of daily and monthly discharge above 264 second-feet differ from those published in the Report to the Railroad Commission of Wisconsin because of a revision of the rating curve based upon discharge measurements obtained after the publication of that report.

Discharge measurements of Aminicon River near Aminicon Falls, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 19	Hoyt and Canfield	0.80	[a] 6.6	June 11	M. F. Rather	2.20	295
Mar. 17	H. C. Beckman	1.96	[b] 54.4	Aug. 6	do	.70	15
Apr. 11	M. F. Rather	1.36	64.6	6	do	.70	16
June 4	do	1.70	157	10	do	2.20	299

[a] Measurement made through complete ice cover. [b] Measurement made through partial ice cover.

Daily discharge, in second-feet, of Aminicon River near Aminicon Falls, Wis., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	422	233	390	23	90	16	[a]136	136	136	233	180	98
2	.....	422	180	422	23	98	17	136	126	136	180	157	107
3	.....	454	180	326	23	98	18	136	116	116	146	136	98
4	.....	422	168	326	23	98	19	136	98	116	136	116	98
5	.....	422	192	295	19	90	20	358	90	116	126	116	90
6	.....	422	205	233	15	82	21	326	90	126	116	98	82
7	.....	390	422	205	15	82	22	486	82	136	90	98	90
8	.....	358	205	168	15	74	23	486	82	116	82	107	82
9	.....	358	486	136	19	60	24	486	82	157	67	126	82
10	.....	264	358	116	280	82	25	518	82	157	54	116	74
11	.....	233	295	116	264	74	26	486	90	233	42	107	74
12	.....	219	233	248	233	74	27	486	90	454	37	98	67
13	.....	205	205	470	233	67	28	550	90	422	37	98	60
14	.....	157	192	486	205	85	29	583	422	358	32	82	48
15	136	146	157	295	192	90	30	486	454	358	32	98	42
							31	.....	390	.....	28	98	.....

[a] Interpolated.

NOTE.—Daily discharge determined from a rating curve fairly well defined between 15 and 550 second-feet. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records as follows: Mar. 17–31, 55 second-feet; Apr. 1–14, 60 second-feet.

Monthly discharge of Aminicon River near Aminicon Falls, Wis., for the year ending Sept. 30, 1914.

[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.		
March 17–31	.....	.....	55	0.539	0.30	D.
April	583	.....	226	2.22	2.48	B.
May	454	82	239	2.34	2.70	B.
June	486	116	231	2.26	2.52	B.
July	486	28	183	1.79	2.06	B.
August	280	15	110	1.08	1.24	B.
September	107	42	81	.794	.89	B.

BRULE RIVER NEAR BRULE, WIS.

Location.—At the Brule Outing Club, about 4½ miles downstream from Brule, and 9 miles above mouth of river.

Drainage area.—162 square miles.

Records available.—March 19 to September 30, 1914.

Gage.—Staff; low-water section 0 to 7.9 feet, fastened to downstream side of Brule Outing Club boat landing; high-water section 8 to 9.9 feet, fastened to tree on shore end of landing; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3 feet, half-tenths between 3 and 4, and tenths above 4 feet.

Discharge measurements.—Made from a boat held in place by a wire across the river below gage; at low stages, made by wading.

Channel and control.—Gravel; probably permanent.

Extremes of stage.—Maximum stage recorded March 19 to September 30, 1914: 4.45 feet at 7 a. m., April 29. Minimum stage recorded: 2.75 feet at 7 a. m., March 20.

Winter flow.—Discharge relation affected by ice; discharge determined from measurements made through the ice.

Regulation.—None except by natural storage in lakes Minnesuing and Nebagamin.

Data insufficient for estimates of discharge.

Discharge measurements of Brule River near Brule, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 20	Hoyt and Canfield	(a)	[b] 148	June 11	M. F. Rather	3.30	[d] 250
Mar. 18	H. C. Beckman	3.05	[c] 182	Aug. 7	do	2.90	[d] 145
Apr. 13	M. F. Rather	3.19	238	8	do	2.90	[d] 147
June 10	do	3.30	[d] 249				

[a] Gage not installed when the measurement was taken.
[b] Complete ice cover below gage.
[c] Measurement made from boat; no ice present.
[d] Made by wading.

Daily gage height, in feet, of Brule River near Brule, Wis., for the year ending Sept. 30, 1914.

[H. A. Wilcox, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	3.3	4.0	3.45	4.0	2.95	3.15
2	.....	3.2	3.9	3.4	3.8	2.91	3.2
3	.....	3.15	3.9	3.3	3.6	2.90	3.1
4	.....	3.05	4.2	3.3	3.6	2.90	3.1
5	.....	3.1	4.1	3.4	3.5	2.90	3.05
6	.....	3.05	4.0	3.5	3.4	2.90	3.05
7	.....	3.1	3.9	3.4	3.3	2.90	3.0
8	.....	3.05	3.85	3.6	3.25	2.95	3.0
9	.....	3.0	3.75	3.6	3.2	3.1	3.0
10	.....	3.05	3.7	3.4	3.15	3.4	3.05
11	.....	3.05	3.6	3.3	3.1	3.2	3.1
12	.....	3.3	3.55	3.2	3.3	3.2	3.1
13	.....	3.15	3.5	3.2	3.4	3.2	3.1
14	.....	3.25	3.4	3.15	3.3	3.1	3.25
15	.....	3.3	3.4	3.1	3.3	3.1	3.2
16	.....	3.35	3.35	3.1	3.25	3.45	3.15
17	.....	3.35	3.35	3.05	3.2	3.25	3.15
18	.....	3.45	3.3	3.1	3.15	3.2	3.1
19	2.96	4.0	3.25	3.2	3.1	3.1	3.1
20	2.95	3.65	3.25	3.1	3.05	3.1	3.05
21	2.91	4.0	3.3	3.1	3.05	3.05	3.1
22	2.90	4.0	3.25	3.2	3.0	3.05	3.2
23	2.90	3.9	3.25	3.2	3.1	3.15	3.15
24	2.92	3.9	3.2	3.3	3.05	3.15	3.1
25	3.2	4.2	3.2	3.3	3.0	3.1	3.1
26	3.4	4.0	3.3	3.2	3.0	3.1	3.05
27	3.2	3.9	3.2	4.4	3.0	3.1	3.0
28	3.0	4.2	3.2	4.6	2.98	3.1	3.0
29	2.96	4.4	3.9	4.1	2.96	3.05	3.0
30	3.25	4.2	3.6	3.8	2.95	3.05	3.0
31	3.5	.....	3.5	.....	2.95	3.05	.....

NOTE.—Discharge relation probably not materially affected by ice.

BAD RIVER NEAR ODANAH, WIS.

Location.—About 8 miles upstream from Odanah, 12 miles above mouth. Potato River enters from the right about 8 miles above station.

Drainage area.—607 square miles.

Records available.—July 31 to September 30, 1914.

Gage.—Gurley water-stage recorder on left bank.

Discharge measurements.—Made from a cable about 700 feet upstream from gage.

Channel and control.—Channel sandy; control, a rock outcrop about 200 feet below the gage; logs may possibly hang on ledge and cause backwater at gage.

Extremes of stage.—Maximum stage recorded July 31 to September 30, 1914: 2.61 feet at 5.15 a. m., September 26. Minimum stage recorded: 1.02 feet at 9.45 a. m., August 2.

Winter flow.—Discharge relation affected by ice.

Regulation.—A number of small reservoirs are operated as an aid to log driving in the early spring and summer, during which time the stage fluctuates rapidly and flow is not normal.

Cooperation.—Station maintained in cooperation with the United States Indian Service.

Data insufficient for estimates of discharge.

Discharge measurements of Bad River near Odanah, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Feb. 29	Hoyt and Canfield	.....	[a] 112
Aug. 1	W. G. Hoyt	1.04	[b] 182
28	G. H. Canfield	1.26	[c] 305

[a] Measurement made under complete ice cover a short distance below cable site.
[b] Measurement made from cable; velocity rather low.
[c] Measurement made by wading about 1 mile below cable.

Daily gage height, in feet, of Bad River near Odanah, Wis., for the year ending Sept. 30, 1914.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	1.06	1.26	11	.....	1.84	1.34	21	.....	.....	1.45
2	.....	1.04	1.71	12	.....	1.66	1.40	22	.....	1.34	1.57
3	.....	.....	2.00	13	.....	.....	1.36	23	.....	1.39	1.93
4	.....	.....	2.03	14	.....	.....	1.39	24	.....	1.54	1.96
5	.....	.....	1.90	15	.....	.....	1.41	25	.....	1.76	1.83
6	.....	.....	1.70	16	.....	.....	1.76	26	.....	1.44	1.98
7	.....	.....	1.62	17	.....	.....	1.58	27	.....	1.35	1.62
8	.....	.....	1.48	18	.....	.....	1.67	28	.....	1.30	1.54
9	.....	.....	1.67	19	.....	.....	1.61	29	.....	1.26	1.44
10	.....	.....	1.33	20	.....	.....	1.56	30	.....	1.20	1.38
								31	1.08	1.20	.....

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, 1914. Discharge measurements only, April, May, and July, 1903.

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

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Probably permanent.

Extremes of discharge.—Maximum stage recorded during year: 7.4 feet at 7 a. m., April 30. Minimum stage recorded: 2.1 feet, June 14 to 20.

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 due to elongation of the gage chain or due to changes in the position of the gage.

No discharge measurements were made at this station during the year ending September 30, 1914.

Daily gage height, in feet, of Escanaba River near Escanaba, Mich., for the year ending Sept. 30, 1914.

[Regis Beauchamp, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.8	3.0	3.0	2.7	.....	.....	3.6	7.0	2.5	4.0	3.3	2.4
2	2.7	2.9	3.1	2.7	2.9	3.3	3.8	6.8	2.5	3.9	2.9	2.5
3	2.9	2.9	3.1	2.5	.....	.....	3.8	6.6	2.5	3.6	2.8	2.7
4	3.0	2.8	2.9	2.5	2.9	3.2	3.8	6.2	2.5	3.4	2.7	2.7
5	3.0	2.8	2.9	2.6	.....	.....	3.8	4.8	2.5	3.4	2.6	2.8
6	3.1	2.7	2.9	2.8	.....	.....	3.8	4.8	2.4	3.3	2.6	2.9
7	3.1	2.7	2.8	2.8	2.9	3.2	3.5	4.6	2.4	3.3	2.5	2.8
8	3.1	2.7	2.7	2.6	.....	.....	3.5	4.5	2.4	3.3	2.5	2.6
9	3.2	2.7	2.7	2.5	2.9	3.4	3.3	4.4	2.3	3.0	2.5	2.6
10	3.2	2.8	2.7	2.9	.....	.....	3.3	4.2	2.3	2.8	2.4	2.5
11	3.3	3.0	2.9	2.9	3.0	3.4	3.3	4.0	2.3	2.5	2.4	2.5
12	3.3	3.0	2.9	2.8	.....	.....	3.3	3.8	2.2	3.5	2.3	2.7
13	3.5	2.9	2.4	2.8	.....	.....	3.3	3.6	2.2	4.3	2.3	2.7
14	3.6	2.8	2.4	2.8	3.0	3.4	3.6	3.5	2.1	4.1	2.3	2.8
15	3.3	2.8	2.3	2.8	.....	.....	3.6	3.4	2.1	3.8	2.4	2.9
16	3.3	2.7	2.3	2.8	3.0	3.4	3.8	3.4	2.1	3.3	2.4	3.0
17	2.9	2.7	2.4	2.8	.....	.....	4.0	3.3	2.1	3.3	2.4	3.0
18	2.9	2.8	2.4	2.8	2.9	3.4	4.0	3.2	2.1	3.0	2.4	2.9
19	2.8	2.8	2.4	2.8	.....	.....	4.8	3.1	2.1	2.8	2.4	2.8
20	2.7	3.0	2.4	2.8	.....	.....	4.9	3.1	2.1	2.6	2.4	2.7
21	2.7	3.2	2.5	2.7	2.9	.....	4.9	2.9	2.2	2.6	2.4	2.6
22	2.7	3.4	2.6	2.7	.....	.....	4.9	2.9	2.3	2.7	2.4	2.5
23	2.7	3.5	2.7	2.7	3.1	3.4	4.7	2.9	2.3	3.7	2.5	2.5
24	2.6	3.7	2.5	2.7	.....	.....	4.7	2.9	2.3	3.8	2.5	2.4
25	2.6	3.7	2.6	2.7	3.2	3.4	4.5	3.0	2.3	3.8	2.6	2.4
26	2.6	3.5	2.7	2.7	.....	.....	4.6	3.0	2.3	3.8	2.6	2.4
27	2.9	3.4	2.7	2.8	.....	.....	4.8	3.0	3.0	3.9	2.7	2.3
28	3.0	3.1	2.7	2.8	3.3	3.4	5.0	3.0	3.4	4.1	2.7	2.3
29	3.3	3.0	2.7	2.9	.....	.....	7.2	2.9	3.9	4.1	2.7	2.3
30	3.2	3.0	2.7	2.9	.....	3.6	7.4	2.6	4.0	3.9	2.6	2.2
31	3.0	.....	2.5	3.1	.....	.....	.....	2.6	.....	3.4	2.5	.....

NOTE.—Discharge relation probably affected by ice Dec. 26, 1913, to Mar. 31, 1914.

MENOMINEE RIVER NEAR IRON MOUNTAIN, MICH.

Location.—At the Homestead highway bridge, 3½ miles south of Iron Mountain.

Drainage area.—2,420 square miles.

Records available.—September 4, 1902, to March 31, 1909; June 5, 1909, to July 31, 1914, when station was discontinued because reliable observer was not available.

Gage.—Standard chain gage attached to the bridge; read daily, morning and evening, to tenths. Gage reader, A. J. St. Arnauld.

Discharge measurements.—Made from highway bridge.

Channel and control.—Practically permanent.

Winter flow.—Prior to 1914 few discharge measurements had been made at Iron Mountain when ice was present. Information obtained from people well acquainted with conditions in the vicinity of gage led to the assumption that discharge relation was not affected by ice; measurements made during 1914 show, however, that this assumption was incorrect.

Extremes of discharge.—Maximum open-water stage recorded October 1, 1913, to July 31, 1914: 12.3 feet at 10 a. m., May 2; discharge, 11,600 second-feet. Minimum open-water stage recorded: 1.6 feet at 9.45 a. m., October 8 and at 9.45 a. m., November 5; discharge, 1,180 second-feet. Minimum discharge measured when stream was ice-covered, 949 second-feet, February 23.

Maximum computed discharge 1902–1914: 15,100 second-feet, April 21, 1906. Minimum discharge computed for open-water period, 1902–1914: 860 second-feet, July 8 and 20–23, 1910.

Regulation.—No storage reservoirs above station. Gage heights, however, show slight diurnal fluctuations due to operation of the Peninsular Power Co.'s plant above. The plant is run continuously but the load varies somewhat throughout the day.

Accuracy.—As ice will affect discharge relation, winter records previous to December 1, 1913, should be used with caution.

Discharge measurements of Menominee River near Iron Mountain, Mich., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	S. B. Soulé	3.17	2,200	Mar. 24	O. A. Steller	1.82	[c] 1,130
3	do	2.76	1,960	Apr. 14	M. F. Rather	2.05	1,440
Jan. 19	G. H. Canfield	1.95	[a] 1,390	May 4	G. H. Canfield	11.31	10,400
Feb. 23	H. C. Beckman	1.95	[b] 949				

[a] Ice along shores.
[b] Nearly complete ice cover.
[c] Original notes lost; data as given from unchecked computations.

Daily discharge, in second-feet, of Menominee River near Iron Mountain, Mich., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.
1	1,690	2,910	2,590	1,970	11,000	4,120	3,000
2	1,970	2,910	2,750	1,690	11,600	4,120	3,250
3	2,120	2,430	2,270	2,120	11,000	4,480	3,080
4	1,970	1,970	2,120	2,270	11,000	3,940	3,420
5	2,510	1,180	2,040	2,120	10,900	4,750	3,300
6	2,510	1,350	1,690	1,830	10,300	4,840	3,250
7	3,080	1,420	2,120	1,690	9,040	4,750	3,000
8	1,180	1,420	1,690	1,620	8,010	4,120	3,500
9	1,350	1,420	1,350	1,420	7,120	4,660	3,420
10	2,590	1,420	2,120	1,420	6,040	3,160	3,000
11	2,590	1,290	2,120	1,420	6,040	4,750	3,940
12	2,910	1,420	2,120	1,480	4,300	3,940	4,480
13	2,910	1,620	2,120	1,480	4,390	3,850	5,040
14	2,910	1,760	1,970	1,480	5,040	4,120	4,840
15	2,910	1,760	1,970	1,480	5,840	5,040	4,940
16	2,750	1,760	2,120	1,480	6,040	5,840	5,440
17	1,550	1,830	2,120	1,690	6,460	6,790	3,500
18	1,690	1,830	2,120	1,690	7,670	6,040	3,160
19	1,690	2,040	2,120	1,690	4,300	3,850	3,420
20	1,970	2,040	2,120	2,120	4,120	3,940	2,670
21	1,970	2,040	2,120	2,120	5,240	4,390	2,590
22	1,830	2,040	1,690	2,590	5,740	4,570	2,910
23	1,830	2,120	1,690	3,000	5,340	4,390	4,120
24	1,970	2,120	1,690	4,660	5,540	4,750	3,160
25	1,970	3,590	1,690	5,940	4,120	4,120	2,270
26	3,590	3,590	1,690	6,040	4,300	4,080	3,250
27	3,590	3,590	1,690	6,790	5,740	3,420	3,080
28	3,420	3,420	1,690	6,790	5,540	3,590	3,420
29	3,420	3,420	1,690	9,160	5,040	3,160	4,750
30	3,420	3,420	1,690	8,930	6,240	3,940	4,660
31	3,420	.....	1,690	.....	6,140	.....	4,840

NOTE.—Daily discharge determined from a rating curve well-defined between 1,290 and 11,300 second-feet. Discharge estimated, because of ice, from records of flow at the Twin Falls hydroelectric plant furnished by D. W. Mead, consulting engineer, Madison, Wis., as follows: Jan. 1–10, 1,230 second-feet; Jan. 11–20, 1,020 second-feet; Jan. 21–31, 1,140 second-feet; Feb. 1–10, 1,040 second-feet; Feb. 11–20, 874 second-feet; Feb. 21–28, 890 second-feet; Mar. 1–10, 782 second-feet; Mar. 11–20, 875 second-feet; and Mar. 21–31, 886 second-feet.

Monthly discharge of Menominee River near Iron Mountain, Mich., for the year ending Sept. 30, 1914.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	3,590	1,180	2,430	1.00	1.15	A.
November	3,590	1,180	2,170	.897	1.00	B.
December	2,750	1,350	1,960	.810	.93	B.
January	.....	.....	1,130	.467	.54	C.
February	.....	.....	938	.388	.40	C.
March	.....	.....	849	.351	.40	C.
April	9,160	1,420	3,010	1.24	1.38	B.
May	11,600	4,120	6,750	2.79	3.22	A.
June	6,790	3,160	4,380	1.81	2.02	A.
July	5,440	2,270	3,640	1.50	1.73	B.

MENOMINEE RIVER AT KOSS, MICH.[1]

Location.—On Wisconsin & Michigan Railroad bridge near Koss, about 4 miles above dam of Menominee & Marinette Light & Traction Co., about 12 miles below junction with Wausaukee River, which enters from the right, and about 26 miles above mouth of the Menominee.

Drainage area.—3,780 square miles.

Records available.—June 21, 1907, to March 31, 1909; January 27 to June 30, 1914, when station was discontinued.

Gage.—Chain fastened to upstream side of bridge. Zero of gage used January 27 to June 30, 1914, is 5 feet above datum previously used.

Discharge measurements.—Made from the bridge.

Channel and control.—Rock and heavy gravel; permanent.

Extremes of discharge.—Maximum stage recorded January 27 to June 30, 1914: 9.6 feet[2] at 8 a. m., May 3. Minimum stage recorded for this period: 1.50 feet at 4 p. m., June 23.

Maximum discharge June 21 to December 21, 1907, and April 14 to December 29, 1908: 14,600 second-feet May 1, 1908. Minimum discharge for this period: 688 second-feet August 16 and September 1, 1908.

Winter flow.—Discharge relation affected by ice; flow determined from discharge measurements made through the ice.

Regulation.—Considerable fluctuation at gage caused by operation of power plants above.

Accuracy.—Discharge relation apparently affected at times by backwater from the dam 3 miles below gage and by operation of power plants above; estimates of discharge for 1914 therefore not published. Gage heights June 21, 1907, to March 31, 1909, not affected by the dam below.

[1] See also Menominee River below Koss, Mich.

[2] Gage height probably affected by backwater from dam 4 miles below.

Discharge measurements of Menominee River at Koss, Mich., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 28	G. H. Canfield	3.32	[a] 1,780	May 5-6	G. H. Canfield	7.92	15,100
Feb. 19	H. C. Beckman	3.22	[a] 1,450	9	do	6.36	10,500
Mar. 27	O. A. Steller	3.15	[a] 1,610	18	H. C. Beckman	4.04	4,520
Apr. 17	M. F. Rather	3.46	2,870	19	do	3.90	4,400

[a] Measurement made under complete ice cover.

NOTE.—Discharge measurements made during 1914 check very closely the computations of discharge made by the Menominee & Marinette Light & Traction Co.

Daily gage height, in feet, of Menominee River at Koss, Mich., for the year ending Sept. 30, 1914.

[J. F. Bronoel, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	3.3	3.2	4.2	8.9	3.3	16	.....	3.1	3.5	3.0	4.4	2.75
2	.....	3.1	3.2	4.2	9.5	3.2	17	.....	3.0	3.4	3.4	4.1	1.65
3	.....	3.3	3.4	4.5	9.5	3.1	18	.....	3.2	3.6	3.9	4.0	3.2
4	.....	3.4	3.5	4.2	9.0	3.4	19	.....	3.3	3.5	4.3	4.0	2.8
5	.....	3.4	3.3	4.3	8.3	3.2	20	.....	3.2	3.4	4.8	3.9	2.05
6	.....	3.5	3.2	3.8	7.7	3.3	21	.....	3.2	3.3	5.3	4.0	3.2
7	.....	3.4	3.2	3.4	7.1	3.3	22	.....	3.2	3.4	5.8	3.2	2.9
8	.....	3.3	3.2	3.4	6.7	3.2	23	.....	3.1	3.2	5.9	3.7	1.60
9	.....	3.1	3.3	3.0	6.4	3.2	24	.....	3.2	3.1	5.7	4.1	3.1
10	.....	3.4	3.2	2.89	6.1	3.1	25	.....	3.2	3.2	5.7	4.1	4.1
11	.....	3.4	3.3	2.55	5.4	3.3	26	.....	3.2	3.2	5.6	3.8	4.1
12	.....	3.3	3.2	2.75	5.4	1.98	27	3.2	3.2	3.1	6.0	3.6	4.1
13	.....	3.0	3.5	2.6	5.3	3.3	28	3.3	3.3	3.2	6.1	3.7	4.4
14	.....	3.0	3.3	2.9	5.0	1.75	29	3.4	.....	3.3	6.7	3.6	5.0
15	.....	3.1	3.5	2.7	4.8	3.1	30	3.2	.....	3.4	7.8	3.5	5.8
							31	3.4	.....	4.0	.....	3.6	.....

NOTE.—See "Gage" and "Accuracy" in station description.

MENOMINEE RIVER BELOW KOSS, MICH.[1]

Location.—At Grand Rapids, about 4 miles below Koss and 3 miles west of Ingalls, Mich. Little Cedar River, which drains an area wholly in Michigan, enters from the left about half a mile below.

Drainage area.—3,790 square miles.

Records available.—July 1, 1913, to September 30, 1914.

Discharge.—Computed by the Menominee & Marinette Light & Traction Co. of Menominee, Mich., from the kilowatt output of the generators plus the waste over the dam and gates, considered as a weir. No account is taken of the water through the exciter turbine or waste water over the "trash gate" at the power house.

Extremes of discharge.—Maximum mean daily discharge computed during year: 20,800 second-feet, May 3. Minimum mean daily discharge computed: 1,000 second-feet, June 14. These estimates represent also the maximum and minimum July 1, 1913, to September 30, 1914, period covered by available records.

[1] See also Menominee River at Koss, Mich.

Accuracy.—No measurements have been made by the survey engineers at this plant, but measurements made at Koss (p. 28) in the year ending September 30, 1914, check closely the computations of the power company.

Cooperation.—Estimates of daily discharge furnished by Edward Daniell, general manager, Menominee & Marinette Light & Traction Co.

Daily discharge, in second-feet, of Menominee River below Koss, Mich., for the years ending Sept. 30, 1913–14.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1913.				1913.				1913.			
1	4,200	2,400	1,800	11	3,900	2,800	2,300	21	2,700	2,300	2,400
2	4,800	3,000	1,400	12	3,800	2,600	2,200	22	2,800	2,200	2,600
3	3,600	2,800	1,800	13	4,200	2,600	2,200	23	2,800	2,200	4,700
4	3,300	2,400	2,500	14	4,400	2,400	2,200	24	2,500	2,200	4,800
5	3,300	2,500	2,600	15	4,300	2,300	2,100	25	2,100	2,100	4,500
6	4,100	2,700	2,900	16	4,100	2,200	1,600	26	2,800	a1,500	4,300
7	4,600	2,700	2,700	17	3,600	2,100	1,700	27	3,000	a1,400	4,600
8	4,700	2,200	2,400	18	3,700	a2,100	1,800	28	2,800	a1,800	4,600
9	4,600	2,400	2,300	19	3,600	1,800	2,200	29	2,500	2,100	4,600
10	4,100	2,600	2,300	20	3,400	2,200	2,300	30	2,700	2,100	3,600
								31	2,500	2,100	.....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	3,000	4,200	3,100	2,000	1,800	1,300	3,000	17,600	3,800	8,480	5,690	3,470
2	2,800	3,500	3,400	1,900	1,400	1,400	2,900	20,500	3,000	7,890	5,130	3,630
3	2,300	3,100	3,300	1,900	1,500	1,500	2,900	20,800	2,900	7,270	4,130	3,480
4	2,700	3,400	2,800	2,100	1,700	1,600	3,000	18,100	3,200	6,560	3,760	3,360
5	3,000	3,000	3,200	1,800	1,600	1,300	3,100	15,700	3,100	6,270	3,480	3,510
6	3,300	2,900	3,100	1,700	1,500	1,300	2,700	13,800	3,100	5,600	3,160	3,990
7	3,000	2,800	2,800	2,100	1,500	1,300	2,700	12,000	2,800	4,710	2,840	3,980
8	4,100	3,300	2,300	2,100	1,700	1,400	2,600	11,600	2,600	3,910	2,640	3,810
9	3,800	3,000	2,000	2,100	1,400	1,400	2,600	10,000	2,800	2,670	2,440	3,170
10	3,000	2,500	2,000	2,000	1,300	1,300	2,500	9,500	2,500	2,740	2,210	3,120
11	3,900	2,700	2,400	1,900	1,400	1,400	2,400	7,500	2,400	2,530	2,490	2,970
12	4,300	2,700	2,900	1,600	1,400	1,300	2,300	7,100	1,300	3,110	2,680	2,960
13	4,200	2,900	3,100	1,300	1,300	1,500	2,500	6,900	2,900	5,720	2,570	3,260
14	4,600	3,000	2,500	1,900	1,300	1,600	2,700	6,400	1,000	7,940	2,620	3,010
15	4,300	3,100	2,400	1,800	1,300	1,500	2,600	6,100	2,200	9,340	2,630	2,750
16	4,200	3,100	2,400	1,600	1,300	1,700	2,700	5,300	1,800	9,290	2,640	4,140
17	4,100	2,800	2,600	1,600	1,200	1,700	3,000	4,600	1,200	7,150	2,870	4,640
18	3,500	2,900	2,700	1,800	1,300	1,900	4,000	4,600	2,300	5,920	2,800	4,960
19	2,900	3,000	2,400	1,700	1,300	1,900	4,800	4,500	1,700	5,130	3,070	4,840
20	2,900	3,000	2,200	1,700	1,200	1,800	5,900	4,400	1,100	4,070	3,220	4,430
21	2,600	3,100	1,900	2,000	1,200	1,700	7,200	4,400	2,300	3,410	3,610	3,610
22	2,800	3,400	1,800	1,900	1,400	1,800	8,500	3,100	2,200	3,030	4,400	2,970
23	2,500	3,800	1,900	1,700	1,400	1,700	8,700	3,700	1,550	3,030	4,590	2,820
24	2,500	3,700	2,000	1,700	1,300	1,600	8,100	4,200	3,000	3,220	5,310	3,100
25	2,800	3,900	1,800	1,800	1,300	1,700	8,300	4,200	3,900	4,540	5,730	2,900
26	2,700	4,000	1,700	1,500	1,300	1,600	8,100	4,000	4,600	4,640	6,500	2,560
27	2,400	3,600	1,700	1,500	1,300	1,600	8,700	3,900	4,500	4,270	6,250	2,340
28	3,400	3,200	2,000	1,700	1,300	1,700	9,000	4,000	5,100	5,460	5,380	2,420
29	4,000	3,300	1,700	1,700	.....	1,900	11,600	3,800	6,500	6,110	4,430	2,900
30	4,000	3,200	1,700	1,600	.....	2,200	13,900	3,900	8,100	6,880	3,890	2,810
31	4,300	.....	2,000	1,800	.....	2,800	.....	3,900	.....	6,550	3,500	.....

a Flow regulated by power plants above.

Monthly discharge of Menominee River below Koss, Mich., for the years ending Sept. 30, 1913–14.

[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.	
1913.					
July	4,800	2,100	3,530	0.931	1.07
August	3,000	1,400	2,280	.602	.69
September	4,800	1,400	2,800	.739	.82
1913–14.					
October	4,600	2,300	3,350	.884	1.02
November	4,200	2,500	3,200	.844	.94
December	3,400	1,700	2,380	.628	.72
January	2,100	1,300	1,790	.472	.54
February	1,800	1,200	1,390	.367	.38
March	2,800	1,300	1,630	.430	.50
April	13,900	2,300	5,100	1.35	1.51
May	20,800	3,100	8,070	2.13	2.46
June	8,100	1,000	2,980	.786	.88
July	9,340	2,530	5,400	1.42	1.64
August	6,500	2,210	3,760	.992	1.14
September	4,960	2,340	3,400	.897	1.00
The year	20,800	1,000	3,550	.937	12.73

BRULE RIVER NEAR FLORENCE, WIS.

Location.—At highway bridge near Washburn farm, 3½ miles north of Florence; 1 mile above mouth of Paint Creek and 6 miles above mouth of Michigamme River, both entering from the left.

Drainage area.—344 square miles.

Records available.—January 24 to September 30, 1914.

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

Discharge measurements.—At low stages made by wading; at medium and high stages from highway bridge.

Channel and control.—Gravel; smooth and probably permanent.

Extremes of discharge.—Maximum open-water stage recorded January 24 to September 30, 1914: 4.6 feet at 1 p. m., May 1 and 3; discharge, 1,730 second-feet. Minimum open-water stage recorded: 2.15 feet at 1 p. m., September 28; discharge, 284 second-feet.

Minimum measured discharge for period when stream was frozen: 209 second-feet February 21; actual minimum during that period probably less.

Winter flow.—Discharge relation affected by ice; flow determined by measurements made through the ice.

Regulation.—Logging dams above gage are so operated that during the spring large volumes of water are released to facilitate log driving; flow during such periods fluctuates rapidly; flow during remainder of year probably natural.

Accuracy.—Rating curve well defined; records good.

Discharge measurements of Brule River near Florence, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 24	G. H. Canfield	3.11	[a] 234	May 6	G. H. Canfield	2.64	526
Feb. 21	H. C. Beckman	3.37	[b] 209	7	do	2.48	454
Mar. 26	O. A. Steller	3.71	[a c] 312	June 30	H. C. Beckman	2.90	686
Apr. 15	M. F. Rather	2.54	332	July 2	do	2.64	520
May 4	G. H. Canfield	3.23	846	Aug. 14	M. F. Rather	2.30	344

[a] Measurement made under partial ice cover.
[b] Measurement made with complete ice cover.
[c] Notes of original measurement lost; data as given from unchecked daily report cards.

Daily discharge, in second-feet, of Brule River near Florence, Wis., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1,600	453	589	401	351	16	.....	968	617	534	328	351
2	.....	1,460	453	506	401	351	17	.....	788	506	534	328	351
3	.....	1,600	453	561	351	305	18	.....	617	480	534	376	453
4	.....	1,210	427	534	305	305	19	.....	561	453	453	453	480
5	.....	968	506	589	305	351	20	.....	561	351	561	453	453
6	.....	848	645	589	305	305	21	1,400	506	305	702	506	401
7	.....	702	848	589	305	351	22	1,270	506	305	617	427	376
8	.....	702	730	506	305	401	23	1,270	453	561	506	453	351
9	.....	788	788	561	305	401	24	1,150	401	589	453	534	305
10	.....	788	788	453	328	351	25	908	401	673	453	506	305
11	.....	968	788	589	305	351	26	968	453	617	401	453	328
12	.....	968	730	702	328	351	27	968	453	589	506	401	305
13	.....	1,030	702	673	376	401	28	968	534	617	453	351	284
14	.....	1,090	673	673	328	427	29	1,210	534	673	453	351	305
15	.....	968	673	561	351	376	30	1,400	534	645	453	305	328
							31	.....	506	.....	305	305	.....

NOTE.—Daily discharge determined from a rating curve well defined between 305 and 968 second-feet. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements and climatic records, as follows: Jan. 24–31, 225 second-feet; Feb. 1–10, 210 second-feet; Feb. 11–20, 195 second-feet; Feb. 21–28, 215 second-feet; Mar. 1–10, 270 second-feet; Mar. 11–20, 285 second-feet; Mar. 21–31, 305 second-feet; Apr. 1–10, 320 second-feet; Apr. 11–20, 325 second-feet; and Apr. 16–30, 670 second-feet.

Monthly discharge of Brule River near Florence, Wis., for the year ending Sept. 30, 1914.

[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.		
January 24–31	.....	.....	225	0.654	0.19	C.
February	.....	.....	206	.599	.62	C.
March	.....	.....	287	.834	.96	C.
April	.....	.....	656	1.91	2.13	C.
May	1,600	401	789	2.29	2.64	B.
June	848	305	588	1.71	1.91	A.
July	702	305	535	1.56	1.80	A.
August	534	305	372	1.08	1.24	A.
September	480	284	358	1.04	1.16	A.

PINE RIVER NEAR FLORENCE, WIS.

Location.—At highway bridge 8 miles southwest of Florence and 12 miles above mouth of river. Popple River enters from the right about 200 feet above the station.

Drainage area.—518 square miles.

Records available.—January 22 to April 30, and June 1 to September 30, 1914.

Gage.—Standard chain gage fastened to upstream side of bridge; read twice daily to half-tenths.

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

Channel and control.—Coarse gravel and rocks; may shift during extremely high water.

Extremes of stage.—Maximum stage recorded January 22 to April 30 and June 1 to September 30, 1914: 8.4 feet, at 4 p. m., April 29. Minimum stage recorded: 1.8 feet, June 20.

Winter flow.—Discharge relation affected by ice; flow determined from measurements made through the ice.

Regulation.—River used for log driving in spring; backwater at gage caused by closing gates of a dam below.

Accuracy.—Gage-height record good except for short periods immediately before or soon after opening and closing of gates of dam below gage.

Data insufficient to warrant publication of estimates of discharge.

Discharge measurements of Pine River near Florence, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 22	G. H. Canfield	2.80	[a]205	June 30	H. C. Beckman	4.67	1,140
Feb. 21	H. C. Beckman	2.96	[a]160	July 2	do	4.20	962
Mar. 25	O. A. Steller	3.57	[b]233	Aug. 14	M. F. Rather	2.75	478
Apr. 15	M. F. Rather	3.35	337				

[a] Measurement made under complete ice cover.
[b] Original notes lost; data as given from unchecked daily report cards.

Daily gage height, in feet, of Pine River near Florence, Wis., for the year ending Sept. 30, 1914.

[William Taft, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	June.	July.	Aug.	Sept.
1	.....	2.7	3.0	3.6	3.2	4.6	3.5	3.3
2	.....	2.7	2.9	3.6	3.1	4.3	2.8	3.4
3	.....	2.7	3.0	3.4	3.1	4.0	2.7	3.5
4	.....	2.7	2.9	3.4	3.3	3.6	2.6	3.4
5	.....	2.7	3.0	3.4	3.3	3.4	2.35	3.2
6	.....	2.7	2.9	3.4	3.0	3.2	2.35	3.0
7	.....	2.7	3.0	3.4	3.0	2.85	2.4	3.2
8	.....	2.7	2.9	3.4	2.1	2.65	2.5	3.2
9	.....	2.6	3.0	3.4	2.85	2.35	2.4	3.2
10	.....	2.6	2.9	3.4	2.65	2.3	2.4	8.5
11	.....	2.6	2.9	3.5	2.6	1.98	2.4	2.8
12	.....	2.6	3.0	3.4	2.4	3.4	2.3	2.95
13	.....	2.6	3.0	3.4	2.3	4.2	2.55	4.0
14	.....	2.7	3.0	3.4	2.1	4.4	2.7	3.9
15	.....	2.6	3.0	3.4	2.0	4.1	2.8	3.7
16	.....	2.6	2.1	3.6	2.0	4.0	2.7	3.6
17	.....	2.6	2.9	3.8	2.0	3.6	3.2	3.4
18	.....	2.6	2.8	4.1	1.92	3.4	3.4	3.2
19	.....	2.6	2.9	4.7	1.88	2.5	3.6	3.0
20	.....	2.6	3.0	4.8	1.80	2.4	4.2	3.0
21	.....	3.0	2.9	4.6	2.05	2.35	4.4	2.9
22	2.8	2.9	3.0	4.4	2.45	2.25	4.5	2.8
23	2.8	2.8	2.9	4.8	2.8	2.85	4.8	2.7
24	2.8	2.8	3.0	5.4	2.9	2.7	5.2	2.6
25	2.7	2.9	3.0	5.8	2.95	2.55	5.2	2.5
26	2.8	2.8	3.5	6.1	3.0	3.4	5.0	2.4
27	2.8	2.9	3.5	6.3	3.9	3.6	4.6	2.4
28	2.8	3.0	3.4	6.9	5.0	4.0	4.4	3.4
29	2.8	.....	3.5	8.4	4.8	3.8	4.2	2.59
30	2.8	.....	3.4	8.2	4.7	3.7	3.4	2.8
31	2.8	.....	3.5	.....	.....	3.6	3.0	.....

NOTE.—Discharge relation affected by ice about Jan. 22 to Apr. 15. During May backwater occurred from the logging dam below and observations were discontinued. Record for remainder of year probably represents natural flow.

PIKE RIVER AT AMBERG, WIS.

Location.—At Chicago, Milwaukee & St. Paul Railway bridge half a mile south of Amberg, immediately below junction of the two branches of Pike River, and about 11 miles above the mouth.

Drainage area.—240 square miles.

Records available.—February 26 to September 30, 1914.

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

Discharge measurements.—At medium and high stages made from a highway bridge one-fourth mile downstream; at extremely low water by wading.

Channel and control.—Solid rock and some loose granite bowlders; channel permanent but very rough at gage.

Winter flow.—Discharge relation affected by ice; flow estimated from discharge measurements made through the ice.

Extremes of discharge.—Maximum open-water stage recorded February 26 to September 30, 1914: 4.65 feet at 8.10 p. m., July 14; discharge, 1,200 second-feet. Minimum open-water stage recorded: 1.65 feet, June 18; discharge, 130 second-feet. Minimum measured discharge for period when ice was present: 126 second-feet February 26; actual minimum for that period slightly lower.

Regulation.—None.

Accuracy.—Rating curve well defined; records excellent.

Discharge measurements of Pike River at Amberg, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 26	H. C. Beckman	2.40	[a]126	June 29	H. C. Beckman	4.21	992
Mar. 21	O. A. Steller	1.84	[a b]162	29	do	4.23	1,010
Apr. 16	M. F. Rather	2.26	278	July 11	do	3.64	779
May 3	G. H. Canfield	3.22	586	Aug. 15	M. F. Rather	2.02	220
8	do	2.57	391				

[a] Measurement made under complete ice cover; about 50 per cent ice cover at the rapids below the gage.
[b] Original notes lost; data as given from unchecked report.

Daily discharge, in second-feet of Pike River at Amberg, Wis., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	904	202	781	457	360	16	284	270	141	742	256	474
2	.....	742	184	742	392	376	17	314	270	137	595	314	457
3	.....	595	169	667	360	360	18	329	256	130	457	344	408
4	.....	525	270	595	329	360	19	424	242	152	360	392	376
5	.....	474	314	508	329	299	20	491	242	176	344	457	344
6	.....	424	284	424	329	329	21	457	242	202	314	474	314
7	.....	424	270	360	284	329	22	408	270	228	284	424	299
8	.....	392	256	299	256	299	23	360	299	256	360	474	284
9	.....	376	228	270	242	284	24	329	284	360	424	667	270
10	.....	360	202	242	242	270	25	360	270	440	424	667	270
11	215	329	176	215	228	299	26	424	270	424	360	595	256
12	202	329	164	424	215	314	27	474	256	457	424	491	256
13	189	329	159	742	215	299	28	491	242	821	704	392	242
14	215	314	152	1,120	228	299	29	742	242	990	821	344	242
15	228	284	146	1,040	228	424	30	990	228	862	667	329	228
							31	.....	210	.....	560	360	.....

NOTE.—Daily discharge determined from a rating curve well defined between 189 and 1,040 second-feet. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Feb. 26–28, 122 second-feet; Mar. 1–10, 142 second-feet; Mar. 11–20, 154 second-feet; 21–31, 195 second-feet; and Apr. 1–10, 220 second-feet.

Monthly discharge of Pike River at Amberg, Wis., for the year ending Sept. 30, 1914.

[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.		
March	.....	.....	165	0.688	0.79	C.
April	990	.....	338	1.41	1.57	C.
May	904	210	351	1.46	1.68	A.
June	990	130	298	1.24	1.38	B.
July	1,120	215	525	2.19	2.52	A.
August	667	215	365	1.52	1.75	A.
September	474	228	321	1.34	1.50	A.

OCONTO RIVER NEAR GILLETT, WIS.

Location.—At steel highway bridge 2½ miles southeast of Gillett, and about 27 miles above mouth of river.

Drainage area.—678 square miles.[1]

Records available.—June 7, 1906, to March 30, 1909; January 16 to September 30, 1914.

Gage.—Chain gage attached to iron railing on upstream side of bridge; read once daily to quarter-tenths. Gage reader, Nettie Gilbertson. Zero of gage used in 1914 is 4 feet above that of gage used June 7, 1906, to March 30, 1909.

Discharge measurements.—Made from upstream side of bridge.

Channel and control.—Gravel; probably permanent; free from vegetation.

Winter flow.—Discharge relation affected by ice; flow determined from discharge measurements made through the ice.

Extremes of discharge.—Maximum open-water stage recorded January 16 to September 30, 1914: 3.8 feet, April 30, May 1 and 2; discharge, 2,020 second-feet. Minimum open-water stage recorded for same period: 1.1 feet, September 9; discharge, 342 second-feet. Minimum discharge when ice was present, not known but probably was considerably less than 342 second-feet.

Maximum open-water discharge computed June 7, 1906, to March 30, 1909, and January 16 to September 30, 1914: 2,630 second-feet, May 1, 1908. Minimum open-water discharge for same periods: 95 second-feet, June 3 and 6, 1907.

Regulation.—Dam above station stores water to float logs during spring; flow at gage natural except when dam is in operation.

Accuracy.—Rating curve well defined; records excellent.

Discharge measurements of Oconto River near Gillett, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 18	H. C. Beckman	2.60	*a* 324	May 20	H. C. Beckman	1.54	538
Mar. 20	O. A. Steller	2.67	*a b* 462	Aug. 13	M. F. Rather	1.45	500
Apr. 18	M. F. Rather	1.83	686	13	....do	1.43	494

a Measurement made under complete ice cover.
b Original notes lost; data as given from unchecked daily report cards.

[1] Revised since Water-Supply Paper 264 was published.

Daily discharge, in second-feet, of Oconto River near Gillett, Wis., for the year ending Sept. 30, 1914.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	960	2,020	615	1,790	725	670
2	.....	1,020	2,020	590	1,640	725	698
3	.....	840	1,860	698	1,720	615	725
4	.....	840	1,430	752	1,720	615	698
5	.....	698	1,570	992	1,430	780	670
6	.....	698	1,570	1,020	1,160	1,020	615
7	.....	698	1,220	1,290	1,290	515	615
8	.....	615	1,570	1,090	1,220	670	565
9	.....	698	1,060	1,160	870	540	342
10	.....	642	1,090	960	930	565	492
11	.....	590	1,060	725	900	[a]615	565
12	.....	565	1,020	725	670	468	565
13	.....	515	992	615	1,090	468	515
14	.....	615	840	590	698	468	446
15	.....	590	960	565	1,090	403	565
16	.....	590	1,720	565	780	515	900
17	.....	590	1,860	515	900	590	1,020
18	.....	642	403	468	870	468	960
19	.....	698	446	565	698	642	960
20	.....	752	565	565	725	590	900
21	.....	670	780	1,160	725	900	840
22	.....	1,060	725	615	642	670	780
23	.....	642	992	590	615	725	590
24	.....	870	1,090	590	540	590	382
25	.....	1,020	1,090	615	515	670	468
26	515	1,160	1,060	780	492	642	424
27	565	1,220	960	1,090	590	615	446
28	492	1,430	930	960	515	670	468
29	930	1,500	642	1,500	565	615	468
30	698	2,020	960	1,430	752	615	468
31	840	.....	780	.....	870	615	.....

[a] Estimated.

NOTE.—Daily discharge determined from a rating curve well defined between 515 and 1,090 second-feet, and fairly well defined beyond these limits.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements and climatic records, as follows: Jan. 16–31, 670 second-feet; Feb. 1–10, 405 second-feet; Feb. 11–20, 310 second-feet; Feb. 21–28, 250 second-feet; Mar. 1–10, 300 second-feet; and Mar. 11–25, 440 second-feet.

Monthly discharge of Oconto River near Gillett, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 678 square miles.[a]]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January (16–31)	.....	.....	670	0.988	0.59	C.
February	.....	.....	327	.482	.50	C.
March	.....	.....	440	.649	.75	C.
April	2,020	515	848	1.25	1.40	A.
May	2,020	403	1,140	1.68	1.94	B.
June	1,500	468	813	1.20	1.34	A.
July	1,790	492	936	1.38	1.59	A.
August	1,020	403	623	.919	1.06	A.
September	1,020	342	627	.925	1.03	A.

[a] Revised since last published report.

WOLF RIVER AT KESHENA, WIS.

Location.—At highway bridge at Keshena, 3 miles below outlet of 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, 1914.

Gage.—Vertical staff; read twice daily to October 1, 1911; since that date read morning, noon, and evening; mean of three readings taken as mean for day.

Discharge measurements.—Made from the bridge.

Channel and control.—Gravel; smooth and permanent.

Winter flow.—Ice covers the stream in vicinity of gage and causes 1 to 3 feet of backwater. At times slush ice and frazil collecting under the ice make accurate discharge measurements impossible. Ice forms at falls above Keshena and floats in river as far as backwater from dam at Shawano.

Extremes of discharge.—Maximum open-water stage recorded during year: 4.1 feet at 5 p. m., April 30; discharge, 1,990 second-feet. Minimum open-water stage recorded: 1.2 feet, November 30; discharge, 444 second-feet. Minimum measured discharge for period when ice was present: 420 second-feet, by current meter, February 16; actual minimum probably lower.

Maximum discharge computed 1907–1909 and 1911–1914: 3,910 second-feet, September 2, 1912. Minimum open-water discharge computed for those periods: 275 second-feet, September 26, 1908.

Regulation.—River and main tributaries above Keshena controlled to some extent by logging dams.

Accuracy.—Conditions favorable; open-water rating curve excellent between gage heights 1 and 4 feet. Accuracy of open-water records depends on accuracy with which mean gage height is determined.

Discharge measurements of Wolf River at Keshena, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 16[a]	O. A. Steller	3.00	420
Mar. 19[a b]	....do	2.82	556
June 12	H. C. Beckman	2.19	833

[a] Measurement made 4 miles below gage.
[b] Original notes lost; data as given from unchecked notes.

Daily discharge, in second-feet, of Wolf River at Keshena, Wis., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	901	853	672	.....	1,850	901	1,400	715	950
2	853	901	806	.....	1,660	806	1,340	715	1,000
3	901	950	760	.....	1,530	760	1,400	760	1,000
4	853	853	630	.....	1,400	950	1,340	760	1,400
5	853	806	552	.....	1,280	1,050	1,280	760	1,220
6	806	853	552	.....	1,280	1,220	1,220	806	950
7	853	853	479	.....	1,220	1,160	1,220	715	950
8	1,000	853	479	.....	1,160	1,110	1,280	715	950
9	1,110	.....	515	715	1,220	1,110	1,220	672	950
10	1,220	.....	479	760	1,160	1,050	1,110	630	950
11	1,460	.....	444	806	1,110	950	1,110	672	950
12	1,280	.....	552	806	1,110	853	1,110	672	1,000
13	1,160	.....	672	760	1,160	806	1,110	672	1,000
14	1,050	.....	630	672	1,050	715	1,050	630	1,050
15	1,000	.....	590	672	1,050	672	950	630	1,050
16	950	.....	630	806	1,050	672	950	630	1,160
17	853	.....	515	806	1,000	672	901	672	1,160
18	853	.....	.....	853	950	630	901	672	1,220
19	853	806	.....	1,050	853	672	806	672	1,280
20	853	715	.....	1,160	760	715	715	715	1,400
21	901	760	.....	1,160	672	715	715	715	1,460
22	950	760	.....	1,160	630	672	672	715	1,340
23	853	672	.....	1,160	1,050	760	672	806	1,220
24	806	715	.....	1,220	1,280	806	672	853	1,110
25	853	760	.....	1,340	1,340	760	672	853	1,050
26	901	630	.....	1,460	1,160	715	672	853	1,000
27	1,050	590	.....	1,530	1,160	806	672	853	901
28	1,110	515	.....	1,590	1,050	950	672	853	853
29	1,050	515	.....	1,720	1,050	1,050	672	901	853
30	950	444	.....	1,920	1,000	1,160	672	950	853
31	901	.....	.....	.....	950	.....	715	950	.....

NOTE.—Daily discharge determined from a well defined rating curve. Discharge estimates Oct. 1 to Dec. 31, 1913, differ slightly from those published in Water-Supply-Paper 354, on account of revision of rating curve.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, climatologic records and discharge of adjacent drainage areas, as follows: Nov. 9–18, 850 second-feet; Dec. 18–31, 1913, 480 second-feet; Jan. 1–31, 1914, 500 second-feet; Feb. 1–28, 450 second-feet; Mar. 1–25, 500 second-feet; Mar. 26–31, 600 second-feet; and Apr. 1–8, 640 second-feet.

Monthly discharge of Wolf River at Keshena, Wis., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,460	806	967	1.21	1.40	A.
November	.....	444	777	.975	1.09	B.
December	.....	.....	538	.675	.78	C.
January	.....	.....	500	.627	.72	D.
February	.....	.....	450	.565	.59	D.
March	.....	.....	519	.651	.75	D.
April	1,920	.....	975	1.22	1.36	C.
May	1,850	630	1,140	1.43	1.65	A.
June	1,220	630	862	1.08	1.20	A.
July	1,400	672	964	1.21	1.40	A.
August	950	630	748	.939	1.08	A.
September	1,460	853	1,070	1.34	1.50	A.
The year	1,920	.....	794	.996	13.52	

WOLF RIVER AT NEW LONDON, WIS.

Location.—At Pearl Street highway bridge, New London. Embarrass River enters from the right three-fourths mile above and Little River, also from the right, 5 miles below.

Drainage area.—2,240 square miles.

Records available.—October 1, 1913, to September 30, 1914. U. S. Army Engineers have kept a gage height record March 1, 1899, to September 30, 1914.

Gage.—Enameled steel gage, reading from 1.0 to 13.0 feet, fastened to pile under downstream side of Pearl Street Bridge; read at noon to nearest tenth.; gage reader, A. H. Pape. Datum of gage was raised 0.641 foot March 1, 1911, according to United States Army Engineers.

Discharge measurements.—Made from the Shawano Street Bridge, 3 blocks below gage.

Channel and control.—Channel of sand, hard pan, and mud.

Winter flow.—Discharge relation affected by ice; flow estimated from discharge measurements made through the ice.

Extremes of discharge.—Maximum mean daily open-water stage recorded during year: 9.9 feet, June 9 and 10; discharge, 8,490 second-feet. Minimum mean daily open-water stage recorded: 1.8 feet, August 15 to 17; discharge, 1,020 second-feet. Minimum measured discharge during period when ice was present: 791 second-feet, by current-meter, February 16, 1914; actual minimum discharge not known.

Maximum stage recorded on gage read by U. S. Army Engineers 1899–1914: 11.6 feet April 16, 1888.

Regulation.—Operation of power plants may cause some diurnal fluctuation; estimates of monthly means probably not affected.

Cooperation.—Gage read under direction of U. S. Army Engineers.

Discharge measurements of Wolf River at New London, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 12	G. H. Canfield	2.90	[a] 947	June 7	W. G. Hoyt	8.96	5,930
Feb. 16	H. C. Beckman	2.60	[a] 791	9	H. C. Beckman	9.90	8,500
Apr. 16	Beckman and Canfield	4.05	1,920	Aug. 17	M. F. Rather	1.80	1,010
May 22	H. C. Beckman	5.53	2,480				

[a] Complete ice cover one-fourth mile below gage.

Daily discharge, in second-feet, of Wolf River at New London, Wis., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,170	1,690	2,090	.....	2,260	3,260	2,980	2,750	1,380	1,350
2	2,170	1,730	2,090	.....	2,500	3,340	2,860	2,800	1,350	1,420
3	2,050	1,730	2,050	.....	2,600	3,500	2,700	2,920	1,310	1,500
4	1,890	1,730	2,030	.....	2,650	3,580	3,120	2,980	1,270	1,540
5	1,810	1,730	2,010	.....	2,600	3,670	3,580	3,120	1,270	1,570
6	1,810	1,770	1,970	.....	2,500	3,760	4,160	3,120	1,270	1,610
7	1,810	1,770	1,850	.....	2,350	3,760	5,810	3,120	1,310	1,650
8	1,930	1,770	1,730	.....	2,220	3,580	7,560	3,050	1,270	1,610
9	2,090	1,730	1,540	.....	2,050	3,420	8,490	2,920	1,230	1,500
10	2,090	1,690	1,350	.....	2,050	3,260	8,490	2,750	1,160	1,500
11	2,220	1,570	1,380	.....	1,930	3,050	7,860	2,600	1,090	1,460
12	2,300	1,460	1,540	.....	1,890	2,980	7,000	2,350	1,090	1,460
13	2,300	1,540	1,570	.....	1,890	2,750	6,020	2,260	1,090	1,500
14	2,260	1,500	1,570	.....	1,850	2,650	5,610	2,170	1,090	1,500
15	2,260	1,570	1,570	.....	1,850	2,600	4,790	2,050	1,020	1,730
16	2,220	1,540	1,610	.....	1,850	2,500	4,160	2,050	1,020	1,930
17	2,220	1,540	1,540	.....	1,890	2,400	3,580	2,010	1,020	2,130
18	2,220	1,540	1,540	.....	1,930	2,350	3,260	1,930	1,120	2,260
19	2,050	1,610	1,460	.....	2,090	2,260	2,920	1,770	1,310	2,260
20	1,930	1,770	1,310	.....	2,260	2,090	2,600	1,690	1,380	2,350
21	1,850	1,890	1,230	.....	2,350	2,090	2,350	1,540	1,570	2,400
22	1,810	2,010	.....	.....	2,450	2,550	2,300	1,500	1,610	2,450
23	1,730	2,050	.....	.....	2,500	2,700	2,220	1,500	1,610	2,450
24	1,650	2,090	.....	.....	2,550	2,860	2,220	1,500	1,570	2,400
25	1,650	2,090	.....	.....	2,650	2,920	2,170	1,420	1,500	2,170
26	1,650	2,010	.....	.....	2,700	2,920	2,050	1,380	1,420	2,090
27	1,690	1,970	.....	.....	2,750	2,980	2,090	1,460	1,420	1,850
28	1,690	1,930	.....	.....	2,800	3,050	2,300	1,420	1,350	1,770
29	1,650	1,930	.....	1,650	2,980	3,050	2,550	1,420	1,310	1,610
30	1,650	1,970	.....	1,850	3,050	2,980	2,600	1,420	1,310	1,570
31	1,690	.....	.....	2,090	.....	2,980	.....	1,420	1,310	.....

NOTE.—Discharge determined from a rating curve well defined between 986 and 8,820 second-feet.
Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 22–31, 1913, 1,160 second-feet; Jan. 1–31, 1914, 950 second-feet; Feb. 1–28, 800 second-feet; and Mar. 1–28, 1,200 second-feet.

Monthly discharge of Wolf River at New London, Wis., for the year ending Sept. 30, 1914.

[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	2,300	1,650	1,950	0.871	1.00	B.
November	2,090	1,460	1,760	.786	.88	B.
December	2,090	.....	1,500	.670	.77	D.
January	.....	.....	950	.424	.49	D.
February	.....	.....	800	.357	.37	D.
March	.....	.....	1,260	.562	.65	D.
April	3,050	1,850	2,330	1.04	1.16	A.
May	3,760	2,090	2,960	1.32	1.52	A.
June	8,490	2,050	4,010	1.79	2.00	A.
July	3,120	1,380	2,140	.955	1.10	A.
August	1,610	1,020	1,290	.576	.66	A.
September	2,450	1,350	1,820	.812	.91	A.
The year	8,490	.....	1,900	.848	11.51	

WEST BRANCH OF WOLF RIVER AT NEOPIT, WIS.

Location.—At the dam and power plant at Neopit, a station of the Wisconsin Northern Railroad, 20 miles north of Shawano, on the Menominee Indian Reservation.

Drainage area.—108 square miles.

Records available.—January 25, 1911, to September 30, 1914.

Gages.—Vertical staff gages on headrace and tailrace.

Determination of flow.—An attempt to measure the flow by current-meter measurements a short distance below the dam proved unsatisfactory and it was decided to rate the turbine and spillway. The power is developed by means of a timber dam about 14 feet high, which backs the water upstream for a considerable distance and forms a service reservoir. The spillway is a rectangular opening about 13 feet wide, which is closed by means of stop planks. Little water leaks through the dam, but considerable passes between the planks when all are in place. The power house is at the dam and is equipped with a 35-inch Leffel-Sampson turbine belted to a 60-kilowatt generator which is used chiefly for lighting. The turbine takes water from the service reservoir through a rectangular flume which is 9 feet wide by 6 feet deep and lined with smooth planks. The turbine was rated by means of current-meter measurements in the flume. The spillway and leakage through the boards were rated by measurements in the sluiceway. Gages were placed in the pond and below the dam to show the head on the turbine. Readings of both gages, voltage, amperage, and number of planks removed from the spillway were recorded seven times each day—at 6, 7, and 10 a. m., 12 m., 3, 6, and 10 p. m. These readings were then weighted in accordance with the elapsed interval.

Extremes of discharge.—Maximum mean daily discharge computed during year: 443 second-feet, September 2; minimum mean daily discharge computed: 17 second-feet, August 30.

Maximum mean daily discharge computed 1911–1914: 999 second-feet, July 24, 1912. Minimum mean daily discharge computed for this period: 17 second-feet, August 30, 1914.

Flow at station is controlled by operation of the power plant and waste gates; therefore the actual maximum may have exceeded the above estimates for brief periods; also the minimum has been reduced to about 6 second-feet of leakage at times when plant has been shut down for brief periods.

Accuracy.—Discharge measurements made at this station indicate that the records were being carefully taken and that the method of computation gave 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, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	83	179	131	88	.....	94	142	157	94	206	89	189
2	136	63	205	94	.....	53	111	138	94	113	105	443
3	135	82	152	95	.....	78	162	160	194	137	48	111
4	102	135	86	93	.....	70	103	154	344	128	37	172
5	216	148	72	98	.....	83	139	79	219	115	80	107
6	133	265	66	90	.....	94	115	93	199	103	104	89
7	98	120	52	96	.....	108	143	150	265	64	45	99
8	79	161	64	95	74	90	111	86	152	122	104	93
9	180	141	78	95	88	104	107	128	140	124	121	74
10	208	39	78	94	89	105	145	128	165	87	44	51
11	171	74	186	86	98	99	105	130	140	104	88	59
12	186	164	110	93	96	99	134	132	113	193	82	63
13	143	99	110	95	87	104	55	145	129	101	114	34
14	199	142	117	92	87	100	136	180	97	137	99	70
15	87	111	119	90	70	111	157	139	131	156	130	292
16	121	149	130	88	77	113	106	124	94	114	120	44
17	137	81	171	91	80	109	108	109	121	53	39	46
18	134	105	83	84	80	98	181	126	83	119	142	43
19	127	177	62	98	82	79	106	87	129	90	137	39
20	140	125	69	102	82	108	138	143	155	146	101	111
21	139	209	72	102	83	97	118	147	146	72	134	77
22	136	188	77	99	78	89	129	224	78	133	121	47
23	130	73	81	98	85	91	176	168	116	124	116	46
24	135	248	106	97	78	97	128	182	150	83	91	68
25	136	80	132	80	77	98	283	179	67	91	95	93
26	188	109	130	87	78	98	156	125	117	108	84	49
27	199	142	130	91	82	97	184	156	224	80	125	29
28	138	128	109	94	83	101	278	127	206	98	93	43
29	188	133	102	106	.....	145	380	157	171	87	94	41
30	140	101	70	106	.....	120	143	135	147	86	17	43
31	168	.....	72	105	.....	100	.....	113	.....	85	187	.....

NOTE.—Estimated mean discharge Feb. 1–7, 1914, 85 second-feet.

Monthly discharge of West Branch of Wolf River at Neopit, Wis., for the year ending Sept. 30, 1914.

[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	216	79	146	1.35	1.56	B.
November	265	39	132	1.22	1.36	B.
December	205	52	104	.963	1.11	B.
January	106	80	94.3	.873	1.01	B.
February	.....	.....	83.2	.770	.80	B.
March	145	53	97.8	.906	1.04	B.
April	380	55	149	1.38	1.54	B.
May	224	79	139	1.29	1.49	B.
June	344	67	149	1.38	1.54	B.
July	206	53	112	1.04	1.20	B.
August	187	17	96.3	.892	1.03	B.
September	443	29	92.2	.854	.95	C.
The year	443	17	116	1.07	14.63	

LITTLE WOLF RIVER AT ROYALTON, WIS.

Location.—At highway bridge in Royalton, about 4 miles above mouth of river.

Drainage area.—485 square miles.

Records available.—January 13 to September 30, 1914.

Gage.—Chain gage fastened to upstream side of highway bridge; read morning and evening, to half-tenths; gage reader, J. C. Jensen. Gage is so fastened to a cantilever arm that it is immediately upstream from the crest of a very decided rapids.

Discharge measurements.—Made from a cable about 1,500 feet upstream from gage.

Channel and control.—Channel at gage, heavy gravel and rock; permanent; at measuring section, fine, smooth gravel.

Winter flow.—Owing to presence of heavy rapids at gage ice rarely forms except during extremely cold weather and effect on discharge relation is slight; discharge during such periods determined from measurements made through the ice at cable section.

Extremes of discharge.—Maximum open-water stage recorded January 13 to September 30, 1914: 7.5 feet at 7 p. m., June 7; discharge, 5,350 second-feet. Minimum open-water stage recorded for that period: 1.35 feet at 8 a. m., August 17; discharge, 175 second-feet. Minimum discharge measured by current-meter during period when ice was present: 163 second-feet, February 17; actual minimum discharge not known.

Regulation.—The several power plants above station have little storage so that their operation has apparently no effect on the flow, which is probably nearly natural.

Accuracy.—Rating curve well defined; records good.

Discharge measurements of Little Wolf River at Royalton, Wis., during the year ending Sept. 30, 1014.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 13	Canfield and Beckman.	1.60	[a] 191	May 21	H. C. Beckman.....	1.74	362
Feb. 17	H. C. Beckman.....	1.70	[b] 163	June 7	W. G. Hoyt.....	7.05	4,840
Apr. 24	.....do.....	1.98	419	10	H. C. Beckman.....	4.56	2,280
May 1	.....do.....	3.07	1,130	Aug. 17	M. F. Rather.....	1.42	[c] 186

[a] Measurement made through ice one-fourth mile above gage; small amount of ice at control.
[b] Considerable ice at control.
[c] Measurement made by wading at cable section.

Daily discharge, in second-feet, of Little Wolf River at Royalton, Wis., for the year ending Sept. 30, 1914.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	509	1,300	392	1,080	244	264
2	.....	596	1,080	316	878	260	264
3	.....	482	878	344	566	244	233
4	.....	428	813	1,680	625	222	244
5	.....	378	718	2,520	749	244	286
6	.....	402	656	3,090	749	222	273
7	.....	363	625	5,000	566	208	233
8	.....	412	509	4,780	566	187	264
9	.....	363	444	3,490	353	197	293
10	.....	378	402	2,160	353	181	208
11	.....	330	412	1,520	378	197	225
12	.....	298	428	1,150	363	208	286
13	.....	316	402	749	402	233	218
14	.....	316	412	686	444	233	363
15	.....	344	392	625	482	187	566
16	.....	392	392	482	397	187	509
17	.....	392	363	509	378	184	944
18	.....	402	330	509	348	307	813
19	.....	402	273	482	330	378	454
20	.....	625	286	566	378	444	482
21	.....	625	402	566	303	412	482
22	.....	566	813	509	260	344	444
23	.....	509	1,010	482	286	298	444
24	264	482	1,010	625	330	286	298
25	286	686	813	509	286	273	286
26	378	749	749	509	294	264	256
27	344	878	686	566	260	256	197
28	378	846	625	878	260	256	316
29	444	1,380	625	1,150	244	256	256
30	566	1,220	566	944	273	218	225
31	509	.....	454	.....	260	233	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined between 225 and 878 second-feet, and well defined between 878 and 5,350 second-feet.

Discharge estimated because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 13–20, 210 second-feet; Jan. 21–31, 230 second-feet; Feb. 1–10, 175 second-feet; Feb. 11–20, 165 second-feet; Feb. 21–28, 170 second-feet; Mar. 1–10, 245 second-feet; and Mar. 11–24, 320 second-feet.

Monthly discharge of Little Wolf River at Royalton, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 485 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January 13–31	.....	.....	222	0.458	0.32	C.
February	.....	.....	170	.351	.37	C.
March	.....	.....	315	.649	.75	C.
April	1,380	298	862	1.78	1.99	B.
May	1,300	273	609	1.26	1.45	B.
June	5,000	316	1,260	2.60	2.90	B.
July	1,080	244	434	.895	1.03	B.
August	444	181	254	.524	.60	B.
September	944	197	352	.726	.81	B.

MILWAUKEE RIVER NEAR MILWAUKEE, WIS.

Location.—Immediately above the remains of a quarry about half a mile below the concrete county bridge and 1 mile above Mineral Spring road; about 4 miles above mouth of river, near the north limits of Milwaukee.

Drainage area.—661 square miles.

Records available.—April 30 to September 30, 1914.

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

Discharge measurements.—At low stages made by wading immediately above the gage; at minimum and high stages from the lower chord of a covered wooden bridge, about 700 feet below the gage; bridge covers an abandoned quarry and the artificial channel beneath affords an excellent measuring section.

Channel and control.—A rock outcrop, at which there is a fall of approximately 4 feet, immediately below the gage; probably permanent.

Extremes of discharge.—Maximum stage recorded April 30 to September 30, 1914: 3.2 feet at 8 a. m., June 22; discharge, 1,960 second-feet. Minimum stage recorded: 0.58 foot on 11 days between August 9 and 21; discharge, 54 second-feet.

Winter flow.—Not determined; data too meager.

Regulation.—No diurnal fluctuation noticed at gage as a result of operation of power plants.

Accuracy.—Rating curve well defined; records good.

Discharge measurements of Milwaukee River near Milwaukee, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 30	G. H. Canfield	1.52	433	May 26	G. H. Canfield	1.97	807
May 1	do	1.46	408	June 8	W. G. Hoyt	2.55	1,320
25	do	1.81	648	July 21	do	.72	[a] 82

[a] Measurement made by wading at a section about 100 feet above gage.

Daily discharge, in second-feet, of Milwaukee River near Milwaukee, Wis., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		494	427	532	83	131	16		415	263	125	68	1,180
2		415	292	415	100	122	17		356	232	125	54	1,180
3		356	245	367	100	122	18		263	168	125	54	1,040
4		397	263	302	83	131	19		227	149	125	78	908
5		569	385	278	74	138	20		210	149	115	54	734
6		650	1,360	210	74	184	21		184	1,220	105	54	427
7		569	1,460	210	74	184	22		210	1,560	83	112	379
8		494	1,360	218	68	184	23		184	864	112	112	273
9		397	1,090	201	61	184	24		273	820	83	112	254
10		367	952	189	54	138	25		460	734	83	122	197
11		323	650	176	54	131	26		820	692	78	122	184
12		650	494	176	54	131	27		952	777	83	122	184
13		908	415	131	54	131	28		650	494	100	105	176
14		650	345	125	54	997	29		569	569	100	100	184
15		569	328	125	54	1,270	30	427	460	569	122	100	184
							31		397		100	92	

NOTE.—Daily discharge determined from a rating curve well defined between 78 and 1,460 second-feet.

Monthly discharge of Milwaukee River near Milwaukee, Wis., for the year ending Sept. 30, 1914.

[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.		
May	952	184	466	0.705	0.81	A.
June	1,560	149	644	.974	1.09	A.
July	532	78	172	.260	.30	B.
August	122	54	80.7	.122	.14	B.
September	1,270	122	389	.589	.66	A.

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, 1914.

Gage.—Staff, attached to bridge; read daily, morning and evening, to hundredths. Limits of use: Hundredths below and tenths above 0.5 foot.

Discharge measurements.—Made from downstream side of bridge.

Extremes of stage.—Maximum stage recorded during year: 6.1 feet at 7.30 a. m., May 18. Minimum stage recorded: −1.7 feet at 8 a. m., October 1.

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 ending September 30, 1914.

Daily gage height, in feet, of Grand River at Grand Rapids, Mich., for the year ending Sept. 30, 1914.

[Roland De Witt, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−1.68	−1.45	−0.3	.....	.....	.....	5.6	2.0	0.2	1.4	−1.15	−1.12
2	−1.30	.....	.0	−1.28	2.4	1.6	5.3	1.9	− .2	1.4	.....	−1.08
3	−1.25	−1.62	− .3	−1.30	2.6	1.6	4.9	.....	− .55	.6	−1.30	−1.0
4	−1.28	−1.48	− .5	.....	3.8	1.6	4.4	1.0	− .2	.....	−1.45	−1.0
5	.....	−1.45	− .2	−1.08	3.8	1.6	.....	.5	.2	.....	−1.45	−1.0
6	−1.42	−1.55	− .2	−1.08	3.7	1.4	3.7	.6	.3	− .85	−1.50	.....
7	−1.30	−1.62	.....	−1.10	3.5	1.2	3.4	.8	.....	− .95	−1.50	.....
8	−1.40	−1.50	− .3	−1.18	.....	.....	3.0	.3	1.2	−1.15	−1.50	− .6
9	−1.45	.....	.0	−1.10	a4.0	.8	2.8	.6	.8	−1.15	.....	− .8
10	−1.45	−1.52	− .3	−1.10	4.2	1.0	2.6	.....	.2	−1.15	−1.45	−1.0
11	−1.48	−1.55	− .6	.....	a4.4	1.1	2.4	.5	− .1	−1.20	−1.35	− .6
12	.....	−1.48	− .7	a−1.05	a4.3	1.0	.....	1.6	− .4	.....	−1.45	.3
13	−1.52	−1.40	− .8	a−1.05	a4.3	.6	1.5	3.2	− .95	−1.30	−1.60	.....
14	−1.48	−1.45	.....	a−1.05	a4.3	4.2	1.2	4.8	.....	−1.30	−1.55	− .85
15	−1.55	−1.40	−1.15	.....	.....	.....	1.3	5.6	−1.12	−1.08	−1.50	− .8
16	−1.52	.....	−1.05	.....	4.3	3.8	.6	6.0	−1.20	− .7	.....	− .85
17	−1.55	−1.45	−1.05	a−1.0	.....	5.2	.2	.....	−1.17	.1	−1.50	−1.02
18	−1.48	− .9	−1.0	.....	.....	5.4	.4	6.0	−1.17	.4	−1.35	− .9
19	.....	− .6	−1.10	a−1.0	.....	5.6	.....	5.0	−1.17	.....	−1.25	−1.12
20	−1.55	.2	−1.05	a−1.0	.....	5.2	− .1	3.4	−1.20	−1.0	−1.25	.....
21	−1.50	.2	.....	a−1.0	.....	4.3	− .1	2.6	.....	−1.08	−1.25	−1.20
22	−1.32	.3	−1.15	a−1.0	.....	.....	− .5	1.8	− .90	−1.15	−1.25	−1.30
23	−1.35	.....	−1.00	a−1.0	.....	3.0	− .75	1.4	− .65	−1.15	.....	−1.30
24	−1.48	.0	−1.08	a−1.0	.....	2.6	− .9	.....	− .70	−1.15	−1.25	−1.30
25	−1.60	.0	.....	.....	.....	2.4	− .9	.8	−1.00	−1.15	−1.25	−1.30
26	.....	− .2	−1.15	− .75	a2.0	2.8	.....	.6	−1.00	.....	−1.60	−1.30
27	−1.62	.....	−1.0	.0	a2.0	3.4	− .8	.8	1.0	−1.15	−1.60	.....
28	−1.58	− .5	.....	4.2	1.6	4.4	.6	.8	.....	−1.20	−1.60	−1.10
29	−1.45	− .4	−1.0	1.2	.....	.....	2.1	.6	1.5	−1.20	−1.60	−1.0
30	−1.35	.....	−1.10	1.8	.....	5.4	2.1	.....	1.5	−1.15	.....	− .9
31	−1.40	.....	−1.18	2.6	.....	5.6	.....	.....	.....	−1.15	−1.50	.....

a Gage height to top of ice.

NOTE.—Discharge relation probably affected by ice about Jan. 9 to Mar. 16.

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, 1914.

Gage.—Standard chain gage; read daily, morning and evening, to hundredths.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Probably permanent.

Extremes of discharge.—Maximum stage recorded during year: 4.66 feet, at 3.30 p. m., March 30; discharge, 2,090 second-feet. Minimum stage recorded: 1.20 feet at 8.10 a. m., January 14; discharge, 637 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 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 ending September 30, 1914, 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 at Sherman, Mich., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	955	1,110	1,240	993	1,280	.....	2,010	1,650	1,110	1,200	919	993
2	1,070	1,110	1,240	1,030	1,240	.....	2,010	1,560	1,110	1,160	955	1,030
3	1,110	1,110	1,240	1,070	1,200	.....	2,010	1,510	1,110	1,110	955	1,030
4	1,110	1,110	1,200	1,070	1,200	.....	1,900	1,460	1,160	1,110	919	1,030
5	1,070	1,110	1,200	1,030	1,240	.....	1,800	1,420	1,200	1,070	919	1,030
6	1,030	1,070	1,200	1,030	1,240	1,070	1,650	1,420	1,240	1,070	919	1,030
7	1,030	1,070	1,160	993	1,240	1,070	1,600	1,370	1,280	1,030	885	993
8	1,030	1,110	1,160	1,030	1,030	1,070	1,510	1,370	1,330	993	885	993
9	1,030	1,070	1,160	1,030	852	1,070	1,510	1,330	1,280	955	885	955
10	1,030	1,070	1,160	1,030	885	1,070	1,460	1,280	1,200	919	919	955
11	1,110	1,070	1,160	993	919	1,070	1,460	1,240	1,110	919	955	955
12	1,160	1,070	1,160	919	.....	1,030	1,460	1,240	1,070	955	919	955
13	1,110	1,070	1,160	758	.....	1,070	1,420	1,200	1,030	1,070	919	955
14	1,110	1,110	1,160	667	.....	1,030	1,420	1,160	993	1,070	885	955
15	1,110	1,110	1,160	789	.....	1,070	1,420	1,160	993	1,030	885	955
16	1,110	1,110	1,160	995	.....	1,420	1,420	1,110	993	993	919	955
17	1,200	1,110	1,110	1,070	.....	1,370	1,460	1,110	993	993	919	955
18	1,280	1,110	1,110	1,160	.....	1,280	1,510	1,070	993	993	1,030	919
19	1,330	1,240	1,110	1,110	.....	1,200	1,560	1,070	993	993	1,330	919
20	1,280	1,600	1,110	1,070	.....	1,160	1,560	1,070	955	955	1,370	919
21	1,240	1,650	1,070	1,070	.....	1,110	1,560	1,110	993	919	1,330	919
22	1,200	1,600	1,070	1,070	.....	1,070	1,560	1,160	993	919	1,370	919
23	1,200	1,600	1,030	1,070	.....	1,070	1,510	1,160	993	993	1,420	919
24	1,200	1,560	1,030	1,070	.....	1,070	1,460	1,200	1,070	993	1,330	919
25	1,200	1,460	1,030	1,110	.....	1,160	1,370	1,200	1,070	993	1,200	955
26	1,160	1,370	955	1,030	.....	1,420	1,460	1,200	1,030	955	1,110	955
27	1,160	1,280	919	955	.....	1,460	1,560	1,200	1,070	955	1,070	919
28	1,160	1,280	955	1,030	.....	1,420	1,600	1,160	1,110	993	1,030	919
29	1,160	1,240	1,070	1,330	.....	1,560	1,700	1,110	1,200	955	1,030	919
30	1,160	1,240	1,030	1,510	.....	2,060	1,700	1,160	1,200	955	1,030	919
31	1,160	.....	1,030	1,460	.....	2,060	.....	1,111	.....	919	993	.....

NOTE.—Discharge determined from well-defined rating curve. Discharge estimated, because of ice, from gage heights and climatic records as follows: Feb. 12–28, 1,000 second-feet; Mar. 1–5, 1,050 second-feet.

Monthly discharge of Manistee River at Sherman, Mich., for the year ending Sept. 30, 1914.

[Drainage area, 900 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,330	955	1,140	1.27	1.46	A.
November	1,650	1,070	1,230	1.37	1.53	A.
December	1,240	919	1,110	1.23	1.42	B.
January	1,510	667	1,050	1.17	1.35	
February	.....	.....	1,050	1.17	1.22	
March	2,060	.....	1,220	1.36	1.57	
April	2,010	1,370	1,590	1.77	1.98	
May	1,650	1,070	1,240	1.38	1.59	
June	1,330	955	1,100	1.22	1.36	
July	1,200	919	1,000	1.11	1.28	
August	1,420	885	1,040	1.16	1.34	
September	1,030	919	958	1.06	1.18	
The year	2,060	.....	1,140	1.27	17.28	

STREAMS TRIBUTARY TO LAKE HURON.

AU SABLE RIVER NEAR LOVELLS, MICH.

Location.—In the SE. ¼ sec. 1, T. 26 N., R. 1 W., about 900 feet below mouth of North Branch of Au Sable River, about 11 miles southeast of Lovells, and about 8 miles southwest of Red Oak post office.

Drainage area.—1,000 square miles (determined by Fargo Engineering Co.).

Records available.—September 11, 1908, to September 30, 1914.

Gage.—Vertical staff bolted to a 1½-inch pipe driven 8 feet into bed of river, installed April 24, 1913, about 7 feet upstream from old vertical staff gage which was attached to overhanging tree on left bank and used previous to that date. Duplicate of new gage installed a few days later on right bank a short distance upstream. Sea-level elevation of zeros of the gages, 1,004.69 feet. Gage read morning and evenings to tenths.

Discharge measurements.—Made from boat at section about 500 feet upstream from gage.

Channel and control.—Sand and gravel; practically permanent.

Winter flow.—Discharge relation affected by ice during extremely cold weather.

Extremes of discharge.—Maximum mean daily stage recorded during year: 2.4 feet, April 1 and 2; discharge, 1,640 second-feet. Minimum mean daily stage recorded: 0.1 foot, August 7, 8, and 11; discharge, 547 second-feet. Minimum discharge may have occurred when ice was present.

Maximum mean daily stage recorded 1908–1914: 4.7 feet, May 29, 1912; discharge, 2,850 second-feet. Minimum discharge not known; probably occurred when ice was present.

Accuracy.—As no discharge measurements were made at this station during the year ending September 30, 1914, the accuracy of the estimates of discharge published in the following tables depends on the constancy of the discharge relation subsequent to September 2, 1913, when last discharge measurement was made.

Daily discharge, in second-feet, of Au Sable River near Lovells, Mich., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	680	817	955	725	909	680	1,640	1,430	863	863	591	725
2	725	817	1,050	725	863	.....	1,640	1,340	817	863	591	771
3	725	817	1,000	725	863	.....	1,530	1,240	771	771	591	771
4	725	817	955	725	863	680	1,430	1,240	955	771	591	725
5	725	817	909	725	817	.....	1,340	1,240	955	771	591	680
6	680	817	909	725	771	680	1,240	1,190	863	680	591	725
7	725	771	909	725	.....	680	1,240	1,190	955	680	547	680
8	771	817	863	725	.....	680	1,100	1,140	863	725	547	680
9	771	817	909	725	.....	680	1,050	1,100	863	680	591	680
10	771	771	863	725	.....	680	1,050	1,050	817	680	591	725
11	955	771	863	725	.....	680	1,100	1,050	771	680	547	680
12	955	817	863	680	.....	635	1,100	1,000	771	680	635	680
13	909	817	863	.....	.....	635	1,100	955	725	680	635	680
14	817	817	863	.....	.....	680	1,050	955	725	725	591	680
15	817	817	817	.....	.....	680	1,140	909	680	680	635	635
16	771	771	817	.....	.....	771	1,140	909	680	635	680	635
17	1,000	817	817	.....	.....	863	1,240	909	680	635	680	680
18	1,100	817	817	.....	.....	817	1,240	863	680	635	725	635
19	1,050	955	817	725	.....	725	1,240	863	680	635	863	635
20	955	1.240	817	725	.....	771	1,240	863	680	635	955	591
21	955	1,190	817	680	.....	771	1,240	863	680	591	955	591
22	955	1,190	771	771	.....	771	1,190	909	725	591	955	591
23	1,050	1,190	771	771	.....	725	1,140	1,380	725	635	955	635
24	1,100	1,140	771	725	.....	725	1,100	1,190	771	635	955	635
25	1,050	1,000	771	725	.....	771	1,240	1,000	771	635	909	635
26	955	955	771	725	.....	863	1,340	955	771	635	863	680
27	863	955	771	725	.....	909	1,290	863	771	635	817	680
28	863	955	771	725	771	909	1,290	863	863	635	771	591
29	863	955	771	863	.....	1,100	1,580	863	909	591	725	591
30	863	955	725	909	.....	1,530	1,530	909	863	591	725	591
31	863	.....	725	909	.....	1,530	.....	863	.....	591	725	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated, because of ice, from gage heights and climatic records as follows: Jan. 13–18, 650 second-feet, Feb. 7–27, 630 second-feet, and Mar. 2, 3, and 5, 700 second-feet.

Monthly discharge of Au Sable River near Lovells, Mich., for the year ending Sept. 30, 1914.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,100	680	871	0.871	1.00	A.
November	1,240	771	907	.907	1.01	A.
December	1,050	725	842	.842	.97	B.
January	.....	.....	727	.727	.84	B.
February	.....	.....	682	.682	.71	D.
March	1,530	635	797	.797	.92	B.
April	1,640	1,050	1,260	1.26	1.41	B.
May	1,430	863	1,040	1.04	1.20	B.
June	955	680	788	.788	.88	B.
July	863	591	673	.673	.78	B.
August	955	547	714	.714	.82	B.
September	771	591	664	.664	.74	B.
The year	1,640	.....	830	.830	11.28	

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, 1914.

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

Daily discharge, in second-feet, of Tittabawassee River at Freeland, Mich., for the yea. ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	685	1,110	1,300	700	1,805	1,206	2,585	1,670	2,504	1,825	1,056	1,985
2	675	1,140	1,600	725	1,760	1,201	2,470	1,560	2,400	1,684	1,050	1,931
3	645	1,170	1,920	833	1,678	1,188	2,410	1,568	2,238	1,600	1,020	2,001
4	663	1,190	2,070	838	1,627	1,195	2,350	1,532	2,001	1,462	990	2,025
5	685	1,170	2,065	863	1,593	1,201	2,300	1,600	1,785	1,340	1,020	1,985
6	702	1,170	2,030	866	1,522	1,201	2,275	1,600	1,670	1,050	990	1,913
7	718	1,200	2,000	928	1,579	1,195	2,250	1,560	1,480	930	960	1,745
8	758	1,220	2,060	983	1,570	1,188	2,250	1,397	1,263	990	930	1,600
9	832	1,240	1,990	990	1,522	1,168	2,240	1,340	1,098	1,020	930	1,488
10	900	1,270	1,750	1,004	1,441	1,180	2,200	1,263	1,020	1,020	960	1,308
11	930	1,300	1,600	928	1,482	1,193	2,160	1,235	830	1,038	990	1,474
12	1,005	1,310	1,390	838	1,517	1,216	2,158	1,200	845	1,122	978	1,340
13	1,030	1,360	1,300	764	1,550	1,244	1,745	1,200	730	1,560	960	1,235
14	1,058	1,350	1,390	725	1,583	1,394	1,600	1,176	658	3,710	990	1,140
15	1,070	1,300	1,300	718	1,623	1,394	1,520	1,140	610	5,805	990	1,110
16	1,100	1,270	1,240	728	1,608	2,535	1,520	1,110	592	5,829	1,014	1,080
17	1,065	1,230	1,200	750	1,532	3,456	1,520	1,080	576	4,250	1,080	1,098
18	1,035	1,200	1,170	764	1,394	4,342	1,520	1,056	566	2,875	1,316	1,686
19	990	1,215	1,140	831	1,320	4,330	1,496	990	540	2,081	1,985	1,056
20	960	1,230	1,100	928	1,244	3,644	1,480	930	540	1,600	3,100	1,038
21	990	1,285	1,080	1,047	1,201	2,850	1,450	936	540	1,410	3,150	1,020
22	990	1,350	1,040	1,058	1,193	2,222	1,418	930	550	1,251	2,929	1,020
23	1,080	1,535	1,000	1,047	1,201	2,115	1,390	1,242	540	1,140	2,902	1,050
24	1,110	1,825	930	1,058	1,232	2,209	1,359	1,600	566	1,110	2,884	1,038
25	1,085	1,600	870	1,068	1,224	2,200	1,340	1,753	581	1,002	2,754	1,020
26	1,050	1,480	800	1,082	1,201	2,318	1,340	1,945	827	930	2,835	1,020
27	1,035	1,390	755	1,193	1,201	2,715	1,462	2,105	1,182	1,002	2,817	1,008
28	1,020	1,350	700	1,390	1,201	2,955	1,560	2,246	1,308	1,140	2,673	1,017
29	1,035	1,300	680	1,618	.....	3,120	1,684	2,355	1,600	1,462	2,520	1,038
30	1,070	1,300	685	1,722	.....	2,890	1,600	2,920	1,833	1,270	2,400	1,122
31	1,100	.....	690	1,860	.....	2,750	.....	2,763	.....	1,170	2,277	.....

Monthly discharge of Tittabawassee River at Freelands, Mich., for the year ending Sept. 30, 1914.

[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	1,110	645	938	0.371	0.43
November	1,825	1,110	1,300	.514	.57
December	2,070	680	1,320	.522	.60
January	1,860	700	995	.393	.45
February	1,805	1,193	1,450	.573	.60
March	4,342	1,168	2,100	.830	.96
April	2,585	1,340	1,820	.719	.80
May	2,920	930	1,520	.601	.69
June	2,504	540	1,120	.443	.49
July	5,829	930	1,800	.711	.82
August	3,150	930	1,720	.680	.78
September	2,025	1,008	1,330	.526	.59
The year	5,829	540	1,450	.573	7.78

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, 1914.

Gage.—Standard chain attached to bridge; read daily, morning and evening, to half-tenths. Limits of use: Hundredths below 0.5 foot, half-tenths from 0.5 to 1.5, and tenths above 1.5 feet.

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: 4.2 feet, at 7 a. m., May 13. Minimum stage recorded: −0.3 foot, at 5. p. m., August 23.

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 in year ending September 30, 1914.

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

[D. M. Litchfield, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	−0.25	0.15	0.5	0.02	0.5	−0.02	1.6	1.3	0.48	0.15	−0.10	0.15
2	− .20	.15	.55	.00	.45	.55	1.8	1.2	.38	.20	− .18	.38
3	− .20	.10	.5	.00	.5	.55	1.7	1.2	.35	.20	− .18	.38
4	− .22	.10	.48	.10	.6	.15	1.6	1.1	.40	.15	− .20	.30
5	− .25	.05	.45	.05	.65	.15	1.5	1.1	.42	.18	− .20	.22
6	− .20	.02	.48	.05	.6	.12	1.4	1.05	.38	.12	− .22	.42
7	− .18	.02	.5	.02	.55	.20	1.4	.95	.35	.10	− .22	.48
8	− .22	.00	.42	.00	.5	.20	1.4	.95	.38	.10	− .22	.48
9	− .22	.02	.38	.05	.65	.22	1.3	1.05	.30	.00	− .25	.45
10	− .22	.02	.35	.05	.9	.18	1.25	1.0	.32	− .02	− .22	.45
11	− .18	.02	.32	− .05	.7	.22	1.1	1.1	.22	− .05	− .15	.42
12	− .20	.08	.30	− .05	.9	.22	1.1	3.5	.20	− .05	− .20	.40
13	− .20	.18	.30	.32	1.0	.22	.9	4.1	.18	.00	− .18	.45
14	− .18	.25	.30	.28	1.0	.38	.8	3.4	.10	.65	− .12	.42
15	− .20	.28	.28	.05	.55	.6	.7	3.2	.05	.8	− .10	.30
16	− .20	.25	.25	− .02	.48	.8	.7	3.1	− .02	.7	− .15	.25
17	− .20	.20	.22	− .02	.30	.9	.6	3.0	− .10	.6	− .10	.20
18	− .15	.22	.20	.08	.38	.9	.5	2.8	− .15	.5	− .12	.12
19	− .12	.32	.20	.00	.35	.8	.5	2.5	− .12	.45	− .15	.05
20	− .12	.45	.20	− .02	.50	.8	.48	2.3	− .20	.38	− .10	.05
21	− .12	.42	.18	− .02	.40	.7	.40	2.0	− .15	.32	− .15	.00
22	− .08	.35	.12	.00	.28	.7	.38	1.8	− .08	.28	− .25	.02
23	− .02	.30	.10	.05	.6	.7	.30	1.6	.00	.22	− .28	.02
24	.05	.30	.10	.42	.5	.6	.28	1.35	− .02	.20	− .15	.00
25	.00	.28	.10	.5	.6	.55	.6	1.2	− .10	.20	− .15	.00
26	.00	.22	.10	.45	.6	.6	.9	1.0	− .10	.12	− .18	.00
27	.05	.22	.05	.42	.12	1.1	1.0	.9	− .02	.15	− .15	.00
28	.20	.28	.00	.48	− .02	1.8	1.1	.8	.20	.00	− .12	.00
29	.22	.32	.00	.6	.....	1.8	1.2	.7	.18	.00	− .02	.00
30	.20	.38	.05	.65	.....	1.7	1.3	.6	.12	− .02	− .05	.00
31	.12	.....	.05	.6	.....	1.6	.....	.5	.....	− .10	− .05	.....

NOTE.—Discharge relation probably affected by ice Jan. 11–18, and Feb. 9 to Mar. 9.

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.[1]

Records available.—January 1 to September 30, 1914.

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 turbines were calibrated by a specially constructed weir, the crest of which was formed by a ¼-inch by 5-inch milled plate; discharge over the weir was 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., from Jan. 1 to Sept. 30, 1914.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	270	508	297	1,266	993	542	335	140	409
2	294	491	248	1,546	978	512	341	260	451
3	308	542	318	1,780	921	431	332	223	428
4	281	609	324	1,355	892	480	361	161	441
5	294	605	286	1,033	874	490	348	195	457
6	303	542	317	1,100	842	473	329	189	492
7	272	680	413	1,026	785	476	313	185	519
8	251	249	371	1,137	808	478	304	195	542
9	290	331	379	983	852	468	281	171	503
10	298	416	353	899	810	428	229	239	513
11	249	420	407	832	883	404	232	200	515
12	203	383	416	794	2,881	371	216	200	506
13	227	370	416	760	3,266	363	286	209	438
14	220	365	515	728	2,725	317	589	212	423
15	264	318	649	701	2,263	305	642	215	413
16	253	330	744	660	2,173	253	626	227	392
17	271	335	787	599	2,177	195	566	239	372
18	275	321	764	583	2,036	203	517	227	357
19	285	322	780	501	1,772	212	471	192	342
20	298	309	704	524	1,570	191	465	231	331
21	300	296	684	556	1,345	200	446	189	315
22	303	270	667	391	1,193	228	426	160	311
23	303	268	628	463	1,051	256	404	197	314
24	503	290	612	423	1,002	235	387	209	309
25	478	264	588	600	906	235	368	286	313
26	507	283	623	742	796	227	319	167	294
27	570	292	846	809	809	289	302	133	278
28	555	277	1,438	829	705	390	305	194	277
29	648	.....	1,337	974	626	334	260	270	282
30	630	.....	1,340	1,023	544	300	278	233	278
31	625	.....	1,264	.....	594	.....	244	304	.....

[1] Reported by G. S. Williams.

Monthly discharge of Huron River at Barton, Mich., for the year ending Sept. 30, 1914.

[Drainage area, 723 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	648	203	349	0.482	0.56
February	680	249	382	.528	.55
March	1,438	248	630	.871	1.00
April	1,780	391	854	1.18	1.32
May	3,266	544	1,293	1.79	2.06
June	542	191	343	.474	.53
July	642	216	372	.514	.59
August	304	133	208	.288	.33
September	542	277	394	.545	.61

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 September 30, 1914.

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 board 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. The mean flow from January 1 to September 30, 1914, computed for this station is slightly less than that for the same period for the station at Barton. Estimates of flow prepared for the latter station are more reliable, as they are based on special calibrations of the turbines and sluices. A comparison of the estimates in the following tables with those for the station at Barton will make it possible to determine a correction factor applicable to the past records for the station at Geddes.

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 year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	172	380	591	286	539	319	1,247	880	650	337	208	386
2	198	301	601	336	581	274	1,293	882	447	325	154	406
3	203	360	623	316	551	338	1,395	1,029	430	327	227	422
4	197	419	572	340	670	324	1,044	973	480	324	218	420
5	183	360	540	310	613	315	926	1,012	458	356	156	420
6	174	319	542	323	558	333	930	876	316	309	164	490
7	207	308	509	345	593	415	1,083	760	400	295	170	475
8	203	292	655	342	339	377	1,085	886	449	278	196	508
9	193	274	586	313	280	356	1,024	919	504	255	164	448
10	199	313	422	301	470	382	1,031	887	387	257	165	446
11	215	304	510	291	426	501	778	1,094	360	270	202	468
12	200	330	473	268	463	393	915	2,954	333	195	170	474
13	173	308	480	177	388	438	842	2,581	353	279	200	396
14	183	414	480	218	400	541	700	2,450	295	488	206	390
15	210	406	496	195	356	647	659	2,030	310	576	213	391
16	215	420	473	216	319	718	617	1,853	268	577	177	386
17	223	404	285	134	361	734	615	1,852	332	566	226	362
18	231	415	476	264	365	715	501	1,723	158	486	197	401
19	236	396	459	340	353	723	527	1,555	88	386	244	329
20	236	435	439	350	346	667	504	1,444	186	411	219	382
21	257	451	430	317	350	650	579	1,299	143	390	185	265
22	252	439	590	310	317	661	349	1,199	331	379	167	341
23	294	440	460	268	298	601	593	1,136	193	382	178	267
24	307	437	404	475	326	600	459	1,102	178	364	213	319
25	288	436	500	442	292	562	488	918	168	324	171	289
26	303	456	321	570	332	605	671	818	176	329	260	288
27	305	399	335	475	324	1,005	748	776	274	329	137	288
28	340	453	358	588	358	1,381	791	718	400	277	182	260
29	369	408	269	659	.....	1,379	895	719	296	264	258	266
30	406	449	339	648	.....	1,381	924	580	281	218	239	262
31	387	.....	342	591	.....	1,288	.....	596	.....	235	271	.....

Monthly discharge of Huron River at Geddes, Mich., for the year ending Sept. 30, 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	406	172	244	0.322	0.37
November	456	274	384	.507	.57
December	655	269	470	.621	.72
January	659	134	355	.469	.54
February	670	280	411	.543	.57
March	1,381	274	633	.836	.96
April	1,395	349	807	1.07	1.19
May	2,954	580	1,240	1.64	1.89
June	650	88	321	.424	.47
July	577	195	348	.460	.53
August	271	137	198	.262	.30
September	508	260	375	.495	.55
The year	2,954	88	483	.638	8.66

NOTE.—See "Accuracy" in station description.

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, 1914.

Gage.—Staff; read daily, morning and evening, to tenths. **Limits of use:** Half-tenths below and tenths above 1.5 feet.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Probably permanent.

Extremes of stage.—Maximum stage recorded during year: 9.4 feet, at 7 a. m., May 14. Minimum stage recorded: 0.6 foot, at 4.45 p. m., June 21.

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, 1914.

[C. L. Melter, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.1	2.1	2.7	2.0	3.2	3.0	5.8	4.6	3.2	2.0	1.45	1.8
2	1.2	2.1	3.1	1.8	3.0	2.5	5.7	4.5	3.6	2.2	1.4	2.6
3	1.1	.85	3.0	1.6	3.3	2.5	5.9	4.4	2.8	2.2	1.1	2.6
4	1.35	1.9	3.0	2.1	3.5	2.5	5.9	4.4	2.8	2.2	1.45	2.5
5	1.0	2.2	3.0	1.8	3.0	2.8	6.0	4.4	2.7	2.2	1.3	2.5
6	1.1	2.1	2.9	1.8	3.4	2.6	5.8	4.4	2.9	2.2	1.15	2.8
7	1.0	2.0	2.7	1.8	3.4	3.0	5.0	4.1	2.4	2.0	.95	2.8
8	1.1	2.0	2.8	1.9	2.6	3.4	4.9	4.2	2.4	2.0	1.1	2.8
9	1.1	1.9	2.8	1.8	3.6	3.4	4.9	4.6	2.4	1.8	1.0	3.1
10	1.1	1.4	2.8	1.8	3.2	3.2	4.7	4.4	2.6	2.0	1.2	2.9
11	1.05	1.9	2.6	1.6	3.4	3.4	4.8	4.6	2.6	1.8	1.3	2.8
12	1.0	1.8	2.6	1.8	4.0	3.8	3.8	7.2	2.3	1.6	1.7	2.8
13	1.1	2.0	2.6	2.4	3.6	3.8	4.2	8.6	2.2	1.3	1.35	2.8
14	1.05	2.0	2.6	2.2	3.1	3.9	3.8	9.2	2.2	2.1	1.5	2.4
15	1.45	2.2	2.4	1.6	3.0	4.3	3.7	8.6	2.2	3.4	1.6	2.6
16	1.8	2.2	2.5	2.0	2.8	4.8	3.4	8.0	1.9	3.7	1.5	2.2
17	1.25	2.2	2.2	2.0	2.8	4.9	3.4	7.7	2.0	3.4	1.3	2.4
18	1.1	2.1	2.2	1.9	2.6	4.0	3.4	7.3	2.2	3.1	1.6	2.4
19	1.6	2.4	2.1	2.0	2.7	3.8	3.0	7.2	1.9	2.7	1.5	2.2
20	1.15	2.2	2.0	2.0	2.6	3.8	2.8	7.0	1.0	2.6	1.3	2.1
21	1.3	2.2	2.0	1.9	2.5	3.7	2.8	6.6	.6	2.6	1.8	2.0
22	1.3	2.2	1.8	2.6	2.3	3.6	2.8	6.2	1.1	2.4	1.6	2.0
23	1.15	2.3	2.2	2.0	2.5	3.4	2.6	5.8	2.4	2.2	1.4	2.1
24	1.9	2.3	2.2	2.4	2.4	3.4	2.6	5.2	1.8	2.4	1.0	2.2
25	1.9	2.5	2.0	3.5	2.4	3.2	3.1	4.8	1.4	2.2	1.5	2.0
26	1.9	2.4	1.8	3.5	2.5	3.3	3.4	4.6	1.5	2.4	1.3	2.0
27	1.4	2.2	2.0	3.3	2.3	3.5	3.7	4.2	1.45	1.6	1.7	1.9
28	2.1	2.4	2.2	3.3	2.5	4.4	3.9	4.2	1.6	2.2	1.25	1.9
29	2.0	2.2	2.0	3.8	.....	6.4	4.2	3.8	2.3	1.6	1.7	1.9
30	2.2	2.4	2.2	4.0	.....	6.3	4.5	3.5	2.0	1.7	1.8	1.8
31	2.2	.....	2.0	4.2	.....	6.0	.....	3.3	.....	1.8	1.8	.....

NOTE.—Observer took no notes relative to ice. Discharge relation probably affected by ice about Feb. 9 to Mar. 5.

CATTARAUGUS CREEK AT VERSAILLES, N. Y.

Location.—On a three-span highway bridge in the village of Versailles, about 6 miles below Gowanda, and about 8 miles above mouth of stream; 2¼ miles above mouth of Clear Creek.

Drainage area.—467 square miles. (Measured on Post Route map.)

Records available.—September 23, 1910, to September 30, 1914. 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 the upstream side of bridge; read daily, about 9 a. m. and 6 p. m., to quarter-tenths. Gage reader, James Palmer.

Discharge measurements.—Made from downstream side of bridge.

Channel and control.—Rock and gravel; occasionally shifting.

Extremes of discharge.—Maximum stage recorded during year: 9.7 feet at 8.30 a. m., March 28; discharge approximately 13,600 second-feet. Minimum stage recorded: 4.7 feet at 6.30 p. m., August 8; discharge, 60 second-feet.

Maximum stage recorded 1910–1914: 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 second-feet.

Winter flow.—Discharge relation affected by ice; observations discontinued.

Accuracy.—Rating curve well defined. Estimates fairly good.

Discharge measurements of Cattaraugus Creek at Versailles, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 31	R. S. Barnes	5.19	287	Aug. 22	C. S. DeGolyer	5.21	277
Mar. 31	C. S. DeGolyer	6.61	2,350	Sept. 30	E. D. Burchard	4.92	129
Aug. 22	do	5.26	318	30	do	4.94	143

Daily discharge, in second-feet, of Cattaraugus Creek at Versailles, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	118	300	248	277	1,600	.....	1,600	515	350	157	90	315
2	135	315	248	277	1,110	.....	3,980	418	294	165	97	1,260
3	224	315	248	360	862	.....	2,570	367	280	165	90	700
4	180	338	248	345	1,600	.....	1,700	367	435	145	90	960
5	158	300	248	277	1,340	.....	1,340	2,000	619	133	97	588
6	158	248	248	315	968	.....	1,150	2,700	367	125	90	336
7	107	208	248	315	375	.....	1,260	1,180	336	117	90	280
8	118	180	300	345	300	.....	5,320	392	280	125	66	232
9	118	418	248	443	.....	.....	1,900	6,050	268	108	75	220
10	107	1,700	268	875	.....	.....	1,510	5,320	232	97	90	176
11	118	718	248	508	.....	.....	1,900	6,050	209	90	176	176
12	180	576	224	300	.....	.....	2,330	7,640	220	90	133	176
13	208	1,340	287	280	.....	.....	1,510	6,050	192	117	108	176
14	158	1,340	338	.....	.....	.....	1,150	2,110	192	133	118	157
15	158	875	338	.....	.....	.....	1,030	1,340	176	145	125	145
16	135	555	360	.....	.....	4,630	2,000	918	176	133	118	176
17	118	460	315	.....	.....	3,370	1,510	736	165	108	125	157
18	135	418	287	.....	.....	2,820	918	619	165	117	157	133
19	158	443	287	.....	.....	1,700	960	556	176	125	535	133
20	268	1,340	287	.....	.....	1,340	890	455	232	125	232	133
21	338	1,340	287	.....	.....	1,060	918	435	192	117	315	133
22	418	555	287	.....	.....	660	918	392	192	90	220	133
23	479	392	360	.....	.....	576	1,000	418	165	90	220	125
24	576	338	576	.....	.....	576	918	392	165	133	1,900	133
25	660	300	536	.....	.....	1,260	960	350	165	97	1,030	209
26	536	287	418	.....	.....	8,440	1,150	350	145	90	435	157
27	392	287	338	.....	.....	9,640	960	367	133	108	250	118
28	300	300	287	8,640	.....	11,200	619	435	157	90	367	97
29	287	268	338	4,630	.....	3,370	619	350	165	97	455	125
30	300	248	287	3,980	.....	2,820	588	1,340	176	90	485	125
31	287	.....	287	2,700	.....	1,900	.....	588	.....	97	315	.....

NOTE.—Daily discharge determined from a rating curve well defined below 4,500 second-feet. Discharge estimated, because of ice, by comparison with records on Genesee River and Little Tonawanda Creek as follows: Jan. 14–27, 227 second-feet; Feb. 9–28, 210 second-feet; Mar. 1–15, 171 second-feet.

Monthly discharge of Cattaraugus Creek at Versailles, N. Y., for the year ending Sept. 30, 1914.

[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	660	107	246	0.53	0.61	B.
November	1,700	180	557	1.19	1.33	B.
December	576	224	307	.66	.76	B.
January	8,640	.....	903	1.93	2.23	B.
February	1,600	.....	441	.944	.98	C.
March	11,200	.....	1,870	4.00	4.61	B.
April	5,320	588	1,510	3.23	3.60	A.
May	7,640	350	1,650	3.53	4.07	A.
June	619	133	234	.501	.56	B.
July	165	90	117	.251	.29	B.
August	1,900	66	280	.600	.69	B.
September	1,260	97	266	.570	.64	B.
The year	11,200	66	701	1.50	20.37	

STREAMS TRIBUTARY TO LAKE ONTARIO.

LITTLE TONAWANDA CREEK AT LINDEN, N. Y.

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

Drainage area.—22.0 square miles (measured on topographic maps).

Records available.—July 8, 1912, to September 30, 1914. Data published also in annual reports of New York State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Vertical staff on right-hand upstream abutment of bridge; read daily, morning and evening, to half-tenths. Gage reader, C. L. Schenck.

Discharge measurements.—High-water measurements made from a cable and car 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 upstream side of bridge. When the water overtops this weir it flows over a 2-inch plank about 13 feet long (including the 2 feet of weir). Weir carried away by floating tree March 25, 1913, and replaced June 20, 1913.

Extremes of discharge.—Maximum stage recorded during year: 7.97 feet at 6 p. m., March 26; discharge, approximately 1,000 second-feet. Minimum stage recorded: 0.18 foot at 8 a. m. and 6 p. m., October 8; discharge, 0.43 second-foot.

Maximum stage recorded 1912–1914: 8.08 feet with the weir in its damaged condition at noon, March 25, 1913; discharge, approximately 1,300 second-feet. Minimum stage recorded: 0.18 foot, August 20 and 21, September 14 to 16, and October 8, 1913; discharge, 0.43 second-foot.

Accuracy.—Accuracy of data for stages below 0.70 foot when flow is confined to weir is that of a properly constructed Francis weir. For stages above gage height 0.69 foot, the weir has been rated with a current-meter, and data for such stages should also be excellent.

Discharge measurements of Little Tonawanda Creek at Linden, N. Y., for the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 6	C. H. Pierce	0.27	0.89	Aug. 21	C. S. DeGolyer	0.792	5.57
21	C. S. DeGolyer	.66	3.14				

Daily discharge, in second-feet, of Little Tonawanda Creek at Linden, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.59	0.82	4.1	5.1	40	8.4	91	19	6.1	2.12	0.91	4.4
2	.59	.77	3.7	4.6	30	4.6	274	15	5.6	3.07	.96	19.1
3	.55	.82	3.9	4.6	29	7.8	126	13	4.6	4.6	1.07	9.4
4	.55	.87	3.9	5.1	83	7.2	67	12	12	2.79	.87	36.6
5	.51	.77	3.7	5.1	41	7.8	59	235	9.4	2.38	.77	11.8
6	.51	.77	3.48	5.9	30	7.2	47	187	6.6	2.12	.87	7.8
7	.51	.77	3.9	5.6	28	7.5	63	59	6.1	1.99	.87	6.4
8	.43	.77	5.6	6.1	10	7.2	235	47	5.6	1.87	.68	5.6
9	.43	2.72	3.9	7.8	13	6.6	91	144	4.6	1.81	.63	4.2
10	.51	8.4	4.1	13	14	6.6	95	55	4.1	1.74	.77	3.9
11	.63	3.9	3.48	12	12	6.6	164	43	3.7	1.62	.87	3.7
12	.68	2.79	3.9	9.7	11	6.9	108	91	3.48	1.56	.77	3.60
13	.55	3.07	5.6	9.4	9.4	6.6	67	199	3.14	1.62	.77	3.21
14	.51	4.1	7.5	9.7	9.0	7.8	55	87	3.00	1.62	.91	2.93
15	.51	3.9	6.6	8.4	9.0	18	51	47	2.86	1.68	.77	2.72
16	.55	3.21	5.3	8.4	9.0	112	144	35	2.93	1.62	.68	2.51
17	.55	3.07	5.3	9.7	8.7	235	67	26	2.65	1.62	.72	2.38
18	.59	2.93	5.1	9.0	8.7	126	51	21	2.51	1.68	.87	2.32
19	.59	3.6	4.2	9.0	8.7	51	47	18	3.21	1.23	3.60	2.25
20	1.07	19.1	3.9	9.0	8.1	55	41	15	3.7	1.17	2.79	2.12
21	.82	9.7	3.7	9.0	7.8	55	36	13	3.14	1.07	4.4	2.05
22	.63	8.1	3.6	9.0	7.8	47	29	12	2.93	1.07	4.9	1.99
23	.59	7.2	4.2	8.4	7.8	38	22	13	6.4	1.28	2.38	1.93
24	.82	6.6	6.1	11	7.2	35	18	10	3.07	1.51	62.	2.25
25	1.12	6.9	7.2	14	6.6	79	19	9.0	2.45	1.17	9.7	2.12
26	1.07	6.1	5.3	16	6.6	584	37	8.4	2.25	1.07	5.1	1.93
27	.96	5.6	4.2	16	6.6	516	28	13	2.38	1.28	3.7	2.12
28	.87	4.6	5.3	87	7.2	436	22	9	2.45	1.17	3.07	1.87
29	.77	4.2	4.4	302	.....	187	22	7.8	2.25	1.07	9.0	1.87
30	.91	4.2	5.3	223	.....	199	26	9.7	2.32	1.01	11.1	1.99
31	.87	.....	5.6	63	.....	122	26	7.2	.....	.96	6.1	.....

NOTE.—Daily discharge determined from well-defined rating curve.

Monthly discharge of Little Tonawanda Creek at Linden, N. Y., for the year ending Sept. 30, 1914.

[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	1.12	0.43	0.672	0.031	0.04	A.
November	19.1	.77	4.34	.197	.22	A.
December	7.5	3.48	4.71	.214	.25	A.
January	302	4.6	29.5	1.34	1.54	A.
February	83	6.6	16.8	.764	.80	A.
March	584	4.6	96.6	4.39	5.06	A.
April	235	18	73.4	3.34	3.73	A.
May	235	7.2	47.7	2.17	2.50	A.
June	12	2.25	4.18	.190	.21	A.
July	4.6	.96	1.69	.077	.09	A.
August	62	.63	4.60	.209	.24	A.
September	36.6	1.87	5.23	.238	.26	A.
The year	584	.43	24.2	1.10	14.94	

GENESEE RIVER AT ST. HELENA, N. Y.

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

Drainage area.—1,030 square miles.

Records available.—August 14, 1908, to September 30, 1914. (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 to hundredths. Gage reader, Herman Piper. Since August 24, 1911, Gurley water-stage recorder, with intake pipe to the well, a few feet downstream from the chain gage. In September, 1914, the intake pipe was extended about 27 feet to the first bridge pier from the left bank. Datum same as that of chain gage, but slope of water surface makes readings different.

Discharge measurements.—Made from bridge or by wading.

Channel and control.—Gravel and rocks; occasionally shifting.

Extremes of discharge.—Maximum stage recorded during year: 9.73 feet at 2 a. m., March 29; discharge, 21,600 second-feet. Minimum stage recorded: 1.70 feet at 5 p. m., October 5, and 8 a. m., October 17; discharge, approximately 18 second-feet.

Maximum stage recorded 1908–1914: 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 slightly affected by ice; determination of winter discharge good when frequent discharge measurements are made.

Accuracy.—Records good. Automatic gage records eliminate error caused by diurnal fluctuations due to operation of mill above station.

Discharge measurements of Genesee River at St. Helena, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.[a]	Discharge.	Date.	Made by—	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	R. S. Barnes	2.93	487	June 8	C. S. De Golyer	3.06	520
Jan. 10	W. S. Easterly	2.92	544	9	do	3.06	530
28	do	3.58	[b]985	Aug. 6	C. H. Pierce	2.07	85
Feb. 14	C. S. De Golyer	2.80	389	6	do	2.07	83
Mar. 6	C. C. Covert	[c]3.92	[b]258	20	C. S. De Golyer	2.68	285
18	C. S. De Golyer	[c]6.00	5,450	25	do	3.78	1,220
19	do	[c]4.62	2,310	Sept. 21	E. D. Burchard	2.28	134
19	do	[c]4.55	2,310	25	do	2.43	176
29	do	[c]8.88	16,800	25	do	2.37	151
29	do	[c]7.69	11,200	26	do	2.15	102
30	do	[c]6.98	8,300				

[a] From automatic gage except as noted. [b] Backwater from ice. [c] Chain gage.

Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	69	372	408	317	5,940	548	4,920	910	450	176	122	260
2	64	327	378	333	2,990	455	8,200	770	362	170	75	1,810
3	114	302	360	250	2,450	372	4,670	680	317	125	130	3,290
4	109	333	355	250	4,680	406	3,490	638	638	133	50	1,640
5	20	273	344	296	2,990	349	2,700	1,720	770	92	102	1,080
6	111	249	322	338	1,840	258	2,350	9,630	520	142	82	656
7	103	235	322	287	1,710	178	2,020	3,940	373	122	96	485
8	76	222	360	317	1,220	282	11,200	2,890	450	122	96	370
9	36	355	372	338	666	237	6,000	8,550	520	79	100	300
10	92	4,360	349	468	624	258	4,180	4,920	376	122	100	255
11	56	1,950	384	773	586	297	4,920	3,080	290	74	122	224
12	132	1,180	384	764	548	250	5,180	5,450	260	94	110	206
13	178	966	372	556	480	268	3,280	19,000	236	122	100	177
14	90	1,330	390	548	372	237	2,520	8,200	202	80	100	188
15	69	1,550	474	514	430	306	2,350	4,420	211	102	98	166
16	85	1,160	467	624	449	514	8,200	3,080	188	130	94	147
17	56	977	396	586	468	6,590	4,670	2,350	177	72	90	138
18	100	890	366	480	424	6,290	3,080	1,870	166	107	102	110
19	29	791	344	418	430	2,700	2,520	1,650	173	90	166	120
20	161	1,040	273	514	372	1,870	1,950	1,250	213	124	322	118
21	201	1,030	302	437	360	1,440	2,180	1,020	176	92	1,250	122
22	263	860	302	424	480	1,310	1,870	860	198	80	1,060	118
23	268	701	317	586	480	1,070	1,720	815	183	94	560	104
24	200	638	360	624	449	960	1,310	680	150	114	987	115
25	287	588	588	586	548	1,310	1,070	638	150	133	1,260	118
26	344	532	474	666	430	10,060	1,310	595	173	104	632	118
27	1,170	488	360	850	406	15,400	1,650	815	206	130	389	104
28	692	447	328	1,120	372	22,000	1,310	1,070	144	133	295	138
29	460	415	349	5,960	.....	13,900	1,070	860	163	100	295	108
30	415	402	372	10,600	.....	8,900	1,070	770	159	102	300	122
31	415	.....	401	5,680	.....	7,860	.....	595	.....	57	312	.....

NOTE.—Daily discharge, except as noted below, determined from well-defined rating curves. New rating curve used since Mar. 17, 1914. Discharge estimated, because of ice, Jan. 1–28 and Feb. 21 to Mar. 16. Automatic gage record, except Oct. 1–23, Dec. 28 to Jan. 10, Jan. 15–27, Jan. 31 to June 9, and June 20 to Aug. 6, when intake pipe of the automatic gage was clogged, was used in the determination of daily discharge estimates. Records for the period when the automatic gage was not working properly were obtained from the chain gage.

Monthly discharge of Genesee River at St. Helena, N. Y., for the year ending Sept. 30, 1914.

[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	1,170	20	208	0.202	0.23	A.
November	4,360	222	832	.808	.90	A.
December	588	273	373	.362	.42	A.
January	10,600	250	1,180	1.15	1.33	B.
February	5,940	360	1,190	1.16	1.21	B.
March	22,000	178	3,450	3.35	3.86	A.
April	11,200	1,070	3,430	3.33	3.72	A.
May	19,000	595	3,020	2.93	3.38	A.
June	770	144	286	.278	.31	B.
July	176	57	110	.107	.12	B.
August	1,260	50	310	.301	.35	A.
September	3,290	104	430	.417	.47	A.
The year	22,000	20	1,230	1.19	16.30	

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

Location.—At the highway bridge known as Jones Bridge, about 5 miles below the village of Mount Morris, 6 miles by river above the village of Geneseo, 1¾ miles below 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 April 30, 1914, when station was discontinued. Data also published in annual reports of the State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Chain fastened to upstream side of highway bridge; read daily, at about 6 a. m. and 6 p. m., to quarter-tenths. Gage reader, T. S. Trewer.

Discharge measurements.—Made from footbridge erected on the outriggers of the bridge.

Channel and control.—Sandy clay; likely to shift, but measurements indicate that it has been fairly permanent in recent years.

Extremes of discharge.—Maximum stage recorded during year: 27.1 feet at 10 p. m., March 28; discharge, 18,800 second-feet.

Maximum stage recorded 1903–1914: 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 affected by ice; observations discontinued; flow determined by comparison with records of the Genesee at Rochester and at St. Helena.

Accuracy.—Records for open-water periods good.

No discharge measurements were made at this station during the year ending September 30, 1914.

Daily discharge, in second-feet, of Genesee River at Jones Bridge near Mount Morris, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	Day.	Oct.	Nov.	Dec.	Mar.	Apr.
1	98	572	572	.....	9,840	16	213	1,230	687	.....	8,040
2	106	572	572	.....	9,570	17	134	1,120	572	.....	7,270
3	102	484	528	.....	9,060	18	148	1,120	528	.....	4,800
4	136	442	484	.....	5,720	19	143	1,060	484	.....	3,610
5	138	422	484	.....	4,100	20	198	1,010	484	.....	3,260
6	148	402	484	.....	3,190	21	346	1,010	484	.....	2,920
7	198	422	484	.....	2,790	22	383	1,060	484	.....	2,530
8	198	506	484	.....	9,310	23	422	810	422	.....	2,150
9	260	910	528	.....	10,900	24	422	810	422	1,500	1,790
10	148	4,870	484	.....	6,760	25	364	810	664	2,660	1,500
11	124	2,400	528	.....	7,270	26	484	687	618	8,720	1,790
12	124	1,910	550	.....	7,100	27	710	687	.....	15,500	2,030
13	277	1,670	572	.....	5,170	28	860	664	.....	18,000	1,790
14	260	1,450	550	.....	3,680	29	810	618	.....	17,900	1,560
15	228	1,620	641	.....	3,050	30	664	595	.....	16,000	1,450
						31	572	.....	.....	14,300	.....

NOTE.—Discharge determined from fairly well-defined rating curve. Discharge, Mar. 1-23, estimated because of ice, from records of the Genesee at St. Helena and Rochester, at 1,660 second-feet.

Monthly discharge of Genesee River at Jones Bridge near Mount Morris, N. Y., for the year ending Sept. 30, 1914.

[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.		
October	860	98	304	0.216	0.25	A.
November	4,870	402	1,060	.752	.84	A.
December	687	422	529	.375	.43	A.
March	18,000	.....	4,280	3.04	3.50	C.
April	10,900	1,450	4,800	3.41	3.80	A.

GENESEE RIVER AT ROCHESTER, N. Y.

Location.—At Elmwood Avenue Bridge, at the north end of South Park, 3½ miles above the center of the city of Rochester, 3¼ miles below mouth of Black Creek, and 7½ miles above mouth of river.

Drainage area.—2,360 square miles.

Records available.—February 9, 1904, to September 30, 1914. Fragmentary records for previous periods published in water-supply papers 24, 65, and 97. Data also published in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

Gage.—Gurley water-stage recorder in the pumphouse immediately below bridge on right bank. Prior to December, 1910, a staff gage bolted to downstream end of first pier from right abutment was read once daily. Elevation of zero of gage, 506.848 feet, Barge canal datum, and 245.591 feet, Rochester city datum.

Discharge measurements.—Made from the bridge.

Channel and control.—Gravel, smooth; considered permanent.

Extremes of discharge.—Maximum stage recorded during year: 10.84 feet at 2 p. m., March 30; discharge, 26,900 second-feet. Minimum stage recorded: 0.71 foot from 10 p. m., September 30, to 4 a. m., October 1, 1913; discharge, 154 second-feet.

Maximum stage 1904–1914: 15.02 feet during the afternoon of March 28, 1913 (determined by leveling from a flood height marked by observer); approximate discharge, 42,000 second-feet. Minimum stage 1904 to 1914: 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 only, as channel is usually open.

Accuracy.—Rating curve well developed for all stages; published data for open-water periods good.

Cooperation.—Gage operated by George A. Bailey, of the Rochester Light & Railway Co.

Discharge measurements of Genesee River at Rochester, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 1	R. S. Barnes	1.32	589	Jan. 27	W. S. Easterly	1.63	[a] 928
Jan. 9	W. S. Easterly	1.30	[a] 622	Feb. 16	C. S. DeGolyer	1.90	[a] 808

[a] Backwater from ice.

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	190	587	587	564	12,800	.....	21,900	2,640	1,650	542	320	755
2	196	554	554	500	12,800	.....	18,200	2,410	1,490	532	313	705
3	202	480	598	490	8,400	.....	17,200	2,100	1,270	554	313	1,760
4	190	500	576	500	6,800	.....	14,300	1,900	1,230	554	306	3,670
5	186	490	542	564	8,680	.....	9,530	2,050	1,350	510	313	2,550
6	186	451	532	532	8,680	.....	7,060	10,400	1,710	470	320	1,840
7	170	432	542	521	4,280	.....	6,040	15,600	1,600	451	306	1,270
8	214	387	480	500	1,210	.....	9,820	11,900	1,350	442	292	970
9	220	387	521	554	1,840	.....	16,200	8,960	1,270	432	292	794
10	257	692	532	874	1,930	.....	14,600	12,800	1,380	414	320	680
11	264	4,180	521	984	1,760	.....	12,200	10,400	1,260	405	306	610
12	250	2,840	510	970	1,520	.....	11,600	7,320	1,140	387	306	521
13	226	1,740	554	874	1,130	.....	10,400	13,700	984	370	313	480
14	202	1,340	564	742	1,010	.....	7,590	17,800	914	362	336	432
15	250	1,490	622	633	900	.....	5,920	19,500	820	370	306	432
16	250	1,790	705	564	742	.....	7,320	17,200	806	396	278	423
17	250	1,520	656	587	755	7,590	11,900	9,820	742	405	299	405
18	257	1,300	576	970	755	12,800	9,820	5,670	718	396	320	405
19	244	1,230	521	942	656	14,300	7,060	3,970	692	387	336	387
20	232	1,140	490	794	742	10,700	5,670	3,480	680	336	451	362
21	214	1,300	432	755	914	6,800	5,070	3,000	680	313	833	313
22	278	1,440	470	860	820	4,610	4,500	2,550	692	344	2,190	320
23	292	1,270	490	742	806	3,770	3,970	2,300	705	344	1,700	336
24	405	1,060	521	705	820	3,570	3,480	2,100	718	328	1,290	328
25	423	984	755	887	680	4,180	3,000	1,900	692	353	1,930	306
26	423	887	984	1,010	633	9,820	3,100	1,790	633	378	1,790	344
27	510	833	610	928	500	18,200	3,480	1,700	587	353	1,150	396
28	1,010	718	542	1,140	460	22,200	3,570	2,080	564	353	820	378
29	1,100	742	554	2,460	.....	24,600	3,190	2,460	554	353	730	378
30	780	656	576	7,590	.....	26,800	2,820	2,030	564	344	705	396
31	610	.....	598	11,900	.....	25,300	.....	1,790	.....	328	730	.....

NOTE.—Daily discharge determined from well-defined rating curve except as follows: May 24, 25, and July 13–15, estimated from hydrograph. Discharge estimates for periods when ice was present, Jan. 12–28 and Feb. 9–28, only approximate. Discharge Mar. 1–16 estimated, because of ice, at 706 second-feet.

Monthly discharge of Genesee River at Rochester, N. Y., for the year ending Sept. 30, 1914.

[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	1,100	170	338	0.143	0.16	A.
November	4,180	387	1,110	.470	.52	A.
December	984	432	571	.242	.28	A.
January	11,900	490	1,380	.585	.67	B.
February	12,800	460	2,970	1.26	1.31	B.
March	26,800	.....	6,660	2.82	3.25	B.
April	21,900	2,820	8,680	3.68	4.11	A.
May	19,500	1,700	6,560	2.78	3.20	A.
June	1,710	554	982	.416	.46	A.
July	554	313	403	.171	.20	B.
August	2,190	278	652	.276	.32	B.
September	3,670	306	765	.324	.36	B.
The year	26,800	170	2,580	1.09	14.84	

CANADICE LAKE OUTLET NEAR HEMLOCK, N. Y.

Location.—In outlet at foot of lake, about 4 miles southeast of Hemlock. Canadice Lake is tributary to Genesee River through Hemlock Lake outlet and Honeoye Creek.

Drainage area.—12.6 square miles, of which 1.0[1] square mile is lake surface.

Records available.—April, 1903, to September 30, 1914. Data also published in annual reports of the New York State engineer and surveyor and the reports of the city engineer of Rochester, N. Y.

Gage.—Hook in channel above gate.

Discharge measurements.—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 with no end contractions during high water. The weir crest stands 3 feet above the stream channel and is never submerged by backwater. Two additional rectangular gates, each 1 foot square, with three complete contractions and a fourth partial contraction at the bottom, afford by-passes during low water. The depth of water on the weir is read each morning to hundredths of a foot by means of the hook gage. Each change of the gates is also noted. Corrections are made for velocity of approach for the higher stages. All computations are made by the Francis formula.

Winter flow.—Pool above weir is free from ice throughout winter.

Diversions.—None from Canadice Lake above the station.

Regulation.—The outflow of the lake at the dam above the weir is regulated by the gates; discharge estimates not corrected to indicate natural run-off.

Accuracy.—Records excellent.

Cooperation.—Observations and computations are made by engineers of the city engineer's office of Rochester, N. Y., under the direction of E. A. Fisher, city engineer, and John F. Skinner, principal assistant city engineer.

[1] Figure published in previous water-supply papers is in error.

Monthly discharge of Canadice Lake outlet near Hemlock, N. Y., for the year ending Sept. 30, 1914.

Month.	Mean discharge (second-feet).	Mean elevation of lake above low-water mark (feet.)
October	3.737	0.341
November	3.964	.427
December	4.016	.389
January	4.845	.379
February	12.554	1.412
March	30.279	1.218
April	41.639	2.947
May	47.534	3.195
June	6.708	2.744
July	4.954	2.281
August	4.479	2.091
September	5.936	2.619
The year	14.220	1.670

NOTE.—Water surface 1.83 feet higher Sept. 30, 1914, than on Oct. 1, 1913. Gain in storage, 53,405,700 cubic feet, corresponding to 1.693 second-feet for year.

OWASCO OUTLET NEAR AUBURN, N. Y.

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

Drainage area.—206 square miles (measured on United States Geological Survey topographic maps).

Records available.—November 17, 1912, to September 30, 1914. Data published also in annual reports of New York State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Gurley water-stage recorder installed over a concrete well connected with the river with 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 a low concrete weir a short distance below gage; crest of weir is 1 foot wide and the slopes of both upstream and downstream faces are ½ : 1.

Extremes of discharge.—Maximum stage recorded during year: 4.43 feet at 7 a. m., April 3; discharge, 2,430 second-feet. Minimum stage recorded: 1.41 feet at 1 a. m., October 15; discharge, 5.6 second-feet.

Maximum stage, 1912–1914: 4.6 feet during high water, March 25 to 30, 1913 (determined by leveling from flood marks); discharge, 2,750 second-feet. Minimum stage recorded: 1.41 feet at 1 a. m., October 15, 1913; discharge, 5.6 second-feet.

Winter flow.—Sufficient ice does not form to obstruct control 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.

Accuracy.—Records excellent. The discharge corresponding to the mean daily gage height does not represent the mean daily discharge. The daily discharge in the following tables is the mean of 24 hourly discharges for each day.

The following discharge measurement was made by C. H. Pierce:
August 4, 1914: Gage height, 2.17 feet; discharge, 156 second-feet.

Daily discharge, in second-feet, of Owasco outlet near Auburn, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	52.9	106	.....	.....	1,960	600	177	118	155	286
2	.....	a 56.2	83.4	.....	.....	2,120	530	159	121	a 155	372
3	78.6	.....	95.2	.....	.....	2,180	a 510	159	120	161	361
4	56.6	63.8	83.9	.....	.....	2,090	476	153	91.5	155	397
5	a 56.0	76.7	90.8	129	211	a 1,960	463	148	a 91.1	149	404
6	90.1	66.8	78.2	134	211	1,790	372	150	154	158	a 373
7	79.6	70.2	a 83.3	136	237	1,680	366	a 148	138	168	385
8	71.6	46.8	84.6	132	a 247	1,820	372	174	136	156	296
9	73.3	a 99.9	.....	139	234	1,970	.....	176	148	a 149	349
10	67.7	89.5	.....	140	264	1,880	.....	169	137	170	375
11	64.7	67.1	.....	143	233	1,820	.....	163	144	153	373
12	a 47.3	66.3	.....	151	220	a 1,710	.....	176	a 128	151	357
13	99.1	77.3	.....	154	263	1,610	.....	152	149	147	a 312
14	74.4	76.0	.....	201	232	1,510	.....	a 134	136	142	326
15	74.4	56.0	.....	247	a 235	1,450	584	168	147	146	302
16	70.6	a 70.0	115	254	272	1,430	569	161	148	a 143	267
17	67.3	122	117	220	281	1,390	a 533	183	327	149	315
18	56.7	80.9	109	a 255	287	1,330	500	172	372	129	309
19	a 53.3	94.9	90.2	273	307	a 1,260	486	181	a 397	134	262
20	113	93.4	74.8	316	305	1,210	483	140	317	130	a 116
21	83.5	90.7	a 117	342	300	1,170	418	a 148	245	125	212
22	70.0	71.2	144	397	a 301	1,120	370	158	246	133	102
23	70.0	a 76.2	112	394	299	1,080	351	163	241	a 127	227
24	69.4	103	110	442	289	1,030	a 317	159	227	169	220
25	60.2	83.8	.....	a 272	315	1,020	302	149	225	153	223
26	a 90.2	89.8	.....	220	409	a 978	301	151	a 212	141	248
27	99.5	67.4	.....	218	595	900	302	155	216	150	a 179
28	77.3	105	.....	220	1,080	788	292	a 142	185	143	211
29	72.6	78.5	.....	207	a 1,390	714	287	140	149	202	203
30	74.2	a 78.0	.....	.....	1,690	667	226	130	161	a 194	192
31	70.9	.....	.....	.....	1,870	.....	a 156	.....	156	228	.....

a Sunday.

NOTE.—Daily discharge determined from a very well defined rating curve. Discharge estimated as follows: Oct. 1–2, 78 second-feet; Nov. 3, 81 second-feet; Dec. 9–15, 100 second-feet; Dec. 25–31, 128 second-feet; Jan. 1–4, 132 second-feet; Jan. 30 and 31, 210 second-feet; Mar. 1–4, 217 second-feet; May 9–14, 435 second-feet. Discharge, Feb. 1–28, estimated from three gage geights observed during the month and the elevation of Owasco Lake, at 290 second-feet.

Monthly discharge of Owasco outlet near Auburn, N. Y., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	113	47.3	73.8	A.
November	122	46.8	78.4	A.
December	144	74.8	106	A.
January	442	129	216	B
February			290	D.
March	1,870	210	434	A.
April	2,180	667	1,450	A.
May	600	156	412	A.
June	183	130	158	A.
July	397	91.1	187	A.
August	228	125	154	A.
September	404	102	285	A.
The year	2,180	46.8	319	

SALMON RIVER NEAR PULASKI, N. Y.

Location.—At Fox's bridge, about 2½ miles above the village of Pulaski, about 2½ miles above Trout Brook, and 6½ miles above mouth of river.

Drainage area.—260 square miles (measured on United States Geological Survey topographic maps).

Records available.—September 5, 1900, to June 30, 1907; August 16 to December 6, 1908; July 14, 1910, to April 30, 1914, when station was discontinued. Data published also in annual reports of New York State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Chain gage; read twice daily by S. J. Fox. Prior to July 23, 1902, a vertical staff attached to the upstream end of the center pier of the bridge. Zero of chain gage is 1.20 feet below that of the original staff gage.

Discharge measurements.—Made by wading or from bridge.

Channel and control.—Gravel; fairly permanent.

Extremes of discharge.—Maximum stage recorded during year: 6.75 feet at 5 p. m., April 20; discharge, 5,950 second-feet. Minimum stage recorded: 2.35 feet at 7 a. m. and 5 p. m., October 1, and 5 p. m., October 11; discharge, 76 second-feet.

Maximum stage recorded 1900–1914: 8.2 feet during the night of March 27, 1913; discharge, 13,300 second-feet. Minimum stage recorded: 2.2 feet at 7 a. m. and 7 p. m., September 19, 1906; discharge, 46 second-feet.

Winter flow.—Discharge relation affected by ice.

Accuracy.—Records good.

No discharge measurements were made at this station during the year ending September 30, 1914.

Daily discharge, in second-feet, of Salmon River near Pulaski, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Apr.	Day.	Oct.	Nov.	Dec.	Jan.	Apr.
1	79	535	500	313	3,330	16	152	720	642	.....	3,330
2	112	465	465	112	3,520	17	152	570	605	.....	3,520
3	191	400	535	235	3,330	18	145	535	605	.....	3,330
4	213	400	605	.....	2,130	19	152	500	465	.....	3,710
5	172	605	845	.....	1,760	20	845	2,400	465	.....	5,650
6	125	500	680	.....	1,290	21	2,240	2,400	500	.....	3,900
7	112	432	642	.....	1,120	22	1,800	1,330	465	.....	2,290
8	104	340	1,680	.....	1,410	23	1,020	930	400	.....	2,130
9	90	400	1,020	.....	2,620	24	1,020	930	535	.....	1,610
10	90	1,440	1,020	.....	2,290	25	2,090	845	500	.....	1,290
11	86	1,120	760	.....	1,830	26	1,800	680	500	.....	1,980
12	104	760	605	.....	1,980	27	1,330	680	312	.....	1,980
13	191	605	680	.....	1,410	28	845	605	296	.....	1,680
14	152	930	642	.....	1,290	29	760	535	340	.....	1,540
15	152	1,020	642	.....	1,410	30	760	535	370	.....	1,680
						31	642	.....	340	.....	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. No records collected during period when ice was present.

Monthly discharge of Salmon River near Pulaski, N. Y., for the year ending Sept. 30, 1914.

[Drainage area, 260 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	2,240	79	572	2.20	2.54	B.
November	2,400	340	805	3.10	3.46	B
December	1,680	296	602	2.32	2.68	B.
April	5,650	1,120	2,340	9.00	10.04	B.

ORWELL BROOK NEAR ALTMAR, N. Y.

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

Drainage area.—22.1 square miles (measured on United States Geological Survey topographic maps).

Records available.—June 23, 1911, to September 30, 1914. Data published also in annual reports of New York State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Chain attached to downstream side of bridge; read morning and evening to quarter-tenths. Gage reader, 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: 4.9 feet at 8 a. m., April 28; discharge, 475 second-feet. Minimum stage recorded: 1.7 feet, August 10, 12, and 16; discharge, 6 second-feet.

Maximum stage recorded 1911–1914: 5.5 feet at 6 p. m., April 7, 1912; discharge, 610 second-feet. Minimum stage recorded for same period: 1.65 feet, August 6, 7, 14, 22, 23, and 24, and September 5, 1911; discharge, 5 second-feet.

Winter flow.—Discharge relation affected by ice.

Accuracy.—Records good.

No discharge measurements were made at this station during the year ending September 30, 1914.

Daily discharge, in second-feet, of Orwell Brook near Altmar, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9	42	34	42	.....	.....	232	49	17	34	9	18
2	10	34	36	42	.....	.....	250	38	15	30	8	17
3	11	30	38	42	.....	.....	173	38	15	24	8	17
4	9	34	42	40	68	.....	134	34	20	17	8	22
5	8	34	42	38	61	.....	51	76	18	17	8	15
6	8	30	38	42	72	.....	72	76	17	15	8	16
7	8	26	47	52	66	.....	66	64	20	13	7	22
8	8	23	94	52	61	.....	105	45	327	13	7	16
9	8	45	81	47	.....	.....	149	42	119	13	6	15
10	8	64	54	32	.....	.....	116	38	52	11	8	15
11	8	49	49	.....	.....	.....	105	38	42	9	9	15
12	15	42	64	.....	.....	.....	102	38	38	9	6	13
13	15	40	45	.....	.....	.....	64	66	30	9	6	11
14	13	52	42	.....	.....	.....	88	66	22	9	6	9
15	11	42	42	.....	.....	.....	78	45	17	9	6	9
16	11	42	42	.....	.....	.....	181	38	17	8	6	9
17	11	34	51	.....	.....	.....	126	34	17	11	7	9
18	13	32	49	.....	.....	84	98	30	16	9	12	9
19	17	38	48	.....	.....	61	91	30	17	9	13	9
20	119	112	42	.....	.....	58	94	26	17	9	13	9
21	134	76	42	.....	.....	52	76	26	17	9	17	8
22	84	61	40	.....	.....	42	58	26	17	9	13	8
23	61	56	47	.....	.....	38	54	32	17	13	11	8
24	112	52	47	.....	.....	38	47	26	15	10	16	8
25	105	47	47	.....	.....	102	52	26	15	9	12	13
26	108	42	42	.....	.....	198	72	23	13	9	9	12
27	71	38	78	.....	.....	431	68	23	11	9	8	13
28	61	34	58	.....	.....	453	58	23	16	8	8	17
29	47	34	52	.....	.....	368	54	20	22	9	36	15
30	47	34	52	.....	.....	288	61	20	47	9	52	13
31	47	.....	47	.....	.....	215	.....	15	.....	9	32	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge Mar. 1–17 estimated, because of ice, by comparison with flow of near-by streams, 13 second-feet.

Monthly discharge of Orwell Brook River near Altmar, N. Y., for the year ending Sept. 30, 1914.

[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	134	8	38.6	1.75	2.02	B.
November	112	23	44.0	1.99	2.22	A.
December	94	34	49.4	2.24	2.58	A.
January 1–10	.....	.....	42.9	1.94	.72	B.
February	.....	.....	.....	.....	.....	.....
March	453	.....	85.6	3.87	4.46	C.
April	250	47	99.1	4.48	5.00	A.
May	76	15	37.8	1.71	1.97	A.
June	327	11	34.8	1.57	1.75	B.
July	34	8	12.3	.556	.64	C.
August	52	6	12.1	.547	.63	C.
September	22	8	13.0	.588	.65	C.

BLACK RIVER NEAR BOONVILLE, N. Y.

Location.—At highway bridge about 2 miles northeast of Boonville, an equal distance by river downstream from Hawkinsville, and about 1 mile above mouth of Sugar River.

Drainage area.—303 square miles (measured on United States Geological Survey topographic maps).

Records available.—February 16, 1911, to September 30, 1914. Data published also in annual reports of the New York State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Chain fastened to the downstream side of the bridge; read daily, morning and evening; gage reader, W. D. Charbonneau. A staff gage, graduated from 6 to 13 feet and fastened to downstream right-hand abutment, is used for high-water readings.

Discharge measurements.—At high stages made from a cable about one-half 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: 9.25 feet at 8 a. m., March 29; discharge, 4,480 second-feet. Minimum stage recorded: 3.0 feet at 8 a. m., November 8; discharge, 27 second-feet.

Maximum stage recorded, 1911–1914: Approximately 12.5 feet during the night of March 28, 1913 (determined by leveling from flood marks); discharge, approximately 10,000 second-feet. Minimum stage recorded: 3.0 feet at 8 a. m., September 29 and November 8, 1913; 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 which flows west to a basin in Boonville. The Black river canal flows north from this basin and enters 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 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 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 1 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 station. The water flowing south from the basin is measured at a private farm bridge about 1 mile southeast of Boonville. These measurements are published below.

Accuracy.—Rating curve well defined. Records do not give total discharge of drainage area.

Discharge measurements of Black River near Boonville, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 12	W. S. Easterly	5.00	[a] 235	Mar. 25	C. S. De Golyer	4.55	[a] 213
21	do	4.92	[a] 248	June 20	R. S. Barnes	3.55	77
22	do	4.97	[a] 240	Aug. 31	H. W. Fear	6.11	952
Feb. 20	C. S. De Golyer	4.92	[a] 212				

[a] Backwater from ice.

Discharge measurements of Forestport feeder at Boonville, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	W. S. Easterly	0.88	262	Aug. 5	M. J. Maguire	1.00	219
28	G. H. Canfield	1.05	262	19	do	.99	228
June 20	R. S. Barnes	1.25	296	19	do	1.01	220
July 11	C. S. De Golyer	1.28	240	31	Hartwell and Fear	1.19	207
22	M. J. Maguire	1.00	240	Sept. 14	M. J. Maguire	.95	220
22	do	1.00	240	14	do	.95	219
Aug. 5	do	.99	223				

Discharge measurements of Black River canal flowing south at Boonville, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	W. S. Easterly	1.20	200	Aug. 6	M. J. Maguire	1.53	155
28	G. H. Canfield	1.17	222	19	do	1.19	85
June 20	R. S. Barnes	1.15	208	19	do	1.14	83
July 11	C. S. De Golyer	1.44	158	31	H. W. Fear	1.79	142
22	M. J. Maguire	1.35	165	Sept. 14	M. J. Maguire	1.39	155
22	do	1.36	168	14	do	1.40	152
Aug. 5	do	1.53	156				

Discharge measurements of Black River canal flowing north at Boonville, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	W. S. Easterly	4.25	50	Aug. 5	M. J. Maguire	.72	44.6
28	G. H. Canfield	1.94	14.8	19	do	3.74	65
June 20	R. S. Barnes	4.05	43.6	19	do	3.70	65
July 11	C. S. De Golyer	3.72	67	31	O. W. Hartwell	4.26	47.4
22	M. J. Maguire	1.22	57	Sept. 14	M. J. Maguire	4.28	46
23	do	1.26	58	14	do	4.38	44
Aug. 5	do	.60	45.5				

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	136	370	194	630	194	2,380	1,940	84	59	44	795
2	55	111	470	227	630	205	2,620	1,210	71	61	40	490
3	66	205	535	275	558	216	2,380	1,140	71	84	36	305
4	154	59	630	250	605	216	2,160	1,140	66	70	40	275
5	184	72	680	216	580	227	1,940	1,370	84	84	33	194
6	136	53	535	205	238	216	1,370	1,540	84	84	37	127
7	59	34	535	227	250	227	1,290	1,370	111	104	33	164
8	47	72	580	250	194	238	1,540	1,460	164	127	36	164
9	33	490	470	227	238	205	2,270	1,370	164	90	38	127
10	36	3,110	450	250	390	227	1,940	1,290	145	63	40	136
11	45	2,860	512	.....	335	194	1,540	1,370	164	57	62	90
12	59	2,380	580	.....	290	164	1,540	1,290	164	78	164	63
13	46	2,050	535	.....	275	194	1,540	1,460	145	136	90	53
14	49	855	450	.....	290	216	1,460	1,640	145	145	44	63
15	44	580	430	.....	290	238	1,540	990	127	111	43	68
16	44	580	352	.....	335	205	1,640	1,060	111	104	49	55
17	42	430	410	.....	275	174	2,160	1,140	84	84	43	51
18	36	390	410	.....	238	194	2,380	1,140	55	84	44	41
19	36	370	275	.....	227	216	2,980	795	49	66	57	49
20	174	795	320	.....	194	216	5,240	630	57	53	78	53
21	680	1,210	275	216	174	275	4,410	490	49	56	127	55
22	1,140	920	290	238	174	305	2,980	370	53	43	184	44
23	580	795	227	238	164	305	2,740	370	56	53	227	46
24	558	795	275	238	174	390	2,500	410	44	56	305	47
25	512	735	305	216	184	227	2,500	390	49	63	275	53
26	450	535	335	227	154	490	2,380	390	40	53	250	64
27	352	430	250	262	164	1,140	2,500	370	44	49	227	56
28	335	335	250	238	194	4,010	2,380	335	51	44	227	44
29	320	410	250	305	.....	4,540	2,160	275	111	46	410	53
30	370	335	250	430	.....	3,360	2,160	119	84	49	1,140	51
31	305	.....	250	580	.....	2,160	.....	97	.....	42	990	.....

NOTE.—Daily discharge determined from well-defined rating curve, except as follows: Dec. 27, 1913, to Mar. 27, 1914, estimated because of ice, and approximate only; Jan. 11–20, estimated at 154 second-feet.

Monthly discharge of Black River near Boonville, N. Y., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	1,140	33	225	B.
November	3,110	34	738	A.
December	680	227	403	A.
January	580	.....	227	C.
February	630	154	302	B.
March	4,540	164	690	B.
April	5,240	1,290	2,290	A.
May	1,940	97	934	A.
June	164	40	90.9	A.
July	145	42	74.1	B.
August	1,140	33	175	A.
September	795	41	129	B.
The year	5,240	33	523	

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

Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	229	545	710	476	.....	.....	2,390	2,960	316	545	126	710
2	272	286	625	426	.....	.....	2,390	2,480	316	409	151	362
3	442	510	545	409	.....	.....	2,300	2,480	316	855	164	121
4	545	510	409	331	.....	.....	2,120	2,300	331	625	164	910
5	377	665	442	316	.....	.....	1,940	2,120	585	216	202	710
6	316	625	409	229	.....	.....	1,760	2,210	625	229	243	510
7	316	545	257	243	.....	.....	1,510	2,300	545	346	272	476
8	286	510	545	243	.....	.....	1,430	2,030	625	393	316	476
9	243	710	1,020	271	.....	.....	2,120	1,940	710	476	216	426
10	176	4,230	710	316	.....	.....	2,210	1,850	625	755	257	409
11	151	2,300	545	229	.....	.....	2,120	1,760	377	625	229	346
12	79	1,430	545	.....	.....	.....	1,940	1,430	476	805	286	164
13	136	1,430	625	.....	.....	.....	1,670	1,290	476	665	216	176
14	229	1,220	545	.....	.....	.....	1,430	1,290	216	393	176	316
15	286	1,290	545	.....	.....	.....	1,430	1,220	229	545	202	316
16	346	1,220	442	.....	.....	.....	2,120	1,080	202	393	164	316
17	316	965	476	.....	.....	476	1,760	1,020	189	229	202	301
18	377	855	545	.....	.....	476	2,570	855	176	202	164	272
19	229	910	476	.....	.....	510	4,230	625	138	103	346	286
20	476	1,290	476	.....	.....	476	10,000	585	286	176	316	176
21	1,760	2,120	202	.....	.....	442	7,260	545	202	151	272	316
22	1,760	1,590	316	.....	.....	510	5,030	426	216	126	545	316
23	1,220	1,850	243	.....	.....	625	3,500	476	164	202	393	257
24	1,020	1,360	93	.....	.....	805	2,960	189	146	286	510	243
25	805	1,150	101	.....	.....	910	2,660	362	176	393	625	286
26	965	1,020	176	.....	.....	1,020	2,660	476	151	272	476	393
27	1,430	1,020	362	.....	.....	1,430	2,660	476	126	101	331	362
28	1,220	1,150	301	.....	.....	1,940	3,170	442	99	128	316	393
29	1,020	965	377	.....	.....	3,060	3,860	476	625	103	442	409
30	855	910	476	.....	.....	2,960	3,740	393	710	103	1,290	346
31	625	.....	393	.....	.....	2,570	.....	151	.....	126	1,150	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge Mar. 1–16 estimated, because of ice, by comparison with flow of adjacent streams, 340 second-feet.

Monthly discharge of Moose River at Moose River, N. Y., for the year ending Sept. 30, 1914.

[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	1,760	79	597	1.61	1.86	B.
November	4,230	286	1,170	3.16	3.53	B.
December	1,020	93	449	1.21	1.40	B.
January 1–11	476	229	317	.856	.35	B.
February	.....	.....	.....	.....	.....	.....
March	3,060	.....	763	2.06	2.38	C.
April	10,000	1,430	2,900	7.84	8.75	B.
May	2,960	202	1,230	3.34	3.73	B.
June	710	99	346	.961	1.07	B.
July	855	101	354	.957	1.10	B.
August	1,290	126	347	.938	1.08	B.
September	910	121	370	1.00	1.12	B.

NOTE.—Estimates indicate flow as regulated by storage at Old Forge and McKeever dams.

MOOSE RIVER AT MOOSE RIVER, N. Y.

Location.—In the village of Moose River, about 3 miles downstream from McKeever station on the Adirondack division of the New York Central & Hudson River Railroad, 5 miles below 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 United States Geological Survey topographic maps).

Records available.—June 5, 1900, to September 30, 1914. 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. The gage datum was lowered 0.17 foot, February 28, 1903, and again 5.00 feet, January 1, 1913.

Discharge measurements.—Made from a cable a short distance below gage.

Channel and control.—Composed of cobble and bowlders; fairly permanent; current smooth.

Extremes of discharge.—Maximum stage recorded during year: 14.4 feet at 8 a. m. and 5 p. m., April 20; discharge, 10,200 second-feet. Minimum stage recorded: 5.2 feet at 8 a. m., December 25, 5 p. m., July 19, and 8 a. m., July 27 and 30; discharge, 83 second-feet.

Maximum stage recorded 1900–1914: 16.3 feet during the afternoon of March 27, 1913; discharge, approximately 15,500 second-feet. Minimum stage recorded for same period: 4.94 feet, July 21, 23, 25, 26, 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 parts 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. Published discharge estimates for open-water periods good.

Discharge measurements of Moose River at Moose River, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 27	G. H. Canfield	8.37	1,380	June 19	R. S. Barnes	5.48	[a] 150
27	....do	8.34	1,360				

[a] Made by wading.

Daily discharge, in second-feet, of Middle Branch of Moose River at Old Forge, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	60	142	120	9.0	11	14	262	76	56	26	15	9.0
2	60	142	120	9.8	11	15	262	87	56	60	44	5.8
3	60	142	48	9.8	11	15	262	100	15	22	70	5.8
4	60	142	11	9.8	11	39	258	100	99	5.8	70	5.8
5	60	142	11	9.8	11	166	256	202	201	5.8	70	5.8
6	60	142	11	9.8	11	158	253	240	166	5.8	70	5.8
7	60	158	11	9.8	11	158	252	150	106	60	70	5.8
8	60	184	11	9.8	11	158	249	120	127	106	70	5.8
9	60	184	11	9.8	11	158	246	120	75	22	70	5.8
10	60	184	11	9.8	11	150	246	120	56	5.8	70	9.0
11	99	184	9.0	9.8	11	150	246	120	65	5.8	70	22
12	150	184	9.0	9.8	11	150	225	120	142	5.8	92	86
13	150	184	9.0	9.8	11	175	220	192	86	5.8	106	92
14	150	220	9.0	9.8	11	298	175	134	15	36	106	92
15	150	262	9.0	9.8	12	298	155	99	5.8	36	80	92
16	150	251	9.0	9.8	12	298	155	99	5.8	12	70	92
17	150	240	9.0	9.8	12	298	160	65	5.8	5.8	70	113
18	150	230	9.0	9.8	13	286	160	56	5.8	5.8	70	166
19	150	230	9.0	11	13	274	170	56	5.8	5.8	70	166
20	150	220	9.0	11	14	262	.....	56	5.8	5.8	70	175
21	150	230	9.0	11	14	262	.....	56	5.8	5.8	70	175
22	150	230	9.0	11	14	251	.....	56	5.8	36	70	175
23	150	220	9.0	11	15	251	.....	56	5.8	99	70	175
24	150	220	9.0	11	15	261	.....	56	5.8	127	70	175
25	150	210	9.0	11	15	251	.....	56	5.8	24	70	175
26	142	210	9.0	11	15	251	.....	56	5.8	5.8	70	175
27	150	210	9.0	11	56	262	.....	56	5.8	5.8	70	175
28	142	127	9.0	11	27	262	.....	56	99	5.8	70	175
29	142	274	9.0	11	.....	262	.....	56	230	36	70	166
30	142	127	9.0	11	.....	262	.....	56	150	56	70	166
31	142	.....	9.0	11	.....	262	.....	56	.....	56	28	.....

NOTE.—Daily discharge determined from a well-defined rating curve, except as follows: Mar. 28 to Apr. 19, and May 1–5, computed from elevations of lake surface and gate openings at Old Forge dam; Apr. 20–30 estimated from records of lake elevation and gate opening at the dam at 220 second-feet.

Monthly discharge of Middle Branch of Moose River at Old Forge, N. Y., for the year ending Sept. 30, 1914.

[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	150	60	118	2.29	2.64	A.
November	262	127	194	3.77	4.21	A.
December	120	9	17.9	.348	.40	B.
January	11	9	10.3	.200	.23	B.
February	56	11	14.3	.278	.29	B.
March	298	14	205	3.98	4.59	A.
April	.....	.....	221	4.29	4.79	C.
May	240	56	94.5	1.83	2.11	B.
June	230	5.8	60.6	1.18	1.32	B.
July	127	5.8	29.7	.577	.67	B.
August	106	15	69.4	1.35	1.56	A.
September	175	5.8	96.4	1.87	2.09	A.
The year	298	5.8	94.4	1.83	24.90	

NOTE.—Estimates of monthly discharge indicate the flow as regulated 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 and about 400 feet below the dam.

Drainage area.—51.5 square miles (measured on United States Geological Survey topographic maps).

Records available.—November 9, 1911, to September 30, 1914. 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 of stream 300 feet below highway bridge.

Discharge measurements.—Made by wading at low and medium stages and from highway bridge at high stages.

Channel and control.—Channel fairly straight and uniform from dam to a rock ledge about 200 feet below gage; ledge forms the control.

Extremes of discharge.—Maximum stage recorded during the year: 3.0 feet, March 14 to 17; discharge, 298 second-feet. The minimum stage (0.6 foot, discharge 5.8 second-feet) occurs whenever the gates at the dam are closed, and represents the leakage and discharge through the fish hatcheries.

Maximum stage recorded, 1911–1914: 6.3 feet, March 28, 1913 (affected by back water from Moose River); approximate 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, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 24	C. S. DeGolyer	2.75	242	June 18	R. S. Barnes	2.50	192
24	do	2.75	238	18	do	1.90	98.8
June 18	R. S. Barnes	.55	4.3				

NOTE.—Measurements made by wading.

STREAMS TRIBUTARY TO ST. LAWRENCE RIVER.

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

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

Drainage area.—166 square miles.

Records available.—October 6, 1912, to September 30, 1914. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

Gage.—Vertical staff; read twice daily by C. H. Corp.

Discharge measurements.—Made by wading at low stages, and from a cable 30 feet above gage during high water.

Channel and control.—Bed of channel consists of small bowlders and gravel, covered with waste from the pulp mill.

Extremes of discharge.—Maximum stage recorded during year: 4.4 feet at 7.30 a. m., April 20 and 27; discharge, 1,100 second-feet. Minimum stage (gage height, 0.1 foot; discharge, 28 second-feet) is reached every Sunday during a large part of the year, when the paper mill is shut down.

Maximum stage recorded, 1912–1914: 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 pondage and disturbance of the water at the paper mill.

Regulation.—Dams of 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 have yet been made. Estimates good.

Cooperation.—Gage-height record furnished by Newton Falls Paper Co.

Discharge measurements of East Branch of Oswegatchie River at Newton Falls, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 28	O. W. Hartwell	1.91	289
29	H. W. Fear	.20	[a] 36.7

[a] Made by wading.

Daily discharge, in second-feet, of East Branch of Oswegatchie River at Newton Falls, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	266	366	366	304	.....	99	402	860	262	262	262	350
2	266	127	353	304	.....	350	402	940	262	262	75	402
3	266	340	327	304	.....	326	402	750	262	205	28	376
4	266	340	266	28	.....	304	402	715	262	99	50	376
5	53	327	302	304	.....	304	205	715	262	171	262	376
6	290	290	353	304	.....	304	460	715	262	376	262	93
7	266	266	101	262	.....	304	460	680	28	304	262	242
8	278	266	366	242	.....	28	460	645	262	304	262	376
9	266	74	366	282	.....	350	460	645	282	304	75	304
10	266	422	302	304	.....	350	402	520	304	304	163	304
11	255	366	302	28	.....	350	402	645	262	304	282	304
12	51	366	366	282	.....	350	28	520	262	171	304	304
13	202	366	366	262	.....	350	430	490	262	304	304	81
14	314	380	84	.....	.....	350	376	460	28	304	304	205
15	278	380	366	.....	.....	99	326	430	262	304	304	304
16	266	120	366	.....	.....	350	304	430	262	304	148	304
17	255	353	366	.....	.....	350	350	188	262	304	282	304
18	255	340	366	.....	.....	326	460	376	262	304	402	304
19	42	366	366	.....	.....	304	680	350	140	148	376	304
20	266	452	302	.....	.....	304	1,020	350	106	205	326	81
21	302	482	30	.....	.....	304	860	376	28	262	326	188
22	353	366	244	.....	.....	28	860	376	28	262	326	304
23	394	314	302	.....	.....	326	940	376	28	262	155	304
24	452	366	266	.....	.....	304	940	28	50	304	282	304
25	512	340	84	.....	.....	304	900	304	262	304	326	304
26	512	340	174	.....	.....	350	940	304	262	81	304	304
27	576	314	222	.....	.....	350	1,060	262	262	50	304	81
28	544	290	222	.....	.....	376	1,020	262	28	262	205	205
29	512	290	222	.....	.....	262	940	262	262	262	59	304
30	512	290	222	.....	.....	490	820	262	262	262	28	304
31	366	.....	255	.....	.....	490	.....	28	.....	262	59	.....

NOTE.—Daily discharge determined from a rating curve well defined below 600 second-feet. New ating curve used since January 1, 1914.

Monthly discharge of East Branch of Oswegatchie River at Newton Falls, N. Y., for the year ending Sept. 30, 1914.

[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	576	42	313	1.89	2.18	A.
November	482	74	323	1.95	2.18	A.
December	366	30	277	1.67	1.92	A.
January 1-13	304	28	247	1.49	.72	A.
March	490	28	304	1.83	2.11	A.
April	1,060	28	590	3.55	3.96	B.
May	940	28	460	2.77	3.19	B.
June	304	28	201	1.21	1.35	A.
July	376	50	252	1.52	1.75	A.
August	402	28	229	1.38	1.59	A.
September	402	81	277	1.67	1.86	A.

NOTE.—Discharge estimates indicate flow as regulated by Cranberry Lake dam and paper Mills above station.

OSWEGATCHIE RIVER NEAR OGDENSBURG, N. Y.

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

Drainage area.—1,580 square miles.

Records available.—April 22, 1903, to September 30, 1914. Data published also in annual reports of New York State engineer and surveyor and State of New York Conservation Commission.

Gage.—Chain; fastened to upstream side of bridge; read once daily by J. H. La Rue.

Discharge measurements.—Usually made from the bridge.

Channel and control.—Channel rocky and partly artificial, the rock underneath the bridge having been removed by blasting to increase the bridge opening. Control practically permanent.

Extremes of discharge.—Maximum stage recorded during year: 8.9 feet from 5 p. m., April 3, to 5 p. m., April 5; discharge, 11,400 second-feet. Minimum stage recorded: 4.5 feet from 8 a. m., August 11, to 5 p. m., August 19; discharge, 330 second-feet.

Maximum stage recorded 1903–1914: 9.9 feet, March 31, 1913; approximate discharge, 18,000 second-feet. Minimum stage recorded: 4.5 feet, September 1 and 2, 1913; discharge, 300 second-feet.

Winter flow.—Discharge relation not affected by ice.

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

Accuracy.—Rating curve fairly well defined.

Discharge measurements of Oswegatchie River near Ogdensburg, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	G. H. Canfield	6.52	3,760	Apr. 15	C. S. DeGolyer	7.18	6,230
31	do	6.46	3,530	15	do	7.15	6,180
Dec. 6	C. S. DeGolyer	5.89	2,380	18	do	7.37	6,700
6	do	5.89	2,320	Aug. 25	H. W. Fear	4.70	[a] 584
Feb. 21	do	5.07	1.230				

[a] Made by wading.

Daily discharge, in second-feet, of Oswegatchie River near Ogdensburg, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	390	3,930	2,770	1,450	4,620	750	9,900	6,000	1,010	750	590	670
2	545	2,770	2,560	1,370	4,100	750	10,500	6,000	920	750	670	670
3	600	2,770	2,560	1,290	4,100	835	11,100	6,000	1,010	835	590	956
4	600	2,770	2,770	1,140	4,100	920	11,400	5,720	835	920	590	920
5	600	2,770	2,560	990	4,620	920	11,400	5,160	920	920	590	920
6	600	2,560	2,360	990	4,620	750	10,500	4,880	920	1,100	590	1,200
7	600	2,360	2,460	990	4,100	750	9,900	4,620	920	1,100	590	956
8	600	2,360	2,560	990	4,360	835	8,700	4,100	1,010	1,100	450	920
9	720	1,790	2,360	990	4,100	920	8,700	4,100	920	1,100	450	920
10	720	2,560	2,360	990	3,600	835	8,100	3,840	1,100	1,100	390	920
11	720	2,990	2,360	990	3,140	750	7,500	3,600	1,100	1,100	330	920
12	720	2,990	2,360	990	3,140	750	7,500	3,140	1,100	1,100	330	920
13	600	3,440	2,160	990	3,140	750	7,500	3,360	1,100	1,010	330	920
14	600	3,680	2,360	990	2,920	750	7,200	3,140	1,100	1,100	330	920
15	600	3,680	2,360	990	2,810	750	7,200	2,490	1,100	1,100	330	920
16	600	3,680	2,360	990	2,490	1,380	6,900	2,490	1,100	1,100	330	784
17	600	3,680	2,560	850	2,380	1,770	6,600	2,600	1,010	1,010	330	750
18	600	2,990	2,460	850	1,970	2,280	6,600	2,380	920	1,100	330	750
19	600	2,770	2,160	850	1,770	2,810	7,200	2,070	920	1,100	330	718
20	850	2,990	2,360	850	1,670	3,140	7,200	2,070	920	920	450	590
21	1,290	2,990	2,560	850	1,380	3,600	7,500	1,870	920	750	450	590
22	1,450	3,680	2,460	850	1,100	3,600	7,200	1,870	750	750	450	590
23	2,360	3,930	2,260	850	1,100	3,360	6,900	1,580	835	750	450	622
24	2,560	3,930	2,160	850	1,100	2,920	6,900	1,480	835	750	450	590
25	2,770	3,440	2,160	785	1,010	2,700	6,900	1,480	750	750	450	590
26	2,770	3,440	1,790	720	920	2,920	6,600	1,870	590	750	520	590
27	3,440	3,440	2,060	720	920	5,160	6,300	1,580	520	750	520	520
28	3,930	3,440	1,880	720	835	6,300	6,000	1,290	590	750	450	520
29	3,930	3,440	1,790	785	.....	8,100	5,720	1,480	920	590	450	478
30	3,930	2,990	1,700	1,450	.....	9,300	6,000	1,480	750	670	590	450
31	3,680	.....	1,620	3,440	.....	9,300	.....	1,480	.....	590	670	.....

NOTE.—Daily discharge determined from fairly well-defined rating curve; new rating curve used since Feb. 1, 1914. Open-water rating curve used throughout the year.

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for the year ending Sept. 30, 1914.

[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	3,930	390	1,440	0.911	1.05	B.
November	3,930	1,790	3,140	1.99	2.22	B.
December	2,770	1,620	2,300	1.46	1.68	B.
January	3,440	720	1,050	.665	.77	B.
February	4,620	835	2,720	1.72	1.79	C.
March	9,300	750	2,600	1.65	1.90	B.
April	11,400	5,720	7,920	5.01	5.59	B.
May	6,000	1,290	3,070	1.94	2.24	B.
June	1,100	520	913	.578	.64	C.
July	1,100	590	909	.575	.66	C.
August	670	330	464	.294	.34	C.
September	1,200	450	759	.480	.54	C.
The year	11,400	330	2,260	1.43	19.42	

NOTE.—Seasonal distribution of flow somewhat affected by operation of storage reservoir at Cranberry Lake.

RAQUETTE RIVER AT PIERCEFIELD, N. Y.

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

Drainage area.—723 square miles. (All but 16 square miles measured on United States Geological Survey topographic maps.)

Records available.—August 20, 1908, to September 30, 1914. 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.

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 recorded during year: 9.5 feet at 10 a. m., May 12; discharge, 4,600 second-feet. Minimum stage recorded: 2.05 feet at noon, August 30; discharge, 92 second-feet.

Maximum stage recorded 1908–1914: 11.68 feet (water-stage recorder) at 3 a. m., April 1, 1913; discharge, 7,100 second-feet. Minimum stage, 0.85 foot (water-stage recoder) 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. Open-water rating curve usually applicable throughout year.

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, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 1	W. S. Easterly	3.34	252	Feb. 24	C. S. DeGolyer	4.08	482
Dec. 10	C. S. DeGolyer	6.23	1,460	Apr. 20	do	8.87	3,890
11	do	6.38	1,560	20	do	8.57	3,590
30	W. S. Easterly	5.36	989	June 17	R. S. Barnes	5.20	942
Jan. 20	do	4.40	601	July 10	C. S. DeGolyer	4.24	548
23	do	4.24	568	10	do	4.24	554

Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1				849	250	193	1,230	6,430	1,480	515		
2				807	530	513	1,440	6,430	1,480	520		
3				807	530	547	1,510	6,310	1,380	525		402
4				287	564	530	1,580	6,310	1,230			
5				547	530	530	1,350	6,080	1,000			
6				689	564	547	1,810	5,850	982	530		
7		1,030		807	564	530	1,810	5,620	318	530	513	
8				786	318	198	1,890	5,390	849	530		
9				849	417	417	2,010	5,280	982	530		
10			1,450	828	598	448	2,230	5,020	892	530		464
11			1,450	358	480	372	2,320	4,750	870	464		
12			1,520	387		417	2,060	4,490	766	115		
13			1,480	849		530	2,510	4,380	828	530		
14			1,260			530	2,510	4,050	212	530		
15			1,350		131	331	2,510	3,840	513	530		
16			1,380		464	306	2,510	3,620	766	530		
17			1,450		547	547	2,610	3,310	766	530		598
18			1,450		564	581	2,710	3,310	689	513	581	
19			1,380		513	581	3,010	3,110	634	148		
20			1,170	547	513	598	3,840	2,910	581	358		
21		2,060	610	530	530	547	4,380	2,810	212	480		
22			1,000	547	306	240	4,820	2,610	358	448		
23			1,170	547	344		5,280	2,510	564	448		
24	590		1,080	547	547		5,620	2,320	513	480		581
25			232	206	564		5,850	2,420	448	513		
26			980	372	513		6,080	2,230	417			
27			1,290	547	547		5,960	2,060	432		372	
28			555	564	417		5,960	1,970	141			294
29			1,000	547		564	6,080	1,850	316			480
30			1,000	564		960	6,310	1,690	513			448
31			955	547		1,100		1,380		513		

NOTE.—Daily discharge determined from well-defined rating curves. New rating curve used Jan. 1 to Sept. 30. Water-stage recorder not running Oct. 1 to Dec. 9, 1913, July 1–9, and July 26 to Sept. 27, 1914. Discharge May 10 and 11 interpolated. Discharge July 26 to Sept. 27 was determined from one gage reading a day and may therefore not be the mean discharge for the day. Discharge estimated as follows: Dec. 1–9, 1,400 second-feet; Jan. 14–19, 607 second-feet; Feb. 12–14, 475 second-feet; Mar. 23–28, 575 second-feet; July 1, 515 second-feet; July 2, 520 second-feet; July 3, 525 second-feet; July 4–5, 132 second-feet; July 6, 7, 8, and 9, 530 second-feet; July 26–30, 442 second-feet; and Sept. 1–27, 452 second-feet.

Monthly discharge of Raquette River at Piercefield, N. Y., for the year ending Sept. 30, 1914.

[Drainage area, 723 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October			[a] 411	0.569	0.66	D
November			[a] 1,260	1.74	1.94	D.
December			1,220	1.69	1.95	B.
January	849	206	599	.828	.95	B.
February	598	131	474	.656	.68	B.
March	1,100	193	520	.720	.83	B.
April	6,310	1,230	3,330	4.61	5.14	A.
May	6,430	1,380	3,880	5.37	6.19	A.
June	1,480	141	704	.974	1.09	A.
July			446	.617	.71	B.
August			431	.596	.69	C.
September			448	.620	.69	C.
The year	6,430		1,150	1.59	21.52	

[a] Estimated from records of flow of Raquette River at Massena Springs.

NOTE.—Estimates indicate the flow as regulated by the dam and numerous lakes immediately above station.

RAQUETTE RIVER AT MASSENA SPRINGS, N. Y.

Location.—At concrete highway bridge in Massena Springs, 8 miles below Raymondville and 10 miles above mouth of stream.

Drainage area.—1,170 square miles.

Records available.—September 21 to October 17, 1903; and April 9, 1904, to September 30, 1914. 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.

Discharge measurements.—Made from bridge.

Channel and control.—Bed of river, coarse gravel and small bowlders; fairly permanent.

Extremes of discharge.—Maximum stage recorded during year: 9.6 feet at 8.30 a. m., May 1; discharge, 8,960 second-feet. Minimum stage recorded: 0.95 foot at 8.30 a. m., June 29; discharge, 175 second-feet.

Maximum stage recorded 1903–1914: 14.2 feet between 9 and 11 a. m., March 31, 1913; discharge, 16,500 second-feet. Minimum stage recorded for same period: 0.8 foot at 8.30 a. m., September 21, 1913; discharge, approximately 50 second-feet.

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.

Winter flow.—Discharge relation affected by ice; gage observations suspended during period when ice is present.

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, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 8	C. S. De Golyer	3.85	1,910	Apr. 16	C. S. De Golyer	5.96	3,930
9	do	4.39	2,270	Aug. 27	H. W. Fear	1.37	280

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	300	1,840	2,690	8,200	8,800	3,160	690	752	1,360
2	300	1,260	2,690	8,050	8,200	3,900	720	545	920
3	320	1,500	2,790	6,310	8,050	2,660	752	920	1,060
4	300	1,660	2,110	8,200	7,750	2,200	450	600	520
5	220	1,580	2,290	6,870	8,960	1,940	290	450	818
6	240	1,420	2,290	.....	7,160	2,380	520	290	1,440
7	280	1,580	2,490	.....	6,590	1,760	850	472	990
8	185	1,580	1,930	.....	6,450	1,600	720	428	785
9	185	1,260	1,580	.....	7,450	1,360	990	545	1,280
10	110	1,580	2,290	.....	6,730	1,520	545	720	1,680
11	110	1,930	2,390	.....	6,310	1,440	785	920	385
12	110	1,750	2,290	.....	8,050	1,280	630	385	1,140
13	52	1,750	2,490	.....	8,350	1,210	365	365	1,210
14	370	1,580	2,590	.....	6,040	1,210	365	428	630
15	280	1,420	2,390	.....	5,120	1,760	405	405	690
16	52	2,110	2,390	4,250	4,610	1,060	850	520	630
17	98	2,200	.....	5,770	4,370	1,440	495	495	785
18	85	2,200	.....	4,490	4,490	1,210	495	450	308
19	470	2,110	.....	5,900	6,040	785	428	365	600
20	45	2,200	.....	5,240	4,490	1,940	520	365	920
21	220	2,490	.....	6,310	4,250	1,520	520	660	630
22	470	2,590	.....	5,640	4,020	920	428	450	308
23	1,500	2,390	.....	8,050	3,580	1,060	850	290	405
24	1,040	2,790	.....	6,450	3,800	572	365	450	472
25	1,420	2,690	.....	8,650	2,760	785	720	660	630
26	2,110	2,690	.....	7,600	2,860	785	385	850	1,140
27	1,930	2,890	.....	8,200	3,580	785	472	450	1,210
28	1,750	2,590	.....	8,200	3,680	545	520	630	260
29	1,750	2,690	.....	7,750	2,760	290	495	920	520
30	1,750	2,890	.....	7,900	3,360	690	428	308	325
31	2,590	.....	.....	.....	3,360	.....	660	520	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. New rating curve used Apr. 1 to Sept. 30. Discharge estimated, by comparison with flow at Piercefield, N. Y., as follows: Dec. 17-31, 1,660 second-feet; Apr. 6-15, 5,510 second-feet.

Monthly discharge of Raquette River at Massena Springs, N. Y., for the year ending Sept. 30, 1914.

[Drainage area, 1,200 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	2,590	52	666	0.555	0.64	B.
November	2,890	1,260	2,040	1.70	1.90	B.
December	.....	.....	2,020	1.68	1.94	C.
April	8,650	4,250	6,440	5.37	5.99	B.
May	8,960	2,760	5,550	4.62	5.33	B.
June	3,900	290	1,460	1.22	1.36	B.
July	990	290	571	.476	.55	C.
August	920	290	536	.447	.52	C.
September	1,680	260	802	.668	.75	C.

ST. REGIS RIVER AT BRASHER CENTER, N. Y.

Location.—At the steel highway bridge in the village of Brasher Center, 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, 1914. 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: 9.1 feet at 7 a. m., March 27; 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; discharge, 105 second-feet.

Maximum stage recorded 1910–1914: 9.1 feet at 7 a. m., March 27, 1914; discharge, 16,200 second-feet. Minimum stage recorded for same period: 3.75 feet at 5 p. m., August 9, 7 a. m. and 5 p. m., August 10, and 7 a. m., August 12; discharge, 105 second-feet.

Winter flow.—Discharge relation affected by ice; gage observations suspended during period when ice is present.

Accuracy.—Rating curve well developed; estimates good.

Discharge measurements of St. Regis River at Brasher Center, N. Y., during the year ending Sept. 30, 1914.

[Made by C. S. DeGolyer.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Feb. 23	6.08	[a] 339	Apr. 17	5.89	3,010
Apr. 17	5.87	3,120	July 9	4.12	[b] 320

[a] Backwater from ice; measurement made through ice. [b] Made by wading.

Daily discharge, in second-feet, of St. Regis River at Brasher Center, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	277	1,130	801	.....	.....	3,950	4,270	428	500	152	820
2	322	925	590	.....	.....	6,850	3,360	500	482	152	820
3	638	801	925	.....	.....	5,650	2,710	500	550	140	940
4	990	690	1,130	.....	.....	4,600	2,360	455	395	210	940
5	1,060	561	1,060	.....	.....	3,950	2,150	550	322	222	765
6	860	561	860	.....	.....	2,480	1,940	600	302	160	500
7	638	638	990	.....	.....	3,090	1,940	580	335	128	455
8	524	690	1,130	.....	.....	1,640	1,940	500	350	120	655
9	463	742	1,060	.....	.....	1,940	1,740	600	322	114	710
10	392	990	860	.....	.....	1,940	1,460	550	322	105	820
11	362	1,430	860	.....	.....	1,940	1,220	395	283	120	655
12	376	1,350	742	.....	.....	1,640	880	335	283	114	395
13	438	1,130	690	.....	.....	1,640	1,000	302	222	140	302
14	438	1,060	860	.....	.....	1,640	880	240	205	222	222
15	472	990	1,200	.....	.....	1,380	940	270	240	200	410
16	524	860	1,510	.....	.....	1,840	820	283	372	160	322
17	454	860	925	.....	.....	2,830	600	372	240	152	240
18	415	742	990	.....	.....	3,360	710	302	210	258	185
19	454	638	1,680	.....	.....	3,950	655	302	200	210	200
20	524	1,430	1,130	.....	.....	7,700	550	335	152	200	170
21	1,510	1,940	860	.....	.....	7,250	710	322	240	210	128
22	1,760	1,760	742	.....	.....	5,650	600	350	200	302	160
23	1,760	1,590	860	339	.....	3,950	428	372	200	222	160
24	1,590	1,430	860	.....	.....	3,950	455	302	283	170	140
25	1,430	1,430	742	.....	.....	2,830	600	270	283	185	120
26	1,430	1,590	638	.....	.....	2,830	600	258	283	152	120
27	1,760	1,200	.....	.....	.....	3,950	655	350	240	120	152
28	1,680	1,130	.....	.....	8,150	4,270	520	258	372	210	210
29	1,590	1,060	.....	.....	6,850	4,270	500	270	240	185	520
30	1,430	925	.....	.....	6,050	4,270	455	500	200	283	550
31	1,130	.....	.....	.....	4,600	.....	410	.....	185	410	.....

NOTE.—Daily discharge for open-water periods determined from well-defined rating curves. New rating curve used since Mar. 28, 1914. Discharge Dec. 27–31, estimated at 760 second-feet. Daily discharge Apr. 2–4, when discharge relation was affected by backwater from ice jam, estimated by hydrograph study of backwater conditions.

Monthly discharge of St. Regis River at Brasher Center, N. Y., for the year ending Sept. 30, 1914.

[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	1,760	277	893	1.44	1.66	A.
November	1,940	561	1,080	1.74	1.94	A.
December	1,680	590	919	1.48	1.71	A.
April	7,700	1,380	3,570	5.75	6.42	B.
May	4,270	410	1,230	1.98	2.28	A.
June	600	240	388	.625	.70	A.
July	550	152	291	.469	.54	B.
August	410	105	185	.298	.34	B.
September	940	120	426	.686	.77	A.

DEER RIVER AT BRASHER IRON WORKS, N. Y.

Location.—About 1,000 feet below steel highway bridge in the village of Brasher Iron Works (railroad station is Ironton) and 2 miles above the confluence of Deer River with St. Regis River in Helena, N. Y. 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, 1914. 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 feet; read morning and evening. Gage reader, 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: 9.0 feet at 6 p. m., March 26; discharge, approximately 8,900 second-feet. Minimum stage recorded: 0.9 foot at 6 p. m., July 27; 7 a. m. and 6.30 p. m., July 22; 7 p. m., August 9; and 7 a. m., August 10; discharge, 25 second-feet.

Maximum stage recorded 1912–1914: 9.3 feet at 4 p. m., January 17, 1913; discharge, approximately 9,700 second-feet. Minimum stage recorded for same period: 0.80 foot at 6 a. m., August 20, 1913, 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 well defined below 3,500 second-feet.

The following discharge measurement was made by wading by C. S. De Golyer:
July 9, 1914: Gage height, 1.36 feet; discharge, 75 second-feet.

Daily discharge, in second-feet, of Deer River at Brasher Iron Works, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	143	171	.....	864	656	61	96	44	124
2	51	124	180	.....	1,190	524	74	92	40	157
3	166	122	199	.....	656	375	78	85	44	149
4	199	117	279	.....	446	309	82	85	30	124
5	143	122	279	.....	428	325	85	78	45	102
6	112	115	238	.....	375	294	85	85	40	74
7	102	112	197	.....	309	279	58	74	37	88
8	85	99	199	.....	410	251	64	96	37	124
9	78	133	199	.....	808	225	72	82	27	115
10	64	309	199	.....	610	341	72	72	30	107
11	64	251	187	.....	610	171	63	59	30	96
12	64	199	225	.....	610	157	72	52	46	92
13	77	177	187	.....	375	149	71	51	48	92
14	86	164	265	.....	358	153	58	37	46	68
15	71	151	375	.....	251	149	45	45	51	68
16	71	133	309	.....	656	124	33	46	53	74
17	78	115	194	.....	864	124	57	46	64	68
18	70	113	225	.....	704	102	68	40	64	52
19	71	112	212	.....	864	107	64	37	58	46
20	96	375	225	.....	1,420	93	58	40	52	48
21	392	341	153	.....	1,500	91	56	27	78	41
22	309	279	149	294	980	86	47	25	64	33
23	225	392	175	279	704	88	61	44	58	58
24	180	294	225	225	524	85	66	61	48	71
25	239	251	187	212	465	82	74	53	35	52
26	212	199	143	2,810	610	93	64	46	46	61
27	279	175	187	.....	980	74	48	44	44	68
28	225	164	199	1,500	704	85	35	44	40	58
29	199	137	.....	1,190	754	82	52	46	53	64
30	180	151	.....	864	1,050	64	93	45	85	58
31	175	.....	.....	704	.....	63	.....	44	102	.....

NOTE.—Daily discharge determined from a rating curve well defined below 3,500 second-feet. Discharge Dec. 29–31, estimated at 187 second-feet.

Monthly discharge of Deer River at Brasher Iron Works, N. Y., for the year ending Sept. 30, 1914.

[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	392	30	142	0.689	0.79	A.
November	392	99	186	.903	1.01	A.
December	375	143	210	1.02	1.18	A.
April	1,500	251	703	3.41	3.80	A.
May	656	63	187	.908	1.05	A.
June	93	33	63.9	.310	.34	B.
July	96	25	57.3	.278	.32	B.
August	102	27	49.6	.241	.28	B.
September	157	33	81.1	.394	.44	B.

RICHELIEU RIVER AT FORT MONTGOMERY, ROUSES POINT, N. Y.

Location.—About half a mile from the head of Richelieu River, the outlet of Lake Champlain, about 1 mile northeast of the village of Rouses Point and three-eighths mile south of the international boundary; in the fort.

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 September 30, 1914. Data also published in the reports of the New York State engineer and surveyor and the Deep Waterway Survey.

Gage.—Staff; read once daily. Elevation of gage zero is 92.50 feet above mean sea level.

Extremes of stage.—Maximum stage recorded during year: 99.65 feet at 10 a. m., May 3. Minimum stage recorded: 92.6 feet at 10 a. m., October 14 and 16. Maximum stage recorded 1869–1914: 103.28 [1] feet. Minimum stage recorded: 91.9 feet, November 13, 1908. (These elevations refer to mean sea level. See "Gage.")

Cooperation.—Gage heights observed under the direction of the Corps of Engineers of the United States Army, and reported weekly to the United States Geological Survey.

Daily gage height, in feet, of Richelieu River at Fort Motgomery, Rouses Point, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.20	0.75	0.90	1.05	1.20	1.35	3.40	7.00	4.30	2.30	1.35	1.00
2	.25	.55	.80	1.10	1.25	1.40	3.50	7.10	4.10	2.30	1.40	1.20
3	.30	.75	.60	1.00	1.50	1.40	3.80	7.15	4.00	2.20	1.30	1.00
4	.30	.60	.80	.90	1.35	1.50	4.00	7.10	4.10	2.20	1.30	.95
5	.35	.50	.85	.90	1.30	1.60	4.00	7.00	3.80	2.15	1.30	1.10
6	.45	.70	.75	1.00	1.40	1.60	4.10	7.00	3.85	2.10	1.45	1.20
7	.45	.75	1.00	.95	1.50	1.65	4.10	7.00	3.80	2.00	1.40	1.00
8	.40	.80	.95	1.00	1.45	1.70	4.10	6.90	3.70	2.05	1.10	.70
9	.35	.60	1.00	1.00	1.45	1.70	4.40	6.80	3.80	1.90	1.00	.80
10	.30	1.20	1.20	1.00	1.40	1.70	4.60	6.80	3.80	2.00	1.20	.80
11	.60	.70	.70	1.00	1.40	1.65	4.80	6.60	3.50	2.10	1.10	.85
12	.35	.60	1.20	1.05	1.35	1.70	4.90	6.50	3.50	2.10	.90	.80
13	.30	.85	1.10	1.00	1.45	1.70	5.00	6.40	3.30	1.90	.85	.85
14	.10	.60	1.00	.95	1.40	1.70	5.10	6.30	3.25	2.10	1.00	.85
15	.25	.60	1.10	1.00	1.40	1.60	5.00	6.20	3.20	2.00	.85	.85
16	.10	.65	1.15	1.00	1.50	1.70	5.00	6.10	3.00	2.05	.80	.80
17	.20	.75	1.20	.90	1.50	1.70	5.10	6.00	3.00	2.00	.90	.75
18	.50	.75	1.10	.95	1.50	1.80	5.20	5.90	3.00	1.90	1.00	.70
19	.20	.65	1.10	1.00	1.45	1.85	5.30	5.80	3.00	1.80	.95	.70
20	.40	.70	1.30	.90	1.40	1.90	5.50	5.70	2.80	1.75	1.00	.80
21	.50	.70	1.10	1.00	1.40	2.00	6.10	5.60	2.70	1.50	1.10	.75
22	.40	.80	1.05	1.00	1.45	2.10	6.50	5.45	2.70	1.50	1.00	.80
23	1.10	.75	1.00	1.00	1.40	2.00	6.50	5.30	2.70	1.55	1.10	.70
24	.40	.80	1.10	1.00	1.40	2.00	6.80	5.20	2.60	1.40	.80	.65
25	.30	.70	1.10	.95	1.45	2.00	6.80	5.30	2.50	1.50	.75	.70
26	.35	.65	.....	1.00	1.45	2.05	7.00	5.20	2.50	1.40	.80	.60
27	.50	.70	1.15	1.05	1.40	2.20	6.80	4.90	2.20	1.40	.80	.40
28	.60	1.00	1.10	1.00	1.45	2.45	6.90	4.60	2.40	1.30	.75	.50
29	.60	.75	1.05	1.10	.....	2.70	6.80	4.70	2.50	1.10	.80	.60
30	.50	.80	1.15	1.10	.....	3.00	6.90	4.80	2.35	1.30	.80	.40
31	.55	.....	1.05	1.10	.....	3.20	.....	4.50	.....	1.40	.90	.....

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 mouth of river at Plattsburg.

Drainage area.—607 square miles (from United States Geological Survey topographic maps).

Records available.—March 27, 1903, to September 30, 1914. Data published also in the annual reports of the New York State engineer and surveyor and the State of New York Conservation Commission.

[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.

Gage.—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 determined 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 derived from experiments made in the hydraulic laboratory of Cornell University on a model section of the dam;[1] 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 recorded during year: 6,410 second-feet, April 20. Minimum discharge recorded: 90 second-feet, September 28.

Maximum daily discharge recorded 1908–1914: 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 recording gage, 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.

Discharge measurements of Saranac River near Plattsburg, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.[a]	Discharge.	Date.	Made by—	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 13	C. S. DeGolyer	2.88	1,300	July 8	C. H. Pierce	2.22	[b] 620
13	do	2.85	1,220	8	do	2.19	[b] 584
26	do	2.26	[b] 584				

[a] Slope gage at cable section. [b] Made by wading.

[1] Horton, R. E., Weir experiments, coefficients, and formulas: U. S. Geol. Survey Water-Supply Paper 200, pp. 98–100, 1907.

Monthly discharge of Saranac River near Plattsburg, N. Y., for the years ending Sept. 30, 1909–1914.

[Drainage area, 607 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1908–9.					
October	420	230	294	0.484	0.56
November	500	165	330	.543	.61
December	410	140	309	.509	.59
January	1,000	230	406	.668	.77
February	1,270	355	785	1.29	1.34
March	1,060	440	756	1.24	.4
April	5,150	840	2,520	4.15	4.63
May	3,840	1,290	2,040	3.36	3.87
June	1,630	270	903	1.49	1.66
July	600	275	412	.678	.78
August	465	245	346	.570	.66
September	570	135	341	.561	.63
The year	5,150	135	785	1.29	17.53
1909–10.					
October	540	210	353	.581	.67
November	610	225	437	.719	.80
December	520	260	375	.617	.71
January	630	310	402	.662	.76
February	570	305	394	.649	.68
March	2,770	720	1,510	2.49	2.87
April	2,030	750	1,240	2.04	2.28
May	2,200	700	982	1.62	1.87
June	1,330	320	724	1.19	1.33
July	470	255	319	.526	.61
August	410	250	333	.549	.63
September	690	300	365	.601	.67
The year	2,770	210	618	1.02	13.88
1910–11.					
October	660	295	436	.718	.83
November	770	295	455	.750	.84
December	475	220	385	.634	.73
January	540	265	412	.679	.78
February	490	350	397	.654	.68
March	1,690	330	613	1.01	1.16
April	3,260	850	1,960	3.23	3.60
May	2,210	830	1,320	2.17	2.50
June	1,160	630	788	1.30	1.45
July	610	170	394	.649	.75
August	370	140	266	.438	.50
September	530	190	346	.570	.64
The year	3,260	140	647	1.06	14.46

Monthly discharge of Saranac River near Plattsburg, N. Y., for the years ending Sept. 30, 1909–1914—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches or drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1911–12.					
October	585	275	378	0.623	0.72
November	770	325	463	.763	.85
December	1,300	360	757	1.25	1.44
January	670	300	463	.763	.88
February	550	340	419	.690	.74
March	930	255	491	.809	.93
April	5,580	570	2,300	3.79	4.23
May	2,120	750	1,180	1.94	2.24
June	2,170	265	869	1.43	1.60
July	485	255	371	.611	.70
August	520	225	361	.595	.69
September	1,670	430	855	1.41	1.57
The year	5,580	225	742	1.22	16.59
1912–13.					
October	1,130	320	670	1.10	1.27
November	1,500	560	850	1.40	1.56
December	1,180	500	789	1.30	1.50
January	2,960	660	1,350	2.22	2.56
February	1,080	465	625	1.03	1.07
March	6,090	400	2,190	3.61	4.16
April	4,960	1,240	2,090	3.44	3.84
May	2,170	450	840	1.38	1.59
June	1,360	370	719	1.18	1.32
July	490	260	364	.599	.69
August	535	160	326	.537	.62
September	500	155	280	.461	.51
The year	6,090	155	923	1.52	20.69
1913–14.					
October	680	250	468	.771	.89
November	1,050	325	672	1.11	1.24
December	970	440	656	1.08	1.24
January	710	320	516	.850	.98
February	640	430	521	.858	.89
March	1,760	420	677	1.11	1.28
April	6,410	950	2,310	3.80	4.24
May	2,870	430	1,210	1.99	2.29
June	670	305	482	.793	.88
July	560	260	384	.632	.73
August	625	250	368	.606	.70
September	580	90	369	.607	.68
The year	6,410	90	719	1.18	16.04

NOTE.—Discharge tables for 1908–9 and preceding years (Water-Supply Papers 97, 129, 170, 206, 244, and 264) included flow through turbines computed from manufacturers' gate ratings; comparison of record with results of current-meter measurements showed the estimates to be too small, the percentage difference being greatest at the lower stages. Recomputation of data from Oct. 1, 1908, to Dec. 31, 1909, based on a current-meter rating of the discharge through the turbines and corresponding determinations of kilowatt output.

AUSABLE RIVER AT AUSABLE FORKS, N. Y.

Location.—In the village of Ausable Forks, 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 United States Geological Survey topographic maps).

Records available.—August 17, 1910, to September 30, 1914. 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: 7.87 feet at 5 p. m., April 19; approximate discharge, 10,400 second-feet. Minimum stage recorded: 3.5 feet at 7 a. m., February 24; discharge, 115 second-feet.

Maximum stage recorded 1910-1914: 10.2 feet, evening of March 27, 1913; discharge, approximately 25,000 second-feet. Minimum stage recorded for same period: 3.03 feet at 7 a. m., July 21, 1912; discharge practically zero.

Winter flow.—Discharge relation slightly affected by ice. Flow determined from discharge measurements and climatic records.

Accuracy.—Conditions at measuring section favorable. A portable water-stage recorder was installed at this station and a continuous gage-height record obtained July 11 to September 30, inclusive, 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 errors were compensating.

Discharge measurements of Ausable River at Ausable Forks, N. Y., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 1	W. S. Easterly	3.72	[a]250	Apr. 22	C. S. DeGolyer	5.52	3,220
24	do	3.65	[a]190	22	do	5.41	2,950
Feb. 25	C. S. De Golyer	3.60	[a]129	22	do	5.39	2,950
Mar. 23	W. S. Easterly	3.66	235	July 7	do	3.76	274
31	do	4.42	1,040	7	do	3.74	[b]269
Apr. 1	do	4.38	1,000	10	C. H. Pierce	3.68	[b]217
1	do	4.46	1,070	24	C. S. DeGolyer	3.71	[b]237
21	C. S. DeGolyer	6.25	5,170	Aug. 19	C. C. Covert	3.58	[b]177

[a] Backwater from ice.

[b] Made by wading.

Daily discharge, in second-feet, of Ausable River at Ausable Forks, N. Y., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	160	452	329	250	520	151	550	2,840	294	204	161	302
2	462	348	388	241	431	179	1,240	3,070	294	217	120	230
3	932	348	431	265	409	198	954	1,860	270	270	135	211
4	694	331	520	202	409	185	766	2,490	310	217	120	230
5	431	311	790	174	409	198	716	2,720	692	192	130	185
6	367	282	918	202	567	198	620	1,960	484	347	146	140
7	367	257	962	194	265	198	680	2,490	347	246	120	246
8	292	218	1,080	282	358	198	562	1,960	310	319	111	384
9	226	388	790	241	642	204	3,190	1,860	262	294	87	328
10	210	3,500	720	265	420	262	1,160	1,670	262	204	95	294
11	167	1,420	932	1,080	.....	198	1,320	1,670	179	238	103	224
12	181	1,070	694	388	.....	211	1,320	1,400	166	319	99	194
13	292	1,050	508	218	.....	192	898	1,140	161	278	87	151
14	249	1,250	431	147	.....	166	818	1,160	161	211	95	146
15	292	860	388	301	.....	146	1,040	1,010	156	179	83	140
16	282	520	339	420	.....	230	1,240	818	156	161	99	140
17	226	452	320	265	.....	779	1,080	779	151	146	107	125
18	226	431	292	234	.....	766	1,760	968	166	115	120	115
19	210	388	241	431	.....	356	8,400	996	120	120	140	95
20	496	1,080	241	249	.....	402	12,100	968	125	135	166	83
21	1,700	1,550	257	249	140	270	6,490	1,860	204	120	172	95
22	1,330	1,250	257	358	117	192	3,190	644	179	125	156	103
23	1,250	832	320	339	70	217	2,840	982	156	135	172	99
24	590	720	257	194	87	217	2,380	620	151	198	146	111
25	932	1,600	311	174	127	270	2,160	484	179	179	125	135
26	1,080	1,330	257	846	140	1,240	2,720	516	146	161	107	140
27	976	1,000	249	301	134	2,160	3,070	504	107	161	107	135
28	790	452	339	257	140	2,060	4,480	740	91	140	111	254
29	1,330	378	249	320	.....	230	5,890	402	262	146	146	204
30	655	311	399	804	.....	140	4,750	347	198	166	402	211
31	1,330	.....	339	567	.....	792	.....	270	.....	172	393	.....

NOTE.—Daily discharge, except as noted below, determined from well-defined rating curves. New rating curve used beginning Mar. 1, 1914. Daily discharge, Oct. 1, 1913, to July 11, 1914, determined from mean of two daily readings of gage. Discharge, July 12 to Sept. 30, determined from mean of 24 hourly gage heights each day as given by the portable water-stage recorder. (See "Accuracy" in station description.) Discharge Dec. 27, 1913, to Jan. 27, 1914, and Feb. 21–28 estimated because of ice and approximate only. Discharge Feb. 11–20 estimated because of ice at 391 second-feet.

Monthly discharge of Ausable River at Ausable Forks, N. Y., for the year ending Sept. 30, 1914.

[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	1,700	160	604	1.36	1.57	A.
November	3,500	218	813	1.83	2.04	A.
December	1,080	241	469	1.06	1.22	B.
January	1,080	147	337	.759	.88	B.
February	720	70	332	.748	.78	C.
March	2,160	140	426	.959	1.11	B.
April	12,100	550	2,610	5.88	6.56	B.
May	3,070	270	1,330	3.00	3.46	A.
June	692	91	225	.507	.57	A.
July	347	115	197	.444	.51	A.
August	402	83	141	.317	.36	A.
September	384	83	182	.410	.46	A.
The year	12,100	83	638	1.44	19.52	

LAKE GEORGE.

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.

The gage at Lake George was fastened to the concrete wall underneath the east side of the pagoda at Fort William Henry Hotel, near the landing used for motor boats. The observer is G. L. Martin.

At Sagamore the gage was fastened to the south side of the coal dock for Sagamore Hotel, on the west side of Green Island, about 200 feet north of the eastern end of the highway bridge that joins the island and the mainland. The observer is S. G. Finkle.

At Rogers Rock the gage is fastened to a pile in the back end of a covered boathouse. The boathouse is in a bay on the north side of the steamboat landing. The observer is George O. Cook.

All gages are of the vertical-staff type, made up of standard bronze section graduated to feet, tenths, and half-tenths. They were not set to any particular datum, but each gage was referred to a substantial bench mark by the use of an engineer's level. The gages are read once each day to the nearest half-tenth, and the force and direction of the wind are recorded.

A comparative study of gage heights at these stations and at the dam at the outlet of the lake indicates that the zeros of the three gages are below the crest of the dam, as follows:

	Feet.
Gage at Lake George	4.75
Gage at Sagamore	4.9
Gage at Rogers Rock	3.4

The three gages were read until June 30, 1914. Comparison of the records up to that 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. Data published also in the annual reports of the New York State engineer and surveyor and the State of New York Conservation Commission. The results of the observations are presented in the following tables:

Daily gage height, in feet, of Lake George, N. Y., during the year ending Sept. 30, 1914.

Day.	October.									November.								
	Lake George.			Sagamore.			Rogers Rock.			Lake George.			Sagamore.			Rogers Rock.		
	Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.	
		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]
1	3.35	N	...	3.45	Calm.		1.9	S	M	3.2	SW	...	3.5	NW	M	2.08	SW	H
2	3.35	N	...	3.5	Calm.		1.9	N	H	3.2	S	...	3.5	S	L	2.0	N	M
3	3.35	N	...	3.5	NE	L	2.0	N	M	3.2	N	...	3.5	N	L	2.0	S	M
4	3.35	N	...	3.5	NE	H	1.9	N	H	3.2	S	...	3.45	N	L	2.05	SW	H
5	3.3	S	...	3.5	NE	L	1.95	Calm.		3.2	NW	...	3.45	Calm.		2.0	SE	L
6	3.3	S	...	3.45	Calm.		1.98	SW	H	3.2	N	...	3.45	S	L	1.98	S	H
7	3.25	S	...	3.45	S	L	1.95	S	L	3.2	SE	...	3.4	S	L	1.95	S	L
8	3.25	N	...	3.4	Calm.		1.92	SW	L	3.2	S	...	3.4	S	L	1.92	S	L
9	3.25	N	...	3.4	Calm.		1.92	Calm.		3.2	S	...	3.4	S	H	1.9	NE	L
10	3.25	N	...	3.4	Calm.		1.92	S	M	3.2	S	...	3.4	S	H	2.1	S	H
11	3.25	N	...	3.4	S	H	1.9	SW	M	3.25	NE	...	3.4	S	H	2.02	S	H
12	3.25	S	...	3.35	N	L	1.9	SW	L	3.25	N	...	3.4	S	H	2.0	S	L
13	3.25	S	...	3.35	NE	H	1.9	N	L	3.25	W	...	3.4	S	M	2.0	S	M
14	3.25	NE	...	3.35	NE	H	1.85	N	H	3.25	N	...	3.4	W	L	1.98	Calm.	
15	3.25	NE	...	3.3	NE	H	1.9	N	M	3.25	N	...	3.4	S	L	1.9	NW	L
16	3.25	NE	...	3.3	NE	H	1.8	N	H	3.25	N	...	3.4	N	L	1.9	N	M
17	3.25	NE	...	3.3	NE	H	1.8	N	M	3.25	S	...	3.35	S	H	1.9	Calm.	
18	3.25	NE	...	3.3	NE	H	1.8	S	M	3.2	S	...	3.35	S	L	1.9	S	H
19	3.2	S	...	3.3	NE	H	1.7	N	H	3.2	S	...	3.35	S	H	1.88	S	L
20	3.15	S	...	3.35	S	H	1.9	S	L	3.2	S	...	3.35	Calm.		1.9	S	M
21	3.15	S	...	3.4	S	H	2.1	S	H	3.2	W	...	3.35	Calm.		1.85	Calm.	
22	3.15	N	...	3.4	S	H	1.88	SE	...	3.2	S	...	3.35	S	H	1.8	S	M
23	3.15	SE	...	3.4	S	H	1.98	S	H	3.2	SW	...	3.35	SW	H	1.85	SW	H
24	3.15	S	...	3.45	S	H	1.88	S	L	3.2	W	...	3.35	N	L	1.85	S	H
25	3.15	S	...	3.5	S	H	1.9	Calm.		3.2	N	...	3.3	S	L	1.85	SW	M
26	3.2	N	...	3.55	NE	H	1.95	N	L	3.2	N	...	3.3	NE	H	1.8	N	H
27	3.2	N	...	3.6	S	L	2.05	Calm.		3.2	N	...	3.3	N	L	1.8	N	M
28	3.2	N	...	3.6	S	L	2.1	S	M	3.15	N	...	3.3	Calm.		1.8	SW	L
29	3.2	N	...	3.6	S	L	2.1	S	M	3.15	S	...	3.3	N	L	1.78	N	M
30	3.2	N	...	3.55	Calm.		2.05	N	M	3.15	S	...	3.3	Calm.		1.8	S	M
31	3.2	N	...	3.55	N	L	2.1	SW	H	.....	.....	...	.....	.....	...	.....	.....	...

[a] L=light; H=heavy; M=moderate.

Daily gage height, in feet, of Lake George, N. Y., during the year ending Sept. 30, 1914—Continued.

Day.	December.									January.								
	Lake George.			Sagamore.			Rogers Rock.			Lake George.			Sagamore.			Rogers Rock.		
	Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.	
		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]
1	3.15	S	...	3.3	S	L	1.82	S	M	3.1	N	...	3.3	SW	...	1.75	NE	L
2	3.15	S	...	3.25	Calm.		1.8	Calm.		3.1	N	...	3.3	S	L	1.8	S	M
3	3.15	N	...	3.25	W	L	1.8	N	M	3.1	S	...	3.3	NE	L	1.7	N	L
4	3.15	N	...	3.25	N	L	1.78	Calm.		3.1	NE	...	3.3	NE	L	1.7	N	H
5	3.1	NE	...	3.2	Calm.		1.7	N	M	3.1	NE	...	3.3	NE	H	1.7	N	H
6	3.1	W	...	3.2	NE	L	1.75	S	M	3.1	S	...	3.3	S	L	1.78	S	L
7	3.1	S	...	3.2	S	M	1.78	S	L	3.1	N	...	3.3	S	L	1.75	S.	H
8	3.1	S	...	3.2	Calm.		1.9	S	H	3.1	N	...	3.25	S	L	1.7	Calm.	
9	3.1	SE	...	3.25	S	M	1.95	S	M	3.1	S	...	3.25	Calm.		1.7	Calm.	
10	3.1	S	...	3.25	S	M	1.95	S	H	3.1	S	...	3.25	NW	...	1.75	S	M
11	3.1	N	...	3.3	Calm.		1.85	N	H	3.1	N	...	3.2	S	L	1.68	N	L
12	3.1	N	...	3.3	Calm.		1.95	S	M	3.1	N	...	3.2	W	H	1.7	SW	H
13	3.1	W	...	3.3	Calm.		1.85	Calm.		3.1	N	...	3.2	W	H	1.7	N	M
14	3.1	S	...	3.3	NW	M	1.9	S	M	3.1	W	...	3.2	W	H	1.65	N	L
15	3.1	S	...	3.3	Calm.		1.85	S	H	3.0	S	...	3.25	NE	H	1.65	S	L
16	3.1	N	...	3.3	S	H	1.8	N	L	3.0	N	...	3.25	Calm.		1.95	S	L
17	3.1	N	...	3.25	S	H	1.85	S	H	3.0	S	...	3.25	NE	L	1.6	N	H
18	3.1	SW	...	3.25	S	L	1.8	Calm.		2.95	S	...	3.25	NE	L	1.62	N	L
19	3.1	S	...	3.25	S	L	1.8	S	M	2.95	S	...	3.25	Calm.		1.65	SW	M
20	3.1	S	...	3.25	S	L	1.78	S	M	2.95	S	...	3.25	S	L	1.6	N	M
21	3.1	SW	...	3.25	Calm.		1.75	Calm.		2.95	S	...	3.25	S	L	1.62	S	L
22	3.1	NE	...	3.25	N	L	1.7	N	H	2.95	W	...	3.25	S	H	1.6	S	L
23	3.1	N	...	3.25	Calm.		1.75	Calm.		2.95	N	...	3.25	Calm.		1.6	S	M
24	3.1	N	...	3.3	Calm.		1.75	N	L	2.95	S	...	3.25	W	L	1.65	SW	L
25	3.1	N	...	3.3	NE	L	1.78	N	L	2.95	S	...	3.2	W	L	1.65	N	H
26	3.1	N	...	3.3	NE	H	1.9	N	H	2.95	S	...	3.2	S	L	1.65	NW	L
27	3.1	N	...	3.3	Calm.		1.9	N	M	2.95	E	...	3.2	S	L	1.68	S	H
28	3.1	S	...	3.3	S	L	1.9	N	L	2.95	S	...	3.15	N	L	1.62	NW	M
29	3.1	S	...	3.3	S	L	1.85	NE	M	2.95	W	...	3.15	S	H	1.65	S	H
30	3.1	N	...	3.3	W	M	1.8	S	M	2.95	S	...	3.15	W	L	1.75	NW	L
31	3.1	N	...	3.3	NE	M	1.8	S	M	2.95	S	...	3.2	NE	L	1.78	S	M

[a] L=light; H=heavy; M=moderate.

Daily gage height, in feet, of Lake George, N. Y., during the year ending Sept. 30, 1914—Continued.

Day.	February.									March.								
	Lake George.			Sagamore.			Rogers Rock.			Lake George.			Sagamore.			Rogers Rock.		
	Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.	
		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]
1	3.0	W	...	3.2	S	L	1.75	S	L	3.15	NE	...	3.3	NE	...	1.78	N	H
2	3.05	S	...	3.2	S	L	1.72	SW	M	3.3	W	...	3.3	NE	...	1.9	N	L
3	3.05	S	...	3.2	S	L	1.72	W	M	3.3	S	...	3.3	S	...	1.85	N	M
4	3.05	W	...	3.2	SW	...	1.78	W	H	3.3	W	...	3.3	S	...	1.9	SW	M
5	3.05	S	...	3.2	SW	...	1.7	Calm.		3.3	W	...	3.3	S	...	1.85	N	M
6	3.05	S	...	3.2	NE	...	1.7	SE	L	3.3	N	...	3.3	Calm.		1.8	N	M
7	3.05	S	...	3.2	S	...	1.72	W	H	3.3	W	...	3.3	W	...	1.9	S	M
8	3.05	NW	...	3.2	NE	...	1.72	SW	H	3.3	SW	...	3.3	SW	...	1.9	SW	H
9	3.05	S	...	3.25	NE	...	1.75	S	M	3.3	S	...	3.3	W	...	1.9	S	M
10	3.05	N	...	3.25	NE	...	1.72	N	H	3.3	S	...	3.35	S	...	1.85	N	M
11	3.05	NE	...	3.25	NW	...	1.7	N	L	3.3	W	...	3.35	S	...	1.85	N	M
12	3.05	NE	...	3.25	NW	...	1.68	N	M	3.3	S	...	3.35	S	...	1.88	N	L
13	3.05	NE	...	3.25	NE	...	1.68	NE	H	3.3	S	...	3.35	S	...	1.8	NW	L
14	.....	NE	...	3.25	NE	...	1.7	NE	H	3.3	N	...	3.4	S	...	1.8	N	L
15	3.3	W	...	3.25	NE	...	1.72	N	L	3.25	NE	...	3.4	S	...	1.8	NW	L
16	3.3	S	...	3.25	NE	...	1.8	S	L	3.25	N	...	3.4	S	...	1.82	SW	H
17	3.25	N	...	3.25	NE	...	1.85	Calm.		3.25	N	...	3.4	SW	...	1.9	S	L
18	3.25	N	...	3.25	NE	...	1.85	SW	L	3.25	NE	...	3.4	SW	...	1.85	N	H
19	3.25	NE	...	3.25	NE	...	1.8	NE	M	3.25	S	...	3.4	Calm.		1.88	SW	H
20	3.25	NE	...	3.25	NE	...	1.75	NE	H	3.25	NE	...	3.45	S	...	1.85	Calm.	
21	3.25	NE	...	3.25	NE	...	1.78	Calm.		3.25	S	...	3.45	S	...	1.85	S	L
22	3.25	S	...	3.25	SE	...	1.8	SW	M	3.2	S	...	3.45	S	...	1.85	S	M
23	3.25	E	...	3.25	NE	...	1.75	N	H	3.2	S	...	3.45	S	...	1.82	S	M
24	3.2	NE	...	3.3	NE	...	1.75	N	H	3.2	S	...	3.5	S	...	1.8	Calm.	
25	3.2	S	...	3.3	SE	...	1.78	SW	M	3.2	S	...	3.5	S	...	1.82	S	L
26	3.15	N	...	3.3	SE	...	1.7	S	M	3.25	S	...	3.55	NE	...	1.85	S	M
27	3.15	S	...	3.3	SE	...	1.7	SW	L	3.3	S	...	3.55	NE	...	2.0	SW	
28	3.15	S	...	3.3	SE	...	1.72	Calm.		3.35	NE	...	3.55	NE	...	2.05	N	L
29	.....	.....	...	.....	.....	...	.....	.....	...	3.45	S	...	3.55	Calm.		2.1	N	L
30	.....	.....	...	.....	.....	...	.....	.....	...	3.6	S	...	3.55	S	...	2.25	N	M
31	.....	.....	...	.....	.....	...	.....	.....	...	3.65	N	...	3.55	NE	...	2.3	N	L

[a] L=light; H=heavy; M=moderate.

Daily gage height, in feet, of Lake George, N. Y., during the year ending Sept. 30, 1914—Continued.

Day.	April.									May.								
	Lake George.			Sagamore.			Rogers Rock.			Lake George.			Sagamore.			Rogers Rock.		
	Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.	
		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]
1	3.8	S	...	3.55	SW	...	2.35	S	L	6.3	NW	...	6.5	NE	...	4.95	N	H
2	4.0	S	...	3.65	NE	...	2.6	N	H	6.3	W	...	6.45	NE	...	4.98	N	H
3	4.1	W	...	3.8	NE	...	2.8	N	M	6.3	SE	...	6.45	Calm.		4.95	Calm.	
4	4.15	SW	...	3.9	S	...	2.85	S	M	6.25	SE	...	6.4	N	L	4.92	N	M
5	4.2	SW	...	4.0	NE	...	2.9	N	M	6.25	S	...	6.4	Calm.		4.88	Calm.	
6	4.25	SW	...	4.1	NE	...	2.95	SW	H	6.25	N	...	6.35	Calm.		4.8	N	H
7	4.3	SW	...	4.2	NE	...	2.9	NE	L	6.25	N	...	6.35	Calm.		4.8	Calm.	
8	4.4	N	...	4.4	NW	...	3.0	N	L	6.2	NE	...	6.3	NE	...	4.78	S	L
9	4.7	W	...	4.8	SW	...	3.35	SW	M	6.2	S	...	6.3	NE	...	4.75	N	L
10	4.8	N	...	5.0	SW	...	3.45	SW	H	6.1	W	...	6.25	SW	...	4,7	SW	M
11	4.85	S	...	5.15	SW	...	3.55	S	H	6.05	N	...	6.25	SW	...	4.65	N	M
12	5.0	W	...	5.2	W	...	3.6	SW	H	6.0	NW	...	6.2	Calm.		4.6	N	L
13	5.1	NE	...	5.25	NW	...	3.7	N	M	5.95	NW	...	6.15	Calm.		4.65	SW	L
14	5.15	N	...	5.3	NE	...	3.75	S	M	5.9	NE	...	6.1	W	L	4.62	S	L
15	5.15	SE	...	5.35	NE	...	3.8	S	M	5.9	W	...	6.5	Calm.		4.55	N	M
16	5.25	S	...	5.4	NE	...	3.9	N	H	5.85	S	...	6.0	NE	...	4.5	N	M
17	5.3	W	...	5.45	NE	...	3.95	Calm.		5.8	W	...	6.0	Calm.		4.5	Calm.	
18	5.35	NE	...	5.5	SW	...	4.05	S	M	5.8	W	...	6.0	Calm.		4.48	S	M
19	5.55	SW	...	5.55	SW	...	4.2	S	M	5.8	SW	...	6.0	Calm.		4.45	S	L
20	5.8	SW	...	5.9	Calm.		4.5	N	H	5.8	SW	...	5.95	Calm.		4.4	Calm.	
21	6.0	N	...	6.1	Calm.		4.72	NW	M	5.75	S	...	5.95	W	L	4.38	Calm.	
22	6.1	SW	...	6.2	W	...	4.8	SW	H	5.75	S	...	5.9	W	L	4.35	S	M
23	6.15	N	...	6.3	W	...	4.75	NE	H	5.7	NW	...	5.9	Calm.		4.32	SW	H
24	6.15	SE	...	6.35	Calm.		4.75	NW	M	5.65	NW	...	5.85	S	L	4.32	S	L
25	6.15	S	...	6.35	SE	...	4.8	S	H	5.6	SE	...	5.85	S	L	4.35	S	M
26	6.15	SE	...	6.35	NE	...	4.8	Calm.		5.6	S	...	5.8	S	L	4.3	S	H
27	6.2	N	...	6.35	NE	...	4.85	N	L	5.55	NE	...	5.75	Calm.		4.3	SW	H
28	6.2	S	...	6.4	SW	...	4.88	S	L	5.55	W	...	5.75	Calm.		4.2	NE	H
29	6.2	NE	...	6.45	NE	...	4.85	N	H	5.55	SW	...	5.7	NW	L	4.2	S	L
30	6.3	NE	...	6.5	NE	...	4.92	N	H	5.5	S	...	5.7	Calm.		4.18	S	M
31	.....	.....	...	.....	.....	...	.....	.....	...	5.45	W	...	5.65	SW	L	4.15	S	M

[a] L=light; H=heavy; M=moderate.

Daily gage height, in feet, of Lake George, N. Y., during the year ending Sept. 30, 1914—Continued.

Day.	June.									July.			August.			September.		
	Lake George.			Sagamore.			Rogers Rock.			Rogers Rock.			Rogers Rock.			Rogers Rock.		
	Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.		Gage height in feet.	Wind.	
		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]		Direction.	Force.[a]
1	5.45	N	...	5.65	Calm.		4.15	N	M	3.62	N	L	3.28	S	L	3.12	S	M
2	5.45	W	...	5.6	Calm.		4.1	N	M	3.65	Calm.		3.3	S	M	3.12	S	M
3	5.45	SE	...	5.6	NE	...	4.1	Calm		3.68	S	L	3.28	N	H	3.15	S	M
4	5.45	SE	...	5.6	Calm.		4.15	Calm.		3.65	S	L	3.25	N	L	3.12	SW	H
5	5.45	NW	...	5.6	Calm.		4.12	N	M	3.65	S	L	3.2	S	M	3.1	S	M
6	5.45	N	...	5.55	Calm.		4.1	Calm.		3.65	N	L	3.25	S	M	3.05	S	M
7	5.4	W	...	5.55	S	L	4.1	S	M	3.65	N	M	3.22	S	L	3.1	S	M
8	5.4	NE	...	5.55	Calm.		4.1	Calm.		3.7	S	M	3.2	Calm.		3.0	N	M
9	5.4	S	...	5.5	N	L	4.1	S	M	3.65	Calm.		3.15	Calm.		2.98	N	M
10	5.4	NW	...	5.5	N	L	4.1	SW	M	3.6	S	M	3.18	S	M	2.92	N	L
11	5.4	W	...	5.5	N	L	4.05	Calm.		3.65	S	M	3.2	S	M	2.9	N	M
12	5.4	N	...	5.45	Calm.		4.05	SW	M	3.6	Calm.		3.05	N	H	2.88	N	M
13	5.35	NE	...	5.45	Calm.		4.0	SW	L	3.62	S	L	3.1	Calm.		2.85	N	M
14	5.35	NE	...	.....	.....	...	3.98	S	L	3.6	S	M	3.12	S	H	2.85	Calm.	
15	5.3	S	...	.....	.....	...	4.0	SW	M	3.6	S	L	3.08	Calm.		2.8	S	L
16	5.25	S	...	.....	.....	...	3.9	NW	M	3.6	S	M	3.08	Calm.		2.8	N	L
17	5.2	N	...	.....	.....	...	3.9	SW	L	3.65	S	H	3.1	Calm.		2.78	Calm.	
18	5.15	S	...	.....	.....	...	3.88	S	M	3.62	S	M	3.1	S	M	2.75	N	L
19	5.15	S	...	.....	.....	...	3.9	S	H	3.55	NW	M	3.05	S	L	2.7	N	L
20	5.15	N	...	.....	.....	...	3.8	SW	H	3.6	S	L	3.05	S	M	2.7	N	L
21	5.1	N	...	.....	.....	...	3.8	Calm.		3.55	S	M	3.2	S	M	2.7	Calm.	
22	5.1	N	...	.....	.....	...	3.8	Calm.		3.5	Calm.		3.1	N	M	2.68	S	L
23	5.1	W	...	.....	.....	...	3.78	SW	L	3.5	S	M	3.05	S	H	2.68	S	M
24	5.1	N	...	.....	.....	...	3.8	S	M	3.45	N	M	3.05	N	M	2.62	N	M
25	5.1	N	...	.....	.....	...	3.78	S	L	3.45	S	L	3.1	Calm.		2.6	N	M
26	5.05	S	...	.....	.....	...	3.7	N	L	3.4	NW	M	3.0	N	M	2.6	N	M
27	5.05	NE	...	.....	.....	...	3.68	N	M	3.38	N	M	3.0	Calm.		2.55	N	H
28	5.0	NE	...	.....	.....	...	3.65	S	M	3.35	N	M	3.02	S	L	2.55	N	M
29	5.0	S	...	.....	.....	...	3.7	S	M	3.25	N	H	3.05	N	M	2.55	Calm.	
30	5.0	NE	...	.....	.....	...	3.6	N	M	3.28	N	L	3.15	SW	L	2.5	E	M
31	.....	.....	...	.....	.....	...	.....	.....	...	3.3	S	L	3.05	N	L	.....	.....	...

[a] L=light; H=heavy; M=moderate.

LAKE CHAMPLAIN AT BURLINGTON, VT.

Location.—On the south side of the roadway leading to the dock of the Champlain Transportation Co., at the foot of King Street, Burlington.

Records available.—May, 1907, to September 30, 1914. Data published also in the annual reports of the New York State engineer and surveyor and the State of New York Conservation Commission.

Gage.—Staff; read once daily. Comparisons of gage readings indicate that the zero of the gage at Burlington is at practically the same elevation as that of the gage at Fort Montgomery, namely, 92.50 feet above mean sea level.

Extremes of stage.—Maximum stage recorded during year: 7.5 feet, May 1. Minimum stage recorded: 0.50 foot at various times during October, 1913.

Maximum stage recorded 1907–1914: 8.20 feet, April 7, 1913. Minimum stage recorded for same period: −0.25 foot, December 4, 1908.

Cooperation.—Gage heights furnished through the courtesy of Mr. D. A. Loomis, general manager of the Champlain Transportation Co.

Daily gage height, in feet, of Lake Champlain River at Burlington, Vt., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.50	0.80	1.05	.....	.....	.....	3.52	7.50	4.50	2.52	1.55	1.03
2	.50	.....	1.05	1.32	1.17	.....	3.80	7.45	4.38	2.50	.....	1.05
3	.55	.80	1.08	1.32	1.17	.....	4.00	.....	4.29	2.50	1.48	1.05
4	.....	.80	1.10	.....	1.15	.....	4.12	7.30	4.22	.....	1.48	1.08
5	.60	.78	1.10	1.28	1.15	1.65	.....	7.28	4.16	2.43	1.47	1.10
6	.63	.78	1.15	1.28	1.10	.....	4.21	7.24	4.02	2.43	1.43	.....
7	.65	.80	.....	1.25	1.05	.....	4.26	7.18	.....	2.38	1.42	1.10
8	.65	.80	1.15	1.25	.....	.....	4.34	7.12	3.90	2.38	1.42	1.08
9	.65	.....	1.18	1.25	.....	1.80	4.55	7.05	3.78	2.32	.....	1.06
10	.63	.80	1.20	1.22	.....	.....	4.90	.....	3.65	2.30	1.37	1.06
11	.62	.82	1.20	.....	.....	.....	4.99	6.95	3.60	2.30	1.36	1.04
12	.....	.82	1.20	1.22	.....	.....	.....	6.88	3.55	.....	1.36	1.03
13	.60	.85	1.20	1.20	.....	.....	5.13	6.78	3.48	2.24	1.33	.....
14	.60	.85	.....	1.20	.....	.....	5.18	6.60	.....	2.22	1.32	1.00
15	.60	.85	1.20	1.20	.....	.....	5.20	6.55	3.30	2.18	1.32	1.00
16	.62	.....	1.20	.....	.....	1.68	5.24	6.50	3.22	2.16	.....	1.00
17	.62	.87	1.22	1.20	.....	1.80	5.32	.....	3.15	2.16	1.29	.95
18	.63	.87	1.22	.....	.....	.....	5.38	6.30	3.03	2.16	1.25	.95
19	.....	.90	1.25	1.19	.....	.....	.....	6.08	2.90	.....	1.21	.90
20	.65	.90	1.25	1.19	.....	2.10	5.74	5.82	2.78	2.13	1.17	.....
21	.65	.92	.....	1.18	.....	.....	6.35	5.72	.....	2.13	1.16	.87
22	.65	.92	1.25	1.18	.....	.....	6.73	5.60	2.68	2.12	1.12	.87
23	.65	.....	1.28	1.18	.....	.....	6.98	5.50	2.65	2.12	.....	.87
24	.65	.92	1.30	1.18	.....	2.17	6.98	.....	2.62	1.94	1.08	.85
25	.65	.....	.....	.....	.....	.....	6.95	5.25	2.58	.....	1.05	.85
26	.....	.95	1.30	1.17	.....	2.22	.....	5.16	2.55	1.72	1.03	.85
27	.70	.95	1.30	1.17	.....	2.30	7.05	5.08	2.55	1.61	1.00	.....
28	.75	.98	.....	1.17	.....	2.60	7.10	4.90	.....	1.60	1.00	.83
29	.80	1.00	1.32	1.17	.....	.....	7.20	4.75	2.55	1.59	1.00	.82
30	.80	.....	1.32	1.18	.....	3.12	7.35	4.60	2.52	.....	.....	.82
31	.80	.....	1.32	1.18	.....	3.40	.....	.....	.....	.....	1.03	.....

NOTE.—The lake was frozen completely over Feb. 13. The thickest ice recorded was 16 inches Mar. 16 and 23. No information as to date on which lake opened. Ice was reported 4½ inches thick Apr. 6.

WINOOSKI RIVER AT MONTPELIER, VT.

Location.—At a point opposite Green Mount Cemetery, about a mile downstream from the covered wooden highway bridge in Montpelier. Dog River enters from the left about three-eighths of a mile downstream, and Worcester Branch of Winooski River enters from the right about 1¼ miles upstream. Prior to June 16, 1914, station was located at highway bridge.

Drainage area.—420 square miles (approximate).

Records available.—May 19, 1909, to September 30, 1914.

Gage.—Gurley 7-day graph water-stage recorder on right bank about 100 feet above buildings of caretaker of cemetery; installed July 4, 1914. Prior to June 16, 1914, chain gage on highway bridge; June 16 to July 3, 1914, staff gage at new site.

Discharge measurements.—Made from cable 250 feet above the water-stage recorder or by wading. Measurements at original site made from bridges or by wading.

Channel and control.—Control for the gage at new location sharply defined by a rock outcrop about 500 feet downstream. Control section for gage at highway bridge formed by reef of rocks about 200 feet downstream.

Extremes of discharge.—Maximum stage recorded during year: 13.8 feet (chain gage) on afternoon of April 20; discharge not computed. Minimum stage recorded during year: 2.77 feet (water-stage recorder) at 5 a. m., August 13; discharge, 17 second-feet.

Elevations of high water marked by the caretaker of the cemetery on a barn near the new gage site were determined by leveling in July, 1914, as follows: High water of February 15, 1908, 16.6 feet; April 14, 1909, 15.1 feet; April 7, 1912, 17.3 feet.

Winter flow.—Discharge relation affected by ice.

Regulation.—Operation of the plant of the Colton Manufacturing Co. causes decided diurnal fluctuation in discharge at low stages. Fluctuations in discharge of Worcester Branch are also apparent at this station.[1]

Accuracy.—Mean daily discharge not determinable from two gage readings a day owing to large diurnal fluctuations. Estimates based on continuous gage-height record considered good, and the discharge corresponding to two gage readings a day taken from continuous gage record, from July 4 to September 30, is given to provide means of comparing the old record with the new.

Discharge measurements of Winooski River at Montpelier, Vt., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 23[a]	R. S. Barnes	7.86	2,760	July 1	C. S. DeGolyer	3.86	257
25[a]	do	7.38	2,580	1	do	3.92	268
27[b]	do	7.85	3,170	2	do	4.19	361
May 15	C. S. DeGolyer	5.07	592	19	do	3.00	39.1
16	do	4.99	574	21	do	3.63	170
29	do	4.46	311				

[a] Measurement made from highway bridge; conditions unfavorable for good results.
[b] Made from railroad bridge.

NOTE.—Gage heights corresponding to measurements made previous to July 1 refer to chain gage at highway bridge. Gage heights corresponding to measurements beginning July 1, refer to gage at new location. All measurements, except those of Apr. 23, 25, and 27, were made by wading. Results of measurements July 2, 19, and 21, are of doubtful accuracy.

[1] See Pierce, C. H., Conditions requiring the use of automatic gages in obtaining records of stream flow: U. S. Geol. Survey Water-Supply Paper 375-F, p. 139, fig. 30, 1915.

Gage height, in feet, and discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914.

[Chain gage at highway bridge.]

Day.	October.				November.				December.			
	A. M.		P. M.		A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	3.8	109	3.85	121	4.4	290	4.3	254	4.35	272	4.45	309
2	3.9	133	4.0	160	4.1	189	4.0	160	4.35	272	4.35	272
3	3.4	37	3.3	25	4.3	254	4.4	290	4.35	272	4.4	290
4	4.1	189	4.2	220	4.2	220	4.3	254	4.45	309	4.55	348
5	4.0	160	3.9	133	4.3	254	4.35	272	4.5	328	4.45	309
6	3.6	68	3.7	87	4.3	254	4.3	254	4.35	272	4.25	237
7	3.7	87	3.65	78	4.3	254	4.2	220	4.15	204	4.25	237
8	3.7	87	3.8	109	4.15	204	4.3	254	4.65	389	5.05	595
9	3.8	109	3.9	133	4.2	220	4.3	254	4.75	432	4.6	368
10	3.85	121	4.0	160	4.3	254	4.3	254	4.45	309	4.45	309
11	4.0	160	4.0	160	4.15	204	4.05	174	4.4	290	4.45	309
12	3.95	146	4.0	160	4.05	174	4.1	189	4.45	309	4.45	309
13	4.0	160	4.0	160	4.15	204	4.15	174	4.45	309	4.45	309
14	4.3	254	4.4	290	4.25	237	4.45	309	4.4	290	4.45	309
15	4.3	254	4.3	254	4.75	432	4.35	272	4.45	309	4.4	290
16	4.2	220	4.3	254	4.15	204	4.05	174	4.35	272	4.35	272
17	4.1	189	4.0	160	4.15	204	4.25	237	4.25	237	4.3	254
18	3.8	109	3.9	133	4.25	237	4.25	237	4.25	237	4.4	290
19	3.5	51	3.6	68	4.35	272	4.55	348	4.35	272	4.45	309
20	4.3	254	4.4	290	5.05	595	5.6	960	4.35	272	4.35	272
21	5.0	565	5.2	690	5.15	688	4.75	432	4.15	204	4.0	160
22	4.75	432	4.7	410	4.55	348	4.45	309	4.45	309	4.55	348
23	4.8	455	4.9	505	4.15	204	4.25	237	4.35	272	4.3	254
24	4.9	505	5.0	565	4.35	272	4.45	309	4.25	237	4.35	272
25	5.0	565	5.05	595	4.35	272	4.4	290	4.25	237	4.25	237
26	5.1	625	5.1	625	4.25	237	4.25	237	4.25	237	4.3	254
27	5.0	565	5.1	625	4.1	189	4.05	174	4.45	309	4.55	348
28	4.8	455	4.7	410	4.05	174	4.25	237	4.55	348	4.6	368
29	4.6	368	4.65	389	4.25	237	4.35	272	4.45	309	4.45	309
30	4.6	368	4.55	348	4.15	204	4.05	174	4.55	348	4.55	348
31	4.4	290	4.5	328								

Gage height, in feet, and discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	March.				April.				May.			
	A. M.		P. M.		A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1					6.0	1,300	6.1	1,390				
2					7.0	2,260	7.1	2,360	6.9	2,160	6.8	2,060
3					6.2	1,480	6.1	1,390	6.9	2,160	6.6	1,860
4					5.7	1,040	5.8	1,120	6.9	2,160	6.6	1,860
5					5.7	1,040	5.4	820	7.0	2,260	7.0	2,260
6					5.0	565	5.1	625	6.8	2,060	6.6	1,860
7					5.1	625	5.1	625	6.4	1,660	6.3	1,570
8					6.5	1,760	7.0	2,260	6.1	1,390	5.9	1,210
9					8.1	3,460	8.2	3,570	5.8	1,120	5.5	890
10					7.5	2,800	7.1	2,360	5.5	890	5.5	890
11					6.8	2,060	6.7	1,960	5.3	755	5.25	722
12					7.5	2,800	8.1	3,460	5.25	722	5.1	625
13					7.0	2,260	6.7	1,960	5.35	788	5.3	755
14					6.7	1,960	6.7	1,960	5.3	755	5.2	690
15	4.2	220	4.3	254	6.7	1,960	6.7	1,960	5.1	625	4.95	535
16	4.4	290	4.6	368	6.7	1,960	6.5	1,760	4.95	535	4.7	410
17	4.8	455	5.1	625	6.9	2,160	7.8	3,130	4.65	389	4.7	410
18	4.9	505	4.6	368	7.8	3,130	8.0	3,350	4.65	389	4.7	410
19	4.5	328	4.6	368	9.0	4,500	11.7	.....	4.7	410	4.65	386
20	4.6	368	4.65	389	13.4	.....	13.8	.....	4.7	410	4.65	389
21	4.9	505	4.7	410	13.0	.....	11.6	.....	4.7	410	4.65	389
22	4.6	368	4.8	455	8.6	4,020	8.4	3,790	4.65	389	4.55	348
23	4.65	389	4.7	410	8.1	3,460	7.9	3,240	4.7	410	4.3	254
24	4.9	505	4.6	368	7.5	2,800	7.3	2,580	4.45	309	4.35	272
25	4.7	410	4.5	328	7.5	2,800	7.2	2,470	4.55	348	4.5	328
26	4.65	389	5.0	565	7.2	2,470	7.4	2,690	4.5	328	4.5	328
27	6.2	1,480	6.9	2,160	7.7	3,020	7.9	3,240	4.45	309	4.5	328
28	7.1	2,360	7.2	2,470	8.1	3,460	7.9	3,240	4.5	328	4.3	254
29	6.9	2,160	6.4	1,660	8.2	3,570	.....	.....	4.4	290	4.5	328
30	6.0	1,300	6.2	1,480	.....	.....	.....	.....	4.15	204	4.1	189
31	5.7	1,040	5.8	1,120	.....	.....	.....	.....	4.2	220	4.05	174

Gage height, in feet and discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	June.				July.			
	A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	4.2	220	4.4	290	3.76	229	3.90	279
2	4.3	254	4.35	272	4.05	343	4.2	416
3	4.2	220	4.2	220	4.2	416	4.1	366
4	4.4	290	4.5	328	3.81	246	3.74	223
5	4.9	505	4.7	410	3.62	187	3.68	204
6	4.5	328	4.15	204	3.86	264	3.87	268
7	4.1	189	4.1	189	3.86	264	3.89	275
8	4.3	254	4.4	290	3.81	246	4.05	343
9	4.3	254	4.7	410	3.86	264	3.90	279
10	4.2	220	4.2	220	3.93	291	3.90	279
11	4.1	189	4.15	204	3.89	275	3.70	210
12	4.1	189	4.2	220	3.32	113	3.40	131
13	4.2	220	4.1	189	3.67	201	3.67	201
14	3.20	15	3.80	109	3.20	86	3.83	253
15	4.0	160	4.2	220	3.77	232	3.55	168
16	3.45	143	3.74	223	3.71	213	3.42	136
17	2.99	48	3.72	216	3.67	201	3.30	108
18	3.08	63	3.77	232	3.80	242	.....	.....
19	3.30	108	3.73	220	.....	.....	.....	.....
20	3.38	126	3.75	226	.....	.....	3.77	232
21	3.61	184	3.71	213	3.50	155	3.75	226
22	3.56	171	3.76	229	3.56	171	3.57	173
23	3.44	141	3.77	232	3.58	176	3.66	198
24	3.30	108	3.81	246	3.50	155	3.68	204
25	3.66	198	3.80	242	3.65	196	3.52	160
26	3.14	74	3.66	198	3.25	97	2.80	21
27	3.44	141	3.66	198	3.30	108	3.63	190
28	3.11	68	.....	.....	3.40	131	3.67	201
29	3.36	122	3.62	187	3.63	190	3.50	155
30	3.34	117	3.70	210	3.68	204	3.71	213
31	.....	.....	.....	.....	3.68	204	3.68	204

Gage height, in feet, and discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	August.				September.			
	A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	3.52	160	3.55	168	3.98	312	3.90	279
2	3.39	129	2.82	24	3.88	272	3.79	239
3	3.50	155	3.66	198	3.88	272	3.81	246
4	3.66	198	3.67	201	3.87	268	3.89	275
5	3.65	196	3.64	193	3.87	268	.....	.....
6	3.66	198	3.66	198	.....	.....	.....	.....
7	3.65	196	3.63	190	.....	.....	.....	.....
8	3.62	187	3.50	155	.....	.....	.....	.....
9	2.81	22	2.77	17	.....	.....	.....	.....
10	3.53	163	3.50	155	.....	.....	3.93	291
11	3.48	150	3.42	136	3.50	155	3.90	279
12	3.57	173	3.35	120	3.71	213	3.73	220
13	3.51	158	3.50	155	3.08	63	3.06	59
14	3.42	136	3.37	124	3.73	220	3.81	246
15	3.43	138	3.35	120	3.50	155	3.64	193
16	3.10	66	2.81	22	3.72	216	3.74	223
17	3.10	66	3.35	120	3.79	239	3.70	210
18	3.14	74	3.45	143	3.58	176	3.70	210
19	3.40	131	3.68	204	3.65	196	3.57	173
20	3.00	49	3.65	196	2.81	22	2.81	22
21	3.50	155	3.76	229	3.60	181	3.54	165
22	3.40	131	3.88	272	3.42	136	3.57	173
23	3.65	196	3.46	145	3.55	168	3.65	196
24	3.85	260	3.80	242	3.72	216	3.68	204
25	3.71	213	3.50	155	3.60	181	3.41	133
26	3.78	236	3.55	168	3.89	275	3.78	236
27	3.30	108	3.35	120	3.50	155	3.20	86
28	3.05	58	3.67	201	3.77	232	3.90	279
29	3.00	49	3.77	232	3.95	300	3.72	216
30	.....	.....	.....	.....	3.48	150	3.81	246
31	.....	.....	4.05	343	.....	.....	.....	.....

NOTE.—Gage read at about 8.30 a. m. and 4.30 p. m. Chain gage on highway bridge read until June 15; staff gage at new station read June 16 to July 3; after that date two readings a day were taken from automatic gage record for comparison. Discharge determined as follows: Oct. 1 to June 15, from a fairly well defined rating curve; June 16 to Sept. 30, from a well-defined rating curve. The discharge estimates given in the above table correspond to the observed gage heights and do not represent the mean discharge for the day.

Mean daily discharge, in second-feet, of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914.

[New gage.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		260	104	198	16	171	95	43	101
2		391	56	171	17	158	99	52	104
3		406	76	153	18	148	136	76	86
4		232	86	160	19	173	134	63	99
5		193	70	158	20	184	133	70	34
6		198	72	158	21	207	104	99	66
7		196	68	158	22	226	74	165	59
8		160	108	157	23	195	74	176	78
9		181	43	157	24	190	64	165	104
10		204	51	157	25	220	131	106	82
11		160	49	155	26	168	42	78	148
12		110	54	155	27	160	63	66	108
13		155	76	84	28	162	63	97	165
14		124	66	141	29	165	70	117	143
15		108	72	120	30	176	90	234	131
					31		108	352	

NOTE.—Water-stage recorder installed July 4. From June 16 to July 3 several readings a day on staff gage at location of new gage were used to determine mean daily discharge. Discharge determined from rating curve well defined between 30 and 1,000 second-feet; discharge interpolated July 19, Aug. 30, and Sept. 5–10, when recorder was not operating.

Monthly discharge of Winooski River at Montpelier, Vt., July 4 to Sept. 30, 1914.

[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.		
June 16–30	226	148	180	0.429	0.24	B.
July	406	42	147	.350	.40	A.
August	352	43	97.1	.231	.27	A.
September	198	34	126	.300	.33	B.

WORCESTER BRANCH OF WINOOSKI RIVER AT MONTPELIER, VT.

Location.—A short distance below the plant of the Lane Manufacturing Co. at Montpelier, and about half a mile above confluence of Worcester Branch with Winooski River.

Drainage area.—Not measured.

Records available.—May 15, 1909, to September 30, 1914.

Gage.—Vertical staff fastened to a stone wall and tree about 100 feet below the plant.

Discharge measurements.—Made from steel highway bridge about 300 feet below gage, or by wading at low stages.

Channel and control.—Channel covered with bowlders and gravel; probably somewhat shifting. Gage heights apparently affected by backwater from Winooski River at high stages.

Extremes of discharge.—Maximum stage recorded during year: 10.3 feet, April 20; data insufficient for estimating discharge. Minimum stage recorded: 0.0 foot, June 19 and 23; discharge, zero.

Winter flow.—Discharge relation affected by ice.

Regulation.—The distribution of flow during the day is affected by operation of power plant just above station.

Accuracy.—Several rating curves have been used; apparently impossible to develop one rating curve for all stages owing to shifting of the channel and the varying effect of backwater from Winooski River. Mean daily stage not determinable from two gage readings a day owing to diurnal fluctuations caused by power plants above. A study of the continuous records obtained by means of a portable recording gage June 18 to July 2, 1914, indicates that the errors in computing daily discharge from the mean of two gage readings a day varied from +144 per cent to —60 per cent. Gage readings and the corresponding discharge published in the following tables show in a general way the variations in flow during the year.

Discharge measurements of Worcester Branch of Winooski River at Montpelier, Vt., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	R. S. Barnes	3.21	520	May 16	C. S. DeColyer	1.59	[a] 89
27	do	3.40	632	29	do	1.44	68
May 15	C. S. DeGolyer	1.62	[a] 108	July 1	do	.82	3.9

[a] Considerable fluctuation in stage during this measurement.

NOTE.—Measurements of Apr. 25 and 27 made from highway bridge below gage; others made by wading.

Gage height, in feet, and discharge, in second-feet, of Worcester Branch of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914.

[S. A. Luke, observer.]

Day.	October.				November.				December.			
	A. M.		P. M.		A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	0.8	2.5	1.1	22	1.2	32	1.4	54	1.1	22	1.5	66
2	.8	2.5	.8	2.5	.....	.....	[a] 1.1	22	1.3	43	1.6	79
3	.8	2.5	.9	7.5	1.2	32	1.2	32	1.5	66	1.9	127
4	.8	2.5	.9	7.5	1.1	22	1.4	54	1.7	94	1.7	94
5	.....	.....	[a].9	7.5	1.1	22	1.3	43	1.6	79	1.6	79
6	1.0	14	1.1	22	1.1	22	1.25	38	1.4	54	1.5	66
7	.8	2.5	1.1	22	1.1	22	1.2	32	.....	.....	[a] 1.3	43
8	.8	2.5	1.0	14	1.1	22	1.25	38	2.2	187	2.3	210
9	.8	2.5	1.0	14	1.1	22	1.3	43	1.7	94	1.75	102
10	.8	2.5	1.0	14	1.8	110	1.9	127	1.4	54	1.7	94
11	.8	2.5	.9	7.5	1.3	43	1.5	66	1.35	48	1.6	79
12	.....	.....	[a].9	7.5	1.3	43	1.5	66	1.3	43	1.5	66
13	1.1	22	1.2	32	1.2	32	1.5	66	1.3	43	1.55	72
14	1.1	22	1.4	54	1.15	27	1.4	54	.....	.....	[a] 1.4	54
15	1.15	27	1.25	38	1.1	22	1.4	54	1.4	54	1.5	66
16	1.0	14	1.1	22	1.1	22	1.1	22	1.3	43	1.5	66
17	1.0	14	1.2	32	1.1	22	1.3	43	1.2	32	1.3	43
18	.9	7.5	1.0	14	1.1	22	1.2	32	1.2	32	1.5	66
19	.....	.....	[a].8	2.5	1.1	22	1.25	38	1.3	43	1.5	66
20	1.4	54	1.45	60	3.1	418	2.8	335	1.2	32	1.5	66
21	2.0	145	1.5	66	2.3	210	2.0	145	.....	.....	[a] 1.2	32
22	1.6	79	1.8	110	1.7	94	1.7	94	1.2	32	1.35	48
23	1.4	54	1.8	110	1.55	72	1.5	66	1.3	43	1.4	54
24	1.2	32	1.4	54	1.4	54	1.6	79	1.1	22	1.35	48
25	1.2	32	2.6	283	1.3	43	1.5	66	1.15	27	1.2	32
26	2.1	165	2.3	210	1.3	43	1.4	54	1.2	32	1.3	43
27	2.5	258	2.2	187	1.0	14	1.0	14	1.1	22	1.3	43
28	1.7	94	1.6	79	1.0	14	1.4	54	.....	.....	[a] 1.2	32
29	1.3	43	1.5	66	1.05	18	1.4	54	1.2	32	1.5	66
30	1.3	43	1.5	66	.....	.....	[a] 1.0	14	1.2	32	1.4	54
31	1.2	32	1.45	60	.....	.....	.....	.....	1.3	43	1.5	66

[a] On Sunday usually one gage reading, between 2 and 5 p. m.

Gage height, in feet, and discharge, in second-feet, of Worcester Branch of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	January.				March.				April.			
	A. M.		P. M.		A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	1.3	43	1.5	66	.....	.....	.....	.....	2.4	290	2.8	415
2	1.35	48	1.5	66	.....	.....	.....	.....	3.2	570	3.0	490
3	1.3	43	1.55	72	.....	.....	.....	.....	2.5	320	2.7	380
4	.....	.....	1.35	48	.....	.....	.....	.....	2.1	205	2.5	320
5	1.3	43	1.6	79	.....	.....	.....	.....	2.0	182	2.2	230
6	1.4	54	1.2	32	.....	.....	.....	.....	1.8	136	2.1	205
7	1.3	43	1.55	72	.....	.....	.....	.....	1.8	136	1.8	136
8	1.25	38	1.5	66	.....	.....	.....	.....	2.1	205	2.6	350
9	1.25	38	1.6	79	.....	.....	.....	.....	5.2	.....	4.2	.....
10	1.3	43	1.6	79	.....	.....	.....	.....	3.6	730	3.3	610
11	.....	.....	1.4	54	.....	.....	.....	.....	2.8	415	3.1	530
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.7	775
13	.....	.....	.....	.....	.....	.....	.....	.....	2.7	380	3.0	490
14	.....	.....	.....	.....	.....	.....	.....	.....	2.8	415	3.0	490
15	.....	.....	.....	.....	.....	.....	.....	.....	2.7	380	3.2	570
16	.....	.....	.....	.....	.....	.....	.....	.....	3.2	570	3.0	490
17	.....	.....	.....	.....	.....	.....	.....	.....	2.7	380	3.3	610
18	.....	.....	.....	.....	.....	.....	.....	.....	3.1	530	4.2	.....
19	.....	.....	.....	.....	.....	.....	.....	.....	5.1	.....	7.6	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	10.2	.....	10.3	.....
21	.....	.....	.....	.....	.....	.....	.....	.....	8.9	.....	5.6	.....
22	.....	.....	.....	.....	.....	.....	.....	.....	5.8	.....	3.5	690
23	.....	.....	.....	.....	.....	.....	.....	.....	3.4	650	3.3	610
24	.....	.....	.....	.....	.....	.....	.....	.....	3.3	610	3.0	490
25	.....	.....	.....	.....	2.5	320	2.8	415	3.4	650	2.9	450
26	.....	.....	.....	.....	2.8	415	3.0	490	3.0	490	3.0	490
27	.....	.....	.....	.....	3.0	490	3.2	570	3.3	610	3.5	690
28	.....	.....	.....	.....	3.4	650	3.0	490	4.1	.....	4.0	910
29	.....	.....	.....	.....	2.7	380	2.9	450	4.5	.....	5.0	.....
30	.....	.....	.....	.....	2.8	415	2.6	350	4.6	.....	4.9	.....
31	.....	.....	.....	.....	2.4	290	2.7	380	.....	.....	.....	.....

Gage height, in feet, and discharge, in second-feet, of Worcester Branch of Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	May.				June.				July.			
	A. M.		P. M.		A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	3.4	650	3.1	530	0.9	8	1.4	62	1.1	25	1.25	41
2	3.0	490	2.9	450	1.0	16	1.4	62	1.3	48	1.95	170
3	.....	.....	3.0	490	1.0	16	1.2	35	1.65	106	1.7	115
4	3.4	650	3.0	490	1.0	16	1.45	70	1.35	55	1.4	62
5	3.5	690	3.2	570	1.25	41	1.55	87	1.35	55	1.25	41
6	3.1	530	3.0	490	1.2	35	1.0	16	1.25	41	1.1	25
7	2.9	450	2.5	320	.....	.....	.9	8	1.05	20	1.3	48
8	2.5	320	2.4	290	.9	8	1.4	62	1.0	16	1.4	62
9	2.4	290	2.2	230	1.0	16	1.2	35	1.1	25	1.45	70
10	.....	.....	2.1	205	1.0	16	1.2	35	1.2	35	1.45	70
11	2.0	182	1.8	136	.9	8	1.25	41	1.2	35	1.15	30
12	1.8	136	1.9	159	.7	0	1.4	62	.....	.....	1.05	20
13	1.8	136	1.75	126	.8	3	1.05	20	1.0	16	1.4	62
14	1.7	115	1.75	126	.....	.....	.8	3	1.0	16	1.45	70
15	1.5	78	1.7	115	.9	8	.8	3	.9	8	1.2	35
16	1.6	96	1.4	62	.7	0	1.0	16	.8	3	1.2	35
17	.....	.....	1.35	55	.8	3	1.0	16	.8	3	1.25	41
18	1.4	62	1.65	106	.9	8	.8	3	1.4	62	.8	3
19	1.3	48	1.5	78	.7	0	.0	0	.....	.....	.8	3
20	1.2	35	1.45	70	.8	3	.7	0	.8	3	1.15	30
21	1.2	35	1.4	62	.....	.....	.7	0	.85	5.5	1.25	41
22	1.2	35	1.4	62	.75	1.5	1.0	16	.8	3	1.1	25
23	1.1	25	1.35	55	.7	0	.0	0	.8	3	1.15	30
24	.....	.....	1.2	35	.7	0	1.45	70	.8	3	1.1	25
25	1.25	41	1.5	78	.75	1.5	1.0	16	1.25	41	.8	3
26	1.2	35	1.4	62	.75	1.5	1.45	70	.....	.....	.8	3
27	1.2	35	1.4	62	.7	0	.75	1.5	.8	3	1.1	25
28	1.1	25	1.3	48	.....	.....	.75	1.5	.8	3	1.05	20
29	1.1	25	1.4	62	.75	1.5	1.45	60	.7	0	1.3	48
30	1.0	16	1.0	16	.8	3	1.3	48	1.1	25	1.15	30
31	.....	.....	.9	8	.....	.....	.....	.....	.8	3	1.05	20

Gage height, in feet, and discharge, in second-feet, of Worcester Branch af Winooski River at Montpelier, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	August.				September.			
	A. M.		P. M.		A. M.		P. M.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	1.2	35	0.8	3	1.55	87	1.5	78
2	.....	.....	.85	5.5	1.6	96	1.45	70
3	.85	5.5	.9	8	1.2	35	1.35	55
4	.7	0	1.0	16	1.35	55	1.45	70
5	.8	3	1.2	35	1.45	70	.9	8
6	.8	3	1.1	25	.....	.....	1.3	48
7	.8	3	1.1	25	1.5	78	1.7	115
8	1.15	50	.8	3	1.7	115	1.95	170
9	.....	.....	.75	1.5	1.5	78	1.55	87
10	.75	1.5	1.1	25	1.35	55	1.45	70
11	.7	0	1.05	20	1.35	55	1.45	70
12	.8	3	1.0	16	1.45	70	1.25	41
13	.75	1.5	.9	8	.....	.....	1.2	35
14	.85	5.5	1.1	25	1.2	35	1.45	70
15	1.1	25	.8	3	1.1	25	1.2	35
16	.....	.....	.8	3	1.0	16	1.15	30
17	.75	1.5	1.05	20	.9	8	1.15	30
18	.8	3	1.1	25	.85	5.5	1.1	25
19	.88	5.5	1.1	25	1.45	70	.85	5.5
20	.8	3	1.1	25	.....	.....	.8	3
21	.8	3	1.1	25	.8	3	1.05	20
22	1.15	30	1.05	20	.8	3	1.1	25
23	.....	.....	1.1	25	.85	5.5	1.15	30
24	1.1	25	1.15	30	.8	3	1.25	41
25	.9	8	1.15	30	.8	3	1.15	30
26	.95	12	1.1	25	1.35	55	1.1	25
27	.8	3	1.1	25	.....	.....	1.25	41
28	.85	5.5	1.1	25	1.3	48	1.45	70
29	1.1	25	1.5	78	1.35	55	1.45	70
30	.....	.....	.....	.....	1.15	30	1.3	48
31	2.1	205	1.7	115	.....	.....	.....	.....

NOTE.—Gage read about 6.50 a. m. and 4.30 p. m., except Sundays and holidays, when reading was made about 2.30 p. m. Discharge determined from two rating curves, the period of applicability of the second beginning Mar. 25, 1914, when the ice went out.

DOG RIVER AT NORTHFIELD, VT.

Location.—At highway bridge 200 feet west of the Central Vermont Railroad and about three-fifths of a mile southwest of Northfield. Union Brook flows into Dog River a short distance below station.

Drainage area.—49[a] square miles (measured on post-route map).

Records available.—May 14, 1909, to September 30, 1914. Records May 14, 1909, to August 23, 1910, at lower highway bridge; August 23, 1910, to September 30, 1914, at present location.

Gage.—Vertical staff attached to highway bridge.

Discharge measurements.—Made from the highway bridge at high stages and by wading at low stages.

Channel and control.—Gravel and alluvial deposits.

Extremes of discharge.—Maximum stage recorded during year: 7.0 feet at 8.30 a. m. April 19, and 8.30 a. m. and 6 p. m. April 20; discharge, 2,000 second-feet. Minimum stage recorded: 0.80 foot at 8.30 a. m. and 5 p. m. September 23, and 8.30 a. m. September 24, 1913; discharge, 5.0 second-feet.

[a] Revised since last published.

Maximum stage recorded 1909–1914: 8.5 feet at 10 p. m. March 25, 1913; discharge, 3,400 second-feet. Minimum stage recorded: 0.60 foot at 6 p. m. September 10, and 8. 30 a. m. September 11, 1913; discharge, 3.0 second-feet.

Winter flow.—Discharge relation affected by ice.

Regulation.—Small diurnal fluctuation caused by operation of a mill above station.

Accuracy.—Rating curve used prior to August 12, 1914, very well defined; at some subsequent date control became obstructed by stones and débris and a new rating curve was made necessary. The effect of the diurnal fluctuation on determination of discharge was studied by means of a portable water-stage recorder during July and August, 1914. Although the daily discharge estimates obtained from mean of two gage readings a day were found to be occasionally in error the mean discharge from July 18 to August 12 as determined from two daily gage readings was only 1.3 per cent in error.

Discharge measurements of Dog River at Northfield, Vt., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 26	R. S. Barnes	3.62	364
July 17	C. S. DeGolyer	1.06	[a] 14.5

[a] Made by wading.

Daily discharge, in second-feet, of Dog River at Northfield, Vt., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5	52	57	39	82	215	496	39	30	13	15
2	28	48	67	39	99	223	353	30	28	10	14
3	25	40	94	39	77	192	353	48	44	12	23
4	15	35	82	38	71	223	312	62	28	9.2	26
5	10	46	72	39	68	163	312	72	53	7.9	14
6	5	39	62	48	77	62	293	39	44	7.7	13
7	4	39	65	43	67	149	231	39	35	7.3	12
8	4	44	117	39	57	312	200	40	24	8.9	18
9	7	117	136	38	56	312	185	39	24	7.6	14
10	8	177	88	31	57	443	156	31	24	7.6	12
11	5	105	75	.....	55	419	142	24	24	7.2	14
12	21	75	75	.....	62	583	123	18	21	7.8	11
13	28	77	69	.....	62	231	142	18	18	6.7	9.8
14	28	69	73	.....	57	274	136	18	13	8.2	8.8
15	23	65	72	.....	53	312	123	15	10	7.9	11.5
16	15	62	62	.....	62	239	111	23	15	9.0	9.3
17	12	62	65	.....	94	293	99	28	34	8.6	7.2
18	8	56	62	.....	111	419	92	19	65	9.6	8.3
19	12	67	52	.....	82	1,850	88	18	26	8.1	7.2
20	97	149	53	.....	75	2,010	81	31	17	9.6	7.0
21	99	94	55	.....	142	756	78	19	14	28	7.0
22	75	79	50	.....	86	496	72	17	12	20	6.0
23	35	78	31	.....	67	396	67	12	15	11	5.0
24	30	75	41	.....	62	396	57	9.0	21	7.8	11
25	79	65	48	.....	62	583	55	15	16	11	12
26	149	58	50	.....	49	682	57	9.0	11	9.8	11
27	156	52	57	.....	312	396	49	10	9.9	8.1	14
28	76	62	50	.....	177	443	44	10	8.5	9.3	14
29	82	57	48	.....	223	838	39	21	12	33	18
30	78	52	39	.....	192	496	41	28	26	55	17
31	65	.....	39	.....	215	.....	38	.....	17	26	.....

NOTE.—Daily discharge July 17 to Aug. 13 determined from portable automatic-gage records; for other periods, from mean of two gage readings a day. A new rating curve, based on measurements made in October and November, 1914, has been used for obstructed channel condition which was assumed as beginning Aug. 18.

Monthly discharge of Dog River at Northfield, Vt., for the year ending Sept. 30, 1914.

[Drainage area, 49 square miles.[a]]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	156	4	41.4	0.845	0.97	B.
November	177	35	69.9	1.43	1.60	A.
December	136	31	64.7	1.32	1.52	A.
March	312	49	97.1	1.98	2.28	A.
April	2,010	62	480	9.80	10.93	B.
May	496	38	149	3.04	3.50	A.
June	72	9.0	26.7	.545	.61	A.
July	65	8.5	23.8	.486	.56	A.
August	55	6.7	12.7	.259	.30	C.
September	26	5.0	12.3	.251	.28	C.

[a] Revised.

LAMOILLE RIVER AT CADYS FALLS, VT.

Location.—One-fourth mile below power plant of Morrisville Electric Light & Power Co., at place formerly known as Cadys Falls, a mile south of Hyde Park, and about 2 miles downstream from village of Morrisville. Hyde Park and Morrisville are stations on St. Johnsbury & Lake Champlain Railroad.

Drainage area.—Not measured.

Records available.—September 4, 1913, to September 30, 1914. A station maintained from July 28, 1909, to July 13, 1910, at highway bridge just below the power plant at Cadys Falls, was replaced by station at Johnson, Vt., July 14, 1910, to December 31, 1913. (See Water-Supply Paper 284.)

Gage.—Gurley water-stage recorder in wooden shelter on right bank.

Discharge measurements.—Made from cable, or at low stages by wading.

Channel and control.—Bed, smooth gravel; well-defined control 500 feet downstream from gage.

Extremes of discharge.—Maximum stage recorded during year: 10.53 feet at 4 a. m., April 20; discharge, 7,250 second-feet. Minimum stage recorded: 1.82 feet at 2 a. m., August 17; discharge, 50 second-feet.

Maximum stage recorded 1913–14: 10.53 feet, April 20, 1914; discharge, 7,250 second-feet. Minimum stage recorded for same period: 1.82 feet, August 17, 1914; discharge, 50 second-feet.

Winter flow.—Discharge relation affected by ice during extremely cold weather.

Regulation.—The large amount of storage in the pond above the power plant and the fluctuations caused by operation of plant affect in a large degree the natural flow of the river at this point.

Accuracy.—Results good.

Discharge measurements of Lamoille River at Cadys Falls, Vt., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 31	C. S. DeGolyer	2.54	251	Mar. 29	W. S. Easterly	[b] 4.02	931
Jan. 3	W. S. Easterly	2.18	[a] 135	30	do	4.10	944
17	do	2.25	[a] 131	Apr. 21	R. S. Barnes	8.30	4,350
Feb. 2	do	2.37	[a] 180	21	do	7.93	4,130
25	C. C. Covert	2.56	[a] 160	22	do	6.06	2,320
Mar. 20	W. S. Easterly	2.73	320	22	do	5.80	2,090
29	do	4.02	904	May 28	C. S. DeGolyer	2.31	175

[a] Discharge relation affected by ice. [b] Gage height somewhat uncertain.

Daily discharge, in second-feet, of Lamoille River at Cadys Falls, Vt., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	99	237	211	.....	770	1,590	.....	.....	112	158
2	80	164	302	.....	920	1,380	.....	.....	80	137
3	84	230	383	.....	720	1,420	.....	.....	94	129
4	112	237	428	.....	582	1,380	.....	.....	94	137
5	92	220	305	.....	484	1,280	.....	.....	89	121
6	87	182	262	.....	416	1,520	.....	.....	89	102
7	82	167	185	.....	383	950	.....	.....	84	254
8	89	188	462	.....	475	695	.....	.....	102	230
9	80	149	367	.....	1,620	770	.....	.....	75	230
10	82	240	294	.....	1,120	.....	.....	.....	84	185
11	89	234	244	.....	1,030	.....	.....	.....	115	164
12	99	195	176	.....	1,160	.....	.....	.....	129	143
13	123	161	220	.....	950	.....	.....	.....	102	112
14	146	167	195	.....	870	462	.....	.....	102	110
15	115	149	195	.....	950	395	.....	.....	97	112
16	94	132	211	.....	1,060	324	.....	.....	78	110
17	87	110	201	.....	920	324	.....	.....	78	99
18	78	135	207	.....	1,590	.....	.....	.....	97	110
19	60	140	161	.....	3,920	.....	.....	.....	143	110
20	164	578	167	324	6,650	.....	.....	.....	110	92
21	347	403	158	313	5,020	.....	.....	.....	102	92
22	217	298	161	298	2,510	.....	.....	107	158	99
23	192	217	140	258	2,020	.....	.....	102	110	112
24	.....	244	126	207	1,660	.....	.....	102	94	161
25	.....	248	149	240	1,730	.....	.....	123	94	176
26	.....	237	152	265	1,800	.....	.....	115	82	140
27	.....	188	123	672	1,870	.....	.....	132	82	167
28	.....	161	99	950	2,260	176	.....	137	97	251
29	.....	176	.....	1,000	2,860	164	.....	161	188	214
30	.....	143	.....	922	2,600	140	.....	161	309	188
31	.....	.....	.....	770	.....	121	.....	152	204	.....

NOTE.—Daily discharge determined from a well-defined rating curve and based upon gage height, recorded by a Gurley electric printing gage prior to July 21. After that date gage heights obtained by a Gurley 7-day graph gage. Discharge estimated, because of ice, from gage heights, discharge measurements, and climatic records, as follows: Dec. 29–31, 1913, 110 second-feet; Jan. 1–31, 1914, 124 second-feet; Feb. 1–28, 112 second-feet; and Mar. 1–19, 268 second-feet. Discharge May 10–13 estimated 560 second-feet; May 18–27, 200 second-feet.

Monthly discharge of Lamoille River at Cadys Falls, Vt., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	.....	60	188	B.
November	578	110	211	A.
December	462	99	213	A.
January	.....	.....	124	C.
February	.....	.....	112	C.
March	1,000	.....	365	B.
April	6,650	383	1,700	A.
May	1,590	121	556	C.
August	309	75	112	B.
September	254	92	148	B.

MISSISQUOI RIVER NEAR RICHFORD, VT.

Location.—At highway bridge 3 miles downstream from Richford, about 3 miles below mouth of North Branch and 2 miles above mouth of Trout River.

Drainage area.—300 square miles.

Records available.—May 22, 1909, to September 30, 1914.

Gage.—Chain fastened to downstream side of the bridge. Prior to June 26, 1911, the gage was just below plant of the Sweat-Comings Co., in Richford.

Discharge measurements.—Made from downstream side of bridge at high stages; by wading, at low stages.

Channel and control.—Channel deep; bed composed of gravel, bowlders, and rock ledge. Control, about half a mile downstream, not well defined. At high stages control is at dam at Enosburg Falls.

Extremes of discharge.—Maximum stage recorded during year: 16.15 feet at 6.30 p. m., April 20; discharge, computed from extension of rating curve, approximately 9,600 second-feet. Minimum stage recorded: 4.45 feet at 6.30 a. m., August 29; discharge, 30 second-feet.

Maximum stage recorded 1909–1914: 16.7 feet at 8.30 a. m., March 26, 1913; approximate discharge, computed from extension of rating curve, 10,200 second-feet. Minimum flow past the gage at the old station practically zero at various times, owing to water being held back by the mills.

Winter flow.—Discharge relation affected by ice.

Regulation.—The operation of mills and power plants above the station cause large variations during the day, especially at low stages.

Accuracy.—Rating curve well defined; mean daily discharge not determinable from two gage readings a day owing to sudden diurnal fluctuations in stage. Discharge corresponding to each gage reading is published to show general character of flow.

The following discharge measurement was made by C. S. De Golyer:

May 27, 1914: Gage height, 5.46 feet; discharge, 244 second-feet.

Gage height, in feet, and discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1914.

[P. Sloan, observer.]

Day.	October.						November.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	6.40	4.85	86	5.45	4.7	61	6.50	5.9	395	.....	.....	.....
2	6.45	4.65	54	5.30	4.85	86	7.30	5.75	330	4.20	5.7	310
3	7.00	5.7	310	4.50	5.7	310	6.55	5.6	275	4.30	5.6	275
4	6.45	5.85	372	.....	.....	.....	7.05	5.55	258	4.50	5.85	372
5	7.15	5.5	240	5.15	5.3	182	6.25	6.05	472	4.45	6.0	445
6	6.45	5.2	157	5.10	5.3	182	6.30	5.85	372	4.40	5.7	310
7	6.40	5.0	114	4.50	5.0	114	6.50	5.65	292	4.45	5.5	240
8	6.40	5.0	114	5.10	4.75	69	6.45	5.55	258	.....	.....	.....
9	6.35	4.95	104	4.45	5.1	135	7.30	5.5	240	4.45	5.3	182
10	6.45	5.0	114	5.15	5.1	135	7.10	5.15	146	4.30	5.2	157
11	7.00	4.9	95	.....	.....	.....	7.15	5.1	135	4.20	5.4	210
12	7.30	5.0	114	5.10	5.2	157	7.35	5.6	275	4.35	5.45	225
13	6.30	5.0	114	4.50	4.85	86	7.00	5.5	240	4.15	5.55	258
14	6.35	5.15	146	4.50	5.05	124	7.10	5.45	225	4.20	5.55	258
15	7.10	5.1	135	4.45	5.2	157	7.35	5.5	240	.....	.....	.....
16	6.35	5.0	114	4.50	5.1	135	7.40	5.35	196	4.10	5.4	210
17	7.50	4.95	104	4.45	4.85	86	7.20	5.25	170	4.40	5.1	135
18	6.40	4.95	104	.....	.....	.....	7.35	5.4	210	4.35	5.35	196
19	7.15	5.0	114	4.45	4.95	104	7.15	5.4	210	4.20	5.6	275
20	7.10	5.05	124	4.50	5.0	114	7.10	7.6	1,540	4.30	8.4	2,200
21	6.30	6.0	445	5.10	6.25	590	7.20	8.1	1,940	4.10	7.6	1,540
22	6.35	6.2	560	4.50	6.0	445	7.35	6.8	950	.....	.....	.....
23	6.30	5.8	350	5.10	5.5	240	7.15	6.45	718	4.20	7.2	1,240
24	6.50	5.4	210	4.40	5.45	225	8.05	7.1	1,160	4.30	7.0	1,090
25	6.25	5.4	210	.....	.....	.....	7.50	6.7	880	4.15	6.6	815
26	6.50	6.25	590	4.30	6.8	950	7.10	6.4	685	4.20	6.4	685
27	6.50	7.0	1,090	4.45	7.1	1,160	7.15	6.15	530	4.30	6.2	560
28	6.35	7.0	1,090	5.00	6.6	815	8.15	5.9	395	4.10	5.6	275
29	6.30	6.6	815	4.45	6.4	685	7.15	5.8	350	.....	.....	.....
30	6.50	6.25	590	4.40	6.2	560	8.10	5.8	350	4.15	5.75	330
31	6.40	6.1	500	4.10	6.1	500	.....	.....	.....	.....	.....	.....

Day.	December.					
	A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	7.25	5.8	350	4.10	6.0	445
2	7.15	5.95	420	4.20	5.8	350
3	7.45	6.2	560	3.50	7.0	1,090
4	7.20	6.8	950	4.10	6.8	950
5	7.50	6.6	815	4.15	6.6	815
6	7.10	6.3	620	.....	.....	.....
7	7.55	6.0	445	3.50	6.25	590
8	7.30	7.1	1,160	4.10	7.2	1,240
9	8.10	6.6	815	4.15	6.8	950
10	7.40	7.0	1,090	3.45	7.4	1,380
11	8.10	7.1	1,160	4.00	7.5	1,460
12	7.45	7.9	1,780	3.30	8.4	2,200
13	7.35	8.5	2,280	.....	.....	.....
14	.....	.....	.....	.....	.....	.....
15	.....	.....	.....	.....	.....	.....

Gage height, in feet, and discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	April.						May.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1							7.00	9.0	2,730	4.15	8.6	2,370
2							7.00	8.1	1,940			
3	8.45	8.6	2,370	4.30	8.2	2,030	7.30	7.9	1,780	4.00	8.1	1,940
4	8.15	7.8	1,700				6.45	8.1	1,940	4.30	8.1	1,940
5	9.00	7.5	1,460	4.15	7.5	1,460	7.00	8.2	2,030	4.00	8.3	2,120
6	8.00	7.2	1,240	4.45	7.2	1,240	7.00	8.3	2,120	4.15	8.3	2,120
7	7.00	7.0	1,090	4.00	6.8	950	7.30	8.1	1,940	4.30	7.9	1,780
8	7.30	6.6	815	5.00	6.9	1,020	7.00	7.6	1,540	4.30	7.4	1,380
9	7.30	9.2	2,910	4.30	9.1	2,820	6.45	7.1	1,160			
10	7.30	8.9	1,640	4.45	8.9	2,640	7.30	7.0	1,090	4.30	6.9	1,020
11	7.45	9.0	2,730				6.45	6.7	880	5.00	6.6	815
12	7.30	9.6	3,270	4.30	9.3	3,000	6.45	6.5	750	4.30	6.4	685
13	7.45	8.3	2,120	4.00	8.3	2,120	6.45	6.25	650	4.00	6.2	560
14	7.15	7.9	1,780	4.15	7.7	1,620	6.45	6.05	472	4.30	6.05	472
15	7.15	7.4	1,380	5.00	7.8	1,700	6.45	6.0	445	4.30	5.95	420
16	7.45	7.9	1,780	4.30	8.1	1,940	7.00	5.85	372			
17	7.00	8.4	2,200	4.30	8.9	2,640	6.45	5.7	350	4.30	5.7	310
18	7.30	9.3	3,000				6.30	5.65	292	4.30	5.6	275
19	7.30	11.1	4,680	4.30	12.3		6.00	5.55	257	4.30	5.55	257
20	7.15	15.0		6.30	16.2		6.00	5.55	257	4.30	5.5	240
21	7.15	15.5		7.00	14.2		6.00	5.45	225	4.30	5.5	240
22	7.30	13.1		5.00	12.3		6.00	5.45	225	4.30	5.45	225
23	7.15	10.4	4,000	4.15	9.8	3,450	6.30	5.45	225			
24	7.15	8.9	2,640	4.30	9.2	2,910	8.00	5.45	225	4.45	5.45	225
25	7.00	9.0	2,730				6.00	5.40	210	5.00	5.35	196
26	7.45	8.7	2,460	3.15	8.8	2,550	6.00	5.25	170	4.30	5.20	157
27	7.00	9.1	2,820	4.30	9.3	3,000	5.45	5.10	135	7.30	5.10	135
28	7.15	9.2	2,910	4.00	9.7	3,360	5.45	5.00	114	5.00	5.00	114
29	7.15	9.9	3,540	4.30	10.4	4,000	5.45	5.10	135	4.30	5.00	114
30	7.00	10.7	4,280	5.00	9.9	3,540	6.00	5.05	124			
31												

Gage height, in feet, and discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	June.						July.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	6.00	4.95	104	5.30	4.90	95	5.45	5.10	135	5.00	5.15	146
2	6.00	4.80	77	4.00	4.90	95	6.15	5.25	170	4.30	5.30	182
3	6.00	5.10	135	4.00	5.00	114	6.00	5.40	210	4.30	5.55	257
4	6.15	5.00	114	4.30	5.00	114	6.00	5.5	240	.....	.....	.....
5	6.00	5.00	114	4.30	4.90	95	7.30	5.30	182	4.30	5.25	170
6	6.15	4.95	104	.....	.....	.....	6.00	5.10	135	4.45	5.10	135
7	7.30	4.85	86	4.30	4.90	95	6.00	5.00	114	4.30	5.10	135
8	6.15	4.95	104	4.45	4.90	95	6.15	5.8	350	5.00	5.95	420
9	6.00	4.90	95	4.30	4.90	95	6.15	5.9	395	4.30	5.75	330
10	6.00	4.90	95	4.30	4.85	86	6.15	5.5	240	4.30	5.35	196
11	5.45	4.85	86	4.00	4.85	86	6.30	5.15	146	.....	.....	.....
12	6.00	4.80	77	5.00	4.80	77	7.30	5.0	114	4.45	5.00	114
13	6.00	4.80	77	.....	.....	.....	6.15	4.90	95	4.45	4.85	86
14	7.15	4.75	69	4.30	4.70	61	6.00	4.85	86	5.00	4.80	77
15	6.00	4.80	77	5.00	4.75	69	6.00	4.80	77	4.00	4.75	69
16	5.45	4.70	61	4.00	4.70	61	6.15	4.75	69	4.30	4.70	61
17	6.30	4.80	77	4.30	4.80	77	6.00	4.70	61	4.30	4.70	61
18	6.00	4.90	95	4.30	4.95	104	6.30	4.90	95	.....	.....	.....
19	6.00	4.85	86	4.45	4.90	95	7.30	5.10	135	4.30	5.10	135
20	6.15	4.85	86	.....	.....	.....	6.30	5.00	114	7.00	4.90	95
21	7.30	4.85	86	4.30	4.80	77	6.00	4.90	95	4.45	4.80	77
22	6.00	4.70	61	4.45	4.70	61	6.00	4.75	69	3.00	4.75	69
23	5.45	4.80	77	4.30	4.70	61	6.15	4.60	47	4.00	4.60	47
24	5.45	4.95	104	4.00	4.90	95	6.15	4.70	61	4.30	4.75	69
25	5.45	4.85	86	4.00	4.80	77	6.00	4.70	61	.....	.....	.....
26	6.15	4.80	77	4.30	4.80	77	8.00	4.60	47	3.30	4.65	54
27	6.00	4.80	77	.....	.....	.....	6.00	4.65	54	5.30	4.70	61
28	7.30	4.75	69	5.00	4.70	61	6.15	4.65	54	5.00	4.75	69
29	5.45	4.85	86	4.30	4.85	86	6.00	4.70	61	4.30	4.70	61
30	6.00	4.95	104	4.30	5.00	114	6.00	4.60	47	4.30	4.65	54
31	.....	.....	.....	.....	.....	.....	6.00	4.60	47	4.00	4.70	61

Gage height, in feet, and discharge, in second-feet, of Missisquoi River near Richford, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	August.						September.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1							7.00	5.9	395	4.30	5.7	310
2	7.30	4.90	95	5.15	4.80	77	7.30	6.1	500	4.45	6.0	445
3	6.00	4.80	77	5.00	4.80	77	6.30	6.0	445	4.00	6.1	500
4	5.45	4.70	61	5.00	4.70	61	7.30	6.3	620	5.00	6.2	560
5	5.45	4.70	61	5.30	4.80	77	7.00	6.2	560	4.30	6.1	500
6	6.30	4.60	47	5.30	4.70	61	8.00	6.1	500	5.30	6.1	500
7	6.30	4.70	61	5.30	4.70	61	7.00	6.2	560	4.30	6.3	620
8	6.00	4.90	95				7.30	6.3	620	4.00	6.3	620
9	7.30	4.70	61	5.30	4.70	61	7.30	6.35	652	4.00	6.25	590
10	6.00	4.80	77	5.00	4.80	77	7.00	6.1	500	4.30	6.0	445
11	6.00	4.80	77	5.30	4.90	95	7.15	5.9	395	4.30	5.8	350
12	6.15	4.90	95	5.30	4.90	95	7.45	5.6	275			
13	6.00	4.80	77	5.45	4.75	69	8.30	5.40	210	4.30	5.40	210
14	6.00	4.70	61	5.30	4.70	61	6.45	5.20	157	4.30	5.20	157
15	6.15	4.70	61				7.30	5.30	182	4.30	5.20	157
16	7.45	4.60	47	5.00	4.55	41	7.00	5.20	157	4.30	5.10	135
17	6.00	4.50	35	4.30	4.60	47						
18	6.15	4.65	54	5.00	4.65	54	7.00	5.10	135	4.30	5.00	114
19	6.15	4.75	69	5.00	4.80	77	7.30	4.90	95			
20	6.00	4.80	77	5.00	4.85	86	8.30	4.70	61	5.00	4.70	61
21	6.00	4.80	77	4.30	4.90	95	9.00	4.60	47	4.30	4.60	47
22	6.00	5.10	135				7.00	4.60	47	4.30	4.55	41
23	7.45	4.90	95	4.30	4.90	95	7.30	4.55	41	4.00	4.50	35
24	6.00	4.85	86	5.40	4.80	77	7.30	4.50	35	4.30	4.70	61
25	6.00	4.70	61	4.30	4.80	77	7.30	4.90	95	5.00	4.95	104
26	6.30	4.65	54	4.15	4.65	54	8.00	4.90	95			
27	6.30	4.50	35	4.15	4.60	47	7.30	5.10	135	4.45	5.30	182
28	6.30	4.50	35	4.00	4.50	35	6.45	5.5	240	4.30	5.6	275
29	6.30	4.45	30				7.00	5.55	257	4.30	5.5	240
30	7.30	5.7	310	4.30	6.2	560	7.15	5.4	210	5.00	5.35	196
31	6.30	6.8	950	4.45	6.4	685						

CLYDE RIVER AT WEST DERBY, VT.

Location.—Just below the plant of the Newport Electric Light Co. at West Derby.

Drainage area.—150 square miles (measured on post-route map.)

Records available.—May 25, 1909, to September 30, 1914.

Gage.—Chain attached to a tree about 85 feet below the plant; read morning and evening to quarter-tenths; gage reader, E. C. Rogers. Prior to August 18, 1910, staff gage in two sections; low-water section about 75 feet below the plant; high-water section nailed to tree to which chain gage is now attached.

Discharge measurements.—Made from highway bridge about half a mile below the gage; at low stages by wading.

Channel and control.—Channel rough; fall of river near and below station very rapid.

Extremes of discharge.—Maximum stage recorded during year: 4.3 feet at 6.35 a. m., April 22; discharge, 2,080 second-feet. Minimum stage recorded: 1.60 feet 7.30 p. m., July 30, and 4.50 p. m., August 17; discharge, 17 second-feet.

Maximum stage recorded 1909–1914: 5.8 feet during high water of March 25–30, 1913 (determined by engineers of Geological Survey from high-water marks). Corresponding discharge approximately 6,300 second-feet. Minimum stage recorded for same period: 1.60 feet at 5.45 p. m., August 25, 1913, 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 during extremely cold weather.

Regulation.—Two dams at West Derby operated under same management. At upper dam part of water is used by a paper mill, and remainder is delivered to the water wheels at the electric plant through a steel penstock. At ordinary stages all the flow from the second dam is diverted to the wheels in the power house.

Accuracy.—Rating curve fairly well defined. Owing to fluctuations caused by operation of power plants, mean daily discharge not determinable from two gage readings a day. Discharge corresponding to each gage reading is published to show general characteristics of flow.

No discharge measurements were made during the year ending September 30, 1914, but measurements made in November, 1914, indicated that there was no change in the rating curve.

Gage height, in feet, and discharge, in second-feet, of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1914.

Day.	October.						November.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	8.00	1.90	59	5.20	1.92	63	7.35	2.52	231	4.10	2.50	223
2	6.30	1.90	59	5.00	2.00	78	7.50	2.48	216	4.30	2.48	116
3	7.10	1.92	63	5.30	1.92	63	8.15	2.45	204	4.40	2.40	186
4	7.15	1.90	59	5.30	1.95	68	8.00	2.40	186	4.25	2.38	180
5	7.30	1.90	59	5.00	1.88	56	6.45	2.35	170	4.45	2.32	160
6	6.30	1.90	59	5.20	1.90	59	6.50	2.32	160	4.40	2.30	154
7	6.40	1.95	68	5.40	1.88	56	6.20	2.32	160	4.25	2.30	154
8	7.50	1.88	56	5.15	1.90	59	.....	.....	.....	4.15	2.28	148
9	6.10	1.85	50	3.50	1.68	26	7.50	2.25	140	4.30	2.25	140
10	7.35	1.85	50	5.30	1.98	74	7.50	2.25	140	4.40	2.25	140
11	6.40	1.88	56	5.20	1.90	59	6.35	2.22	132	4.25	2.20	126
12	7.45	1.92	63	3.45	1.92	63	7.35	2.20	126	4.30	2.25	140
13	6.50	1.90	59	5.10	1.95	68	6.30	2.22	132	4.10	2.25	140
14	7.50	1.90	59	5.10	1.90	59	.....	.....	.....	4.20	2.22	132
15	6.05	1.98	74	5.00	1.92	63	7.35	2.20	126	4.15	2.15	113
16	7.30	2.02	82	5.05	2.02	82	7.20	2.12	105	4.30	2.15	113
17	7.30	2.08	96	5.15	2.05	89	7.30	2.20	126	4.40	2.15	113
18	7.00	2.08	96	4.50	2.05	89	7.35	2.18	121	3.20	2.00	78
19	9.00	2.08	96	5.00	2.05	89	6.45	2.15	113	4.00	2.15	113
20	6.10	2.05	89	5.00	2.22	132	6.55	2.25	140	4.15	2.20	126
21	7.00	2.22	132	5.05	2.22	132	7.00	2.25	140	4.00	2.28	148
22	6.45	2.32	160	4.55	2.45	204	6.50	2.30	154	4.00	2.30	154
23	6.50	2.42	193	4.50	2.50	223	8.55	2.38	180	3.00	2.38	180
24	7.45	2.52	231	4.15	2.60	265	8.10	2.38	180	4.10	2.38	180
25	6.30	2.55	244	4.30	2.58	257	6.50	2.40	186	3.55	2.38	180
26	7.55	2.52	231	4.50	2.55	244	7.20	2.35	170	4.25	2.35	170
27	6.30	2.55	244	4.45	2.55	244	6.50	2.30	154	4.30	2.28	148
28	6.35	2.55	244	4.30	2.60	265	7.15	2.30	154	7.30	2.18	121
29	8.40	2.55	244	4.25	2.58	257	8.00	2.25	140	4.00	2.20	126
30	7.15	2.58	257	4.50	2.62	275	8.05	2.20	126	4.20	2.18	121
31	7.05	2.60	265	5.00	2.58	257	.....	.....	.....	.....	.....	.....

Gage height, in feet, and discharge, in second-feet, of Clyde River, West Derby, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	December.						January.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	7.25	2.20	126	4.00	2.18	121	7.30	2.30	154	3.45	2.30	154
2	7.45	2.20	126	7.30	2.15	113	7.35	2.28	148	.....	.....	.....
3	7.45	2.20	126	4.00	2.20	126	7.35	2.30	154	4.20	2.42	193
4	7.00	2.22	132	4.05	2.20	126	7.55	2.20	126	4.30	2.30	154
5	8.00	2.20	126	4.25	2.25	140	8.15	2.20	126	3.50	2.15	113
6	7.50	2.25	140	4.20	2.22	132	7.35	2.08	96	4.10	2.22	132
7	7.35	2.25	140	4.00	2.25	140	7.30	2.10	100	4.20	2.12	105
8	8.40	2.28	148	4.15	2.32	160	7.55	2.12	105	4.15	2.10	100
9	7.25	2.30	154	4.10	2.28	148	7.40	2.12	105	2.50	2.00	78
10	7.15	2.30	154	4.00	2.30	154	7.45	2.10	100	2.45	2.05	89
11	7.15	2.30	154	4.10	2.32	160	8.35	2.10	100	4.20	2.10	100
12	7.20	2.32	160	3.30	2.48	216	8.00	2.10	100	3.15	2.02	82
13	7.25	2.30	154	4.15	2.30	154	8.10	2.02	82	3.15	1.98	74
14	7.40	2.30	154	3.40	2.22	132	.....	.....	.....	4.10	2.00	78
15	7.15	2.30	154	4.00	2.20	126	8.50	2.15	113	4.15	1.92	63
16	8.15	2.22	132	3.25	2.20	126	7.45	2.12	105	3.35	1.98	74
17	8.00	2.20	126	4.10	2.20	126	7.30	2.10	100	3.10	2.02	82
18	7.45	2.20	126	4.15	2.20	126	.....	.....	.....	4.00	2.00	78
19	7.15	2.20	126	4.05	2.18	121	8.15	2.05	89	3.40	2.02	82
20	7.30	2.20	126	4.00	2.15	113	7.30	2.05	89	5.15	1.98	74
21	7.30	2.20	126	4.35	2.15	113	7.35	2.05	89	4.55	2.05	89
22	8.15	2.12	105	4.15	2.10	100	8.00	2.10	100	8.00	2.10	100
23	7.15	2.12	105	4.00	2.08	96	7.45	2.18	121	3.50	1.85	50
24	7.35	2.15	113	3.40	2.15	113	7.55	2.15	113	3.40	2.10	100
25	8.15	2.15	113	4.20	2.10	100	7.50	2.08	96	5.15	2.10	100
26	8.10	2.15	113	3.30	2.12	105	8.05	2.08	96	4.50	1.95	63
27	7.45	2.12	105	4.10	2.20	126	7.15	2.08	96	3.30	2.02	82
28	7.50	2.22	132	4.35	2.18	121	8.00	2.08	96	4.10	2.08	96
29	7.50	2.42	193	4.20	2.50	223	7.35	2.08	96	4.50	2.10	100
30	7.40	2.48	216	4.00	2.30	154	7.40	2.05	89	3.20	2.02	82
31	7.25	2.30	154	4.00	2.28	148	7.30	2.10	100	4.00	2.10	100

Gage height, in feet, and discharge, in second-feet, of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	February.						March.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	9.25	2.12	105	5.00	2.10	100	7.30	2.00	78	5.30	2.00	78
2	7.35	2.12	105	4.45	2.12	105	7.40	2.02	82	4.30	2.08	96
3	8.00	2.15	113	4.15	2.18	121	7.40	2.02	82	5.50	2.08	96
4	8.05	2.12	105	4.40	2.12	105	7.35	2.10	100	5.50	2.12	105
5	7.55	2.05	89	5.00	2.12	105	7.25	2.10	100	5.15	2.15	113
6	7.00	2.08	96	4.15	2.15	113	7.00	2.15	113	5.00	2.15	113
7	7.35	2.15	113	4.50	2.15	113	6.50	2.18	121	5.50	2.18	121
8	7.45	2.10	100	5.10	2.12	105	7.30	2.20	126	5.10	2.25	140
9	8.15	2.10	100	4.40	2.10	100	7.45	2.22	132	5.30	2.12	105
10	8.00	2.08	96	4.40	2.05	89	7.15	2.18	121	5.00	2.18	121
11	7.55	2.28	148	.....	.....	.....	6.55	2.18	121	5.15	2.15	113
12	7.15	2.18	121	4.30	2.15	113	7.55	2.15	113	5.40	2.10	100
13	8.00	2.12	105	4.30	2.10	100	7.55	2.12	105	5.30	2.08	96
14	7.05	2.10	100	3.30	2.02	82	6.40	2.10	100	4.50	2.10	100
15	8.10	2.08	96	4.50	2.05	89	8.10	2.12	105	5.45	2.12	105
16	7.05	2.05	89	4.20	1.92	63	7.10	2.12	105	5.15	2.18	121
17	7.05	2.02	82	.....	.....	.....	7.45	2.15	113	5.40	2.15	113
18	7.40	2.12	105	5.10	2.00	78	7.45	2.22	132	6.00	2.18	121
19	7.55	2.10	100	5.30	1.98	74	7.45	2.30	154	3.20	2.28	148
20	7.35	2.02	82	4.50	1.95	68	7.45	2.25	140	5.45	2.25	140
21	6.30	2.02	82	.....	.....	.....	6.30	2.25	140	6.00	2.28	148
22	7.45	2.02	82	5.40	1.98	74	8.00	2.28	148	5.00	2.28	148
23	7.30	2.00	78	4.50	1.95	68	7.15	2.25	140	5.40	2.25	140
24	7.30	2.02	82	4.45	1.98	74	7.35	2.22	132	5.30	2.18	121
25	7.35	2.02	82	5.40	2.00	78	7.20	2.20	126	5.15	2.22	132
26	7.05	2.00	78	5.00	1.98	74	7.30	2.20	126	5.30	2.28	148
27	7.15	2.02	82	4.50	1.95	68	.....	.....	.....	5.30	2.35	170
28	6.55	2.00	78	5.30	1.90	59	7.30	2.42	193	6.15	2.50	223
29	.....	.....	.....	.....	.....	.....	7.40	2.55	244	6.00	2.58	257
30	.....	.....	.....	.....	.....	.....	7.30	2.60	265	6.20	2.60	265
31	.....	.....	.....	.....	.....	.....	7.00	2.62	275	5.00	2.68	303

Gage height, in feet, and discharge, in second-feet, of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	April.						May.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	7.55	2.70	313	5.15	2.70	313	7.30	3.70	1,200	6.50	3.70	1,200
2	7.00	2.75	340	6.10	2.78	357	7.10	3.70	1,200	6.15	3.55	1,020
3	7.45	2.78	357	5.30	2.72	324	9.40	3.50	970	5.00	3.50	970
4	7.25	2.72	324	6.10	2.65	289	8.00	3.40	860	6.10	3.40	860
5	7.45	2.68	303	5.40	2.62	275	7.50	3.40	860	5.00	3.40	860
6	7.30	2.60	265	6.00	2.55	244	8.10	3.45	915	6.30	3.50	970
7	7.00	2.55	244	5.50	2.48	216	7.30	3.50	970	6.40	3.50	970
8	7.20	2.50	223	6.15	2.55	244	7.35	3.50	970	6.15	3.40	860
9	8.15	2.70	313	6.30	2.78	357	7.30	3.50	970	5.30	3.40	860
10	8.25	2.75	340	5.30	2.80	368	7.25	3.40	860	5.00	3.30	760
11	6.20	2.85	399	2.50	2.90	430	8.00	3.30	760	6.15	3.25	715
12	7.35	3.00	500	5.30	3.10	580	8.00	3.20	670	7.00	3.20	670
13	8.45	3.05	540	5.50	3.05	540	8.35	3.20	670	5.10	3.10	580
14	7.30	3.05	540	6.15	3.10	580	7.55	3.10	580	6.40	3.10	580
15	7.45	3.00	500	6.30	3.10	580	8.00	3.05	540	5.30	2.98	486
16	8.00	3.10	580	6.20	3.10	580	7.30	2.98	486	6.10	2.92	444
17	7.00	3.05	540	5.30	3.10	580	7.15	2.90	430	4.30	2.88	418
18	8.20	3.10	580	4.15	3.20	670	9.35	2.85	399	5.30	2.72	324
19	7.20	3.30	760	5.30	3.50	970	6.50	2.65	289	6.00	2.60	265
20	6.10	3.65	1,140	5.10	3.85	1,400	7.00	2.65	289	7.00	2.60	265
21	6.25	4.10	1,750	5.40	4.20	1,910	6.45	2.62	275	6.10	2.50	223
22	6.35	4.30	2,080	3.40	4.20	1,910	7.10	2.48	216	6.15	2.50	223
23	7.30	4.20	1,910	6.10	3.95	1,530	7.15	2.68	303	7.00	2.90	430
24	6.40	3.90	1,460	4.45	3.75	1,260	7.00	2.92	444	4.30	2.80	368
25	6.50	3.60	1,080	5.30	3.60	1,080	7.10	2.78	357	7.00	2.62	275
26	8.20	3.50	970	4.00	3.60	1,080	7.50	2.60	265	6.10	2.50	223
27	7.30	3.55	1,020	5.45	3.50	970	6.35	2.52	231	5.00	2.50	223
28	7.40	3.50	970	6.00	3.50	970	6.55	2.50	223	5.30	2.40	186
29	.....	.....	.....	4.40	3.60	1,080	7.15	2.50	223	6.00	2.38	180
30	7.40	3.70	1,200	5.30	3.75	1,260	8.50	2.42	193	6.10	2.40	186
31	.....	.....	.....	.....	.....	.....	7.15	2.40	186	5.10	2.35	170

Gage height, in feet, and discharge, in second-feet, of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	June.						July.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	8.35	2.35	170	6.00	2.25	140	7.55	2.08	96	5.30	2.02	82
2	8.00	2.32	160	5.45	2.25	140	7.20	2.08	96	6.50	2.10	100
3	7.15	2.35	170	5.30	2.22	132	6.30	2.10	100	6.20	2.08	96
4	8.15	2.30	154	4.20	2.30	154	7.20	2.10	100	6.40	2.05	89
5	7.20	2.30	154	4.30	2.25	140	7.15	2.10	100	6.30	2.05	89
6	6.45	2.25	140	4.45	2.28	148	8.20	2.10	100	6.15	2.05	89
7	4.15	2.25	140	5.30	2.28	148	7.35	2.08	96	7.00	2.08	96
8	7.30	2.25	140	5.20	2.20	126	7.30	2.10	100	6.30	2.08	96
9	8.10	2.22	132	5.30	2.15	113	7.40	2.10	100	5.15	2.05	89
10	7.30	2.20	126	5.15	2.12	105	7.10	2.10	100	6.10	2.00	78
11	7.50	2.18	121	4.00	2.12	105	6.55	2.08	96	6.00	2.02	82
12	7.20	2.12	105	6.10	2.05	89	.....	.....	.....	6.20	2.02	82
13	7.50	2.15	113	5.15	2.05	89	7.45	2.10	100	5.50	2.02	82
14	8.05	.....	.....	6.30	2.02	82	6.45	2.10	100	6.15	2.00	78
15	8.05	2.10	100	5.30	2.02	82	7.15	2.10	100	7.00	2.18	121
16	7.05	2.10	100	6.45	2.00	78	6.15	2.10	100	6.15	2.05	89
17	6.05	2.02	82	6.30	2.08	96	6.55	2.05	89	5.50	1.98	74
18	7.20	2.08	96	7.00	2.02	82	7.05	2.10	100	5.15	2.08	96
19	7.10	2.05	89	5.40	2.00	78	8.00	2.02	82	5.30	1.98	74
20	7.40	2.15	113	6.00	2.05	89	7.15	1.98	74	7.00	1.92	63
21	8.45	2.10	100	6.20	2.05	89	7.10	1.98	74	5.30	1.95	68
22	8.00	2.10	100	5.30	2.05	89	7.10	1.98	74	6.20	1.88	56
23	7.05	2.10	100	6.30	2.05	89	6.55	1.92	63	6.00	1.92	63
24	7.30	2.10	100	6.00	2.02	82	6.45	1.90	59	5.30	1.85	50
25	8.15	2.08	96	7.00	2.02	82	7.20	1.95	68	6.30	1.80	42
26	7.15	2.10	100	5.30	2.00	78	5.40	1.85	50	6.30	1.85	50
27	7.00	2.05	89	6.30	1.98	74	6.50	1.88	56	6.00	1.80	42
28	5.10	1.98	74	6.00	2.00	78	7.45	1.90	59	5.50	1.82	45
29	8.50	2.05	89	5.50	2.08	96	7.50	1.90	59	5.00	1.88	56
30	8.00	2.05	89	6.20	2.02	82	7.20	1.95	68	7.30	1.60	17
31	.....	.....	.....	.....	.....	.....	6.40	1.90	59	7.00	1.80	42

Gage height, in feet, and discharge, in second-feet, of Clyde River at West Derby, Vt., for the year ending Sept. 30, 1914—Continued.

Day.	August.						September.					
	A. M.			P. M.			A. M.			P. M.		
	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.	Time.	Gage height.	Discharge.
1	7.00	1.85	50	5.40	1.80	42	4.50	1.80	42	4.30	2.02	82
2	6.50	1.90	59	4.00	1.82	45	7.50	1.85	50	5.00	1.90	59
3	7.10	2.00	78	6.00	1.95	68	7.40	1.98	74	5.15	1.92	63
4	7.50	1.95	68	7.30	2.00	78	6.30	1.95	68	5.30	1.90	59
5	8.00	2.00	78	6.00	1.88	56	7.45	1.98	74	5.00	1.90	59
6	6.25	1.98	74	6.00	1.85	50	9.10	1.95	68	6.00	1.95	68
7	7.50	1.88	56	6.10	1.82	45	6.35	1.98	74	4.30	2.00	78
8	7.30	1.92	63	7.00	1.85	50	6.35	1.98	74	4.30	2.05	89
9	7.30	1.90	59	4.30	1.85	50	6.30	2.00	78	5.00	1.95	68
10	6.45	1.88	56	5.45	1.82	45	6.50	2.00	78	.....	.....	.....
11	.....	.....	.....	5.00	1.92	63	10.45	2.00	78	.....	.....	.....
12	7.15	1.90	59	3.30	1.75	35	7.45	1.98	74	.....	.....	.....
13	.....	.....	.....	6.30	1.82	45	7.45	2.00	78	5.45	1.92	63
14	7.50	1.90	59	5.45	1.85	50	8.10	1.95	68	5.00	1.92	63
15	7.10	1.90	59	6.30	1.95	68	7.10	1.95	68	5.15	1.90	59
16	7.00	1.88	56	7.00	1.85	50	6.30	1.95	68	4.30	1.85	50
17	7.10	1.92	63	4.50	1.60	17	8.10	1.90	59	5.30	1.82	45
18	.....	.....	.....	4.20	1.90	59	6.45	1.88	56	5.45	1.65	22
19	6.00	1.90	59	4.30	2.00	78	7.00	1.90	59	4.30	1.80	42
20	4.45	1.88	56	4.30	1.70	28	.....	.....	.....	6.00	1.82	45
21	5.00	1.85	50	4.20	1.95	68	6.35	1.88	56	5.10	1.80	42
22	5.10	1.90	59	4.25	2.10	100	8.00	1.88	56	5.20	1.80	42
23	5.00	1.90	59	4.30	1.90	59	6.30	1.88	56	5.00	1.82	45
24	4.50	1.90	59	4.30	1.85	50	7.40	1.90	59	6.00	1.82	45
25	4.40	1.85	50	4.40	1.90	59	7.20	1.92	63	5.10	1.88	56
26	4.45	1.80	42	6.05	1.80	42	7.00	1.90	59	5.30	1.85	50
27	4.50	1.78	39	4.20	1.90	59	8.00	1.95	68	5.30	1.95	68
28	5.15	1.78	39	6.00	1.85	50	6.35	1.95	68	3.45	1.92	63
29	5.15	1.88	56	4.45	1.95	68	6.30	1.92	63	5.00	1.92	63
30	5.15	1.90	59	4.35	1.88	56	6.30	1.95	68	4.40	2.00	78
31	5.05	1.85	50	4.30	1.95	68	.....	.....	.....	.....	.....	.....

MISCELLANEOUS MEASUREMENTS.

The results of discharge measurements made during 1914 at points other than regular stations, and a few miscellaneous measurements made prior to 1914 by the Fargo Engineering Co., of Jackson, Mich., are shown in the following table:

Miscellaneous measurements in St. Lawrence River drainage basin in 1914.

Lake Superior Basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
1914.				*Feet.*	*Sec.-ft.*
Feb. 23	White River	Bad River	White River crossing of M. St. P. & S. S. M. Railway.		130
24	do	do	500 feet below dam of White River Power Co., at Mason, Wis.		145

Lake Michigan Basin.

1909.[a]					
Sept. 13	Fletcher Creek	Manistee River	Mouth		6.5
15	Slagel Creek	do	do		43.7
15	Blind Creek	do	do		2.6
16	Sands Creek	do	do		12.1
16	Little Bear Creek	do	200 feet above mouth		7.9
16	Cedar Creek	do	100 feet above mouth		8.4
20	Manistee River	Lake Michigan	[b]		1,520
20	South Branch of Manistee River.	Manistee River			292
22	Pine Creek	do			29.8
23	Big Bear Creek	do	500 feet above mouth		128
23	Chief Creek	do	1,300 feet above mouth		8.4
1912.[a]					
Oct. 8	Manistee River	Lake Michigan	Highway bridge west of Sharon and below mouth of North Branch of Manistee River.		465
19	do	do	do		476
Nov. 11	do	do	do		542
1914.					
Jan. 7	Wolf River	Fox River	Immediately above mouth of Embarrass River, a short distance upstream from New London.		840

[a] Measurements made by engineers of Fargo Engineering Co., Jackson, Mich.
[b] "Junction gaging station" of the Fargo Engineering Co.

Tributary of St. Lawrence River.

Aug. 24	South Branch of Oswegatchie River.	Oswegatchie River	Talcville, N. Y.	[a] 4.0	77.0

[a] Reading of gage in tailrace; gage height of pond, 4.2 feet.

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

1885–1914

PART IV. ST. LAWRENCE RIVER BASIN

24017°—wsp 384—16——9

STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES, 1885-1914.

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, 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., Custom House.
Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., in care of Railroad Commission of Wisconsin.
St. Paul, Minn., Old Capitol Building.
Austin, Tex., Old Post Office Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Phoenix, Ariz., 417 Fleming Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 416 Couch Building.
San Francisco, Cal., 328 Custom House.
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 3,400 points in the United States, and the data obtained have been published in the reports tabulated below:

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

[A=Annual Report; B=Bulletin; 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 Sept., 1890.
12th A, pt. 2	....do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
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.

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

Report.	Character of data.	Year.
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[a]	do	1913.
WS 381 to 394[a]	do	1914.

[a] In preparation.

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

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

The following table gives, by years and drainage basins, the numbers of papers on surface-water supply published from 1899 to 1913. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data from 1902 to 1914 for any station in the area covered by Part III are published in Water-Supply Papers 83, 98, 128, 169, 205, 243, 263, 283, 303, 323, 353, and 383, which contain records for the Ohio River basin for those years.

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.

Numbers of water-supply papers containing results of stream measurements, 1899-1914.

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	[n] 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	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

[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.
[j] Rogue, Umpqua, and Siletz rivers only.

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 into Lake Superior from the United States are St. Louis, Ontonagon, Dead, and Carp rivers. Streams flowing into Lake Michigan are Escanaba, Menominee, Iron, Peshtigo, Oconto, Fox, St. Joseph, and Grand Rivers. Into Lake Erie flow Huron, St. Marys, Maumee, Sandusky, Black, and Cuyahoga rivers. Streams flowing into Lake Ontario are Genesee, Oswego, Salmon, and Black rivers. The St. Lawrence receives Oswegatchie, Raquette, Richelieu (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. xv–xvi.)

GAGING STATIONS.

NOTE.—Dash following a date indicates that station was being maintained September 30, 1914. 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.
- Dead River near Negaunee, Mich., 1902–3.
- Dead River at Forestville, Mich., 1898–1902.
- Carp River near Marquette, Mich., 1902–3.

Streams tributary to Lake Michigan:
- Escanaba River near Escanaba, Mich., 1903–
- Brule River (head of Menominee River) near Florence, Wis., 1914–
- Menominee River near Iron Mountain, Mich., 1902–1914.
- Menominee River at Lower Quinnesec Falls, Wis., 1898–99.
- Menominee River at Koss, Mich., 1902–1909; 1914.
- Menominee River below Koss, Mich., 1913–
  - Iron River near Iron River, Mich., 1900–1905.
  - Pine River near Florence, Wis., 1914–
  - Pike River at Amberg, Wis., 1914–
- Peshtigo River near Crivitz, Wis., 1906–1909.
- Peshtigo River at Crivitz, Wis., 1906.
- Oconto River near Gillett, Wis., 1906–1909; 1914–
- Oconto River at Stiles, Wis., 1906.
- Fox River at Omro, Wis., 1902–3.
- Fox River at Oshkosh, Wis., 1902.
- Fox River at Wrightstown, Wis., 1902–1904.
  - Wolf River at Keshena, Wis., 1907–1909; 1911–
  - Wolf River at White House Bridge, near Shawano, Wis., 1906–7.
  - Wolf River at Darrows Bridge, near Shawano, Wis., 1906.
  - Wolf River at New London, Wis., 1913–
  - Wolf River at Northport, Wis., 1905.
  - Wolf River at Winneconne, Wis., 1902–3.
    - West Branch of Wolf River at Neopit, Wis., 1911–
    - Little Wolf River near Royalton, Wis., 1914–
    - Little Wolf River near Northport, Wis., 1907–1910.
  - Fond du Lac River, West Branch (head of Fond du Lac River) at Fond du Lac, Wis., 1903.
    - East Branch of Fond du Lac River at Fond du Lac, Wis., 1903.
- Milwaukee River at Milwaukee, Wis., 1914–
- St. Joseph River at Mendon, Mich., 1902–1905.
- St. Joseph River near Buchanan, Mich., 1901–1906.
  - Fawn River at White Pigeon, Mich., 1903–4.
- Kalamazoo River near Allegan, Mich., 1901–1907.
  - Reeds Springs near Albion, Mich., 1904–1906.
- Grand River at North Lansing, Mich., 1901–1906.
- Grand River at Grand Rapids, Mich., 1901–
  - Crockery Creek at Slocums Grove, Mich., 1902–3.
  - Red Cedar River at Agricultural College, Mich., 1902–3.
- Muskegon River at Newaygo, Mich., 1901–1906.
- Manistee River near Sherman, Mich., 1903–
- Boardman River at Traverse City, Mich., 1904.

Streams tributary to Lake Huron:
- Thunder Bay River near Alpena, Mich., 1901–1908.
- Au Sable River near Lovells, Mich., 1908–
- Au Sable River at Bamfield, Mich., 1902–1913.
- Rifle River near Sterling, Mich., 1905–1908.
- Rifle River at Omer, Mich., 1902–3.
- 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–
- 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; 1908–1914.
- Genesee River at Rochester, N. Y., 1904–
  - Canaseraga Creek at Dansville, N. Y., 1910–1912.
    - Keshequa Creek near Sonyea, N. Y., 1910–1912.
  - Hemlock Lake at Hemlock, N. Y., 1894–1902.
    - Canadice Lake 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. (Oswego drainage), 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.
  - 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–
    - 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.

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 land 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.

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 a brief report on wells and springs 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.

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[1] For stream measurement reports, see tables on pp. IV, V, VI.

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.

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. 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. 144 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 portion 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. Ground 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; souces, 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 anayyses of waters. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effect of the constituents on waters for domestic and industrial and medicinal uses, methods of purification, chemical composition; many analyses and field assays.

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, pp. xx, 597, 73 pls. $2.10. Contains:

*Potable waters of the 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. CVIII to CXIII. 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, pp. x, 756, 102 plates. $1.75. Contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419–560, pls. xxxiii to xxxvii. 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; describes the mineral springs, and gives analyses of the waters; contains also tabulated lists of cities using surface waters for waterworks, 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. lxxi to lxxiii. 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. (See Finding lists, pp. 89, 118.)

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 the 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 a 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 val-

[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.

leys 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 published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also 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 utilzation of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*81. Chicago, Illinois-Indiana.

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 special, Wisconsin. 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, New York.[1] 5c.

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,

[1] Octavo edition out of stock.

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.

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, Kansas; 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, experiment 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.

32. Water resources of Puerto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. 15c.
Describes briefly topography, climate, rivers, irrigation methods, soils, forestation, water power, and transportation facilities.

*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.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.
Gives elevations and distance along rivers of the United States, also brief descriptions of many of the streams. Arrangement geographic. Many river profiles are scattered through other reports on surface waters in various parts of the United States.

*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.

77. The water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls. 10c.
Describes briefly the topography, geology, coral reefs, climate, soils, vegetation, forests, fauna of the island, the springs, running streams and wells, and discusses the utilization of the surface and underground waters.

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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 Merrimac, 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 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 meaduring 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 formation, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

115. River surveys and profiles made during 1903, by W. C. Hall and J. C. Hoyt. 1905. 115 pp., 4 pls. 10c.
Contains results of surveys made to determine location of undeveloped power sites.

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.

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.
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 technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:
Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by Mr. 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 United States in 1904, by E. C. Murphy. 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.
Scope indicated by title.

*155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.
Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906, 104 pp., 1 pl.
Gives account of work in 1905, lists 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 steam 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. 10c.
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 amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.
Scope indicated by amplification of title.

*196. Water supply of Nome region, Seward Peninsula, Alaska, 1906, by J. C. Hoyt and F. F. Henshaw. 1907. 52 pp., 6 pls. 15c.
Gives results of measurements of flow of Alaskan streams, discusses available water supply for ditch and pipe lines and power development; presents notes for investors.

*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.

*218. Water-supply investigations in Alaska, 1906–7 (Nome and Kougarok regions, Seward Peninsula; Fairbanks district, Yukon-Tanana region), by F. F. Henshaw and C. C. Covert. 1908. 156 pp., 12 pls. 25c.
Describes the drainage basins, gives results of observations at the gaging stations, and discusses the water supply of the ditches and pipe lines, and possibilities of development; gives also meteorological records.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1908. 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 steam pollution.

228. Water-supply investigations of the Yukon-Tanana region, Alaska, 1907 and 1908 (Fairbanks, Circle, and Rampart districts), by C. C. Covert and C. E. Ellsworth. 1909. 108 pp., 7 pls. 20c.
Describes the drainage basins; gives results of observations at gaging stations; discusses the water supplies of the ditches and pipe lines and possibilities of hydraulic development.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.
Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.
Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parke.

*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. 125 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, or 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.

280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

314. Surface water supply of Seward Peninsula, Alaska, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith, and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., 17 pls. 45c.
Contains results of work at gaging stations.

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.

318. Water resources of Hawaii, 1909–1911, by W. F. Martin and C. H. Pierce. 1913. 552 pp., 15 pls. 50c.

Describes the general features of the islands and gives results of measurements of streams and of observations of rainfall and evaporation; contains a gazetteer.

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., 32 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.

336. Water resources of Hawaii, 1912, by C. H. Pierceand G. K. Larrison. 1914. 392 pp. 50c.

Contains results of stream measurements on the islands in 1912.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls 15c.

Discusses methods of measuring the winter flow of streams.

342. Surface water supply of the Yukon-Tanana region, Alaska, by C. E. Ellsworth and R. W. Davenport. 1915. 343 pp., 13 pls.

Presents results of 6 years' observations of the water supply of the Yukon-Tanana region, discusses climate and precipitation, and gives station records.

*345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer.

(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.

(f) The discharge of Yukon River at Eagle, Alaska, by E. A. Porter and R. W. Davenport, pp. 67–77, pls. IV–V. 5c.

Describes briefly the location and size of the Yukon basin, the climatic conditions in the basin, and methods of collecting hydrometric data; compares run-off with precipitation, and gives table showing the discharge of some of the large rivers in the United States as compared with the discharge of the Yukon and the Nile.

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-water gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls.

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

373. Water resources of Hawaii, 1913, by G. K. Larrison. 1915. 190. pp.

Contains results of stream measurements on the islands in 1913.

375. Contributions to the hydrology of the United States, 1915. N. C. Grover, chief hydraulic engineer.

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

A paper presented at the conference of engineers of the Water Resources Branch in December, 1914.

(e) A method for correcting river discharge for changing stage, by B. E. Jones, pp. 117–130.

A paper presented at the conference of engineers of the Water Resources Branch in December, 1914.

(f) Conditions requiring the use of automatic gages in obtaining stream-flow records, by C. H Pierce, pp. 131–139.

A paper 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.

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. Chamberlain, pp. 125 to 173, pl. xxi. 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. 368–561, pls. cvii to cxlvi. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 pls. $1.85. Contains:

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

*Potable waters of the 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.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. iii and iv. 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 theoretical nature, pp. v, 958, 127 plates. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. vi to xvii. Discusses the amount of warer 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 sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

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

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, vii, 660 pp., 75 plates. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563–637, pls. lxiv to lxxv. Describes the topographic features of the boundary, the lake basin, and Rio San Juan; gives a brief résumé of the boundary dispute; discusses rainfall, temperature, and relative humidity, evaporation resources, and productions, the ship, railway, and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Juan and its tributaries.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. Pt. IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507–630, pls. xxxvii to l. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharges of many of the streams, rainfall, and evaporation tables at various points.

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. 265 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 communication 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.

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

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

Bulletins 264 and 298 discuss 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 by States, and detailed records selected as affording valuable stratigraphic information.

*319. Summary of the controlling conditions of artesian flows, by Myron L. Fuller, 1908. 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.