DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 385

SURFACE WATER SUPPLY OF THE UNITED STATES

1914

PART V. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS

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Prepared in cooperation with the States of Minnesota, Wisconsin, Iowa, and Illinois

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SURFACE WATER SUPPLY OF HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS, 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 authority implied in the organic law (20 Stat. L., p. 394), which contains the following paragraph:

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 of water supply for irrigation. Since the fiscal year ending June 30, 1895, successive sundry civil 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 18.

Measurements of stream flow have been made at about 3,400 points in the United States and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and the Hawaiian Islands. In July, 1914, 1,480 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in the regular water-supply papers from time to time.

PUBLICATIONS.

A report has been prepared for each year, embodying the stream-flow data collected during that year. Previous to 1911 the basis of publication was a calendar year. One volume of the report for 1911 (Pt. XII), three volumes for 1912 (Pts. X, XI, and XII), six volumes for 1913 (Pts, III, V, VIII, X, XI, and XII), and all the parts of the report for 1914 contain records for the year ending September 30. An index to the reports containing stream-flow measurements prior to 1904 has been published as Water-Supply Paper 119. Circulars are also available giving complete lists of the gaging stations maintained by the Survey to date and a list of the reports relating to the water resources of the country.

Gage heights and discharge measurements prior to 1901 were published in water-supply papers or bulletins and estimates of monthly discharge in annual reports. Since 1901 complete records of both classes of data have been published in water-supply papers. They are now being published in 14 parts, as shown in the following table:

Papers on surface water supply of the United States, 1914.

No.	Title.
381	North Atlantic basins.
382	South Atlantic and eastern Gulf of Mexico basins.
383	Ohio River basin.
384	St. Lawrence River basin.
385	Hudson Bay and Upper Mississippi River basins.
386	Missouri River basin.
387	Lower Mississippi River basin.
388	Western Gulf of Mexico basins.
389	Colorado River basin.
390	Great Basin.
391	Pacific drainage basins in California.
392–394	North Pacific drainage basins:
392	Pacific basins in Washington and Upper Columbia River basin.
393	Snake River basin.
394	Lower Columbia River and Pacific basins in Oregon.

A list of reports containing stream-flow data is presented in the following table:

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.
9th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332	do	1912.
WS 351 to 362[a]	do	1913.
WS 381 to 394[a]	do	1914.

[a] In preparation.

NOTE.—No data regarding stream flow are given in the fifteenth and seventeenth annual reports.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1914. As a rule the data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for any station in the area covered by Part I are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, and 351, which contain records for the New England streams from 1903 to 1913.

Numbers of water-supply papers containing results of stream measurements, 1899–1914.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific drainage basins.		
	North Atlantic basins (St. John River to York River).	South Atlantic and eastern Gulf basins (James River to the Mississippi).	Ohio River.	St. Lawrence River and Great Lakes.	Hudson Bay and upper Mississippi River.	Missouri River.	Lower Mississippi River.	Western Gulf of Mexico.	Colorado River.	Great Basin.	Pacific slope in California.	Pacific basins in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific basins in Oregon.
1899[a]	35	[b] 35, 36	36	36	36	[c] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900[g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[h] 98, [m] 99, 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [p] 125 [o] 126	[o] 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, [p] 166 [o] 167	[o] 167, 168	169	170	171	172	[k] 169, 173	174	175, [t] 177	176, [r] 177	177	178	178	[s] 177, 178
1906	[n] 201, [p] 202 [o] 203	[o] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	332	332	332
1913	351	352	353	354	355	356	357	358	359	360	361	362	362	362
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] Scioto 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 drainage 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] Gallatin 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] Susquehanna River to Yadkin River, inclusive.
[p] Hudson River to Delaware River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California, except Truckee and Carson river basins.
[s] Rogue, Umpqua, and Siletz rivers only.
[t] Below junction with Gila.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

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

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

Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., Capitol Building.
St. Paul, Minn., Old Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Phoenix, Ariz., Fleming Building.
Austin, Tex., Old Post Office Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., Federal Building.
Portland, Oreg., 416 Couch Building.
San Francisco, Cal., 505 Customhouse.
Los Angeles, Cal., Federal Building.
Honolulu, Hawaii, Kapiolani Building.

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, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in depth in inches, acre-feet, and millions of cubic feet. The principal terms used in this series of reports are second-feet, second-feet per square mile, run-off in inches, 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 (p. 12).

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

An "acre-foot" is equivalent to 43,560 cubic feet and 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 used to express quantities of water stored in reservoirs, most frequently in connection with studies of flood control.

The following terms used in these reports are not in common use.

"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 in second-feet per square mile.	Run-off 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 figure for one day by the number of days.

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

Discharge in second-feet.	Run-off in 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 figure for one day by the number of days.

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

Discharge in second-feet.	Run-off in 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	10.024	10.368	10.712
5.....	.4320	12.095	12.530	12.960	13.390
6.....	.5184	15.514	15.036	15.552	16.068
7.....	.6048	16.933	17.542	18.144	18.746
8.....	.6912	19.352	20.048	20.736	21.424
9.....	.7776	21.771	22.554	23.328	24.102

NOTE.—For part of a month multiply the figure for one day by the number of day.

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

Discharge in second-feet.	Run-off in 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.....	5.170	144.8	149.9	155.1	160.3
9.....	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of month multiply the figure for one day by the number of days.

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

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

Units.	Tenths.									
	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	2.68
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

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 covers 1 square mile 0.03719 inch deep.
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 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 equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado's miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States Gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 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 foor 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 horse power equals 1 second-foot falling 8.80 feet.
1½ horsepower equals about 1 kilowatt.

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

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1913, and ending September 30, 1914. At the first of January in most parts of the country a large amount of the precipitation for the preceding three months is stored, either as ground water, in the form of snow, or in lakes. This stored water passes off in the streams during the spring break up. At the end of September the only stored water available for run-off in the streams is possibly a small amount held in ground storage. Therefore the run-off for a year beginning with October 1 is practically all derived from precipitation occurring within that year.

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

In addition to statements regarding the location and equipment of gaging stations the descriptions give information in regard to any conditions that may affect the constancy of the discharge relation covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the gage. Statements are also made regarding the accuracy of the data and computed results.

In the tables of daily gage height the use of zeros in the hundredths place indicates the degree of refinement to which the gage was read and to which the mean daily gage height was computed. If a gage is read to tenths or half-tenths once a day or to tenths twice a day, no zeros appear in the hundredths place for any stage. If the gage is read to half-tenths twice a day or to quarter-tenths or hundredths, regardless of the number of readings a day, the gage heights are published to hundredths, and zeros appear in the hundredths place, below a certain limiting stage. This limiting stage is so selected that the average error in the mean daily discharge, resulting from not using the mean daily gage height to hundredths above that stage, shall not be greater than 2 per cent. For automatic gages the allowable average error of the daily discharge has been taken as 1 per cent. The selection of the percentage is arbitrary, but it should be noted that the maximum error will in all cases be twice the average error. In like manner half-tenths are used from the hundredths limit to another higher limit, above which only tenths are used. It is the aim to have the gage-height observations at each gaging station recorded to the degree of refinement required by the above method of use, but in practice it is found necessary, in order to avoid confusion in the gage observer's record, to have the observations for all

stages recorded to the degree of refinement required for low stages, which usually necessitates readings to hundredths of a foot.

The table of daily gage height shows the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day, usually in the morning and in the evening, though at many stations only one reading is made each day. At many stations automatic gages are used, some of which give a continuous record of river stage in the form of a hydrograph and others a record printed at intervals, from which the mean daily gage height can be computed. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. When the discharge relation is affected by the presence of ice in the streams or by backwater from obstructions, all gage heights are published as recorded, with suitable footnotes. The rating table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum, in general, somewhat below the lowest point in the cross section, to avoid negative readings.

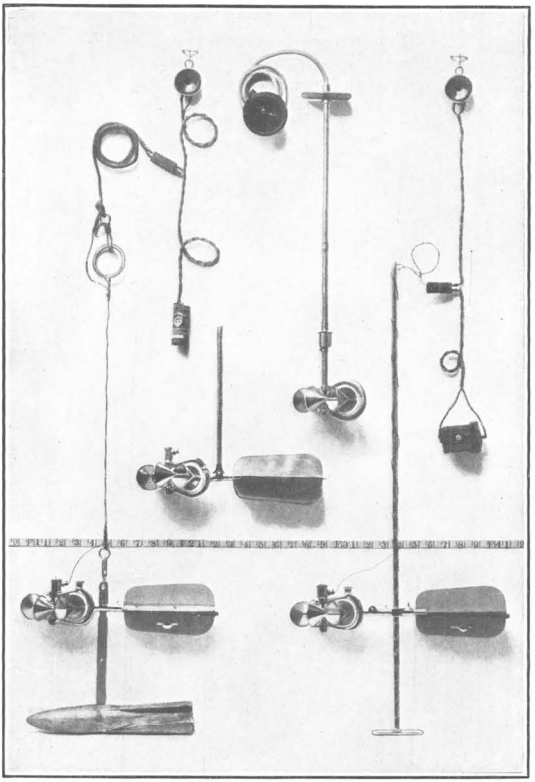
The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The base data presented in this report, unless otherwise stated in description of station, have been collected by the methods commonly used at current-meter gaging stations and described in standard textbooks. (See Pls. I and II.)

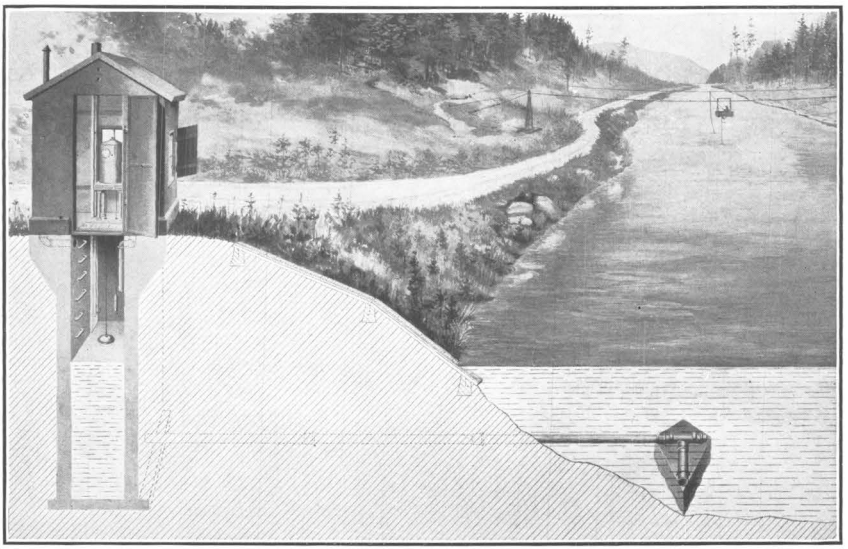
The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report, but can be determined from the tables of daily gage heights and daily discharge.

The table of daily discharge determined from the gage height and rating table gives the discharge in second-feet corresponding to the means of the gage readings observed each day. At some stations subject to rapid or 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. When such stations are equipped with automatic gages the true mean daily discharge may be obtained by weighting discharges for parts of the day.

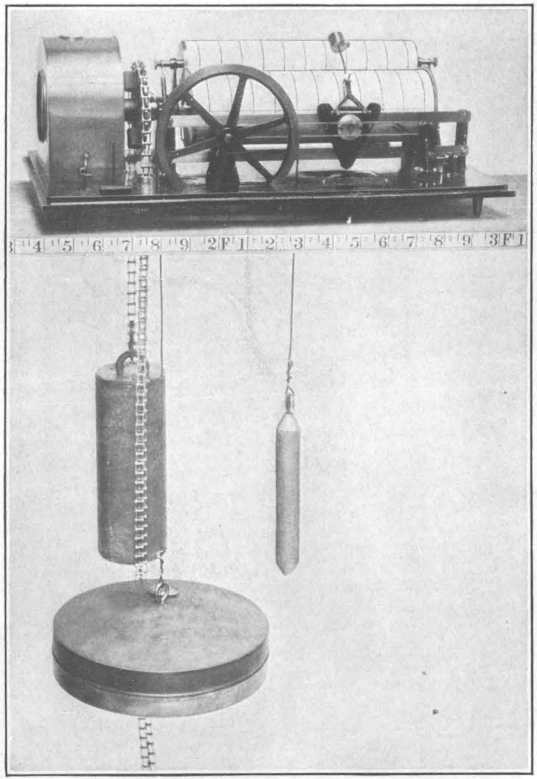
In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage at which the water surface was at crest height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



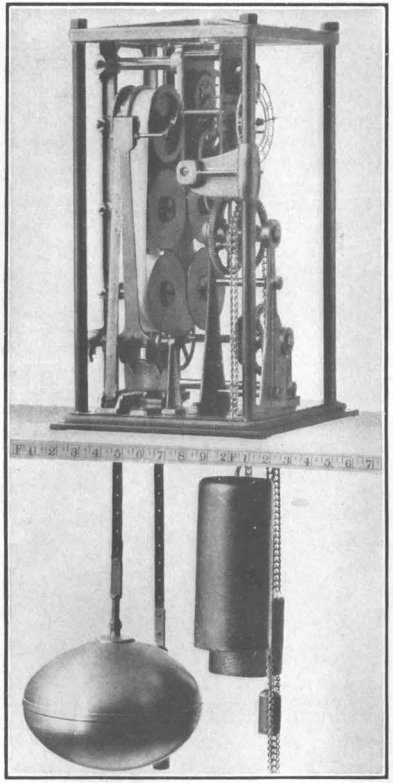
A. PRICE CURRENT METERS.



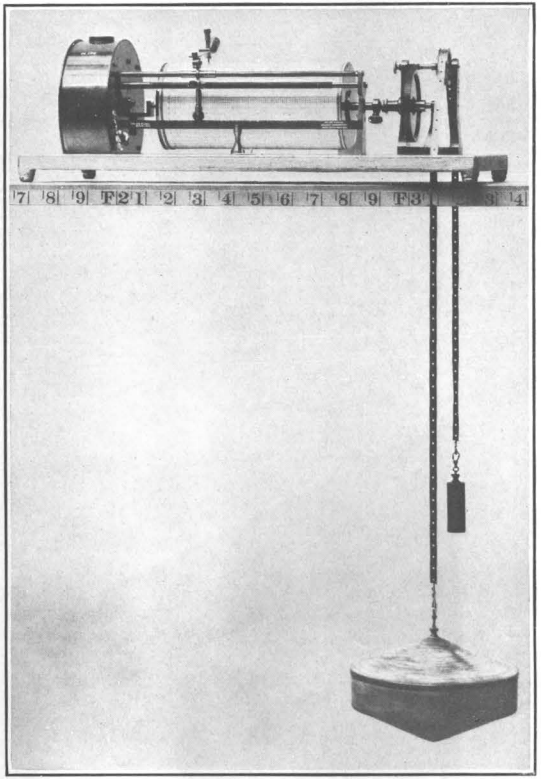
B. TYPICAL GAGING STATIONS.



A. STEVENS.



B. GURLEY.



C. FRIEZ.

AUTOMATIC GAGES.

flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on pages 11 and 12, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

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

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

Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use. On this account computations of "second-feet per square mile" and "run-off (depth in inches)" have not been made for streams draining areas in which the annual rainfall is less than 20 inches, nor for streams draining areas in which the precipitation exceeds 20 inches if such computations might be uncertain or misleading because of the presence of large noncontributing districts in the measured drainage area, because of the omission of estimates of water diverted for irrigation or other use, or because of artificial control or unusual natural control of the flow of the river above the gaging station. All values of "second-feet per square mile" and "run-off (depth in inches)"

previously published by the Survey should be used with care because of possible inherent sources of error not known to the Survey.

In general the base data collected each year by the Survey engineers are published not only to comply with the law but also to afford any engineer the means of analyzing in detail the results of the computations. The table of monthly discharge is so arranged as to give 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 already collected and published.

COOPERATION.

During the year ending September 30, 1914, the stream-measurement work of the Survey in the Hudson Bay and upper Mississippi River basins was carried on in cooperation with the States as indicated in the following paragraphs:

In Montana the work was done in cooperation with the United States Reclamation Service.

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

In Wisconsin the work was done in cooperation with the State Railroad Commission, C. M. Larson, chief engineer.

In Iowa the cooperating organization is the Iowa Geological Survey, George I. Kay, director.

In Illinois the work was done in cooperation with the State of Illinois Rivers and Lakes Commission.

DIVISION OF WORK.

Field data in the Hudson Bay drainage basin, except in Minnesota, were collected under the direction of W. A. Lamb, district engineer, Helena, Mont., by E. F. Chandler, W. B. Stevenson, Ole Christianson, and L. W. Burdick. The ratings and studies of the completed data were made by W. A. Lamb, E. F. Chandler, and B. J. Peterson. Estimates of flow during periods when the discharge relation was affected by ice were made by E. F. Chandler.

Field data in the Hudson Bay drainage basin in Minnesota were collected under the direction of W. G. Hoyt, district engineer, Madison, Wis., by S. B. Soulé, E. F. Chandler, B. J. Peterson, J. B. Stewart, W. B. Stevenson, Ole Christianson, and L. W. Burdick. The ratings and studies of the completed data were made by W. G. Hoyt, E. F. Chandler, and B. J. Peterson. The estimates of flow during periods when the discharge relation was affected by ice were made by S. B. Soulé and E. F. Chandler.

Field data for the upper Mississippi River drainage basin in Minnesota and Iowa were collected under the direction of W. G. Hoyt, district engineer, Madison, Wis., by S. B. Soulé, B. J. Peterson, and J. B. Stewart. The ratings and studies of the completed data were made by S. B. Soulé and B. J. Peterson. Estimates of flow when the discharge relation was affected by ice were made by S. B. Soulé.

Field data for the upper Mississippi River drainage basin in the State of Wisconsin were collected under the direction of W. G. Hoyt, district engineer, Madison, Wis., by G. H. Canfield, H. C. Beckman, M. F. Rather, O. A. Stellar, and E. E. Dillon. The ratings and studies of the completed data were made by W. G. Hoyt and B. J. Peterson. Estimates of flow when the discharge relation was affected by ice were made by W. G. Hoyt.

In the upper Mississippi River drainage basin in Illinois the field data were collected under the direction of A. H. Horton, district engineer, Washington, D. C., by B. J. Peterson and William Kessler.

The completed data for the report were prepared for publication by B. J. Peterson. Computations for stations in the State of Wisconsin were made under the direction of B. J. Peterson, by G. H. Canfield, H. C. Beckman, W. C. Muehlstein, and Joe Entringer. Computations for stations outside of the State of Wisconsin were made by J. G. Mathers, B. J. Peterson, M. I. Walters, and W. A. Elwood.

The report was edited by Mrs. B. D. Wood.

STATION RECORDS.

HUDSON BAY DRAINAGE AREA IN THE UNITED STATES.

ST. MARY RIVER NEAR BABB, MONT.

Location.—Near dam site one-fourth mile below outlet of lower St. Mary Lake, 1 mile above mouth of Swiftcurrent Creek, and about 2 miles south of Babb, Mont.

Records available.—April 9, 1902, to September 30, 1914.

Drainage area.—177 square miles.

Gage.—Chain gage on right bank; a temporary low-water gage used during winter months.

Channel and control.—Practically permanent.

Discharge measurements.—Made from cable 300 feet below gage. In September, 1909, the cable was moved from a point 300 feet downstream. Low-water measurements made by wading one-fourth mile above gage.

Winter flow.—Channel freezes over at gage but records are not affected thereby.

Floods.—The flood of June 5, 1908, reached a stage of about 9.4 feet.

Accuracy.—Records good.

Discharge measurements of St. Mary River near Babb, Mont., during the year ending Sept. 13, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Dec. 19	0.93	[a] 95
Mar. 13	.92	82

[a] Made by wading.

Daily gage height, in feet, of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1914.

[G. R. Barnhart, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5	1.45	.....	.....	.....	.....	1.0	2.4	3.5	3.1	2.3	1.9
2	1.5	1.45	.....	.....	0.75	.....	1.0	2.4	3.6	3.1	.....	1.85
3	1.45	1.5	.....	0.75	.....	0.90	1.0	2.5	3.8	3.1	.....	1.75
4	1.5	1.5	.....	.....	.....	.....	1.0	2.7	4.0	.....	2.3	1.8
5	1.5	1.5	.....	.....	.....	.....	1.0	2.9	4.0	3.2	2.2	1.75
6	1.5	1.5	.....	.....	.....	.....	1.0	3.0	4.1	3.2	2.25	1.7
7	1.5	1.5	.....	.6	.75	.90	1.0	3.0	4.0	3.4	2.2	.....
8	1.45	1.5	.....	.....	.....	.....	1.0	3.0	3.8	3.3	2.2	.....
9	1.5	1.5	.....	.....	.....	.....	1.0	2.9	3.6	3.4	2.1	1.7
10	1.5	1.5	.....	.....	.....	.....	1.0	3.0	3.3	3.2	2.0	1.65
11	1.45	1.5	.....	.65	.75	.90	1.0	3.0	3.2	3.3	2.1	1.7
12	1.45	1.5	.....	.....	.....	.....	1.0	3.1	3.0	3.2	2.05	1.55
13	1.45	1.5	.....	.....	.....	.....	1.1	3.2	3.1	3.2	2.0	.....
14	1.45	1.5	.....	.....	.....	.....	1.1	3.2	3.2	3.2	.....	1.55
15	1.45	1.45	.....	.7	.8	.90	1.2	3.3	3.2	3.0	2.0	1.6
16	1.4	1.45	.....	.....	.....	.....	1.2	3.4	3.4	3.0	.....	.....
17	1.4	1.4	.....	.....	.....	.....	1.3	3.5	3.5	3.0	2.0	1.6
18	1.4	1.35	.....	.....	.85	.....	1.3	3.7	.....	2.9	2.0	1.55
19	1.45	1.35	.....	.75	.....	.95	1.4	3.8	.....	.....	2.0	1.6
20	1.45	1.35	0.9	.....	.....	.....	1.6	3.7	3.8	2.8	2.1	.....
21	1.5	1.4	.9	.....	.85	.....	1.7	3.9	3.8	2.6	2.05	1.75
22	1.45	1.3	.85	.....	.....	.....	1.7	3.8	3.7	2.6	2.05	.....
23	1.45	1.3	.85	.75	.....	.95	1.9	3.8	3.6	2.6	2.0	1.85
24	1.45	1.3	.85	.....	.....	.....	2.0	3.8	.....	2.6	2.05	1.9
25	1.45	1.3	.8	.....	.9	.....	2.0	3.7	3.2	2.4	2.0	.....
26	1.45	1.3	.8	.....	.....	.....	2.0	3.8	3.1	.....	2.0	.....
27	1.45	1.3	.8	.75	.....	.95	2.1	3.9	3.2	2.4	2.0	.....
28	1.5	1.3	.75	.....	.9	.....	2.3	3.7	.....	2.4	1.9	2.1
29	1.5	1.3	.75	.....	.....	.....	2.3	3.6	3.1	2.3	1.9	2.05
30	1.5	1.3	.7	.7	.....	.....	2.4	3.4	3.0	2.2	.....	2.0
31	1.45	.....	.7	.....	.....	.95	.....	3.5	.....	2.3	1.9	.....

NOTE.—Discharge relation probably not materially affected by ice during the year.

Daily discharge, in second-feet, of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	232	218	.....	62	64	90	108	590	1,280	995	540	367
2	232	218	.....	64	67	90	108	590	1,360	995	540	349
3	218	232	.....	67	67	90	108	645	1,520	995	540	314
4	232	232	.....	62	67	90	108	755	1,680	1,030	540	331
5	232	232	.....	57	67	90	108	875	1,680	1,060	490	314
6	232	232	.....	52	67	90	108	935	1,760	1,060	515	296
7	232	232	.....	48	67	90	108	935	1,680	1,200	490	296
8	218	232	.....	50	67	90	108	935	1,520	1,130	490	296
9	232	232	.....	52	67	90	108	875	1,360	1,200	445	296
10	232	232	.....	53	67	90	108	935	1,130	1,060	405	280
11	218	232	.....	54	67	90	108	935	1,060	1,130	445	296
12	218	232	.....	55	69	90	108	995	935	1,060	425	248
13	218	232	.....	56	71	90	128	1,060	995	1,060	405	248
14	218	232	.....	58	72	90	128	1,060	1,060	1,060	405	248
15	218	218	.....	60	74	90	151	1,130	1,060	935	405	263
16	203	218	.....	62	74	92	151	1,200	1,200	935	405	263
17	203	203	.....	64	82	94	176	1,280	1,280	935	405	263
18	203	190	.....	66	82	96	176	1,440	1,360	875	405	248
19	218	190	.....	67	82	99	203	1,520	1,440	845	405	263
20	218	190	90	67	82	99	263	1,440	1,520	815	445	288
21	232	203	90	67	82	99	296	1,600	1,520	700	425	314
22	218	176	82	67	84	99	296	1,520	1,440	700	425	332
23	218	176	82	67	86	99	367	1,520	1,360	700	405	349
24	218	176	82	67	88	99	405	1,520	1,210	700	425	367
25	218	176	74	67	90	99	405	1,440	1,060	590	405	387
26	218	176	74	67	90	99	405	1,520	995	590	405	406
27	218	176	74	67	90	99	445	1,600	1,060	590	405	425
28	232	176	67	67	90	99	540	1,440	1,030	590	367	445
29	232	176	67	60	.....	99	540	1,360	995	540	367	425
30	232	176	60	60	.....	99	590	1,200	935	490	367	405
31	218	.....	60	62	.....	99	.....	1,280	.....	540	367	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge interpolated for days for which gage heights are missing. Discharge, Dec. 1–19, 1913, estimated by comparison with St. Mary River below Swiftcurrent Creek at 140 second-feet.

Monthly discharge of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 177 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	232	203	222	1.25	1.44	13,700	A.
November	232	176	207	1.17	1.30	12,300	A.
December	.....	.....	115	.650	.75	7,070	C.
January	67	48	61.1	.345	.40	3,760	C.
February	90	64	75.8	.428	.45	4,210	C.
March	99	90	94.2	.532	.61	5,790	C.
April	590	108	232	1.31	1.46	13,800	A.
May	1,600	590	1,170	6.61	7.62	71,900	A.
June	1,760	935	1,280	7.23	8.07	76,200	A.
July	1,200	490	874	4.94	5.70	53,700	A.
August	540	367	436	2.46	2.84	26,800	A.
September	445	248	321	1.81	2.02	19,100	A.
The year	1,760	.....	426	2.41	32.66	308,000	

ST. MARY RIVER BELOW SWIFTCURRENT CREEK, AT BABB, MONT.

Location.—At Babb, Mont., about 1 mile below mouth of Swiftcurrent Creek.

Records available.—July 14, 1901, to October 18, 1902, and May 13, 1910, to September 30, 1914.

Drainage area.—298 square miles.

Gage.—Overhanging chain gage on right bank.

Channel and control.—Likely to change. A small overflow channel from Swiftcurrent Creek enters on left bank about 100 feet below gage.

Discharge measurements.—Made from a cable, 50 feet above gage. Low-water measurements made by wading. The overflow from Swiftcurrent Creek is measured from a footbridge.

Winter flow.—Discharge relation slightly affected by ice during winter.

Floods.—Probably the highest stage was reached June 5, 1908. No records of this flood were obtained at this point.

Accuracy.—Records fair.

Discharge measurements of St. Mary River below Swiftcurrent Creek, at Babb, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 24	4.38	299	June 20	6.79	2,260
Dec. 19	3.91	124	July 21	5.56	1,230
May 22	6.68	2,220	Sept. 9	4.57	454

NOTE.—These measurements do not include the overflow from Swiftcurrent Creek.

Daily gage height, in feet, of St. Mary River below Swiftcurrent Creek, at Babb, Mont., for the year ending Sept. 30, 1914.

[Frank Woolf, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.35	4.5	4.3	3.8	3.9	3.95	4.0	5.45	6.45	.....	.....	.....
2	4.3	4.5	4.3	3.8	3.9	3.95	4.0	.....	6.5	.....	.....	.....
3	4.2	4.5	4.2	3.8	3.9	3.95	4.0	.....	6.5	.....	.....	.....
4	4.2	4.5	4.2	3.75	3.95	.....	4.0	.....	6.65	.....	.....	.....
5	4.25	4.5	4.2	3.75	3.95	.....	4.0	.....	6.7	.....	.....	.....
6	4.3	4.5	4.2	3.75	3.95	.....	4.0	.....	6.8	.....	.....	.....
7	4.3	4.5	4.2	3.75	3.95	3.95	4.1	.....	6.7	.....	.....	.....
8	4.3	4.5	4.35	3.8	3.95	3.95	4.1	6.0	.....	.....	.....	.....
9	4.3	4.5	4.2	3.8	3.95	3.95	4.15	6.1	.....	.....	.....	.....
10	4.3	4.5	4.2	3.85	3.95	3.95	4.15	6.3	.....	.....	.....	.....
11	4.3	4.4	4.2	3.85	3.95	3.95	4.1	6.2	.....	.....	.....	.....
12	4.3	4.3	4.2	3.85	3.95	3.95	4.1	6.4	.....	.....	.....	.....
13	4.3	4.3	4.2	3.9	3.95	3.95	4.3	6.3	.....	.....	.....	.....
14	4.3	4.3	4.4	3.9	3.95	3.95	4.4	6.4	.....	.....	.....	.....
15	4.3	4.3	4.4	3.9	3.95	3.95	4.4	6.3	.....	.....	.....	.....
16	4.3	4.3	3.5	3.9	3.95	3.95	4.55	6.5	.....	.....	.....	.....
17	4.3	4.3	3.7	3.9	3.95	3.95	4.7	6.8	6.6	.....	4.65	.....
18	4.3	4.3	3.9	3.9	3.95	3.95	4.8	6.8	6.7	.....	4.75	4.55
19	4.3	4.3	3.9	3.9	3.95	3.95	4.8	6.9	6.7	.....	4.95	4.55
20	4.35	4.3	3.9	3.9	3.95	3.95	4.8	6.8	6.8	.....	4.95	4.65
21	4.35	4.3	3.9	3.9	3.9	3.95	5.0	6.9	6.7	5.5	.....	4.7
22	4.35	4.25	3.9	3.9	3.9	3.95	5.2	6.7	.....	5.5	.....	4.9
23	4.3	4.3	3.8	3.9	3.9	4.0	5.4	6.7	.....	5.3	.....	4.95
24	4.3	4.3	3.8	3.95	3.9	4.0	5.45	6.75	.....	5.3	.....	4.95
25	4.3	4.3	3.8	3.95	3.9	4.1	5.45	6.75	.....	5.3	.....	4.95
26	4.4	4.3	3.8	3.95	3.9	4.1	5.45	6.75	.....	5.3	.....	4.95
27	4.4	4.3	3.8	3.95	3.9	3.95	5.4	6.65	.....	5.3	.....	4.85
28	4.45	4.3	3.8	3.95	3.9	3.95	5.4	6.6	.....	5.2	.....	4.95
29	4.4	4.3	.....	3.95	.....	4.0	5.4	6.5	.....	5.2	.....	4.95
30	4.4	4.3	.....	3.95	.....	4.0	5.4	6.5	.....	5.2	.....	4.95
31	4.5	.....	.....	3.95	.....	4.0	.....	6.4	.....	5.2	.....	.....

NOTE.—Discharge relation affected by ice Jan. 1 to Feb. 28. No reliable gage-height records were obtained June 22 to July 20, on account of disturbance of gage by high water.

Daily discharge, in second-feet, of St. Mary River below Swiftcurrent Creek, at Babb, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	280	345	260	.....	.....	132	150	952	1,880	1,460	760	530
2	260	345	260	.....	.....	132	150	1,200	1,940	1,420	750	510
3	220	345	220	.....	.....	132	150	1,700	1,940	1,460	740	490
4	220	345	220	.....	.....	132	150	1,660	2,110	1,500	735	480
5	240	345	220	.....	.....	132	150	1,460	2,160	1,600	730	470
6	260	345	220	.....	.....	132	150	1,370	2,280	1,690	720	460
7	260	345	220	.....	.....	132	185	1,360	2,160	1,740	710	460
8	260	345	280	.....	.....	132	185	1,420	1,950	1,640	700	460
9	260	345	220	.....	.....	132	202	1,520	1,770	1,640	670	460
10	260	345	220	.....	.....	132	202	1,720	1,620	1,640	630	440
11	260	300	220	.....	.....	132	185	1,620	1,500	1,550	590	430
12	260	260	220	.....	.....	132	185	1,830	1,570	1,460	560	420
13	260	260	220	.....	.....	132	260	1,720	1,700	1,460	520	380
14	260	260	300	.....	.....	132	300	1,830	1,900	1,370	470	370
15	260	260	300	.....	.....	132	300	1,720	2,130	1,370	470	370
16	260	260	30	.....	.....	132	370	1,940	2,130	1,280	460	370
17	260	260	70	.....	.....	132	450	2,280	2,130	1,280	502	380
18	260	260	115	.....	.....	132	505	2,280	2,240	1,280	568	440
19	260	260	115	.....	.....	132	505	2,400	2,240	1,200	705	440
20	280	260	115	.....	.....	132	505	2,280	2,340	1,120	705	502
21	280	260	115	.....	.....	132	630	2,400	2,240	1,120	700	535
22	280	240	115	.....	.....	132	770	2,160	2,030	1,120	700	670
23	260	260	90	.....	.....	150	915	2,160	1,840	965	695	705
24	260	260	90	.....	.....	150	952	2,220	1,740	965	690	705
25	260	260	90	.....	.....	185	952	2,220	1,740	965	670	705
26	300	260	90	.....	.....	185	952	2,220	1,640	965	640	705
27	300	260	90	.....	.....	132	915	2,110	1,550	965	620	635
28	322	260	90	.....	.....	132	915	2,050	1,550	890	600	705
29	300	260	90	.....	.....	150	915	1,940	1,460	890	580	705
30	300	260	90	.....	.....	150	915	1,940	1,460	890	560	705
31	345	.....	90	.....	.....	150	.....	1,830	.....	890	540	.....

NOTE.—Daily discharge determined from two fairly well defined rating curves applicable Oct. 1 to June 15 and June 16 to Sept. 30. Daily discharge May 2–7, June 8–16, June 22 to July 20, Aug. 1–16, and Aug. 21 to Sept. 17, estimated from flow of St. Mary River near Babb and Kimball.

Daily gage height, in feet, of Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.7	.....	.....	.....	.....	.....	.....	5.3	5.5	5.2	4.6	4.2
2	4.7	.....	.....	.....	.....	.....	.....	5.3	5.5	5.3	4.5	4.1
3	4.7	.....	.....	.....	.....	.....	.....	5.4	5.6	5.3	4.4	4.1
4	4.7	.....	.....	.....	.....	.....	.....	5.5	5.6	5.3	4.4	4.1
5	4.7	.....	.....	.....	.....	.....	.....	5.5	5.6	5.4	4.4	4.1
6	4.7	.....	.....	.....	.....	.....	.....	5.5	5.6	5.4	4.4	4.1
7	4.8	.....	.....	.....	.....	.....	.....	5.4	5.6	5.4	4.3	4.1
8	4.8	.....	.....	.....	.....	.....	.....	5.3	5 6	5.4	4.2	4.2
9	4.8	.....	.....	.....	.....	.....	.....	5.3	5.6	5.4	4.1	4.3
10	4.8	.....	.....	.....	.....	.....	.....	5.3	5.7	5.4	4.1	4.4
11	4.8	.....	.....	.....	.....	.....	.....	5.3	5.7	5.5	4.1	4.5
12	4.6	.....	.....	.....	.....	.....	.....	5.3	5.7	5.4	4.1	4.5
13	4.7	.....	.....	.....	.....	.....	.....	5.2	5.7	5.4	4.1	4.5
14	4.8	.....	.....	.....	.....	.....	.....	5.2	5.7	5.4	4.2	4.5
15	4.9	.....	.....	.....	.....	.....	.....	5.2	5.7	5.3	4.3	4.5
16	4.8	.....	.....	.....	.....	.....	.....	5.4	5.6	5.3	4.4	4.5
17	4.6	.....	.....	.....	.....	.....	4.9	5.7	5.6	5.3	4.5	4.6
18	4.6	.....	.....	.....	.....	.....	4.9	5.8	5.7	5.2	4.6	4.6
19	4.7	.....	.....	.....	.....	.....	4.9	5.8	5.7	5.2	4.7	4.7
20	4.8	.....	.....	.....	.....	.....	5.0	5.8	5.7	5.2	4.7	4.7
21	4.8	.....	.....	.....	.....	.....	5.4	5.9	5.7	5.1	4.7	4.8
22	4.8	.....	.....	.....	.....	.....	5.5	5.8	5.7	5.1	4.8	4.9
23	4.8	.....	.....	.....	.....	.....	5.5	5.8	5.7	5.0	4.8	4.9
24	4.8	.....	.....	.....	.....	.....	5.5	5.8	5.8	4.9	4.8	5.0
25	4.8	.....	.....	.....	.....	.....	5.5	5.8	5.8	4.9	4.9	5.0
26	4.9	.....	.....	.....	.....	.....	5.5	5.8	5.7	4.9	4.9	5.0
27	4.9	.....	.....	.....	.....	.....	5.5	5.9	5.5	4.9	4.8	5.1
28	4.9	.....	.....	.....	.....	.....	5.5	5.9	5.3	4.8	4.5	5.0
29	4.9	.....	.....	.....	.....	.....	5.4	5.9	5.2	4.8	4.2	5.0
30	4.9	.....	.....	.....	.....	.....	5.3	5.6	5.2	4.7	4.2	5.0
31	4.9	.....	.....	.....	.....	.....	.....	5.5	.....	4.6	4.2	.....

Daily discharge, in second-feet, of Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.0	.....	.....	.....	.....	.....	.....	28	42	22	4.4	0.8
2	6.0	.....	.....	.....	.....	.....	.....	28	42	28	3.2	.4
3	6.0	.....	.....	.....	.....	.....	.....	35	50	28	2.2	.4
4	6.0	.....	.....	.....	.....	.....	.....	42	50	28	2.2	.4
5	6.0	.....	.....	.....	.....	.....	.....	42	50	35	2.2	.4
6	6.0	.....	.....	.....	.....	.....	.....	42	50	35	2.2	.4
7	8.0	.....	.....	.....	.....	.....	.....	35	50	35	1.4	.4
8	8.0	.....	.....	.....	.....	.....	.....	28	50	35	.8	.8
9	8.0	.....	.....	.....	.....	.....	.....	28	50	35	.4	1.4
10	8.0	.....	.....	.....	.....	.....	.....	28	58	35	.4	2.2
11	8.0	.....	.....	.....	.....	.....	.....	28	58	42	.4	3.2
12	4.4	.....	.....	.....	.....	.....	.....	28	58	35	.4	3.2
13	6.0	.....	.....	.....	.....	.....	.....	22	58	35	.4	3.2
14	8.0	.....	.....	.....	.....	.....	.....	22	58	35	.8	3.2
15	10	.....	.....	.....	.....	.....	.....	22	58	28	1.4	3.2
16	8.0	.....	.....	.....	.....	.....	.....	35	50	28	2.2	3.2
17	4.4	.....	.....	.....	.....	.....	10	58	50	28	3.2	4.4
18	4.4	.....	.....	.....	.....	.....	10	66	58	22	4.4	4.4
19	6.0	.....	.....	.....	.....	.....	10	66	58	22	6.0	6.0
20	8.0	.....	.....	.....	.....	.....	14	66	58	22	6.0	6.0
21	8.0	.....	.....	.....	.....	.....	35	74	58	18	6.0	8.0
22	8.0	.....	.....	.....	.....	.....	42	66	58	18	8.0	10
23	8.0	.....	.....	.....	.....	.....	42	66	58	14	8.0	10
24	8.0	.....	.....	.....	.....	.....	42	66	66	10	8.0	14
25	8.0	.....	.....	.....	.....	.....	42	66	66	10	10	14
26	10	.....	.....	.....	.....	.....	42	66	58	10	10	14
27	10	.....	.....	.....	.....	.....	42	74	42	10	8.0	18
28	10	.....	.....	.....	.....	.....	42	74	28	8.0	3.2	14
29	10	.....	.....	.....	.....	.....	35	74	22	8.0	.8	14
30	10	.....	.....	.....	.....	.....	28	50	22	6.0	.8	14
31	10	.....	.....	.....	.....	.....	.....	42	.....	4.4	.8	.....

NOTE.—Discharge determined from a well-defined rating curve.

Combined daily discharge, in second-feet, of St. Mary River and Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	286	345	260	.....	.....	132	150	980	1,920	1,480	764	531
2	266	345	260	.....	.....	132	150	1,230	1,980	1,450	753	510
3	226	345	220	.....	.....	132	150	1,740	1,990	1,490	742	490
4	226	345	220	.....	.....	132	150	1,700	2,160	1,530	737	480
5	246	345	220	.....	.....	132	150	1,500	2,210	1,640	732	470
6	266	345	220	.....	.....	132	150	1,410	2,330	1,720	722	460
7	268	345	220	.....	.....	132	185	1,400	2,210	1,780	711	460
8	268	345	280	.....	.....	132	185	1,450	2,000	1,680	701	461
9	268	345	220	.....	.....	132	202	1,550	1,820	1,680	670	461
10	268	345	220	.....	.....	132	202	1,750	1,680	1,680	630	442
11	268	300	220	.....	.....	132	185	1,650	1,560	1,590	590	433
12	264	260	220	.....	.....	132	185	1,860	1,630	1,500	560	423
13	266	260	220	.....	.....	132	260	1,740	1,760	1,500	520	383
14	268	260	300	.....	.....	132	300	1,850	1,960	1,400	471	373
15	270	260	300	.....	.....	132	300	1,740	2,190	1,400	471	373
16	268	260	30	.....	.....	132	370	1,980	2,180	1,310	462	373
17	264	260	70	.....	.....	132	460	2,340	2,180	1,310	508	384
18	264	260	115	.....	.....	132	515	2,350	2,300	1,300	572	444
19	266	260	115	.....	.....	132	515	2,470	2,300	1,220	711	446
20	288	260	115	.....	.....	132	519	2,350	2,400	1,140	711	508
21	288	260	115	.....	.....	132	665	2,470	2,300	1,140	706	543
22	288	240	115	.....	.....	132	812	2,230	2,090	1,140	708	680
23	268	260	90	.....	.....	150	957	2,230	1,900	979	703	715
24	268	260	90	.....	.....	150	994	2,290	1,810	975	698	719
25	862	260	90	.....	.....	185	994	2,290	1,810	975	680	719
26	310	260	90	.....	.....	185	994	2,290	1,700	975	650	719
27	310	260	90	.....	.....	132	957	2,180	1,590	975	628	653
28	332	260	90	.....	.....	132	957	2,120	1,580	898	603	719
29	310	260	90	.....	.....	150	950	2,010	1,480	898	581	719
30	310	260	90	.....	.....	150	943	1,990	1,480	896	561	719
31	355	.....	90	.....	.....	150	.....	1,870	.....	894	541	.....

Combined monthly discharge of St. Mary River and Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 298 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	355	226	277	0.930	1.07	17,000	B.
November	345	240	289	.970	1.08	17,200	B.
December	300	30	164	.550	.63	10,100	B.
January	.....	.....	90	.302	.35	5,530	D.
February	.....	.....	110	.369	.38	6,110	D.
March	185	132	138	.463	.53	8,480	C.
April	994	150	484	1.62	1.81	28,800	B.
May	2,470	980	1,900	6.38	7.36	117,000	B.
June	2,400	1,480	1,950	6.54	7.30	116,000	B.
July	1,780	894	1,310	4.40	5.07	80,600	B.
August	764	462	639	2.14	2.47	39,300	B.
September	718	373	527	1.77	1.98	31,400	B.
The year	2,470	.....	659	2.21	30.03	478,000	

NOTE.—Discharge for January and February estimated.

ST. MARY RIVER NEAR KIMBALL, ALBERTA.

Location.—In the SW. ¼ sec. 25, T. 1 N., R. 25 W. fourth meridian, about 1 mile above the Alberta Railway & Irrigation Co.'s dam and headgate, about 1 mile southwest of Kimball, and about 5 miles north of the Canadian boundary line; about 3,000 feet above station maintained by Irrigation Branch, Department of the Interior, Canada; previous to January 1, 1913, at Cook's ranch,[1] about 5 miles above present site.

Records available.—January 1 to September 30, 1913, at present location; September 4, 1902, to December 31, 1912, at Cook's ranch; 1905 to 1912, at station maintained by Irrigation Branch, Department of the Interior, Canada.

Drainage area.—472 square miles at present site; 452 square miles at Cook's ranch.

Gage.—Friez water-stage register. Staff gage used to obtain winter records at the Canadian station.

Channel and control.—Shifting.

Discharge measurements.—Made from a cable about 3,000 feet downstream or by wading.

Winter flow.—Affected by ice.

Regulation and diversions.—No diversions or regulation above gage.

Accuracy.—Estimates of flow reliable.

Cooperation.—Station maintained jointly with the Irrigation Office, Department of the Interior, Canada, during 1913.

[1] Station known as St. Mary River near Cardston.

Discharge measurements of St. Mary River near Kimball, Alberta, 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. 9	L. Danielson [a]	2.25	408	Apr. 20	O. H. Hoover [a]	3.00	910
14	....do	2.27	553	May 13	....do	4.10	1,952
24	W. A. Lamb	2.26	382	23	W. A. Lamb	4.53	2,510
Nov. 13	L. Danielson [a]	2.06	344	June 2	O. H. Hoover [a]	4.63	2,718
26	J. E. Degnan	2.04	351	21	W. A. Lamb	4.53	2,440
Dec. 5	....do	1.86	244	23	O. H. Hoover [a]	4.19	2,049
16	W. A. Burton [a]	.30	205	July 15	....do	3.77	1,591
30	J. E. Degnan [a]	.29	88	21	W. A. Lamb	3.40	1,190
Jan 12	....do	3.61	214	Aug. 11	O. H. Hoover [a]	2.71	654
23	....do	3.20	82	Sept. 2	....do	2.56	588
Feb. 11	....do	5.40	96	5	....do	2.49	529
26	....do	5.50	119	10	W. A. Lamb	2.46	477
Mar. 13	W. A. Burton [a]	5.11	229	18	O. H. Hoover [a]	2.36	470
25	O. H. Hoover [a]	4.34	100	22	....do	2.97	805
Apr. 7	....do	2.59	295				

[a] Canadian engineer.

NOTE.—Gage heights of discharge measurements Dec. 16, 1913, to Apr. 7, 1914, refer to staff gage. See "gage" in station description.

NOTE.—Daily gage heights Jan. 1 to Apr. 1 when discharge relation was affected by ice, read on staff gage. See "gage" in station description.

Daily gage height, in feet, of St. Mary River near Kimball, Alberta, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.18	2.28	1.72	2.29	.....	.....	3.99	3.28	4.38	3.86	2.97	2.64
2	2.17	2.28	1.98	2.30	3.62	5.25	3.94	3.73	4.59	3.85	2.94	2.57
3	2.16	2.24	2.02	2.35	3.42	5.25	3.94	4.20	4.83	3.89	2.94	2.52
4	2.24	2.27	1.96	.....	.....	5.20	3.84	4.10	5.00	3.92	2.96	2.50
5	2.24	2.23	1.86	2.70	5.42	5.20	3.84	3.93	4.98	4.02	2.93	2.47
6	2.25	2.21	1.84	2.75	5.42	5.20	2.94	3.85	4.88	4.11	2.92	2.46
7	2.25	2.19	1.84	2.85	5.47	5.18	2.64	3.84	4.70	4.12	2.94	2.47
8	2.26	2.27	1.83	2.82	.....	.....	2.59	3.86	4.48	4.06	2.88	2.45
9	2.26	2.23	1.82	2.85	.....	.....	2.59	3.88	4.30	4.03	2.82	2.44
10	2.24	2.23	1.85	3.00	.....	5.15	2.59	4.10	4.08	4.00	2.78	2.42
11	2.30	2.23	1.79	3.30	5.40	5.15	2.54	4.17	3.95	3.97	2.68	2.39
12	2.48	2.25	1.72	3.70	5.40	5.15	2.18	4.09	3.92	3.92	2.67	2.37
13	2.56	2.13	1.77	3.40	5.40	5.12	2.33	4.10	4.25	3.87	2.64	2.34
14	2.61	2.15	1.76	3.25	5.40	5.11	2.47	4.17	4.50	3.87	2.61	2.31
15	2.58	2.17	1.69	3.25	.....	5.11	2.55	4.31	4.45	3.81	2.57	2.27
16	2.55	2.23	.....	3.25	5.50	5.10	2.68	4.50	4.38	3.72	2.53	2.31
17	2.49	2.23	.....	3.25	5.60	5.05	2.68	4.67	4.42	3.62	2.74	2.36
18	2.48	2.23	.....	.....	5.60	5.05	2.63	4.73	4.51	3.58	2.97	2.36
19	2.45	2.22	.....	3.30	5.85	5.00	2.76	4.75	4.60	3.46	2.98	2.48
20	2.43	2.21	.....	3.25	5.90	5.00	3.00	4.78	4.62	3.43	2.94	2.68
21	2.36	2.17	.....	3.25	.....	5.00	3.12	4.76	4.55	3.42	2.87	2.89
22	2.36	2.13	.....	.....	.....	.....	3.10	4.65	4.48	3.35	2.84	2.95
23	2.35	2.21	.....	3.20	6.00	.....	3.15	4.58	4.21	3.24	2.85	2.92
24	2.28	2.14	.....	3.40	5.50	.....	3.23	4.60	4.05	3.18	2.90	2.91
25	2.31	2.09	.....	.....	5.45	4.34	3.23	4.77	3.98	3.13	2.86	2.82
26	2.36	2.04	.....	.....	5.50	.....	3.28	4.78	3.97	3.07	2.82	2.80
27	2.36	2.04	.....	3.55	5.40	.....	3.28	4.62	3.95	3.02	2.75	2.90
28	2.35	1.91	.....	3.55	5.35	.....	3.32	4.53	3.94	3.00	2.72	2.86
29	2.31	1.89	.....	.....	.....	3.85	3.28	4.43	3.92	3.00	2.68	2.82
30	2.31	2.08	.....	3.60	.....	3.95	3.26	4.29	3.91	3.00	2.65	2.80
31	2.25	.....	.....	3.65	.....	3.95	.....	4.28	.....	2.98	2.64	.....

Daily discharge, in second-feet, of St. Mary River near Kimball, Alberta, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	372	416	207	85	81	128	265	1,092	2,314	1,686	832	609
2	368	416	298	94	78	139	275	1,543	2,587	1,675	810	567
3	364	398	312	103	73	148	288	2,085	2,899	1,719	810	537
4	398	412	291	114	71	157	312	1,965	3,120	1,753	825	525
5	398	394	256	123	70	168	290	1,764	3,094	1,869	802	510
6	402	384	249	135	73	177	265	1,675	2,964	1,977	795	505
7	402	376	249	146	78	186	295	1,664	2,730	1,989	810	510
8	407	412	246	159	82	197	320	1,686	2,444	1,917	766	500
9	407	394	242	172	87	207	343	1,708	2,210	1,881	724	495
10	398	394	252	183	90	215	362	1,965	1,941	1,845	697	485
11	425	394	232	198	96	222	364	2,049	1,788	1,810	633	470
12	510	402	207	215	97	226	366	1,953	1,753	1,753	627	460
13	550	352	224	195	98	229	440	1,965	2,148	1,697	609	445
14	576	360	221	182	98	230	510	2,049	2,470	1,697	591	430
15	560	368	197	175	100	228	555	2,223	2,405	1,631	567	410
16	545	394	205	165	105	220	633	2,470	2,314	1,532	543	430
17	515	394	220	156	111	205	633	2,691	2,366	1,426	671	455
18	510	394	227	143	118	190	603	2,769	2,483	1,385	832	455
19	495	389	205	138	122	190	684	2,795	2,600	1,265	840	515
20	485	384	190	128	127	182	855	2,834	2,626	1,235	810	633
21	452	368	172	115	130	178	952	2,808	2,535	1,225	759	773
22	452	352	151	97	127	185	935	2,665	2,444	1,158	738	818
23	448	384	122	82	122	189	978	2,574	2,098	1,056	745	795
24	416	356	100	81	119	160	1,047	2,600	1,905	1,003	780	788
25	430	336	96	85	117	100	1,047	2,821	1,822	960	752	724
26	452	319	93	85	119	98	1,092	2,834	1,810	911	724	710
27	452	319	92	78	120	102	1,092	2,626	1,788	871	678	780
28	448	274	91	77	123	170	1,129	2,509	1,776	855	658	752
29	430	266	90	82	.....	202	1,092	2,379	1,753	855	633	724
30	430	333	87	85	.....	222	1,074	2,198	1,742	855	615	710
31	402	.....	78	84	.....	248	.....	2,185	.....	840	609	.....

NOTE.—Daily discharge determined from two well-defined rating curves applicable Oct. 1 to Dec. 15 and Apr. 12 to Sept. 30. Daily discharge Dec. 16 to Apr. 11 estimated from discharge measurements, gage-heights, temperature records, and comparison with other stations.

Monthly discharge of St. Mary River near Kimball, Alberta, for the year ending Sept. 30, 1914.

[Drainage area, 472 square miles.]

Month.	Discharge in second-feet.				Depth in inches on drainage area.	Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	Per square mile.		
October	576	364	448	0.949	1.09	27,546
November	416	266	371	.786	.88	22,076
December	312	78	190	.403	.46	11,683
January	215	77	128	.271	.31	7,870
February	130	70	101	.214	.22	5,609
March	248	98	184	.390	.45	11,314
April	1,129	265	637	1.350	1.51	37,904
May	2,834	1,092	2,230	4.725	5.45	137,120
June	3,120	1,742	2,331	4.939	5.51	138,700
July	1,989	840	1,430	3.030	3.49	87,927
August	840	543	719	1.523	1.76	44,210
September	818	410	584	1.237	1.38	34,750
The year	3,120	70	783	1.659	22.51	567,000

SWIFTCURRENT CREEK AT McDERMOTT LAKE, MONT.

Location.—In sec. 12, T. 35 N., R. 16 W., at the outlet of McDermott Lake, about 14 miles southwest of Babb, Mont.

Records available.—June 6, 1912, to September 30, 1914.

Drainage area.—31.4 square miles.

Gage.—Vertical staff attached to post on left bank at the lake outlet.

Channel and control.—Channel practically permanent; control is a limestone reef at the lake outlet.

Discharge measurements.—Made by wading or from a cable across the outlet.

Winter flow.—Station discontinued during winter. Ice forms at gage, but control section probably remains unobstructed.

Accuracy.—Records good.

The following discharge measurement was made by W. A. Lamb:
May 22, 1914: Gage height, 2.8 feet; discharge, 381 second-feet.

Daily gage height, in feet, of Swiftcurrent Creek at McDermott Lake, Mont., for the year ending Sept. 30, 1914.

[F. M. Stevenson and R. A. Reynolds, observers.]

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	Day.	Oct.	Nov.	Dec.	Apr.	May.	June.
1	1.85	.....	1.75	.....	.....	2.90	16	2.05	.....	1.65	.....	2.97	2.80
2	.....	1.85	.....	.....	.....	3.02	17	.....	.....	.....	2.1	3.08	2.90
3	.....	.....	.....	.....	.....	3.20	18	2.1	1.85	.....	.....	3.18	2.90
4	1.85	1.95	1.75	.....	.....	3.38	19	.....	.....	1.65	.....	3.00	3.00
5	.....	.....	.....	1.9	.....	3.35	20	1.95	.....	.....	2.2	2.90	3.10
6	1.9	.....	.....	.....	.....	3.02	21	.....	1.85	.....	.....	2.88	2.84
7	.....	1.9	1.75	.....	.....	2.75	22	2.05	.....	1.65	.....	2.75	.....
8	1.95	.....	.....	1.9	.....	2.55	23	.....	.....	.....	2.2	2.78	.....
9	.....	.....	.....	.....	.....	2.40	24	.....	1.8	.....	.....	2.72	2.40
10	.....	.....	.....	.....	.....	2.30	25	2.05	.....	.....	2.3	3.10	2.30
11	1.95	1.75	1.8	2.0	.....	2.30	26	1.95	.....	1.7	.....	3.10	2.20
12	.....	.....	.....	.....	2.76	2.25	27	.....	1.75	.....	2.4	3.00	.....
13	2.05	.....	1.65	.....	2.63	2.28	28	.....	.....	.....	.....	2.75	.....
14	.....	.....	.....	2.1	2.72	2.62	29	1.9	.....	.....	.....	2.75	.....
15	.....	1.75	.....	.....	2.84	2.80	30	.....	.....	1.65	2.3	2.70	.....
							31	1.85	.....	.....	.....	2.78	.....

Daily discharge, in second-feet, of Swiftcurrent Creek at McDermott Lake, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	Day.	Oct.	Nov.	Dec.	Apr.	May.	June.
1	76	76	62	84	186	445	16	115	67	50	127	475	400
2	76	76	62	84	178	500	17	121	71	50	127	530	445
3	76	85	62	84	200	590	18	127	76	50	127	580	445
4	76	94	62	84	250	680	19	110	76	50	155	490	490
5	80	91	62	84	200	665	20	94	76	50	155	445	540
6	84	87	62	84	226	500	21	104	76	50	155	436	418
7	89	84	62	84	250	378	22	115	73	50	155	378	354
8	94	78	64	84	275	288	23	115	71	51	155	391	290
9	94	73	65	84	300	225	24	115	68	52	172	364	225
10	94	68	66	103	325	188	25	115	66	54	188	540	188
11	94	62	68	103	355	188	26	94	64	55	206	540	155
12	104	62	59	103	382	172	27	91	62	54	225	490	238
13	115	62	50	127	324	181	28	87	62	52	225	378	256
14	115	62	50	127	364	319	29	84	62	51	188	378	335
15	115	62	50	127	418	400	30	80	62	50	188	355	314
							31	76	.....	49	.....	391	.....

NOTE.—Daily discharge determined from a rating curve well defined below 500 second-feet, except as follows: Apr. 1–4, May 1–11, and June 27–30, estimated; for days for which gage heights are missing, interpolated.

Monthly discharge of Swiftcurrent Creek at McDermott Lake, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 31.4 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
October	127	76	97.6	3.11	3.58	6,000	B.
November	94	62	71.8	2.29	2.56	4,270	B.
December	68	49	55.6	1.77	2.04	3,420	B.
April	225	84	133	4.24	4.73	7,910	B.
May	580	178	368	11.7	13.49	22,600	B.
June	680	155	360	11.5	12.83	21,400	B.

SWIFTCURRENT CREEK AT SHERBURNE LAKE, MONT.

Location.—In sec. 35, T. 36 N., R. 15 W., at the outlet of lower Sherburne Lake, just above the boundary line between Glacier National Park and Blackfeet Indian Reservation.

Records available.—July 1, 1912, to September 30, 1914.

Drainage area.—64.0 square miles.

Gage.—Vertical staff on left bank near the outlet of the lake.

Channel and control.—Apparently permanent.

Discharge measurements.—Made by wading or from a cable below the gage.

Winter flow.—Affected by ice.

Regulation and diversion.—No artificial storage or diversion above station.

Accuracy.—Accuracy of gage heights may be affected by wave action on the lake.

Discharge measurements of Swiftcurrent Creek at Sherburne Lake, Mont., during the year ending Sept. 30, 1914.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 14	1.06	40	July 19	3.70	276
May 21	4.95	565	Sept. 9	3.45	[a] 135

[a] Discharge relation affected by channel obstruction due to excavation for Sherburne Lake dam.

Daily gage height, in feet, of Swiftcurrent Creek at Sherburne Lake, Mont., for the year ending Sept. 30, 1914.

[R. A. Reynolds, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.5	.....	2.1	.....	.....	.....	.....	3.55	4.8	4.35	3.3	3.4
2	.....	.....	.....	.....	.....	.....	.....	3.5	5.4	4.25	3.3	3.4
3	2.5	2.75	2.1	.....	.....	.....	.....	5.2	6.0	4.0	3.3	3.4
4	.....	.....	.....	.....	.....	.....	.....	5.6	6.2	3.9	3.25	3.35
5	2.5	2.5	.....	.....	.....	.....	.....	5.0	5.9	5.0	3.25	3.35
6	.....	.....	2.2	.....	.....	.....	.....	4.4	5.2	5.1	3.3	3.3
7	.....	.....	.....	.....	.....	.....	.....	4.0	4.5	4.8	3.3	3.35
8	2.5	2.85	2.15	.....	.....	.....	.....	3.75	4.2	4.6	3.3	3.5
9	.....	.....	.....	.....	.....	.....	.....	4.15	3.95	4.4	3.25	3.5
10	.....	2.6	2.1	.....	.....	.....	.....	5.0	3.5	4.2	3.2	3.45
11	2.6	.....	.....	.....	.....	.....	.....	5.0	3.5	4.2	3.1	3.45
12	.....	2.5	2.1	.....	.....	.....	.....	4.6	3.5	4.1	3.05	3.4
13	3.2	.....	.....	.....	.....	.....	.....	4.6	3.7	4.1	3.0	.....
14	.....	.....	2.15	.....	.....	.....	.....	4.8	5.1	4.1	3.0	.....
15	3.5	2.65	.....	.....	.....	.....	.....	5.2	5.1	4.1	3.0	.....
16	.....	.....	2.1	.....	.....	.....	.....	5.6	4.8	4.05	3.0	.....
17	.....	2.7	.....	.....	.....	.....	.....	5.8	4.9	3.9	3.8	.....
18	3.1	.....	2.1	.....	.....	.....	3.5	5.7	5.2	3.8	3.95	.....
19	.....	2.5	.....	.....	.....	.....	3.5	5.4	5.2	3.75	3.7	.....
20	2.7	.....	.....	.....	.....	.....	4.05	5.3	5.0	3.7	3.65	.....
21	.....	.....	2.1	.....	.....	.....	4.1	5.0	4.9	3.6	3.5	.....
22	2.65	2.6	.....	.....	.....	.....	4.0	4.8	4.8	3.6	3.5	.....
23	.....	.....	.....	.....	.....	.....	3.9	4.8	3.9	3.5	3.6	.....
24	3.0	2.4	2.1	.....	.....	.....	4.0	4.9	3.8	3.45	4.0	.....
25	.....	.....	.....	.....	.....	.....	4.0	5.6	3.6	3.4	3.8	.....
26	.....	2.35	2.1	.....	.....	.....	3.8	5.7	3.7	3.3	3.6	.....
27	3.5	.....	.....	.....	.....	.....	3.75	5.2	4.0	3.3	3.5	.....
28	.....	.....	2.1	.....	.....	.....	3.75	4.7	4.1	3.25	3.5	.....
29	3.3	2.2	.....	.....	.....	.....	3.55	4.5	4.5	3.25	3.45	.....
30	.....	.....	.....	.....	.....	.....	3.4	4.25	4.4	3.25	3.45	.....
31	3.0	.....	2.1	.....	.....	.....	.....	4.4	.....	3.65	3.45	.....

Daily discharge, in second-feet, of Swiftcurrent Creek at Sherburne Lake, Mont., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	84	128	61	.....	.....	.....	.....	232	571	435	183	126
2	84	118	61	.....	.....	.....	.....	222	779	407	183	126
3	84	108	61	.....	.....	.....	.....	707	1,010	340	183	126
4	84	96	63	.....	.....	.....	.....	853	1,090	315	174	120
5	84	84	64	.....	.....	.....	.....	638	970	638	174	120
6	84	96	66	.....	.....	.....	.....	449	707	672	183	114
7	84	108	65	.....	.....	.....	.....	340	478	571	183	120
8	84	120	64	.....	.....	.....	.....	278	393	508	183	138
9	87	106	62	.....	.....	.....	.....	380	328	449	174	138
10	90	93	61	.....	.....	.....	.....	638	222	393	166	132
11	93	88	61	.....	.....	.....	.....	638	222	393	151	132
12	130	84	61	.....	.....	.....	.....	508	222	366	144	126
13	166	89	62	.....	.....	.....	.....	508	266	366	138	.....
14	194	93	64	.....	.....	.....	.....	571	672	366	138	.....
15	222	98	62	.....	.....	.....	.....	707	672	366	138	.....
16	198	100	61	.....	.....	.....	.....	853	571	353	138	.....
17	175	103	61	.....	.....	.....	.....	930	604	315	183	.....
18	151	94	61	.....	.....	.....	222	891	707	290	212	.....
19	127	84	61	.....	.....	.....	222	779	707	278	166	.....
20	103	87	61	.....	.....	.....	353	743	638	266	158	.....
21	100	90	61	.....	.....	.....	366	638	604	243	138	.....
22	98	93	61	.....	.....	.....	340	571	571	243	138	.....
23	118	85	61	.....	.....	.....	315	571	315	222	151	.....
24	138	77	61	.....	.....	.....	340	604	290	212	222	.....
25	166	76	61	.....	.....	.....	340	853	243	202	183	.....
26	194	74	61	.....	.....	.....	290	891	266	183	151	.....
27	222	71	61	.....	.....	.....	278	707	340	183	138	.....
28	202	69	61	.....	.....	.....	278	539	366	174	138	.....
29	183	66	61	.....	.....	.....	232	478	478	174	132	.....
30	160	64	61	.....	.....	.....	202	407	449	174	132	.....
31	138	.....	61	.....	.....	.....	.....	449	.....	254	132	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 31, 1913, and Apr. 18 to Aug. 16, 1914, from a rating curve well defined between 90 and 500 second-feet; Aug. 17 to Sept. 12, 1914, from a poorly defined rating curve; Sept. 13–30, 1914, estimated, at 125 second-feet.

Monthly discharge of Swiftcurrent Creek at Sherburne Lake, Mont., for the year ending Sept. 30, 1914.

[Drainage area, 64.0 square miles.]

Month.	Discharge in second-feet.				Depth in inches on drainage area.	Run-off (total in acre-feet.)	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.			
October	222	84	133	2.08	2.40	8,180	B.
November	128	64	91.4	1.43	1.60	5,440	B.
December	66	61	61.7	.966	1.11	3,790	B.
April 18-30	366	202	291	4.55	2.20	7,500	A.
May	930	222	599	9.36	10.79	36,800	A.
June	1,090	222	525	8.20	9.15	31,200	A.
July	672	174	334	5.22	6.02	20,500	A.
August	222	132	162	2.53	2.92	9,960	B.
September	.....	.....	126	1.97	2.20	7,500	C.

OTTERTAIL RIVER AT GERMAN CHURCH, NEAR FERGUS FALLS, MINN.

Location.—At highway bridge on south line of sec. 31, T. 134 N., R. 42 W., about 8 miles north of Fergus Falls; about 5 miles upstream from old station.[1]

Records available.—October 29, 1913, to September 30, 1914, at present site. May 9, 1904, to October 22, 1913, at old station.[1]

Drainage area.—1,300 square miles.

Gage.—Standard chain gage, fastened to downstream handrail; read once daily to quarter-tenths. Limits of use: Hundredths below 2.0, half-tenths between 2.0 and 3.0, and tenths above 3.0 feet.

Channel and control.—Well-defined control about 100 feet below gage; channel of heavy gravel and rock; practically permanent, except for growth of grass at control.

Discharge measurements.—Made from the bridge.

Winter flow.—Affected by ice from December to March; estimates made from measure ments made through the ice, from gage heights, and from climatic data.

Regulation.—Ottertail Lake, about 22 square miles in area, forms a natural reservoir which regulates the flow of the river to such an extent that the range of stage is small. On the upper part of the river are a number of dams used in driving logs to the sawmill at Frazee, where the lowest dam is built. The next dam below Frazee is at Maine, several miles below Ottertail Lake, about sec. 35, T. 134 N., R. 41 W. During the low-water season the closing of the turbine gates at Maine may have an effect on the flow immediately below the dam. Above the station the river flows through small lakes which tend to equalize the flow at the station. Below the station there are a number of power plants, but owing to the fall of the river their influence is not observable at the gage.

Accuracy.—Gage-height record reliable.

Data not sufficient for estimates of discharge.

[1] Published under "Ottertail River near Fergus Falls, Minn."

Discharge measurements of Ottertail River at German Church, near Fergus Falls, 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.*
Oct. 22	W. G. Hoyt	1.83	350	Feb. 28	S. B. Soulé	3.20	171
29	S. B. Soulé	1.90	[a] 340	May 13	do	1.79	324
Dec. 29	do	3.37	[b] 376	June 12	do	1.92	363
Jan. 29	do	2.80	[c] 206	Sept. 18	do	2.17	[d] 391

[a] Discharge relation may be slightly affected by grass.
[b] Partial ice cover at control.
[c] Complete ice cover at control.
[d] Discharge relation may be affected by backwater from grass at the control.

Daily gage height, in feet, of Ottertail River at German Church, near Fergus Falls, Minn., for the year ending Sept. 30, 1914.

[D. S. Danielson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.90	1.92	2.9	.....	.....	.....	1.70	1.80	2.4	2.3	2.1
2	.....	1.90	1.92	.....	3.0	.....	1.50	1.70	1.80	2.35	2.3	2.1
3	.....	1.90	1.92	.....	.....	3.0	.....	1.72	1.82	2.35	2.3	2.1
4	.....	1.92	1.92	.....	.....	.....	1.50	1.72	1.85	2.35	2.3	2.1
5	.....	1.90	1.92	2.6	3.0	3.1	1.55	1.72	1.85	2.35	2.3	2.1
6	.....	1.90	1.95	.....	.....	.....	1.45	1.75	1.82	2.4	2.3	2.1
7	.....	1.90	2.00	.....	.....	.....	1.50	1.75	1.85	2.4	2.3	2.1
8	.....	1.90	1.95	2.6	.....	.....	1.55	1.75	1.90	2.4	2.3	2.1
9	.....	1.90	1.80	.....	3.0	.....	1.45	1.72	1.92	2.4	2.25	2.1
10	.....	1.90	1.80	.....	.....	3.3	1.50	1.72	1.95	2.4	2.2	2.1
11	.....	1.92	1.75	.....	.....	.....	1.40	1.75	1.95	2.4	2.2	2.1
12	.....	1.92	1.80	2.2	3.2	.....	1.55	1.78	1.92	2.35	2.2	2.05
13	.....	1.92	1.85	.....	.....	3.3	1.55	1.78	1.92	2.3	2.2	2.2
14	.....	1.90	1.85	.....	.....	.....	1.60	1.78	1.90	2.3	2.2	2.2
15	.....	1.90	1.90	2.5	.....	.....	1.65	1.78	1.90	2.3	2.2	2.2
16	.....	1.90	2.2	.....	.....	3.2	1.50	1.80	1.90	2.3	2.2	2.2
17	.....	1.92	1.85	.....	3.2	.....	1.50	1.78	2.0	2.3	2.2	2.2
18	.....	1.92	1.85	.....	.....	.....	1.60	1.78	2.0	2.3	2.2	2.15
19	.....	1.92	1.85	2.6	.....	2.9	1.55	1.78	2.0	2.3	2.2	2.1
20	.....	1.95	1.95	.....	3.2	.....	1.55	1.75	2.0	2.3	2.2	2 1
21	.....	1.95	2.25	.....	.....	.....	1.55	1.75	2.1	2.3	2.2	2.1
22	.....	1.95	2.3	2.6	.....	.....	1.45	1.75	2.0	2.3	2.2	2.1
23	.....	1.95	2.4	.....	3.2	.....	1.55	1.75	2.05	2.3	2.25	2.1
24	.....	1.95	2.3	.....	.....	2.9	1.58	1.75	2.35	2.3	2.2	2.1
25	.....	1.95	.....	.....	.....	.....	1.58	1.80	2.35	2.3	2.2	2.1
26	.....	1.95	3.0	2.8	3.2	2.8	1.58	1.78	2.35	2.3	2.2	2.1
27	.....	1.95	.....	.....	.....	.....	1.60	1.78	2.4	2.3	2.2	2.1
28	.....	1.95	3.5	.....	.....	.....	1.62	1.78	2.35	2.3	2.15	2.1
29	1.90	1.95	3.3	2.8	.....	.....	1.70	1.78	2.35	2.3	2.15	2.1
30	1.90	1.95	.....	.....	.....	1.60	1.70	1.78	2.35	2.35	2.1	2.1
31	1.90	.....	2.3	.....	.....	.....	.....	1.80	.....	2.35	2.1	.....

NOTE.—Discharge relation probably affected by ice Dec. 16 and about Dec. 21, 1913, to Mar. 31, 1914.

RED RIVER AT FARGO, N. DAK.

Location.—At the dam one-half mile above the highway bridge connecting Front Street, Fargo, N. Dak., with Moorhead, Minn., 10 miles above the mouth of Sheyenne River.

Records available.—May 27, 1901, to September 30, 1914.

Drainage area.—6,020 square miles.

Gage.—Vertical staff attached to tree on left bank about 6 rods above dam; datum about 1 foot below crest of dam. Prior to September 1, 1914, vertical staff attached to the breakwater for the center pier of the Front Street Bridge; could not be read accurately without a field glass.

Channel and control.—Channel consists of clay and silt; slightly shifting. The dam below the gage forms the control.

Discharge measurements.—Made from the Front Street Bridge or from the Northern Pacific Railway bridge; sometimes from a footbridge 8 rods above the dam.

Regulation.—The dam, which is a tight overflow weir without sluices, was built for the purpose of maintaining a sufficient depth of water for the intake pipe of the waterworks, and raises the water about 5 feet at lowest stage.

Winter flow.—Discharge relation affected by ice from about the middle of November to the 1st of April; observations discontinued. On account of the comparatively sluggish current and the fact that the river flows northward into a colder district, a pronounced backwater caused by ice jams usually occurs at the spring breakup.

Accuracy.—Records good since September 1, 1914; prior to that date only fair, because of the inaccessibility of gage, resulting small errors in observations, and changes in rating curve caused by lack of permanence in channel.

Discharge measurements of Red River at Fargo, N. Dak., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gageg height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	W. B. Stevenson	8.84	508	July 30	E. F. Chandler	[a]8.96	650
Apr. 13	Ole Christianson	8.90	610	Sept. 12	do	[b]8.28	451
May 23	E. F. Chandler	8.58	579				

[a] New gage read 3.16 feet. [b] New gage read 2.84 feet.

NOTE.—Gage heights of discharge measurements in the above table refer to the old staff gage at the Front Street Bridge.

Daily gage height, in feet, of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1914.

[E. H. Grasse and F. L. Anders, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.1	8.1	8.4				8.7	13.2	8.8	14.5	8.6	2.93
2	8.0	8.2	8.4				8.8	13.7	8.8	14.2	8.5	2.86
3	7.9	8.4	8.5				9.1	13.2	9.0	13.6	8.5	2.86
4	7.9	8.6	8.6				9.5	12.0	9.2	12.4	8.6	2.93
5	8.0	8.8	8.7				9.5	11.2	9.5	12.0	8.6	2.91
6	8.2	9.2	8.8				9.4	10.5	9.7	11.9	8.6	2.85
7	8.3	9.0	8.8				9.4	10.2	10.4	11.4	8.7	2.87
8	8.8	8.9	8.6				9.2	10.0	11.1	11.2	8.7	2.79
9	9.4	8.8	8.5				9.2	9.9	12.4	10.9	8.6	2.81
10	9.4	8.6	8.4				9.1	9.7	13.5	10.5	8.6	2.81
11	9.3	8.4	8.2				9.0	9.6	14.1	10.1	8.6	2.80
12	9.3	8.4	8.2				9.0	9.4	15.9	9.9	8.5	2.83
13	9.4	8.3	8.0				9.2	9.3	15.9	9.7	8.5	2.83
14	9.4	8.1	8.0				9.2	9.2	14.7	9.5	8.5	2.94
15	9.3	8.0	8.2				9.3	9.1	14.1	9.4	8.4	3.04
16	9.2	8.2	8.3				9.1	9.0	12.8	9.3	8.5	3.12
17	9.2	8.5	8.3				8.9	9.0	12.1	9.3	8.5	3.29
18	9.1	8.7	8.5				8.7	9.0	11.4	9.2	8.6	3.30
19	9.1	9.0	8.6				8.7	8.9	11.0	9.2	8.6	3.26
20	9.0	8.9	8.9				8.7	8.9	10.6	9.2	8.5	3.20
21	8.9	8.9	8.9				8.7	8.8	10.4	9.1	8.4	3.18
22	8.8	8.8	8.9			8.9	8.8	8.7	10.3	9.0	8.3	3.18
23	8.8	8.6	8.9			8.7	8.8	8.7	10.5	9.0	8.4	3.10
24	8.6	8.4				8.6	8.7	8.7	10.6	8.9	8.5	3.05
25	8.6	8.3				8.6	8.7	8.7	10.9	8.9	8.6	3.06
26	8.6	8.2				8.5	8.7	8.8	11.4	8.9	8.7	3.05
27	8.5	8.1				8.3	8.7	8.9	11.8	8.9	8.7	3.02
28	8.4	8.3				8.1	9.2	8.9	13.3	8.8	8.7	3.00
29	8.2	8.3				8.2	9.3	8.8	14.0	8.8	8.7	2.99
30	8.2	8.3				8.4	11.2	8.8	14.3	8.7	8.7	2.97
31	8.1					8.6		8.8		8.7	8.7	

NOTE.—The discharge relation was affected by ice Dec. 6, 1913, to Mar. 21, 1914. Gage heights Sept. 1-30, 1914, refer to the new gage.

Daily discharge, in second-feet, of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	335	335	406	.....	.....	.....	550	2,030	580	2,330	520	506
2	312	358	406	.....	.....	.....	580	2,220	580	2,410	490	470
3	290	406	430	.....	.....	.....	670	2,030	640	2,180	490	470
4	290	455	455	.....	.....	.....	790	1,600	700	1,740	520	506
5	312	508	481	.....	.....	.....	790	1,330	790	1,600	520	495
6	358	625	.....	.....	.....	.....	760	1,100	852	1,570	520	465
7	382	565	.....	.....	.....	.....	760	1,010	1,070	1,400	550	475
8	508	536	.....	.....	.....	.....	700	945	1,290	1,330	550	435
9	685	508	.....	.....	.....	.....	700	914	1,740	1,230	520	445
10	685	455	.....	.....	.....	.....	670	852	2,140	1,100	520	445
11	655	406	.....	.....	.....	.....	640	821	2,370	976	520	440
12	655	406	.....	.....	.....	.....	640	760	3,060	914	490	455
13	685	382	.....	.....	.....	.....	700	730	3,060	852	490	455
14	685	335	.....	.....	.....	.....	700	700	2,600	790	490	511
15	655	312	.....	.....	.....	.....	730	670	2,370	760	461	564
16	625	358	.....	.....	.....	.....	670	640	1,890	730	490	607
17	625	430	.....	.....	.....	.....	610	640	1,640	730	490	704
18	595	481	.....	.....	.....	.....	550	640	1,400	700	520	710
19	595	565	.....	.....	.....	.....	550	610	1,260	700	520	687
20	565	536	.....	.....	.....	.....	550	610	1,130	700	490	652
21	536	536	.....	.....	.....	.....	550	580	1,070	670	461	641
22	508	508	.....	.....	.....	610	580	550	1,040	640	433	641
23	508	455	.....	.....	.....	550	580	550	1,100	640	461	596
24	455	406	.....	.....	.....	520	550	550	1,130	610	490	569
25	455	382	.....	.....	.....	520	550	550	1,230	610	520	574
26	455	358	.....	.....	.....	490	550	580	1,400	610	550	569
27	430	335	.....	.....	.....	433	550	610	1,530	610	550	553
28	406	382	.....	.....	.....	380	700	610	2,070	580	550	542
29	358	382	.....	.....	.....	406	730	580	2,330	580	550	537
30	358	382	.....	.....	.....	461	1,330	580	2,440	550	550	526
31	335	.....	.....	.....	.....	521	.....	580	.....	550	550	.....

NOTE.—Daily discharge Oct. 1 to Dec. 5, 1913, Mar. 22 to Aug. 31, and Sept. 1–30, 1914, computed from three well-defined rating curves. Discharge estimated, because of ice, from climatic records, and discharge of adjacent drainage areas, as follows: Dec. 6–31, 1913, 336 second-feet; Jan. 1–31, 200 second-feet; Feb. 1–28, 140 second-feet; and Mar. 1–21, 250 second-feet.

Monthly discharge of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	685	290	494	A.
November	625	335	436	B.
December	.....	.....	352	D.
January	.....	.....	200	
February	.....	.....	140	
March	610	.....	327	D.
April	1,330	550	666	C.
May	2,220	550	877	B.
June	3,060	580	1,550	B.
July	2,330	550	1,010	B.
August	550	433	511	B.
September	710	435	542	A.
The year	3,060	.....	594	

NOTE.—See footnote to table of daily discharge.

RED RIVER AT GRAND FORKS, N. DAK.

Location.—At Northern Pacific Railway bridge between Grand Forks, N. Dak., and East Grand Forks, Minn., about half a mile below mouth of Red Lake River.

Records available.—May 26, 1901, to September 30, 1914; gage-height records kept by United States Engineer Corps since 1882, and a few discharge measurements were made by them in early years.

Drainage area.—25,000 square miles.

Gages.—Staff and chain attached to Northern Pacific Railway bridge; same datum. As a rule chain gage is read only during periods of exceptionally low water. Gage of United States Engineer Corps located on bridge breakwater at same place as staff gage of United States Geological Survey; datum 5 feet higher.

Channel and control.—Clay and silt; shifts slightly.

Discharge measurements.—Made from Great Northern Railway bridge, about one-fifth mile above gage.

Regulation.—No dams, other obstructions, or rapids below; channel fairly uniform for many miles. At Crookston, 25 miles above, on Red Lake River, are nearest power plant and reservoir affecting flow; about half the water comes from Red Lake River, but storage at Crookston plant is too small to cause perceptible fluctuation at gage. On Red River proper and its tributaries above Grand Forks, no important power plants or reservoirs within a hundred miles.

Winter flow.—River flows under smooth ice from about middle of November to middle of April; flow usually steady with no sudden fluctuations; since 1905 sufficient discharge measurements have been made each winter to obtain fairly satisfactory summaries. On account of a gentle current and the fact that the river flows north into cooler regions the gage reading is usually excessive for a few days or weeks when ice breaks up in the spring, and flow must be largely estimated unless daily discharge measurements are made; actual measurements when river appeared to be open at station have sometimes shown the reading to be 5 feet greater than would be necessary for same discharge when entire river is open.

Discharge measurement of Red River at Grand Forks, N. Dak., 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. 8	Stevenson and Powers.	4.77	819	Mar. 24	Ole Christianson.....	[a]8.48	1,400
Nov. 29	A. S. Miller.....	5.47	1,190	Apr. 25	Burdick and Powers...	8.30	2,100
Jan. 8	.....do.....	[a]5.40	665	June 2	E. F. Chandler.....	7.96	2,350
13	.....do.....	[a]5.55	530	15	.....do.....	16.77	7,640
15	.....do.....	[a]5.54	466	July 6	.....do.....	13.04	5,130
Feb. 27	Ole Christianson.....	[a]5.38	526	Aug. 29	Chandler and Babcock.	5.74	1,230
Mar. 9	Stevenson and Christianson.....	[a]5.54	530				

[a] River frozen.

Daily gage height, in feet, of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1914.

[H. L. Hayes, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.3	5.42	5.6	.....	.....	.....	7.92	8.38	7.25	13.3	6.02	5.8
2	4.3	5.65	5.7	.....	.....	.....	8.1	8.98	7.35	14.05	6.0	5.6
3	4.3	5.68	5.68	4.8	.....	.....	8.8	10.42	7.4	14.65	6.0	5.52
4	4.3	5.8	5.7	.....	.....	.....	9.62	11.5	7.6	14.4	6.05	5.42
5	4.38	6.0	5.45	.....	.....	.....	10.75	12.22	7.8	12.85	6.1	5.38
6	4.5	6.12	5.3	.....	.....	.....	11.65	11.65	8.25	12.5	6.05	5.7
7	4.55	6.25	4.9	.....	5.1	.....	12.18	10.8	8.45	11.8	5.95	5.65
8	4.6	6.3	.....	.....	.....	.....	12.4	10.35	9.1	10.95	5.78	5.62
9	4.65	6.3	.....	.....	.....	5.45	12.4	9.8	10.15	10.32	5.7	5.55
10	4.95	5.8	.....	5.3	.....	.....	12.4	9.4	11.1	9.65	5.55	5.75
11	5.3	5.75	.....	.....	.....	.....	12.18	9.0	12.15	9.52	5.5	5.7
12	5.8	5.0	.....	.....	.....	.....	11.8	8.72	14.3	8.95	5.5	5.6
13	6.2	5.45	5.3	.....	.....	.....	11.62	8.45	16.35	8.5	5.45	5.5
14	6.4	5.88	.....	.....	5.0	6.0	11.45	8.1	16.95	7.95	5.4	5.25
15	6.4	5.48	.....	.....	.....	.....	11.75	7.65	17.3	7.65	5.3	5.0
16	6.4	5.4	.....	.....	.....	.....	11.88	7.35	17.9	7.55	5.12	5.3
17	6.4	5.4	.....	5.1	.....	.....	11.12	7.95	18.15	7.35	5.1	5.7
18	6.4	5.68	.....	.....	.....	.....	10.98	7.72	17.75	7.05	5.0	5.85
19	6.4	5.9	.....	.....	.....	.....	10.92	7.62	16.15	7.6	4.98	6.05
20	6.4	5.8	5.3	.....	.....	.....	10.6	7.6	15.15	7.6	4.92	6.1
21	6.35	5.8	.....	.....	4.7	7.9	9.5	7.6	14.25	7.6	4.98	6.65
22	6.2	5.82	.....	.....	.....	8.25	9.05	7.92	13.15	7.62	5.0	6.9
23	5.85	5.88	.....	.....	.....	8.45	8.78	7.9	11.98	6.9	5.55	6.75
24	5.72	5.76	.....	5.3	.....	8.7	8.58	7.85	11.15	6.72	5.45	6.48
25	5.58	5.35	.....	.....	.....	8.7	8.45	7.85	10.6	6.5	5.42	6.2
26	5.5	5.3	.....	.....	.....	8.72	8.1	7.9	10.2	6.5	5.5	6.1
27	5.4	5.5	5.1	.....	.....	8.5	8.1	7.75	10.1	6.5	5.5	5.88
28	5.55	5.5	.....	.....	5.0	8.35	8.25	7.65	10.7	6.5	5.65	5.72
29	5.0	5.5	.....	.....	.....	7.95	8.1	7.68	11.25	6.42	5.85	5.6
30	4.48	5.4	.....	.....	.....	7.55	8.0	7.5	12.75	6.32	5.85	5.48
31	4.85	.....	.....	5.3	.....	7.75	.....	7.4	.....	6.3	5.85	.....

NOTE.—Discharge relation affected by ice Dec. 1, 1913, to Apr. 16, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	654	1,040	.....	.....	.....	.....	.....	2,350	1,780	5,490	1,270	1,180
2	654	1,130	.....	.....	.....	.....	.....	2,690	1,830	6,020	1,260	1,110
3	654	1,140	.....	.....	.....	.....	.....	3,570	1,850	6,450	1,260	1,080
4	654	1,180	.....	.....	.....	.....	.....	4,270	1,950	6,270	1,280	1,040
5	680	1,260	.....	.....	.....	.....	.....	4,750	2,050	5,180	1,300	1,030
6	719	1,310	.....	.....	.....	.....	.....	4,370	2,280	4,940	1,280	1,150
7	735	1,360	.....	.....	.....	.....	.....	3,810	2,390	4,470	1,240	1,130
8	752	1,380	.....	.....	.....	.....	.....	3,520	2,760	3,910	1,180	1,120
9	769	1,380	.....	.....	.....	.....	.....	3,180	3,400	3,500	1,150	1,090
10	872	1,180	.....	.....	.....	.....	.....	2,930	4,010	3,080	1,090	1,160
11	998	1,160	.....	.....	.....	.....	.....	2,700	4,700	2,990	1,070	1,150
12	1,180	890	.....	.....	.....	.....	.....	2,540	6,200	2,670	1,070	1,110
13	1,340	1,050	.....	.....	.....	.....	.....	2,390	7,680	2,420	1,050	1,070
14	1,420	1,210	.....	.....	.....	.....	.....	2,200	8,200	2,120	1,030	980
15	1,420	1,060	.....	.....	.....	.....	.....	1,970	8,490	1,970	998	890
16	1,420	1,030	.....	.....	.....	.....	.....	1,830	8,990	1,920	933	998
17	1,420	1,030	.....	.....	.....	.....	4,020	2,120	9,200	1,830	926	1,150
18	1,420	1,140	.....	.....	.....	.....	3,930	2,010	8,860	1,690	890	1,200
19	1,420	1,220	.....	.....	.....	.....	3,890	1,960	7,570	1,950	883	1,280
20	1,420	1,180	.....	.....	.....	.....	3,680	1,950	6,810	1,950	862	1,300
21	1,400	1,180	.....	.....	.....	.....	2,990	1,950	6,160	1,950	883	1,520
22	1,340	1,190	.....	.....	.....	.....	2,730	2,110	5,380	1,960	890	1,630
23	1,200	1,210	.....	.....	.....	.....	2,570	2,100	4,590	1,630	1,090	1,560
24	1,150	1,170	.....	.....	.....	.....	2,460	2,080	4,040	1,550	1,050	1,450
25	1,100	1,020	.....	.....	.....	.....	2,390	2,080	3,680	1,460	1,040	1,340
26	1,070	998	.....	.....	.....	.....	2,200	2,100	3,430	1,460	1,070	1,290
27	1,030	1,070	.....	.....	.....	.....	2,200	2,020	3,360	1,460	1,070	1,210
28	1,090	1,070	.....	.....	.....	.....	2,580	1,980	3,750	1,460	1,130	1,150
29	890	1,070	.....	.....	.....	.....	2,200	1,990	4,100	1,430	1,200	1,110
30	712	1,030	.....	.....	.....	.....	2,150	1,900	5,110	1,390	1,200	1,060
31	837	.....	.....	.....	.....	.....	.....	1,850	.....	1,380	1,200	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 1–31, 1913, 793 second-feet; Jan. 1–31, 509 second-feet; Feb. 1–28, 428 second-feet; Mar. 1–31, 911 second-feet and Apr. 1–16, 3,100 second-feet.

Monthly discharge of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	1,420	654	1,050	A.
November	1,380	890	1,140	B.
December			793	C.
January			509	C.
February			428	C.
March			911	C.
April			2,990	C.
May	4,750	1,830	2,560	B.
June	9,200	1,780	4,820	B.
July	6,450	1,380	2,840	B.
August	1,300	862	1,090	B.
September	1,630	890	1,180	B.
The year	9,200		1,690	

NOTE.—See footnote to table of daily discharge.

WILD RICE RIVER AT TWIN VALLEY, MINN.

Location.—At highway bridge at Twin Valley, 2 miles above nearest tributary which enters at Heiberg.

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

Drainage area.—805 square miles.

Gage.—Vertical staff read daily, morning and evening, to half-tenths. Limits of use: Hundredths below 5.0, half-tenths from 5.0 to 6.5, and tenths above 6.5 feet.

Channel and control.—Practically permanent; river overflows at a stage of 12 feet on the gage, and covers an area several hundred feet wide.

Discharge measurements.—Made from the bridge except at extreme low stages, when they are made at a wading section.

Floods.—An exceptionally severe flood occurred in July, 1909, which overflowed the lower part of the valley and wrecked the power dam at Faith by cutting around the end and greatly increasing the width of the channel. The maximum stage of the flood at Twin Valley was 20 feet and the discharge about 9,200 second-feet.

Regulation.—Discharge affected by storage created by the dams at lower end of Lower Rice Lake and at the outlet of Twin Lakes. Highest point affected by backwater from dam at Heiberg is more than a mile below Twin Valley.

Discharge measurements of Wild Rice River at Twin Valley, 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.*
Dec. 27	Ole Christianson	5.20	[a] 15.5	May 24	W. B. Stevenson	5.31	126
Feb. 9	do	6.0	[a] 14.4	July 11	E. F. Chandler	6.41	352
Mar. 11	do	6.28	[a] 23.4	12	do	6.32	340
Apr. 19	W. B. Stevenson	6.13	170	Aug. 25	do	5.59	203

[a] River frozen over.

Daily gage height, in feet, of Wild Rice River at Twin Valley, Minn., for the year ending Sept. 30, 1914.

[Axel Johnson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.90	5.4	5.5	.....	.....	.....	7.8	6.8	5.8	7.5	5.6	5.05
2	4.82	5.3	5.4	.....	.....	.....	7.4	6.7	5.85	7.4	5.6	5.05
3	4.90	5.35	5.4	.....	.....	.....	7.8	6.7	5.8	7.4	5.5	5.05
4	4.90	5.1	5.4	.....	.....	.....	7.6	6.7	5.85	7.2	5.4	5.2
5	4.90	5.1	5.4	.....	.....	.....	7.4	6.6	6.2	7.0	5.4	5.55
6	5.3	5.2	5.4	.....	.....	.....	7.3	6.6	6.7	6.8	5.4	5.7
7	5.4	5.2	5.3	.....	.....	.....	7.1	6.6	6.8	6.7	5.4	5.7
8	5.5	5.4	5.3	.....	.....	.....	6.8	6.6	7.0	6.6	5.3	5.7
9	5.3	5.4	5.3	.....	.....	.....	6.7	6.0	8.3	6.5	5.2	5.55
10	5.2	5.4	5.35	.....	.....	.....	6.45	5.8	8.4	6.4	5.2	5.4
11	5.2	5.5	5.6	.....	.....	.....	6.3	5.6	8.4	6.4	5.2	5.4
12	5.2	5.4	5.7	.....	.....	.....	6.3	5.45	8.4	6.4	5.2	5.45
13	5.2	5.3	5.6	.....	.....	.....	6.1	5.35	8.3	6.3	5.2	5.5
14	5.2	5.15	5.55	.....	5.6	.....	6.0	5.3	8.3	6.3	5.2	5.5
15	5.2	5.1	5.35	6.7	.....	7.5	6.2	5.3	8.1	6.15	5.15	5.5
16	5.1	5.0	5.15	6.7	.....	.....	6.3	5.2	7.8	6.1	5.1	5.5
17	5.0	5.1	5.1	.....	.....	.....	6.25	5.5	7.0	6.0	5.1	5.45
18	5.0	5.2	.....	.....	.....	.....	6.35	5.1	6.8	6.0	5.15	5.4
19	5.0	5.1	.....	.....	.....	.....	6.15	5.25	6.6	5.9	5.2	5.4
20	4.90	5.0	.....	.....	.....	.....	6.2	5.35	6.6	5.8	5.2	5.35
21	4.80	5.05	.....	.....	.....	.....	6.2	5.4	5.95	5.8	5.2	5.35
22	4.80	5.1	.....	.....	.....	.....	6.9	5.4	5.4	5.8	5.3	5.35
23	4.95	5.5	5.1	.....	.....	.....	7.4	5.4	6.2	5.9	5.3	5.35
24	5.0	5.1	.....	.....	.....	.....	7.7	5.3	6.2	6.0	5.3	5.35
25	5.2	5.2	.....	.....	.....	.....	6.8	5.2	6.0	5.85	5.3	5.35
26	5.3	5.5	.....	.....	.....	.....	6.4	5.2	6.15	5.7	5.3	5.3
27	5.1	5.7	.....	.....	.....	.....	6.4	5.1	6.8	5.8	5.3	5.3
28	5.2	5.7	.....	.....	5.8	.....	6.5	5.15	7.0	5.7	5.3	5.3
29	5.3	5.7	.....	.....	.....	.....	6.8	5.2	7.2	5.7	5.25	5.3
30	5.4	5.65	.....	6.2	.....	6.6	6.8	5.3	7.4	5.6	5.1	5.3
31	5.4	.....	.....	.....	.....	8.0	.....	5.7	.....	5.7	5.1	.....

NOTE.—Discharge relation affected by ice about Dec. 11, 1913 to Apr. 12, 1914, and by backwater from logs about Oct. 1 to Dec. 10, 1913, and Apr. 13–24, 1914. On Mar. 31, the ice was reported to be breaking up.

Daily discharge, in second-feet, of Wild Rice River at Twin Valley, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	37	86	98	.....	.....	.....	.....	464	215	717	176	82
2	31	75	86	.....	.....	.....	.....	434	226	678	176	82
3	37	80	86	.....	.....	.....	.....	434	215	678	158	82
4	37	54	86	.....	.....	.....	.....	434	226	601	140	106
5	37	54	86	.....	.....	.....	.....	405	303	530	140	167
6	75	64	86	.....	.....	.....	.....	405	434	464	140	195
7	86	64	75	.....	.....	.....	.....	405	464	434	140	195
8	98	86	75	.....	.....	.....	.....	405	530	405	123	195
9	75	86	75	.....	.....	.....	.....	258	1,040	378	106	167
10	64	86	80	.....	.....	.....	.....	215	1,080	352	106	140
11	64	98	.....	.....	.....	.....	.....	176	1,080	352	106	140
12	64	86	.....	.....	.....	.....	.....	149	1,080	352	106	149
13	64	75	.....	.....	.....	.....	175	132	1,040	327	106	158
14	64	59	.....	.....	.....	.....	161	123	1,040	327	106	158
15	64	54	.....	.....	.....	.....	189	123	955	292	98	158
16	54	45	.....	.....	.....	.....	203	106	835	280	90	158
17	45	54	.....	.....	.....	.....	196	158	530	258	90	149
18	45	64	.....	.....	.....	.....	210	90	464	258	98	140
19	45	54	.....	.....	.....	.....	182	114	405	236	106	140
20	37	45	.....	.....	.....	.....	189	132	405	215	106	132
21	30	50	.....	.....	.....	.....	189	140	247	215	106	132
22	30	54	.....	.....	.....	.....	296	140	140	215	123	132
23	41	98	.....	.....	.....	.....	380	140	303	236	123	132
24	45	54	.....	.....	.....	.....	434	123	303	258	123	132
25	64	64	.....	.....	.....	.....	464	106	258	226	123	132
26	75	98	.....	.....	.....	.....	352	106	292	195	123	123
27	54	122	.....	.....	.....	.....	352	90	464	215	123	123
28	64	122	.....	.....	.....	.....	378	98	530	195	123	123
29	75	122	.....	.....	.....	.....	464	106	601	195	114	123
30	86	116	.....	.....	.....	.....	464	123	678	176	90	123
31	86	.....	.....	.....	.....	.....	.....	195	.....	195	90	.....

NOTE.—About July 28, 1913, log driving was attempted, and, on account of the low stage, logs lodged along the channel, causing backwater at the gage. The logs remained in the channel until Apr. 24, 1914. Daily discharge Oct. 1 to Dec. 10, 1913, and Apr. 12–24, 1914, computed from a fairly well defined rating curve based on five discharge measurements made during these periods. Daily discharge, Apr. 25 to Sept. 30, 1914, computed from a fairly well defined rating curve.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows:

Dec. 11–31, 1913, 40 second-feet; Jan. 1–15, 1914, 18 second-feet; Jan. 16–31, 24 second-feet; Feb. 1–15, 15 second-feet; Feb. 16–28, 13 second-feet; Mar. 1–15, 27 second-feet; Mar. 16–31, 46 second-feet; Apr. 1–12, 190 second-feet.

Monthly discharge of Wild Rice River at Twin Valley, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	98	30	57.2	B.
November	122	45	75.6	B.
December	.....	.....	54.0	C.
January	.....	.....	21	D.
February	.....	.....	14	C.
March	.....	.....	37	C.
April	464	.....	252	C.
May	464	90	211	C.
June	1,080	140	546	B.
July	717	176	337	A.
August	176	90	119	C.
September	195	82	139	B.
The year	1,080	.....	155	

RED LAKE RIVER AT THIEF RIVER FALLS, MINN.

Location.—One-third mile below the dam at Thief River Falls, and a mile or more below the mouth of Thief River.

Records available.—July 2, 1909, to September 30, 1914.

Drainage area.—3,430 square miles.

Gage.—Inclined staff; read daily, morning and evening, to half-tenths. Limits of use: Hundredths below 4.0, half-tenths from 4.0 to 5.0, and tenths above 5.0 feet.

Channel and control.—Control changed temporarily by log jams that form below; channel practically permanent.

Discharge measurements.—Made from a car and cable at the gage.

Winter flow.—River frozen over from latter part of November to first of April; discharge measurements made through the ice to determine flow.

Regulation.—A short distance above the station is the dam used by the Hansen & Barzen Milling Co. and the city lighting plant. The fluctuating loads on the turbines, produced by the operation of the lighting plant at night and of the mill chiefly during the day time, cause fluctuations in the river stage below the dam.

Accuracy.—Records only fair; logs floated down river may jam below the station and cause backwater. Conditions at station have not been satisfactory, but logging below the gage has now been discontinued.

Discharge measurements of Red Lake River at Thief River Falls, 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.*
Oct. 22	W. B. Stevenson	3.41	62	May 23	W. B. Stevenson	5.34	684
Jan. 1	Ole Christianson	4.42	[a] 157	June 12	do	5.83	974
Feb. 11	do	5.35	[a] 270	July 10	E. F. Chandler	4.69	472
Mar. 13	do	5.45	[a] 240	Aug. 27	do	4.34	302
Apr. 23	L. W. Burdick	4.72	480				

[a] River frozen.

Daily gage height, in feet, of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1914.

[C. P. Quist and H. W. Hoard, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.92	3.90	3.95	4.4	.....	.....	5.9	4.55	4.9	4.9	4.05	4.45
2	3.95	3.75	3.98	.....	.....	.....	6.1	4.65	4.8	4.7	4.25	4.15
3	3.95	4.25	4.2	.....	3.60	4.1	6.3	4.45	4.9	4.65	4.05	4.25
4	3.80	4.3	4.3	.....	.....	.....	6.0	4.6	4.9	4.55	4.25	4.15
5	3.70	4.25	4.1	.....	.....	.....	6.0	4.75	4.95	4.45	4.0	4.15
6	4.1	4.2	4.15	4.4	3.55	4.6	5.6	4.75	5.0	4.75	4.1	4.15
7	4.05	4.2	3.25	.....	.....	.....	5.6	4.7	5.2	4.7	4.05	4.1
8	4.2	4.3	3.25	.....	.....	.....	5.0	4.75	5.2	4.8	3.92	4.35
9	4.3	3.80	3.20	4.2	.....	.....	4.95	4.75	5.3	4.65	4.15	4.15
10	4.1	4.0	4.1	.....	3.40	4.8	5.1	4.7	6.2	4.5	4.0	4.25
11	4.05	4.15	4.0	.....	5.4	.....	5.7	4.75	6.2	4.7	3.94	4.3
12	3.88	4.0	3.70	.....	.....	.....	5.8	4.7	6.0	4.45	3.97	4.3
13	3.95	3.95	3.75	4.0	4.6	5.2	4.9	4.5	5.6	4.55	3.97	4.35
14	4.2	3.90	3.65	.....	3.60	.....	5.1	4.4	5.3	4.3	4.05	4.35
15	4.1	4.25	4.1	.....	.....	.....	5.5	4.55	5.2	4.6	4.15	4.3
16	4.35	3.90	3.90	3.70	.....	.....	5.3	4.45	4.8	4.35	4.05	4.25
17	4.15	3.90	3.85	.....	3.70	5.0	5.5	4.4	5.2	4.4	4.0	4.25
18	4.2	3.85	3.90	.....	.....	.....	5.0	4.55	4.8	4.2	3.92	4.45
19	3.65	3.90	3.70	.....	.....	.....	5.6	4.45	4.6	4.4	3.90	4.45
20	4.15	3.80	3.90	4.2	4.0	4.8	4.9	4.65	4.5	4.35	3.77	4.4
21	4.1	4.05	3.70	.....	.....	.....	5.0	5.1	4.75	4.35	3.87	4.45
22	3.60	4.1	3.75	.....	.....	.....	4.8	5.3	4.85	4.15	3.94	4.4
23	4.1	3.95	3.75	4.3	.....	.....	4.7	5.2	4.8	4.2	3.77	4.45
24	4.1	4.05	3.70	.....	3.55	4.1	4.65	5.1	4.45	4.2	4.4	4.45
25	4.2	4.0	3.70	.....	.....	.....	4.6	5.1	4.55	4.2	4.25	4.45
26	3.75	4.15	3.75	.....	.....	.....	4.25	4.9	4.6	3.94	4.35	4.45
27	4.2	4.05	3.65	3.60	4.0	4.6	4.35	5.0	4.55	4.0	4.3	4.4
28	4.2	4.05	3.55	.....	.....	.....	4.45	5.0	4.6	4.1	4.35	4.45
29	4.2	3.95	4.4	.....	.....	.....	4.4	5.1	4.7	4.15	4.35	4.3
30	4.0	3.95	3.85	3.40	.....	.....	4.55	5.2	4.75	4.05	4.15	4.2
31	4.05	.....	3.80	.....	.....	5.0	.....	4.9	.....	4.25	4.45	.....

NOTE.—Discharge relation affected by ice about Oct. 19–23, 1913, and Dec. 1, 1913, to Apr. 19, 1914.

Daily discharge, in second-feet, of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	175	169	.....	.....	.....	.....	.....	375	515	515	212	340
2	183	131	.....	.....	.....	.....	.....	412	472	431	274	242
3	183	274	.....	.....	.....	.....	.....	340	515	412	212	274
4	143	290	.....	.....	.....	.....	.....	393	515	375	274	242
5	119	274	.....	.....	.....	.....	.....	452	538	340	197	242
6	227	258	.....	.....	.....	.....	.....	452	560	452	227	242
7	212	258	.....	.....	.....	.....	.....	431	650	431	212	227
8	258	290	.....	.....	.....	.....	.....	452	650	472	175	306
9	290	143	.....	.....	.....	.....	.....	452	695	412	242	242
10	227	197	.....	.....	.....	.....	.....	431	1,170	357	197	274
11	212	242	.....	.....	.....	.....	.....	452	1,170	431	180	290
12	164	197	.....	.....	.....	.....	.....	431	1,050	340	189	290
13	183	183	.....	.....	.....	.....	.....	357	840	375	189	306
14	258	169	.....	.....	.....	.....	.....	323	695	290	212	306
15	227	274	.....	.....	.....	.....	.....	375	650	393	242	290
16	306	169	.....	.....	.....	.....	.....	340	472	306	212	274
17	242	169	.....	.....	.....	.....	.....	323	650	323	197	274
18	258	156	.....	.....	.....	.....	.....	375	472	258	175	340
19	97	169	.....	.....	.....	.....	.....	340	393	323	169	340
20	212	143	.....	.....	.....	.....	515	412	357	306	136	323
21	197	212	.....	.....	.....	.....	560	605	452	306	161	340
22	97	227	.....	.....	.....	.....	472	695	494	242	180	323
23	212	183	.....	.....	.....	.....	431	650	472	258	136	340
24	227	212	.....	.....	.....	.....	412	605	340	258	323	340
25	258	197	.....	.....	.....	.....	393	605	375	258	274	340
26	131	242	.....	.....	.....	.....	274	515	393	180	306	340
27	258	212	.....	.....	.....	.....	306	560	375	197	290	323
28	258	212	.....	.....	.....	.....	340	560	393	227	306	340
29	258	183	.....	.....	.....	.....	323	605	431	242	306	290
30	197	183	.....	.....	.....	.....	375	650	452	212	242	258
31	212	.....	.....	.....	.....	.....	.....	515	.....	274	340	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 47 and 2,960 second-feet (gage heights, 3.3 and 8.5 feet). Daily discharge, Oct. 19–23, 1913, estimated because of ice.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows:

Dec. 1–15, 140 second-feet; Dec. 16–31, 83 second-feet; Jan. 1–15, 140 second-feet; Jan. 16–31, 110 second-feet; Feb. 1–15, 100 second-feet; Feb. 16–28, 105 second-feet; Mar. 1–15, 220 second-feet; Mar. 16–31, 210 second-feet; and Apr. 1–19, 490 second-feet.

Monthly discharge of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	306	97	209	B.
November	290	131	207	B.
December	.....	.....	111	C.
January	.....	.....	125	C.
February	.....	.....	102	C.
March	.....	.....	215	C.
April	.....	.....	457	C.
May	695	323	467	B.
June	1,170	340	574	B.
July	515	180	329	B.
August	340	136	225	B.
September	340	227	297	B.
The year	1,170	.....	277	

RED LAKE RIVER AT CROOKSTON, MINN.

Location.—At new Sampson's addition highway bridge in Crookston, Minn., less than one-fourth mile below the dam and power house of the Crookston Waterworks, Power & Light Co.; no tributaries within several miles.

Records available.—May 19, 1901, to September 30, 1914.

Drainage area.—5,320 square miles.

Gage.—Automatic gage installed in September, 1911, replacing chain gage which was attached to the new Sampson's addition bridge July 1, 1909. Chain gage was set to read the same as the original gage, which was fastened to the bridge 20 rods above. A vertical staff near the automatic reads to the same datum as the gages previously used. Limits of use: Hundredths below 4.5, half-tenths 4.5 to 7.0, and tenths above 7.0 feet.

Channel and control.—Changes slightly from year to year.

Discharge measurements.—Made from new bridge.

Winter flow.—Discharge relation affected by ice. Estimates are based on discharge measurements, gage heights, and climatic records.

Regulation.—Operation of power plant causes fluctuations in the water surface.

Accuracy.—Automatic gage should give good results.

Discharge measurements of Red Lake River at Crookston, 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.*
Oct. 18	E. F. Chandler	3.84	427	May 16	Ole Christianson	5.28	1,200
Dec. 22	Ole Christianson	2.64	[a] 54.5	June 8	do	5.48	1,240
Jan. 5	do	3.62	[b] 147	July 11	E. F. Chandler	5.48	1,280
Feb 10	do	3.38	[b] 76.7	Aug. 25	do	3.37	358
Apr. 26	do	4.32	684				

[a] Small quantity of moss on river bed. [b] Complete ice cover.

Daily gage height, in feet, of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1914.

[J. A. Wallace, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.23	3.44	3.50	3.50	4.35	3.82	5.25	4.7	5.8	6.0	3.71	3.75
2	3.18	3.66	3.48	3.74	4.02	3.84	5.95	4.9	5.6	6.2	3.61	3.70
3	3.35	3.42	3.22	3.56	3.97	4.32	6.75	4.8	5.05	5.95	3.55	3.85
4	3.39	3.52	3.32	3.46	4.03	4.17	7.2	4.55	5.35	6.0	3.48	3.80
5	3.52	3.54	3.38	3.62	4.11	4.55	7.3	.....	5.15	5.95	3.40	3.80
6	3.47	3.48	3.08	3.64	3.99	4.24	7.0	.....	5.25	5.85	3.52	3.90
7	3.42	3.48	3.25	3.77	4.16	4.16	6.8	.....	5.25	5.95	3.54	3.90
8	3.64	3.74	3.10	3.74	4.35	4.47	6.4	4.95	5.5	5.6	3.53	3.80
9	3.64	3.42	3.14	3.68	4.00	3.94	6.0	5.25	.....	5.35	3.30	3.95
10	3.82	3.10	3.18	3.79	3.85	4.36	5.65	5.0	.....	5.15	3.36	3.80
11	3.94	3.04	3.02	3.84	3.75	4.42	5.6	4.95	7.0	5.25	3.33	3.85
12	3.70	3.30	2.95	3.74	.....	4.38	5.15	4.75	7.3	5.05	3.41	3.80
13	3.46	3.28	2.76	3.68	.....	.....	5.2	4.85	7.3	5.05	3.39	3.55
14	3.48	3.26	3.28	3.57	.....	.....	5.05	5.0	7.1	4.95	3.35	3.85
15	3.52	3.36	3.28	3.76	.....	.....	5.25	4.7	6.55	4.55	3.40	3.90
16	.....	3.40	2.95	3.59	.....	.....	5.6	4.9	6.4	4.6	3.31	3.90
17	.....	3.62	3.20	3.38	.....	5.25	6.25	4.2	5.9	4.55	3.35	3.90
18	3.84	3.50	3.08	3.85	.....	5.25	6.35	4.8	5.9	4.6	3.47	3.60
19	3.68	3.60	3.10	3.96	4.29	5.2	5.75	4.1	5.65	4.5	3.42	3.85
20	3.72	3.25	3.18	4.02	4.20	5.35	5.6	4.7	5.5	4.75	3.43	3.55
21	3.26	3.30	3.15	4.33	4.04	5.6	5.5	4.95	5.45	4.55	3.42	4.00
22	3.47	3.42	3.08	3.98	4.40	5.2	5.4	5.5	5.5	4.7	3.48	3.90
23	3.56	3.28	3.30	4.14	4.02	5.05	5.4	5.85	5.4	4.85	3.35	3.95
24	3.47	3.20	3.18	.....	4.34	4.65	5.15	6.1	5.5	4.6	3.50	4.00
25	.....	3.30	3.56	3.90	4.12	4.9	4.75	6.05	5.4	4.48	3.30	3.90
26	3.50	3.22	3.15	4.03	4.35	4.85	4.65	5.9	5.05	4.01	3.50	4.00
27	3.72	3.50	3.18	3.88	4.26	4.7	4.85	5.55	5.55	4.06	3.65	3.85
28	3.72	3.40	2.72	4.00	4.01	4.46	4.45	5.35	5.45	4.19	3.63	3.95
29	3.08	3.32	2.96	4.20	.....	4.7	4.39	5.4	5.55	4.24	3.77	3.90
30	3.17	3.42	3.11	4.03	.....	4.6	4.6	5.6	5.8	3.61	3.93	3.70
31	3.28	.....	3.35	4.10	.....	4.65	.....	5.8	.....	3.54	3.63	.....

NOTE.—Discharge relation affected by ice about Dec. 11, 1913, to Apr. 9, 1914.

Daily discharge, in second-feet, of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	210	279	299	.....	.....	.....	.....	883	1,470	1,610	421	517
2	194	358	292	.....	.....	.....	.....	996	1,340	1,750	381	490
3	248	272	206	.....	.....	.....	.....	932	990	1,580	362	559
4	262	306	239	.....	.....	.....	.....	795	1,170	1,620	339	536
5	306	313	258	.....	.....	.....	.....	a 849	1,040	1,580	313	536
6	289	292	166	.....	.....	.....	.....	a 902	1,100	1,520	358	583
7	272	292	216	.....	.....	.....	.....	a 956	1,100	1,580	369	583
8	350	389	171	.....	.....	.....	.....	1,010	1,250	1,360	369	536
9	350	272	183	.....	.....	.....	.....	1,190	a 1,600	1,200	289	606
10	421	171	194	.....	.....	.....	1,450	1,040	a 1,960	1,080	310	531
11	473	155	.....	.....	.....	.....	1,410	1,010	2,310	1,140	303	554
12	373	232	.....	.....	.....	.....	1,130	894	2,550	1,020	335	531
13	285	226	.....	.....	.....	.....	1,160	949	2,550	1,030	331	421
14	292	219	.....	.....	.....	.....	1,070	1,030	2,390	972	317	554
15	306	252	.....	.....	.....	.....	1,190	861	1,980	756	339	578
16	a 347	265	.....	.....	.....	.....	1,420	972	1,870	784	310	578
17	a 388	343	.....	.....	.....	.....	1,870	597	1,520	762	328	573
18	430	299	.....	.....	.....	.....	1,940	905	1,520	795	373	438
19	365	335	.....	.....	.....	.....	1,520	540	1,370	746	358	550
20	381	216	.....	.....	.....	.....	1,430	844	1,270	888	365	417
21	219	232	.....	.....	.....	.....	1,370	978	1,240	778	365	621
22	289	272	.....	.....	.....	.....	1,300	1,320	1,270	866	389	573
23	321	226	.....	.....	.....	.....	1,300	1,540	1,210	954	343	597
24	289	200	.....	.....	.....	.....	1,150	1,700	1,280	822	405	616
25	a 294	232	.....	.....	.....	.....	916	1,670	1,210	756	331	568
26	299	206	.....	.....	.....	.....	861	1,560	1,000	531	409	616
27	381	299	.....	.....	.....	.....	972	1,330	1,310	559	473	545
28	381	265	.....	.....	.....	.....	751	1,190	1,250	626	464	592
29	166	239	.....	.....	.....	.....	715	1,220	1,320	650	527	568
30	191	272	.....	.....	.....	.....	828	1,350	1,480	373	602	477
31	226	.....	.....	.....	.....	.....	.....	1,470	.....	350	464	.....

a Interpolated.

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 10, 1913, from a fairly well defined rating curve; Apr. 10 to Sept. 30, 1914, by the indirect method for shifting channels.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 11–31, 160 second-feet; Jan. 1–15, 180 second-feet; Jan. 16–31, 225 second-feet; Feb. 1–15, 190 second-feet; Feb. 16–28, 220 second-feet; Mar. 1–15, 300 second-feet; Mar. 16–31, 600 second-feet; and Apr. 1–9, 1,770 second-feet.

Monthly discharge of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	473	166	310	B.
November	389	155	264	B.
December	.....	.....	180	C.
January	.....	.....	203	D.
February	.....	.....	204	D.
March	.....	.....	455	D.
April	.....	.....	1,390	C.
May	1,700	540	1,080	B.
June	2,550	990	1,500	B.
July	1,750	350	1,000	B.
August	602	289	376	B.
September	621	417	548	B.
The year	.....	.....	626	

THIEF RIVER NEAR THIEF RIVER FALLS, MINN.

Location.—In sec. 3, T. 154 N., R. 43 W., at the Drybrooke ford, 6 miles north of Thief River Falls. Nearest tributary, outlet of Mud Lake, which enters in the northeastern part of T. 156 N., R. 42 W.

Records available.—July 1, 1909, to September 30, 1914.

Drainage area.—1,010 square miles.

Gage.—Inclined staff installed September 4, 1913, to replace old inclined staff, which was set at incorrect datum; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 5.5, half-tenths from 5.5 to 6.5, and tenths above 6.5 feet. See Water-Supply Paper 325 for history of old gage. All gage heights in the following tables refer to original gage datum.

Channel and control.—Practically permanent.

Discharge measurements.—Made from highway bridge a short distance below gage.

Winter flow.—Discharge measurements made through the ice to determine winter flow.

Regulation.—Dam at Thief River Falls, at the mouth of Thief River, backs up the water in Thief River for several miles, but station is protected by rapids below from influence of dam. During 1910 and 1911 drainage work has been carried on extensively in Thief River basin, and the effect will be to modify the regimen of the river. The extremely low flow of 1910 and 1911 was due partly to the holding back of the run-off by temporary dams for use of the floating dredges above the station.

Accuracy.—See remarks under "Gage."

Discharge measurements of Thief River near Thief River Falls, 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.*
Apr. 22	L. W. Burdick.....	5.41	204	July 10	E. F. Chandler.....	4.99	88
June 13	W. B. Stevenson.....	5.89	326	Aug. 27	.....do.....	4.79	[a]52

[a] Measurement made by wading.

Daily gage height, in feet, of Thief River near Thief River Falls, Minn., for the year ending Sept. 30, 1914.

[H. J. Maland and T. H. Risteigen, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.10	4.40	4.48	.....	.....	.....	5.85	4.82	5.22	5.01	4.43	4.83
2	4.11	4.48	4.50	.....	.....	.....	7.2	4.89	5.00	5.00	4.43	4.84
3	4.10	4.52	4.42	.....	.....	.....	6.9	4.95	5.48	4.98	4.43	4.84
4	4.12	4.40	4.38	.....	.....	.....	.....	5.02	5.10	4.93	4.37	4.77
5	4.19	4.34	4.45	.....	.....	.....	.....	5.08	5.16	5.16	4.34	4.83
6	4.25	4.42	4.65	.....	.....	.....	.....	5.18	5.14	5.34	4.38	4.63
7	4.25	4.48	.....	.....	.....	.....	.....	5.14	5.15	5.23	4.38	4.65
8	4.26	4.48	.....	.....	.....	.....	.....	5.14	5.18	5.22	4.26	4.67
9	4.32	4.52	.....	.....	.....	.....	.....	5.14	5.8	5.11	4.26	4.68
10	4.40	4.60	.....	.....	.....	.....	.....	5.10	7.2	5.06	4.30	4.62
11	4.42	4.50	.....	.....	.....	.....	.....	5.10	7.2	4.90	4.26	4.51
12	4.50	4.42	.....	.....	.....	.....	5.85	5.10	6.35	4.84	4.26	4.60
13	4.48	4.40	.....	.....	.....	.....	6.05	5.03	5.85	4.84	4.15	4.78
14	4.42	4.20	.....	.....	.....	.....	6.5	4.99	5.55	4.76	4.25	4.74
15	5.04	4.30	.....	.....	.....	.....	6.45	4.91	5.39	4.84	4.22	4.72
16	4.80	4.35	.....	.....	.....	.....	5.85	4.84	5.34	4.85	4.30	4.78
17	4.41	4.40	.....	.....	.....	4.80	5.34	4.82	5.16	5.03	4.28	4.84
18	4.41	4.42	.....	.....	.....	4.65	5.18	4.79	5.10	5.02	4.49	4.78
19	4.32	4.45	.....	.....	.....	4.48	4.86	4.82	5.08	4.91	4.53	4.89
20	4.30	4.50	.....	.....	.....	4.40	5.44	5.31	5.01	4.84	4.43	4.87
21	4.30	4.48	.....	.....	.....	4.32	5.47	5.7	4.99	4.82	4.46	4.89
22	4.30	4.55	.....	.....	.....	4.22	5.39	5.75	4.93	4.59	4.66	4.85
23	4.26	4.60	.....	.....	.....	4.15	5.25	5.6	4.91	4.66	4.53	4.79
24	4.25	4.55	.....	.....	.....	4.10	5.12	5.46	4.86	4.69	4.66	4.87
25	4.38	4.50	.....	.....	.....	4.08	5.00	5.45	4.82	4.54	4.85	4.84
26	4.48	4.58	.....	.....	.....	4.18	4.92	5.25	4.82	4.68	4.87	4.82
27	4.42	4.42	.....	.....	.....	.....	4.89	5.22	4.90	4.58	4.89	4.84
28	4.15	4.40	4.50	.....	.....	.....	4.89	5.19	4.91	4.36	4.82	4.82
29	4.38	4.42	.....	.....	.....	.....	4.80	5.49	4.92	4.00	4.91	4.81
30	4.40	4.48	.....	.....	.....	4.50	4.82	5.55	5.01	4.82	4.89	4.78
31	4.42	.....	.....	.....	.....	5.00	.....	5.43	.....	4.49	4.89	.....

NOTE.—Discharge relation affected by ice about Dec. 5, 1913, to Apr. 11, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	11	22	26	.....	.....	.....	.....	56	139	90	20	58
2	11	26	27	.....	.....	.....	.....	67	88	88	20	59
3	11	28	23	.....	.....	.....	.....	78	207	84	20	59
4	12	22	21	.....	.....	.....	.....	92	110	75	18	49
5	14	20	24	.....	.....	.....	.....	106	124	124	17	58
6	15	23	.....	.....	.....	.....	.....	129	120	169	18	33
7	15	26	.....	.....	.....	.....	.....	120	122	142	18	35
8	15	26	.....	.....	.....	.....	.....	120	129	139	14	37
9	19	28	.....	.....	.....	.....	.....	120	300	112	14	38
10	22	33	.....	.....	.....	.....	.....	110	725	101	15	32
11	23	27	.....	.....	.....	.....	.....	110	725	69	14	24
12	27	23	.....	.....	.....	.....	308	110	452	59	14	30
13	26	22	.....	.....	.....	.....	364	95	308	59	11	50
14	23	14	.....	.....	.....	.....	496	86	226	48	14	45
15	73	18	.....	.....	.....	.....	481	71	182	59	13	43
16	48	20	.....	.....	.....	.....	308	59	169	61	15	50
17	22	22	.....	.....	.....	.....	169	56	124	93	15	59
18	22	23	.....	.....	.....	.....	129	52	110	90	23	50
19	19	24	.....	.....	.....	.....	63	56	106	71	25	67
20	18	27	.....	.....	.....	.....	196	162	90	59	20	64
21	18	26	.....	.....	.....	.....	204	266	86	56	21	67
22	18	30	.....	.....	.....	.....	182	280	75	29	36	61
23	15	33	.....	.....	.....	.....	146	239	71	36	25	52
24	15	30	.....	.....	.....	.....	115	201	63	39	36	64
25	21	27	.....	.....	.....	.....	88	198	56	26	61	59
26	26	31	.....	.....	.....	.....	73	146	56	38	64	56
27	23	23	.....	.....	.....	.....	67	139	69	29	67	59
28	13	22	.....	.....	.....	.....	67	132	71	18	56	56
29	21	23	.....	.....	.....	.....	53	209	73	7	71	55
30	22	26	.....	.....	.....	.....	56	226	90	56	67	50
31	23	.....	.....	.....	.....	.....	.....	193	.....	23	67	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined below 1,700 second-feet (gage height, 10.0 feet). Discharge estimated because of ice, from observer's notes and climatic records as follows: Dec. 6–31, 14 second-feet; Jan. 1–15, 9 second feet; Jan. 16–31, 2 second-feet; Feb. 1–28, 1 second-foot; Mar. 1–31, 3 second-feet; and Apr. 1–11, 75 second-feet.

Monthly discharge of Thief River near Thief River Falls, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,010 square miles.][a]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	73	11	21.3	A.
November	33	14	24.8	C.
December	.....	.....	15	
January	.....	.....	5	
February	.....	.....	1	
March	.....	.....	3	
April	496	.....	146	C.
May	280	52	132	A.
June	725	56	176	A.
July	169	7	69.3	A.
August	71	11	29.3	A.
September	67	24	50.6	A.
The year	496	.....	56.1	

[a] "Second-feet per square mile" and "Run-off (depth in inches") are not published because such estimates would be misleading on account of the large amount of swamp and recently drained land in the basin of Thief River.

CLEARWATER RIVER AT RED LAKE FALLS, MINN.

Location.—At Great Northern Railway bridge at Red Lake Falls, Minn., about 1½ miles above mouth of river and 2 miles below nearest tributary.

Records available.—June 18, 1909, to September 30, 1914.

Drainage area.—1,310 square miles.

Gage.—Vertical staff installed September 12, 1911, about half a mile downstream from original gage; set to read 2.23 feet when original gage read 5.83 feet; read daily, morning and evening, to tenths. Limits of use: Half-tenths below and tenths above 4.5 feet. Staff was placed on account of the building of a dam which causes several feet of backwater at the original section.

Channel and control.—Practically permanent.

Discharge measurements.—Made from the railroad bridge or by wading.

Winter flow.—River usually frozen over from middle of November to first of April. Discharge measurements made through the ice.

Regulation.—At low stage the flow is affected by the Steinert mill 40 rods above gage, but as the storage is small only slight fluctuation in stage is caused.

Accuracy.—Daily discharge for September and October, 1911, as published in Water-Supply Paper 305, is too large, as indicated by the discharge measurement made on September 13, 1911. Daily discharge for this period as published in the following tables is more accurate.

Discharge measurements of Clearwater River at Red Lake Falls, 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.*
Oct. 21	W. B. Stevenson	2.37	[a] 89.4	Apr. 22	L. W. Burdick	3.44	485
Jan. 2	Ole Christianson	2.41	[b] 42.3	May 11	W. B. Stevenson	3.56	532
Feb. 7	.....do	4.75	[b] 83.9	July 22	E. F. Chandler	3.43	420
Mar. 12	.....do	5.13	[b] 57.9	22	.....do	3.41	460
Apr. 21	L. W. Burdick	3.52	515	Aug. 28	.....do	2.77	187

[a] Ice along shores of river. [b] River frozen over.

Daily gage height, in feet, of Clearwater River at Red Lake Falls, Minn., for the year ending Sept. 30, 1914.

[Leo Steinert, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.35	2.4	2.45	.....	.....	.....	.....	3.3	3.7	4.45	3.1	2.9
2	2.35	2.4	2.45	2.41	.....	.....	.....	3.3	3.65	4.4	3.0	2.9
3	2.35	2.4	2.5	.....	.....	.....	.....	3.3	3.6	4.1	2.95	2.9
4	2.35	2.4	2.4	.....	.....	.....	.....	3.3	3.55	4.1	2.85	2.9
5	2.25	2.4	2.4	.....	.....	.....	.....	3.3	3.55	4.1	2.8	2.9
6	2.25	2.35	2.35	.....	.....	.....	.....	3.3	3.55	4.1	2.8	2.9
7	2.4	2.35	2.4	.....	4.8	.....	.....	3.4	3.5	4.1	2.7	2.85
8	2.4	2.35	2.3	.....	.....	.....	.....	3.45	3.55	4.0	2.7	2.8
9	2.5	2.35	2.25	.....	.....	.....	.....	3.6	3.8	3.9	2.65	2.75
10	2.55	2.35	2.3	.....	.....	.....	.....	3.55	4.2	3.9	2.6	2.8
11	2.6	2.4	2.35	.....	.....	.....	.....	3.5	4.6	3.9	2.65	2.7
12	2.6	2.35	2.35	.....	.....	5.1	.....	3.45	4.6	3.85	2.7	2.7
13	2.7	2.4	2.35	.....	.....	.....	.....	3.4	4.7	3.75	2.7	2.8
14	2.6	2.35	2.35	.....	.....	.....	.....	3.3	4.6	3.75	2.6	2.8
15	2.6	2.35	2.35	.....	.....	.....	3.45	3.25	4.5	3.65	2.6	2.8
16	2.6	2.35	2.35	.....	.....	.....	3.5	3.25	4.3	3.6	2.5	2.8
17	2.7	2.4	2.35	.....	.....	.....	3.3	3.2	4.25	3.6	2.7	2.8
18	2.7	2.35	2.35	.....	.....	.....	3.45	3.15	4.1	3.65	2.7	2.8
19	2.6	2.35	2.35	.....	.....	.....	3.55	3.2	4.1	3.6	2.7	2.8
20	2.6	2.4	2.35	.....	.....	.....	3.5	3.3	4.1	3.45	2.55	2.8
21	2.5	2.25	2.35	.....	.....	.....	3.45	3.85	4.0	3.4	2.5	2.8
22	2.55	2.25	2.35	.....	.....	.....	3.4	4.15	4.0	3.4	2.5	2.8
23	2.5	2.25	2.35	.....	.....	.....	3.4	4.2	4.0	3.4	2.55	2.8
24	2.5	2.25	2.35	.....	.....	.....	3.4	4.2	4.0	3.35	2.7	2.8
25	2.5	2.25	.....	.....	.....	.....	3.4	4.0	4.05	3.3	2.8	2.8
26	2.5	2.35	.....	.....	.....	.....	3.35	3.9	4.15	3.25	2.8	2.8
27	2.5	2.4	.....	.....	.....	.....	3.3	3.85	4.2	3.15	2.8	2.8
28	2.5	2.4	.....	.....	.....	.....	3.3	3.8	4.3	3.15	2.8	2.8
29	2.45	2.4	.....	.....	.....	.....	3.3	3.75	4.45	3.15	2.8	2.7
30	2.4	2.4	.....	.....	.....	.....	3.3	3.8	4.5	3.15	2.8	2.65
31	2.4	.....	.....	.....	.....	.....	.....	3.8	.....	3.15	2.85	.....

NOTE.—Discharge relation affected by ice about Oct. 19-23, 1913, and Dec. 1, 1913, to Apr. 17, 1914.

Daily discharge, in second-feet, of Clearwater River at Red Lake Falls, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	96	104	.....	.....	.....	.....	.....	400	612	1,120	307	229
2	96	104	.....	.....	.....	.....	.....	400	584	1,080	266	229
3	96	104	.....	.....	.....	.....	.....	400	556	895	247	229
4	96	104	.....	.....	.....	.....	.....	400	529	860	212	229
5	81	104	.....	.....	.....	.....	.....	400	529	860	196	229
6	81	96	.....	.....	.....	.....	.....	400	529	860	196	229
7	104	96	.....	.....	.....	.....	.....	450	502	860	167	212
8	104	96	.....	.....	.....	.....	.....	476	529	795	167	196
9	126	96	.....	.....	.....	.....	.....	556	670	730	154	181
10	138	96	.....	.....	.....	.....	.....	529	930	730	142	196
11	151	104	.....	.....	.....	.....	.....	502	1,250	730	154	167
12	151	96	.....	.....	.....	.....	.....	476	1,250	700	167	167
13	180	104	.....	.....	.....	.....	.....	450	1,340	641	167	196
14	151	96	.....	.....	.....	.....	.....	400	1,250	641	142	196
15	151	96	.....	.....	.....	.....	.....	376	1,160	584	142	196
16	151	96	.....	.....	.....	.....	.....	376	1,000	556	120	196
17	180	104	.....	.....	.....	.....	.....	352	965	556	167	196
18	180	96	.....	.....	.....	.....	476	330	860	584	167	196
19	138	96	.....	.....	.....	.....	529	352	860	556	167	196
20	138	104	.....	.....	.....	.....	502	400	860	476	131	196
21	104	81	.....	.....	.....	.....	476	700	795	450	120	196
22	126	81	.....	.....	.....	.....	450	895	795	450	120	196
23	115	81	.....	.....	.....	.....	450	930	795	450	131	196
24	126	81	.....	.....	.....	.....	450	930	795	425	167	196
25	126	81	.....	.....	.....	.....	450	795	830	400	196	196
26	126	96	.....	.....	.....	.....	425	730	895	376	196	196
27	126	104	.....	.....	.....	.....	400	700	930	330	196	196
28	126	104	.....	.....	.....	.....	400	670	1,000	330	196	196
29	115	104	.....	.....	.....	.....	400	641	1,120	330	196	167
30	104	104	.....	.....	.....	.....	400	670	1,160	330	196	154
31	104	.....	.....	.....	.....	.....	.....	670	.....	330	212	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 30, 1913, and Apr. 18 to Sept. 30, 1914, from two well-defined rating curves; Oct. 19–23, 1913, estimated on account of ice, from discharge measurement made Oct. 21.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 1–15, 76 second-feet; Dec. 16–31, 54 second-feet; Jan. 1–15, 50 second-feet; Jan. 16–31, 60 second-feet; Feb. 1–15, 75 second-feet; Feb. 16–28, 68 second-feet; Mar. 1–15, 60 second-feet; Mar. 16–31, 90 second-feet; and Apr. 1–17, 200 second-feet.

Monthly discharge of Clearwater River at Red Lake Falls, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,310 square miles.][a]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	180	81	125	A.
November	104	81	97	A.
December	.....	.....	65	D.
January	.....	.....	55	D.
February	.....	.....	72	D.
March	.....	.....	75	D.
April	529	.....	307	D.
May	930	330	541	A.
June	1,340	502	863	B.
July	1,120	330	613	A.
August	307	120	178	A.
September	229	154	198	A.
The year	1,340	.....	266	

[a] Because of the large amount of swamp land, some of which is being drained artificially, in the area above this station estimates of "run-off in second-feet per square mile" and "run-off (depth in inches on drainage area)" would be misleading if computed from this drainage area.

SOUTH BRANCH OF TWO RIVERS AT HALLOCK, MINN.

Location.—In sec. 12, T. 161 N., R. 49 W., at private wagon bridge on farm of W. P. Willadson, half a mile north of Hallock; 1 mile below the confluence of the Middle Branch with the South Branch.

Records available.—April 29, 1911, to September 30, 1914.

Drainage area.—776 square miles.

Gage.—Vertical staff; read morning and afternoon to tenths; occasional readings taken to half-tenths. Limits of use: Hundredths below 2.5, half-tenths from 2.5 to 4.0, and tenths above 4.0 feet.

Channel and control.—Control, which is an abandoned loose-rock dam 4 feet high, a mile or more below the station, is probably permanent, The dam was formerly used to raise the water level for a railroad water tank.

Discharge measurements.—Made from the bridge.

Winter flow.—From November to April river is frozen over; readings discontinued.

Discharge measurements of South Branch of Two Rivers at Hallock, 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.*
Dec. 31	Ole Christianson	2.20	[a] 0.2	July 9	E. F. Chandler	1.96	23.5
Apr. 18	W. B. Stevenson	4.33	163	Aug. 26	do	1.53	9.1

[a] Complete ice cover; discharge estimated.

Daily gage height, in feet, of South Branch of Two Rivers at Hallock, Minn., for the year ending Sept. 30, 1914.

[W. P. Willadson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.98	1.42					4.8	3.35	2.6	2.4	1.5	1.65
2	1.78	1.52					4.8	3.2	2.5	2.35	1.45	1.65
3	1.65	1.6					4.5	3.2	2.4	2.32	1.45	1.65
4	1.55	1.7					5.9	3.15	2.35	2.2	1.4	1.65
5	1.5	1.75					7.7	3.15	2.35	2.2	1.35	1.62
6	1.5	1.78					8.2	3.25	2.35	2.12	1.32	1.6
7	1.5	1.78					7.7	3.7	2.4	2.35	1.25	1.55
8	1.5	1.7					6.8	4.3	2.4	1.45	1.2	1.5
9	1.5	1.7					6.0	4.3	2.55	1.9	1.2	1.5
10	1.62	1.75					5.7	4.0	2.55	1.9	1.2	1.45
11	2.0	1.72					5.6	3.6	2.7	1.9	1.2	1.4
12	2.28	1.7				3.3	5.5	3.3	3.0	1.9	1.15	1.4
13	2.15	1.7	1.9			3.05	5.6	3.0	2.85	1.9	1.1	1.4
14	2.0	1.7				3.1	5.4	2.95	2.8	1.9	1.1	1.4
15	1.92	1.7		2.25		3.0	5.4	2.95	2.6	1.85	1.1	1.4
16	1.9	1.7				3.4	5.4	2.8	2.55	1.85	1.1	1.4
17	1.9	1.75				3.5	4.4	2.8	2.5	1.85	1.1	1.45
18	1.9	1.75				3.45	4.2	2.7	2.5	1.8	1.15	1.5
19	1.9	1.75				3.6	4.5	2.6	2.55	1.75	1.2	1.5
20	1.82	1.8	2.1			3.1	4.2	2.6	2.55	1.7	1.2	1.52
21	1.85	1.8				3.0	4.2	2.6	2.55	1.85	1.25	1.77
22	1.98	1.8				2.8	4.8	2.6	2.55	1.85	1.3	1.82
23	1.88	1.85				2.75	5.6	2.8	2.55	1.8	1.35	1.75
24	1.8	1.85				2.9	6.4	2.7	2.5	1.75	1.38	1.75
25	1.8	1.9				3.15	5.9	2.55	2.45	1.7	1.5	1.7
26	1.8	2.35				3.05	4.9	2.55	2.42	1.7	1.5	1.7
27	1.8	2.4				3.05	4.4	2.45	2.5	1.65	1.5	1.65
28	1.78	2.8			2.45	3.05	4.0	2.4	2.48	1.65	1.5	1.65
29	1.6	2.2				3.05	3.8	2.6	2.4	1.58	1.55	1.65
30	1.5	2.2				3.4	3.6	2.7	2.35	1.5	1.6	1.65
31	1.4					3.8		2.48		1.5	1.65	

NOTE.—Discharge relation affected by ice about Nov. 23, 1913, to Apr. 15, 1914.

Daily discharge, in second-feet, of South Branch of Two Rivers at Hallock, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	18	1.4						104	56	46	8	12
2	11	3.6						94	51	43	6	12
3	7.5	6.0						94	46	42	6	12
4	4.5	9.0						90	43	36	5	12
5	3.0	10						90	43	36	4	12
6	3.0	11						97	43	32	3	11
7	3.0	11						130	46	43	2	9
8	3.0	9.0						178	46	48	1	8
9	3.0	9.0						178	53	22	1	8
10	6.6	10						154	53	22	1	6
11	19	9.6						122	62	22	1	5
12	31	9.0						101	80	22	.7	5
13	25	9.0						80	71	22	.4	5
14	19	9.0						77	68	22	.4	5
15	16	9.0						77	56	20	.4	5
16	15	9.0					260	68	53	20	.4	5
17	15	10					172	68	51	20	.4	6
18	15	10					156	62	51	18	.7	8
19	15	10					180	56	53	16	1	8
20	13	12					156	56	53	14	1	9
21	14	12					156	56	53	20	2	17
22	18	12					205	56	53	20	3	19
23	14						280	68	53	18	4	16
24	12						367	62	51	16	5	16
25	12						330	53	48	14	8	14
26	12						231	53	47	14	8	14
27	12						186	48	46	12	8	12
28	11						154	46	50	12	8	12
29	6.0						138	56	46	10	10	12
30	3.0						122	62	43	8	11	12
31	1.0							50		8	12	

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 22, 1913, and Apr. 16–24, 1914, from a fairly well-defined rating curve; Apr. 25 to Sept. 30, 1914, from a rating curve well defined between 8 and 1,140 second-feet (gage heights, 1.5 and 14 feet); Nov. 23–30, 1913, and Mar. 12 to Apr. 15, 1914, estimated because of ice, by Prof. E. F. Chandler, from daily gage height and climatic records, and Dec. 1, 1913, to Mar. 11, 1914, from climatic records, one discharge measurement made on Dec. 31, 1913, discharge of adjacent drainage areas, and observer's reports on marked variation in discharge, as follows: Nov. 23–30, 8 second-feet; Dec. 1–15, 4 second-feet; Dec. 16–31, 1 second-foot; Jan. 1–31, 0.2 second-foot; Feb. 1–28, 0.1 second-foot; Mar. 1–15, 0.5 second-foot; Mar. 16–31, 2.6 second-feet; and Apr. 1–15, 133 second-feet.

These estimates are based on less complete data than estimates at most stations in this report and represent only the best available figures.

Monthly discharge of South Branch of Two Rivers at Hallock, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	31	1.0	11.6	B.
November			8.82	C.
December			2.5	D.
January			.2	
February			.1	
March			1.6	D.
April	367		170	C.
May	178	46	83.4	A.
June	80	43	52.3	A.
July	48	8	23.2	A.
August	12	.4	3.95	B.
September	19	5	10.2	B.
The year			30.5	

PEMBINA RIVER AT NECHE, N. DAK.

Location.—At highway bridge 20 rods east of Great Northern Railway bridge two-thirds of a mile north of Neche, N. Dak.

Records available.—April 29, 1903, to September 30, 1914.

Drainage area.—2,940 square miles.

Gage.—Vertical staff bolted to the concrete abutment at the north end of the railway bridge. At low stages this gage is sometimes not reached by the water, and readings are then made on sections of vertical staff attached to the abutment and piling at the north end of the highway bridge.

Channel and control.—Channel consists of clay and silt; slightly shifting. A loose rock dam about one-third mile below gage forms the control (see remarks under "Regulation").

Discharge measurements.—Made from the highway bridge; at very low stages made by wading at some section below the Great Northern dam.

Winter flow.—The ordinary winter discharge is less than the leakage through the loose-rock dam, and estimates can not be made from gage observations without numerous discharge measurements.

Regulation.—The water is raised at low stages from 1 to 2 feet at the gage by a loose-rock dam about 3 feet high one-third mile below, constructed to give sufficient depth of water for the intake of the Great Northern Railway water tank. There is considerable leakage through the dam, but no permanent determination of the effect of the dam can be made because it is liable to be somewhat disturbed at its crest by ice run or spring floods in any year. There are no reservoirs or power plants that affect the flow.

Accuracy.—Records only fair on account of the varying effect of the dam at low stages in different years.

Discharge measurements of Pembina River at Neche, N. Dak., 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. 22	L. T. Powers	4.58	338	July 7	E. F. Chandler	3.11	63
23	do	4.60	349	Sept. 1	do	2.48	12.3
July 7	E. F. Chandler	3.09	55				

Daily gage height, in feet, of Pembina River at Neche, N. Dak., for the year ending Sept. 30, 1914.

[P. J. Horgan, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.8	3.0	.....	.....	.....	.....	3.0	4.1	3.8	3.3	2.7	2.5
2	2.8	3.4	.....	.....	.....	.....	4.0	.....	3.8	3.3	2.7	2.5
3	2.8	3.5	.....	.....	.....	.....	5.0	4.2	3.8	3.3	2.7	2.6
4	2.8	3.6	.....	.....	.....	.....	6.0	4.3	3.8	3.3	2.7	2.6
5	2.8	3.7	.....	.....	.....	.....	5.4	4.3	3.8	3.3	2.6	2.7
6	2.8	3.8	.....	.....	.....	.....	5.4	4.3	3.8	3.3	2.6	2.7
7	2.7	3.8	.....	.....	.....	.....	5.2	4.3	3.8	3.3	2.5	2.7
8	2.7	3.8	.....	.....	.....	.....	5.5	4.3	3.8	3.2	2.4	2.6
9	2.7	.....	.....	.....	.....	.....	5.5	4.2	3.8	3.2	2.4	2.6
10	2.7	.....	.....	.....	.....	.....	5.0	4.2	3.8	3.1	2.4	2.4
11	2.7	.....	.....	.....	.....	.....	4.8	4.2	3.7	3.1	2.4	2.3
12	2.8	.....	.....	.....	.....	.....	4.6	4.1	3.7	3.1	2.4	2.3
13	2.8	.....	.....	.....	.....	.....	4.4	4.1	3.6	3.1	2.4	2.3
14	2.8	.....	.....	.....	.....	.....	4.4	4.0	3.5	3.1	2.4	2.3
15	2.8	.....	.....	.....	.....	.....	4.5	3.9	3.5	2.9	2.4	2.3
16	2.8	.....	.....	.....	.....	.....	4.5	3.9	3.5	2.8	2.5	2.3
17	2.8	.....	.....	.....	.....	.....	4.7	3.9	3.5	2.8	2.5	2.3
18	2.8	.....	.....	.....	.....	.....	4.8	3.9	3.5	2.8	2.5	2.3
19	2.8	.....	.....	.....	.....	5.5	4.6	3.9	3.4	2.8	2.5	2.3
20	2.8	.....	.....	.....	.....	5.5	4.4	3.9	3.4	2.8	2.5	2.3
21	2.7	.....	.....	.....	.....	5.5	4.5	3.9	3.4	2.8	2.5	2.3
22	2.7	.....	.....	.....	.....	.....	4.5	3.9	3.4	2.8	2.5	2.3
23	2.8	.....	.....	.....	.....	.....	4.5	3.9	3.4	2.7	2.5	2.4
24	2.8	.....	.....	.....	.....	.....	4.4	3.9	3.4	2.7	2.5	2.4
25	2.8	.....	.....	.....	.....	.....	4.3	3.9	3.4	2.7	2.5	2.6
26	2.8	.....	.....	.....	.....	.....	4.3	3.9	3.4	2.7	2.5	2.7
27	2.7	.....	.....	.....	.....	.....	4.3	3.8	3.4	2.7	2.5	2.7
28	2.7	.....	.....	.....	.....	.....	4.2	3.8	3.4	2.7	2.5	2.7
29	2.6	.....	.....	.....	.....	.....	4.1	3.8	3.3	2.7	2.5	2.7
30	2.9	.....	.....	.....	.....	.....	4.1	3.8	3.3	2.7	2.5	2.7
31	.....	.....	.....	.....	.....	.....	.....	3.8	.....	2.7	2.5	.....

NOTE.—Discharge, relation affected by ice Nov. 9, 1913, to Apr. 17, 1914.

Daily discharge, in second-feet, of Pembina River at Neche, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	66	84	.....	.....	.....	.....	.....	208	160	87	22	13
2	66	125	.....	.....	.....	.....	.....	[a] 216	160	87	22	13
3	66	136	.....	.....	.....	.....	.....	224	160	87	22	17
4	66	147	.....	.....	.....	.....	.....	241	160	87	22	17
5	66	159	.....	.....	.....	.....	.....	241	160	87	17	22
6	66	171	.....	.....	.....	.....	.....	241	160	87	17	22
7	57	171	.....	.....	.....	.....	.....	241	160	87	13	22
8	57	171	.....	.....	.....	.....	.....	241	160	74	9	17
9	57	.....	.....	.....	.....	.....	.....	224	160	74	9	17
10	57	.....	.....	.....	.....	.....	.....	224	160	61	9	9
11	57	.....	.....	.....	.....	.....	.....	224	145	61	9	6
12	66	.....	.....	.....	.....	.....	.....	208	145	61	9	6
13	66	.....	.....	.....	.....	.....	.....	208	130	61	9	6
14	66	.....	.....	.....	.....	.....	.....	192	115	61	9	6
15	66	.....	.....	.....	.....	.....	.....	176	115	38	9	6
16	66	.....	.....	.....	.....	.....	.....	176	115	29	13	6
17	66	.....	.....	.....	.....	.....	.....	176	115	29	13	6
18	66	.....	.....	.....	.....	.....	328	176	115	29	13	6
19	66	.....	.....	.....	.....	.....	292	176	101	29	13	6
20	66	.....	.....	.....	.....	.....	258	176	101	29	13	6
21	57	.....	.....	.....	.....	.....	275	176	101	29	13	6
22	57	.....	.....	.....	.....	.....	275	176	101	29	13	6
23	66	.....	.....	.....	.....	.....	275	176	101	22	13	9
24	66	.....	.....	.....	.....	.....	258	176	101	22	13	9
25	66	.....	.....	.....	.....	.....	241	176	101	22	13	17
26	66	.....	.....	.....	.....	.....	241	176	101	22	13	22
27	57	.....	.....	.....	.....	.....	241	160	101	22	13	22
28	57	.....	.....	.....	.....	.....	224	160	101	22	13	22
29	49	.....	.....	.....	.....	.....	208	160	87	22	13	22
30	75	.....	.....	.....	.....	.....	208	160	87	22	13	22
31	80	.....	.....	.....	.....	.....	.....	160	.....	22	13	.....

[a] Discharge interpolated.

NOTE.—Daily discharge computed from two fairly well defined rating curves. Discharge, Apr. 1–17, 1914, estimated, because of ice, from gage heights, observers' notes, and climatic records, at 252 second-feet.

Monthly discharge of Pembina River at Neche, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	75	49	63.6	3,910	B.
April	.....	.....	254	15,100	D.
May	241	160	195	12,000	B.
June	160	87	126	7,500	B.
July	87	22	48.4	2,980	B.
August	22	6	13.4	824	C.
September	22	6	12.9	768	C.

WEST BRANCH OF ROSEAU RIVER NEAR MALUNG, MINN.

Location.—Near the center of sec. 7, T. 161 N., R. 39 W., at the highway bridge, 1 mile west of Malung post office, and 6¼ miles south of Roseau; half a mile above the mouth of the East Branch.

Records available.—May 6, 1911, to September 30, 1914.

Drainage area.—265 square miles.

Gage.—Vertical staff, read once daily to half-tenths. Limits of use: Half-tenths below and tenths above 4.5 feet. During the spring of 1913 (presumably in March) the gage had lowered 0.21 foot, probably on account of settling of the earth approach to the bridge, which pushed down the plank fillers behind the abutment, the gage being attached to these fillers. The gage has remained practically stationary since settlement. All gage heights published in the following tables are therefore referred to a gage datum about 0.21 foot below the original datum, and 0.21 foot should be added to the gage heights previous to that date in order to make them agree with the datum of the gage in its present position.

Channel and control.—Probably fairly permanent, although there is a possibility of temporary backwater from the East Branch.

Discharge measurements.—Made at the bridge except during low stages, when they are made at a wading section. Discharge measurements are also made on the East Branch a short distance above the junction and on Roseau River at Roseau for the purpose of determining the part of the flow at Roseau that comes from the East Branch and of estimating the entire flow below that point, as conditions of flow below the junction of the two branches are very unfavorable for the establishment of a regular station.

Winter flow.—From November to April the river is frozen over; observations discontinued.

Regulation.—Much of the area drained by Roseau River is so swampy that it can not be cultivated without drainage. In connection with this work the river channel has been straightened and widened to 80 feet for a distance of 40 miles; a drainage system benefiting 90,000 acres of land south of the river discharges into the Roseau by 10 ditches 1 mile apart in T. 163 N., Rs. 43 and 44 W. Another ditch system, draining about 20,000 acres, enters Roseau River in sec. 6, T. 162 N., R. 39 W.

Discharge measurements of West Branch of Roseau River near Malung, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 11	W. B. Stevenson	7.83	403
July 23	E. F. Chandler	3.12	19.7

Discharge measurements of East Branch of Roseau River near Malung, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 11	W. B. Stevenson	8.36	628
July 23	E. F. Chandler	1.77	27.0

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

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 12	W. B. Stevenson	8.71	980
July 24	E. F. Chandler	2.94	46

Daily gage height, in feet, of West Branch of Roseau River near Malung, Minn., for the year ending Sept. 30, 1914.

[August Hedin, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.2	2.6	2.4	.....	.....	.....	4.9	4.8	6.2	4.2	2.7	3.0
2	2.2	2.5	2.4	.....	.....	.....	6.4	4.8	5.8	4.2	2.6	3.0
3	2.2	2.5	2.45	.....	.....	.....	6.2	4.6	5.4	4.2	2.6	2.9
4	2.3	2.5	2.5	.....	.....	.....	6.2	4.6	4.6	3.9	2.55	2.8
5	2.3	2.5	2.5	.....	.....	.....	5.2	4.8	4.3	3.85	2.55	2.75
6	2.3	2.5	2.4	.....	.....	.....	2.8	4.7	4.2	3.85	2.5	2.7
7	2.3	2.55	.....	.....	.....	.....	4.8	4.7	4.0	3.85	2.5	2.65
8	2.4	2.6	.....	.....	.....	.....	4.2	4.6	4.0	4.0	2.5	2.6
9	2.5	2.6	.....	.....	.....	.....	4.4	4.5	5.3	4.0	2.5	2.6
10	2.5	2.5	.....	.....	.....	.....	4.2	4.2	7.1	3.75	2.5	2.6
11	2.5	2.5	.....	.....	.....	.....	4.5	4.0	7.8	3.5	2.5	2.6
12	2.5	2.5	.....	.....	.....	.....	4.8	3.9	8.0	3.3	2.5	2.6
13	2.6	2.4	.....	.....	.....	.....	4.9	3.7	8.1	3.2	2.6	2.6
14	2.7	2.4	.....	.....	.....	.....	5.0	3.65	7.9	3.2	2.6	2.6
15	2.8	2.4	.....	.....	.....	.....	5.0	3.55	6.5	3.1	2.5	2.6
16	2.8	2.4	.....	.....	.....	.....	5.0	3.4	5.5	3.3	2.5	2.9
17	2.75	2.4	.....	.....	.....	.....	4.8	3.3	5.1	4.0	2.5	2.85
18	2.7	2.45	.....	.....	.....	.....	4.8	3.2	4.6	4.3	2.5	2.8
19	2.65	2.45	.....	.....	.....	.....	6.7	3.2	4.1	4.1	2.5	2.9
20	2.65	2.4	.....	.....	.....	.....	7.6	4.4	4.0	3.8	2.5	2.85
21	2.6	2.4	.....	.....	.....	.....	8.0	5.0	3.7	3.5	2.5	2.8
22	2.55	2.4	.....	.....	.....	.....	8.5	5.4	3.6	3.3	4.6	2.75
23	2.5	2.4	.....	.....	.....	.....	7.7	5.4	3.5	3.2	2.55	2.7
24	2.5	2.4	.....	.....	.....	.....	6.8	5.6	3.4	3.1	2.5	2.7
25	2.5	2.4	.....	.....	.....	.....	6.1	5.0	3.2	2.95	2.5	2.7
26	2.5	2.4	.....	.....	.....	.....	5.8	4.7	3.1	2.85	2.6	2.65
27	2.6	2.4	.....	.....	.....	.....	5.5	4.4	3.1	2.8	2.75	2.6
28	2.6	2.4	2.4	.....	.....	.....	5.1	4.1	3.3	2.8	2.8	2.6
29	2.7	2.4	.....	.....	.....	.....	4.9	4.25	4.3	2.8	2.9	2.6
30	2.6	2.4	.....	.....	.....	.....	4.8	5.5	4.2	2.8	2.95	2.55
31	2.6	.....	.....	.....	.....	.....	.....	6.4	.....	2.75	3.0	.....

NOTE.—Discharge relation affected by ice about Dec. 3, 1913, to Apr. 17, 1914. Gage heights refer to datum 0.21 foot below original datum.

Daily discharge, in second-feet, of West Branch of Roseau River near Malung, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.8	7.0	4.0	.....	.....	.....	.....	142	268	92	8.0	17
2	1.8	5.4	4.0	.....	.....	.....	.....	142	232	92	6.0	17
3	1.8	5.4	.....	.....	.....	.....	.....	124	196	92	6.0	13
4	1.8	5.4	.....	.....	.....	.....	.....	124	124	69	5.3	10
5	2.8	5.4	.....	.....	.....	.....	.....	142	100	66	5.3	9.0
6	2.8	5.4	.....	.....	.....	.....	.....	133	92	66	4.5	8.0
7	2.8	6.2	.....	.....	.....	.....	.....	133	76	66	4.5	7.0
8	4.0	7.0	.....	.....	.....	.....	.....	124	76	76	4.5	6.0
9	5.4	7.0	.....	.....	.....	.....	.....	116	187	76	4.5	6.0
10	5.4	5.4	.....	.....	.....	.....	.....	92	349	59	4.5	6.0
11	5.4	5.4	.....	.....	.....	.....	.....	76	412	42	4.5	6.0
12	5.4	5.4	.....	.....	.....	.....	.....	69	430	31	4.5	6.0
13	7.0	4.0	.....	.....	.....	.....	.....	55	439	26	6.0	6.0
14	9.0	4.0	.....	.....	.....	.....	.....	52	421	26	6.0	6.0
15	12	4.0	.....	.....	.....	.....	.....	45	295	21	4.5	6.0
16	12	4.0	.....	.....	.....	.....	.....	36	205	31	4.5	13
17	10	4.0	.....	.....	.....	.....	.....	31	169	76	4.5	12
18	9.0	4.7	.....	.....	.....	.....	142	26	124	100	4.5	10
19	6.2	4.7	.....	.....	.....	.....	313	26	84	84	4.5	13
20	4.7	4.0	.....	.....	.....	.....	394	108	76	62	4.5	12
21	5.4	4.0	.....	.....	.....	.....	430	160	55	42	4.5	10
22	4.7	4.0	.....	.....	.....	.....	475	196	48	31	124	9.0
23	5.4	4.0	.....	.....	.....	.....	403	196	42	26	5.3	8.0
24	5.4	4.0	.....	.....	.....	.....	322	214	36	21	4.5	8.0
25	5.4	4.0	.....	.....	.....	.....	259	160	26	15	4.5	8.0
26	5.4	4.0	.....	.....	.....	.....	232	133	21	12	6.0	7.0
27	7.0	4.0	.....	.....	.....	.....	205	108	21	10	9.0	6.0
28	7.0	4.0	.....	.....	.....	.....	169	84	26	10	10	6.0
29	9.0	4.0	.....	.....	.....	.....	151	96	92	10	13	6.0
30	7.0	4.0	.....	.....	.....	.....	142	205	84	10	15	5.3
31	7.0	.....	.....	.....	.....	.....	.....	286	.....	9.0	17	.....

NOTE.—Daily discharge computed from two rating curves fairly well defined between 49 and 440 second-feet and poorly defined below 49 second-feet. Discharge estimated by Prof. E. F. Chandler, because of ice, from climatic records, discharge of adjacent drainage areas, and observer's notes concerning any marked variation in discharge, as follows: Dec. 3–15, 2.7 second-feet; Dec. 16–31, 1.5 second-feet; Jan. 1–15, 1 second-foot; Jan. 16–31, 0.2 second-foot; Feb. 1–15, 0.1 second-foot; Feb. 16–28, zero flow; Mar. 1–31, 3 second-feet. Discharge Apr. 1–17 estimated, because of ice, from gage heights, observer's notes, climatic records, and discharge of adjacent drainage areas, at 65 second-feet. These estimates are based on less complete data than are estimates at most stations in this report and represent only the best that are available for publication.

Monthly discharge of West Branch of Roseau River near Malung, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	12	1.8	5.80	C.
November	7	4	4.79	C.
December	.....	.....	2.2	
January	.....	.....	.6	
February	.....	.....	.1	
March	.....	.....	3	
April	475	.....	158	C.
May	286	26	117	B.
June	439	21	160	A.
July	100	9	46.7	B.
August	124	4.5	10.1	C.
September	17	5.3	8.74	C.
The year	475	.....	43.0	

MOUSE RIVER AT MINOT, N. DAK.

Location.—At the Anne Street Footbridge, northeast of the Great Northern Railway roundhouse at Minot, N. Dak.

Records available.—May 5, 1903, to September 30, 1914.

Drainage area.—8,400 square miles.

Gage.—Vertical staff attached to pier of Anne Street Bridge.

Channel and control.—Clay and silt; slightly shifting.

Discharge measurements.—Made from the Anne Street Bridge at medium and high stages. At low stages made by wading some rods below the dam at the Minneapolis, St. Paul & Sault Ste. Marie Railway water tank.

Winter flow.—Discharge relation slightly affected by ice from about middle of November to middle of April.

Regulation.—A dam 4 feet high at the Minneapolis, St. Paul & Sault Ste. Marie water tank, 1 mile below, raises the water at gage about 3 feet at ordinary low stage. The dam, being designed merely to give enough depth of water for the intake-pipe suction, has no sluices, but it is not absolutely tight. When the discharge is less than about 5 second-feet the water level falls below the crest of the dam.

Accuracy.—Results good for medium stages; for low water, errors of large percentage in the results may be due to small errors made by the gage observer or to changes in the amount of leakage through the dam, but the total error for such period is but a few second-feet.

Discharge measurements of Mouse River at Minot, N. Dak., during the year ending Sept. 30, 1914.

[Made by E. F. Chandler.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 18	9.12	1,000
Sept. 16	4.14	4.2

Daily gage height, in feet, of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1914.

[Ephraim Cox, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.4	4.0	4.95	.....	.....	.....	7.55	5.9	5.4	5.65	4.65	4.4
2	4.35	4.1	4.95	.....	.....	.....	7.35	5.8	5.4	5.55	4.65	4.4
3	4.3	4.1	4.95	.....	.....	.....	7.1	5.8	5.4	5.5	4.65	4.35
4	4.2	4.1	5.0	.....	.....	.....	6.95	5.8	5.5	5.45	4.6	4.35
5	4.15	4.15	5.0	.....	.....	.....	6.9	5.9	5.6	5.3	4.6	4.4
6	4.1	4.15	5.0	.....	.....	.....	6.75	5.95	5.65	5.25	4.55	4.45
7	3.95	4.2	.....	.....	.....	.....	6.7	6.0	5.65	5.15	4.55	4.45
8	3.9	4.2	.....	.....	.....	.....	6.75	5.9	5.7	5.1	4.55	4.45
9	3.95	4.2	.....	.....	.....	.....	6.85	6.0	5.75	5.0	4.5	4.45
10	3.95	4.25	.....	.....	.....	.....	7.2	5.75	5.7	4.95	4.4	4.5
11	3.9	4.25	.....	.....	.....	.....	7.4	5.8	5.6	4.9	4.35	4.5
12	3.9	4.4	.....	.....	.....	.....	7.55	5.95	5.55	4.85	4.35	4.5
13	3.9	4.6	.....	.....	.....	.....	7.5	5.9	5.85	4.85	4.3	4.45
14	3.95	4.8	.....	.....	.....	.....	7.55	6.0	6.65	4.85	4.25	4.45
15	3.95	4.95	4.9	4.4	3.0	4.0	7.75	5.95	6.65	4.8	4.2	4.4
16	4.0	4.95	.....	.....	.....	4.1	8.1	5.5	6.7	4.8	4.2	4.2
17	4.0	4.95	.....	.....	.....	4.2	8.8	5.8	6.6	4.85	4.2	4.1
18	4.0	4.95	.....	.....	.....	4.25	9.0	5.75	6.5	4.85	4.2	3.95
19	4.0	4.95	.....	.....	.....	4.35	9.45	5.7	6.4	4.85	4.15	3.9
20	4.0	5.0	.....	.....	.....	4.65	9.5	5.7	6.3	4.8	4.0	3.85
21	3.95	5.0	.....	.....	.....	4.85	8.0	5.65	6.2	4.8	3.9	3.85
22	3.95	5.0	.....	.....	.....	5.8	8.45	5.65	5.95	4.75	3.85	3.85
23	3.95	5.0	.....	.....	.....	6.8	7.7	5.6	5.85	4.75	3.85	3.8
24	4.0	5.0	.....	.....	.....	7.1	7.0	5.6	5.75	4.75	3.9	3.8
25	4.0	5.0	.....	.....	.....	7.35	6.85	5.55	5.75	4.75	3.95	3.8
26	4.0	5.0	.....	.....	.....	7.4	6.7	5.55	5.7	4.75	4.1	3.8
27	4.0	4.95	.....	.....	.....	7.35	6.35	5.5	5.75	4.7	4.2	3.75
28	4.0	4.95	.....	.....	.....	7.3	6.2	5.5	5.75	4.65	4.35	3.75
29	4.0	4.95	.....	.....	.....	7.0	6.0	5.5	5.8	4.7	4.45	3.75
30	4.0	4.9	.....	.....	.....	7.1	5.9	5.45	5.75	4.7	4.45	3.75
31	4.0	.....	4.0	.....	.....	7.2	.....	5.45	.....	4.7	4.4	.....

NOTE.—Discharge relation affected by ice Dec. 4, 1913, to Mar. 14, 1914.

Daily discharge, in second-feet, of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.6	3	38	.....	.....	.....	702	266	137	200	9	5.6
2	5.2	3.5	38	.....	.....	.....	652	239	137	174	9	5.6
3	4.8	3.5	38	.....	.....	.....	588	239	137	162	9	5
4	4.5	3.5	.....	.....	.....	.....	549	239	162	150	7.5	5
5	3.8	3.8	.....	.....	.....	.....	536	266	187	113	7.5	5.6
6	3.5	3.8	.....	.....	.....	.....	495	280	200	101	7	6
7	2.7	4.1	.....	.....	.....	.....	482	293	200	79	7	6
8	2.7	4.1	.....	.....	.....	.....	495	266	213	68	7	6
9	2.7	4.1	.....	.....	.....	.....	522	293	226	47	6.5	6
10	2.7	4.4	.....	.....	.....	.....	614	226	213	38	5.6	6.5
11	2.5	4.4	.....	.....	.....	.....	665	239	187	29	5	6.5
12	2.5	5.6	.....	.....	.....	.....	702	280	174	23	5	6.5
13	2.5	7.5	.....	.....	.....	.....	690	266	252	23	5	6
14	2.7	17	.....	.....	.....	.....	702	293	468	23	4	6
15	2.7	38	.....	.....	.....	3	750	280	468	17	4	5.6
16	3	38	.....	.....	.....	3	828	266	482	17	4	4.1
17	3	38	.....	.....	.....	4	966	239	455	23	4	3.5
18	3	38	.....	.....	.....	4	1,000	226	428	23	4	3
19	3	38	.....	.....	.....	5	1,070	213	401	23	4	2
20	3	47	.....	.....	.....	9	1,080	213	374	17	3	2
21	2.7	47	.....	.....	.....	23	806	200	347	17	2	2
22	2.7	47	.....	.....	.....	239	900	200	280	13	2	2
23	2.7	47	.....	.....	.....	509	738	187	252	13	2	2
24	3	47	.....	.....	.....	588	562	187	226	13	2	2
25	3	47	.....	.....	.....	652	522	174	226	13	3	2
26	3	47	.....	.....	.....	665	482	174	213	13	3	2
27	3	38	.....	.....	.....	652	388	162	226	10	4	1.8
28	3	38	.....	.....	.....	640	347	162	226	9	5	1.8
29	3	38	.....	.....	.....	562	293	162	233	10	6	1.8
30	3	29	.....	.....	.....	588	266	150	226	10	6	1.8
31	3	.....	.....	.....	.....	614	.....	150	.....	10	6	.....

NOTE.—Daily discharge computed from a fairly well-defined rating curve. Discharge Mar. 1–14, 1914, estimated, because of ice, from observer's notes and climatic records at 1 second-foot.

Monthly discharge of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off total (in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	5.6	2.5	3.17	195	C.
November	47	3	24.5	1,460	B.
March	665	.....	186	11,400	B.
April	1,080	266	646	38,400	B.
May	293	150	227	14,000	B.
June	482	137	265	15,800	B.
July	200	9	47.8	2,940	C.
August	9	2	5.10	314	C.
September	6.5	1.8	4.07	242	C.

EVAPORATION AT UNIVERSITY, N. DAK.[1]

The evaporation gage at University, N. Dak., was established April 17, 1905. It is located on a pool in a ravine called English Coulee, which runs through the campus of the University of North Dakota, which is immediately west of Grand Forks, N. Dak., and 2 miles west of the Minnesota boundary.

The records at this station were continued during the year ending September 30, 1914, daily observations being made during the open season. The gage was protected from disturbance, and the records of observations are reliable.

[1] For complete description of this station and records of evaporation, rainfall, and temperature for 1905 to 1908, see U. S. Geol. Survey Water-Supply Paper 245, pp. 64–67, 1910.

The coulee drains about 60 square miles of very level prairie. Except for brief freshets the flow in the coulee is small, varying from 1 second-foot or less to 20 second-feet. In very dry weather the water lies in pools with scarcely any perceptible flow.

A heavy galvanized-iron tank, 3 feet square and 18 inches deep, is placed in the center of an anchored raft, so that the water in the tank is at the same level as the water surface outside. The tank is filled nearly to the top, to a height prcisely marked by the pointed tip of a vertical rod in the center of the tank. Once each day, after the change produced by evaporation or rainfall, the water level is restored to the original height, the precise amount of water transferred being measured with a cup of such size that one cupful of water is equivalent to 0.01 inch depth in the tank.

A standard rain gage is located on the open prairie about 10 rods distant. On days of rainfall the difference (which is usually small) between the quantity measured by the rain gage and the surplus in the tank is considered the total evaporation for the day.

Observations were made usually about half an hour before sunset. The temperature of the water recorded is the observation of the water in the tank; as the tank is of metal, it has been found that at that time of the day there is rarely a perceptible difference in temperature reading between the water within and without the tank. The temperature of the air as recorded is the mean of the readings of the standard self-recording maximum and the self-recording minimum thermometers for the preceding 24 hours.

The following table shows for each 10-day period during the year ending September 30, 1914, the gross evaporation, the total rainfall, and the mean temperatures for the 10 observations of the water and of the air:

Evaporation observations at University, N. Dak., for year ending Sept. 30, 1914.

Date.	Evaporation.	Rainfall.	Mean temperature.		Date.	Evaporation.	Rainfall.	Mean temperature.	
			Water.	Air.				Water.	Air.
	Inches.	*Inches.*	°*F.*	°*F.*		*Inches.*	*Inches.*	°*F.*	°*F.*
Oct. 1–10	0.78	1.25	45	49	June 1–10	1.54	3.20	70	66
11–20	.68	.01	38	38	11–20	1.40	.84	71	61
21–31	.22	.35	32	29	21–30	1.59	2.47	69	62
Nov. 1–10	.21	.17	32	33	July 1–10	1.79	2.05	80	71
11–20	.15	.13	32	33	11–20	1.98	.31	80	71
21–25	.06	.08	32	31	21–31	1.78	1.83	79	72
Apr. 16–20	.17	1.38	47	44	Aug. 1–10	1.97	.17	74	67
21–30	.78	.61	45	43	11–20	1.23	.41	69	64
					21–31	1.40	2.73	65	58
May 1–10	.72	.78	51	50					
11–20	1.73	.27	59	55	Sept. 1–10	1.33	.13	61	58
21–31	2.41	1.16	67	62	11–20	1.45	.11	66	65
					21–30	1.36	.10	59	57

RAINY LAKE AT RANIER, MINN.

Location.—At the foot of Rainy Lake at Ranier, Minn.

Records available.—January 1, 1910, to September 30, 1914.

Gage.—Haskell water-stage recorder and vertical staff (read once daily) installed December 5, 1913, on protection crib above Canadian Northern Railway bridge. Prior to that date, staff gage attached to foot of Ranier wharf. Prior to August 19, 1911, gage heights were read at the upper gage of the Minnesota & Ontario Power Co., just above the dam at International Falls, 2 miles below Ranier. Comparative readings taken on the two gages during 1911 indicated a slope of 0.50 foot between the two points, and to make the records comparable the readings on the Minnesota & Ontario gage were reduced by 488.50. Recent studies by Mr. A. F. Meyer, consulting engineer of the International Joint Commission, indicate that the actual slope between the two gages varied from 0.3 to 1.2 feet during the period January 1, 1910, to August 18, 1911, so that the readings on the Minnesota & Ontario Power Co.'s gage should have been reduced by an amount ranging from 488.70 to 487.80 instead of 488.50 feet. Gage heights January 1, 1910, to August 18, 1911, published in Water-Supply Papers 285 and 305 are therefore in error as referred to the correct datum by an unknown amount varying from +0.2 to −0.7 foot.

The dam at International Falls controls the level of Rainy Lake, which has an area of approximately 344 square miles. Owing to the great number of small islands in the lake its effective capacity is somewhat uncertain, as the existing maps are too small to show this accurately. Beginning August 19, 1911, the gage heights refer to the gages established by the Canadian Department of Public Works.

The gages were maintained at the following elevations during the year ending September 30, 1914:

	Feet.
Oct. 1 to Dec. 4, 1913	489.25
Dec. 5, 1913, to Sept. 30, 1914	488.00

The records at this station, by indicating the change in the water level, show the gain or loss in storage due to the control of the flow at the International Falls dam, and when used in connection with the records of flow of the Rainy at International Falls, are of value in determining the natural run-off.

Cooperation.—Gages are owned and maintained by the Canadian Department of Public Works.

Daily gage height, in feet, of Rainy Lake at Ranier, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.95	7.80	7.59	.....	6.07	5.18	3.97	3.70	.....	7.65	8.20	7.60
2	7.98	.....	7.54	.....	6.03	5.10	3 93	3.75	.....	7.70	8.20	7.50
3	7.99	.....	7.51	.....	5.94	5.06	3.90	3.90	.....	7.73	8.20	7.55
4	8.01	.....	7.53	.....	5.93	5.04	3.87	3.88	.....	7.87	8.12	7.50
5	8.09	.....	7.55	.....	5.90	4.98	3.92	3.89	.....	7.97	8.00	7.60
6	8.07	.....	.....	6.45	5.87	4.97	3.80	3.95	.....	7.90	8.00	7.65
7	7.97	.....	.....	6.48	5.82	4.96	3.76	4.00	5.75	7.97	8.00	7.65
8	7.96	.....	.....	6.48	5.86	4.97	3.74	4.04	5.80	7.98	8.10	7.55
9	7.98	.....	.....	6.43	5.82	4.86	3.67	4.07	5.95	8.00	8.20	7.50
10	7.97	.....	.....	6.50	5.76	.....	3.63	4.17	6.10	8.00	8.10	7.50
11	7.99	.....	7.08	6.45	5.72	4.77	3.55	4.18	6.20	8.20	8.10	7.50
12	8.05	.....	7.10	6.46	5.70	4.72	3.62	4.21	6.25	8.30	8.00	7.47
13	8.04	.....	7.08	6.43	5.65	4.68	3.50	4.24	6.30	8.25	7.95	7.50
14	8.04	.....	7.08	6.40	5.61	4.65	3.48	4.27	.....	8.30	7.90	7.50
15	8.03	7.70	7.02	6.37	5.64	4.68	3.44	4.28	6.40	8.30	8.00	7.48
16	8.00	7.69	6.92	6.35	5.56	.....	3.47	4.30	6.45	8.20	8.05	7.45
17	7.98	7.67	6.95	6.32	5.52	4.57	3.50	4.30	6.50	8.30	8.00	7.45
18	7.95	7.67	6.95	6.30	5.45	4.51	3.60	4.33	6.60	8.35	7.95	7.50
19	7.97	7.66	6.90	6.28	5.46	4.45	3.67	4.40	6.70	8.30	7.90	7.50
20	7.95	7.65	.....	6.24	5.46	4.42	3.55	4.65	6.75	8.40	7.87	7.60
21	7.94	7.65	.....	6.22	5.36	4.36	3.55	4.75	.....	8.40	7.85	7.50
22	7.97	7.65	.....	6.22	5.41	4.38	3.59	4.77	6.90	8.35	7.87	7.52
23	7.95	7.65	.....	6.18	5.35	4.30	3.60	4.80	7.00	8.35	7.95	7.60
24	7.95	7.63	.....	6.13	5.30	4.25	.....	5.00	7.07	8.30	7.80	7.60
25	7.99	7.63	.....	6.18	5.26	4.27	3.60	5.00	7.13	8.30	7.88	7.60
26	7.96	7.63	.....	6.18	5.24	4.22	3.68	5.10	7.20	8.35	7.80	7.60
27	7.91	7.58	.....	6.17	5.20	4.19	3.64	5.20	7.43	8.35	7.78	7.60
28	7.87	7.57	.....	6.16	5.15	4.14	3.68	5.30	7.43	8.30	7.70	7.59
29	7.84	7.57	.....	6.16	.....	4.17	3.67	5.35	7.45	8.20	7.69	7.60
30	7.84	7.61	.....	6.10	.....	4.07	.....	5.40	7.55	8.27	7.70	7.60
31	7.82	.....	.....	6.09	.....	4.02	.....	.....	.....	8.20	7.65	.....

NOTE.—Gage heights in the above table refer to the same datum as those published in previous water-supply papers.

RAINY RIVER AT INTERNATIONAL FALLS, MINN.

Location.—At the steamboat dock half a mile below the dam at International Falls, Minn.

Records available.—March 1, 1907, to September 30, 1914.

Drainage area.—14,600 square miles.

Gage.—Vertical staff installed April 20, 1911. Prior to this date the gage heights, furnished through the courtesy of the Minnesota & Ontario Power Co., were read on a gage located just below the dam, first on the American side but later on the Canadian side. The zero of the United States Geological Survey gage is 460.99 feet above that of the power company's gage, when the slope of the river between the two points, determined at gage height 2.65 feet, is considered. On September 15, 1913, an automatic gage was installed near staff gage and at same datum by the Canadian Department of Public Works.

Channel and control.—Channel near gage is largely solid rock; permanent. Control point, which is probably a long distance downstream (perhaps at Mountain Rapids, 37 miles below), is subject to frequent obstructions from log jams. Backwater at gage also caused by flood stages of Little Fork and Big Fork rivers.

Discharge measurements.—Made from a boat at a section about 100 feet below the gage where the bed of the river is uniform and the velocity regular.

Winter flow.—Ice rarely forms in the long stretch of water below the dam, but serious backwater, amounting at times to more than 2 feet, is caused by ice that forms at the rapids below the open stretch. The winter flow through the turbines of the power company is computed by the Canadian Department of Public Works.

Regulation.—Since the dam and power house have been in operation practically no water has passed over the crest, the entire flow of the river going through the turbines and sluice gates. The plant is run on a 24-hour basis, however, so that, with the exception of the Sunday flow, the discharge is fairly uniform.

Accuracy.—Studies of previous records of this station, based on more complete data than were available when Water-Supply Paper 305 was prepared, indicate that the estimates of monthly discharge published in that report are in error. The estimated errors were published in Water-Supply Paper 325, page 61, in which that for December, 1908, as given in the table, should be +14 per cent instead of —14 per cent. Throughout the greater part of the open-water period during the year ending September 30, 1914, the discharge relation was affected by backwater from log booms below the station.

Cooperation.—Estimates of flow through the power house and results of discharge measurements furnished by Canadian Department of Public Works. Discharge measurements also furnished by the water power branch of the Canadian Department of the Interior.

Discharge measurements of Rainy River at International Falls, 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.*
Oct. 18	Brown and Jamison....	3.57	7,910	June 15	R. F. Smallian.....	4.78	8,850
Nov. 27	G. M. Brown.....	3.28	7,230	23	.....do.....	4.10	8,940
Dec. 12	.....	4.49	6,820	July 8	.....do.....	4.80	9,320
Feb. 25	Parr and Jamison.....	4.86	7,040	Aug. 6	.....do.....	4.80	10,500
May 15	D. W. Jamison.....	4.61	7,090				

NOTE.—The above measurements were furnished by the Canadian Department of Public Works.

Daily gage height, in feet, of Rainy River at International Falls, Minn., for the year ending Sept. 30, 1914.

[R. Caple, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.5	2.7	2.8	4.3	3.9	4.2	3.1	5.0	4.6	4.1	4.8	.....
2	2.5	2.5	3.4	4.4	3.8	4.2	3.1	5.4	4.8	4.1	4.0	.....
3	2.4	2.6	3.6	4.3	4.6	4.4	3.1	5.6	4.7	4.4	4.1	.....
4	2.3	2.8	3.3	3.7	4.8	4.2	3.1	6.0	4.5	3.7	4.7	.....
5	2.3	2.8	3.0	3.6	4.8	4.3	2.6	6.3	4.4	2.6	4.8	.....
6	2.5	2.8	3.2	4.2	4.9	4.2	2.7	6.3	4.3	3.7	4.8	.....
7	3.0	2.7	2.8	4.1	5.0	4.1	3.0	6.2	3.5	4.8	4.9	.....
8	3.3	2.7	.....	4.0	4.7	3.5	3.1	6.0	3.8	4.7	4.8	
9	3.5	2.0	.....	4.0	4.5	3.6	3.1	5.8	4.6	4.9	3.9	.....
10	3.6	1.8	4.8	4.1	4.8	4.0	3.1	5.0	5.9	4.8	4.2	.....
11	4.0	2.5	4.6	3.5	4.9	4.0	3.2	4.9	6.3	4.9	4.7	.....
12	3.7	2.6	4.5	4.1	5.1	4.0	2.5	4.9	6.2	4.2	4.8	.....
13	3.6	2.7	4.4	4.5	5.0	3.9	2.7	4.8	6.1	4.8	4.8	.....
14	4.0	2.7	3.6	4.4	5.0	3.8	3.0	4.6	5.3	6.5	4.8	.....
15	4.0	2.7	3.6	4.3	4.5	2.8	3.1	4.4	4.5	6.9	4.8	.....
16	3.9	2.2	4.1	4.0	4.7	3.4	3.2	4.2	4.9	6.8	4.4	.....
17	3.7	2.3	5.0	4.1	4.9	3.6	3.3	3.8	4.8	6.5	3.6	.....
18	3.6	2.6	4.0	3.5	4.9	3.6	3.8	3.8	4.8	6.3	4.6	.....
19	2.8	2.6	4.1	3.1	5.0	3.6	3.6	4.0	4.5	5.6	4.7	.....
20	3.3	2.6	4.3	3.6	5.0	3.6	4.0	4.7	4.4	5.4	4.7	.....
21	3.4	2.5	3.6	4.3	4.9	3.5	4.3	5.8	3.4	5.7	4.7	.....
22	3.4	2.8	3.3	4.5	4.3	3.0	4.1	6.0	3.5	6.0	4.6	.....
23	3.3	2.5	3.8	4.4	4.4	3.1	4.1	5.8	4.0	6.2	3.8	.....
24	3.3	2.8	3.9	4.5	4.8	3.4	4.0	5.0	4.1	6.0	4.0	.....
25	3.3	3.2	3.4	4.0	4.8	3.3	4.1	5.0	4.2	6.0	.....	.....
26	2.9	3.3	3.1	3.7	4.8	3.3	3.9	5.1	4.2	5.6	.....	.....
27	2.9	3.3	3.8	4.4	4.7	3.3	3.8	5.0	4.1	5.6	.....	.....
28	2.8	3.3	3.5	4.5	4.4	3.2	3.9	4.9	3.5	5.8	.....	.....
29	2.8	3.1	3.6	.....	.....	2.7	4.1	5.2	3.4	5.8	.....	.....
30	2.8	2.6	3.9	5.0	.....	2.9	4.6	5.3	4.2	5.4	.....	.....
31	2.8	.....	4.1	4.6	.....	3.1	.....	4.4	.....	5.1	.....	.....

Daily gage height, in feet, of Rainy River at International Falls, Minn., for the year ending Sept. 30, 1914.—Continued.

[Stevens recording gage.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.5	2.8	2.7	.....	3.8	5.1	a2.9	4.8	4.4	3.2	4.9	4.6
2	2.5	2.4	3.4	.....	3.4	.....	a3.0	5.4	4.8	4.1	4.0	4.9
3	2.4	2.5	3.5	.....	3.3	.....	a3.1	5.6	4.7	4.4	4.1	4.9
4	2.2	2.8	3.3	.....	3.4	.....	a3.1	6.0	4.6	3.8	4.7	4.9
5	2.2	2.8	3.0	.....	3.4	.....	.....	6.3	4.5	2.5	4.8	4.9
6	2.5	2.7	3.2	.....	3.4	4.2	.....	6.3	4.4	3.1	4.8	4.0
7	3.0	2.7	.....	.....	.....	4.2	a3.0	6.3	3.6	4.7	4.8	2.2
8	3.2	2.8	.....	.....	.....	3.8	3.0	6.2	3.7	4.8	4.8	2.9
9	3.4	2.1	4.7	.....	.....	3.4	a3.1	5.8	4.6	5.0	4.1	4.6
10	3.6	1.7	4.8	.....	3.6	4.0	3.1	5.2	5.7	5.0	3.8	4.7
11	4.0	2.1	4.6	.....	3.6	4.1	3.1	4.9	6.4	4.9	4.7	4.7
12	3.8	2.6	4.5	.....	3.6	4.2	3.2	4.9	6.4	4.1	4.8	4.7
13	3.6	2.7	4.4	4.0	3.6	4.0	3.1	4.8	6.1	4.8	4.8	3.8
14	4.0	2.7	3.6	4.1	3.6	3.7	3.0	4.6	5.2	6.4	4.8	3.8
15	4.0	2.7	3.5	4.1	3.7	3.3	3.1	4.5	4.6	6.9	4.8	4.8
16	3.8	2.3	4.0	4.0	3.7	3.1	3.1	4.4	5.0	6.8	4.0	4.9
17	3.8	2.2	4.0	4.1	.....	3.4	3.2	3.8	4.9	6.5	3.6	5.0
18	3.6	2.6	4.0	3.6	.....	3.5	3.3	3.8	4.8	6.4	4.6	5.0
19	3.5	2.6	4.0	2.7	.....	3.6	3.5	4.0	4.6	5.4	4.7	5.1
20	3.4	2.6	4.2	2.9	.....	.....	.....	4.7	4.4	5.2	4.8	4.4
21	3.8	2.5	3.6	3.1	.....	.....	.....	5.8	3.6	5.6	4.8	4.1
22	3.6	2.8	3.2	3.5	.....	3.4	.....	6.0	3.5	5.8	4.7	5.0
23	3.4	2.6	3.8	3.6	.....	3.3	4.0	5.8	4.0	6.2	4.0	5.0
24	3.3	2.7	3.8	.....	.....	3.4	4.0	5.2	4.2	6.1	3.7	5.1
25	3.3	3.2	3.5	.....	4.7	3.4	4.1	5.2	4.3	6.0	4.6	5.1
26	3.0	3.2	3.3	.....	4.7	3.4	4.1	5.2	4.3	5.7	4.8	5.2
27	2.9	3.3	3.7	.....	4.8	3.4	4.1	6.0	4.2	5.5	4.8	4.4
28	2.8	3.3	.....	.....	5.0	3.4	3.9	6.0	3.5	5.8	4.8	3.9
29	2.9	3.1	.....	.....	.....	3.2	4.0	5.3	3.3	5.8	4.8	4.9
30	2.8	2.6	.....	.....	.....	a2.8	4.2	5.3	4.1	5.4	4.0	5.0
31	2.8	.....	.....	3.8	.....	a2.8	.....	4.6	.....	5.0	3.7	.....

a Gage heights uncertain on account of recording gage not working satisfactorily.

NOTE.—Discharge relation affected by backwater during the greater part of the year. See "Accuracy" in station description. Gage heights given in the first table are the mean daily gage heights as determined from two daily readings of the staff gage. Gage heights in the second table were determined from the record of the recording gage.

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6,126	6,965	5,823	6,070	6,439	6,164	6,898	6,868	7,974	7,778	10,730	10,410
2	6,892	5,406	6,980	6,097	6,586	6,418	6,998	6,784	8,834	8,316	8,331	10,580
3	6,980	5,445	6,987	6,933	6,949	6,980	6,912	5,988	8,976	8,966	9,081	10,540
4	6,870	6,110	6,540	6,251	7,000	6,896	6,892	6,396	9,043	8,416	10,984	10,528
5	6,456	6,055	6,077	5,492	7,020	6,956	6,050	6,598	8,749	6,184	10,854	10,528
6	6,040	5,994	6,542	6,935	6,938	6,942	6,320	6,798	8,792	7,216	10,937	7,630
7	6,565	6,080	5,430	6,877	6,976	6,922	6,936	6,840	6,646	10,058	10,772	4,270
8	6,435	6,075	5,877	6,870	6,468	5,775	6,916	6,788	7,753	9,829	10,895	9,216
9	6,723	5,493	6,901	6,785	6,482	6,394	6,918	6,752	9,054	10,346	8,816	10,599
10	6,920	5,759	6,930	6,856	6,970	7,064	6,928	5,997	9,421	10,699	9,021	10,600
11	6,940	6,105	6,964	6,218	6,978	7,006	6,910	6,214	8,906	10,739	10,907	10,590
12	6,207	6,100	6,963	6,536	7,078	7,030	6,077	6,802	8,415	7,815	10,948	10,570
13	6,389	6,135	6,944	6,961	7,050	6,986	6,244	6,814	8,860	10,756	10,902	7,713
14	7,170	5,889	6,222	6,953	6,944	7,016	6,902	6,842	6,673	11,023	10,850	8,889
15	6,932	6,222	6,391	6,957	6,312	5,589	6,895	6,846	7,203	10,953	10,877	10,600
16	6,257	5,310	6,974	6,980	6,436	6,384	6,894	6,818	8,686	10,933	7,730	10,522
17	6,360	5,242	6,778	7,021	7,280	6,950	6,932	6,269	8,953	11,376	8,618	10,520
18	6,150	6,115	6,988	6,245	6,744	7,002	6,852	6,272	9,126	11,819	10,654	10,513
19	6,048	6,005	6,988	6,455	6,978	7,022	5,878	6,804	9,070	9,503	10,764	10,500
20	5,545	6,440	6,966	6,920	7,042	7,006	6,280	6,818	9,050	10,472	10,599	8,045
21	6,080	5,675	6,205	6,950	7,012	7,016	6,900	6,864	6,968	12,061	10,578	8,848
22	6,140	6,558	5,945	6,921	5,967	6,180	6,834	6,832	7,644	12,441	10,549	10,512
23	6,150	6,237	6,095	6,969	6,410	6,392	6,868	6,856	8,745	12,775	8,549	10,542
24	6,100	6,468	6,118	6,957	6,974	6,958	6,878	6,102	8,916	12,541	8,871	10,505
25	6,120	6,780	4,908	6,326	6,988	6,850	6,876	6,620	9,466	12,445	10,607	10,515
26	5,474	7,175	4,608	7,140	7,018	6,944	6,052	7,398	9,504	10,773	10,609	10,414
27	5,550	6,931	5,201	7,036	6,998	6,928	6,252	7,432	9,104	11,503	10,628	8,187
28	6,070	6,979	6,225	6,958	7,020	6,928	6,862	7,895	6,606	12,262	10,658	8,673
29	6,105	6,606	5,525	7,004	.....	6,056	6,796	8,630	8,198	12,522	10,628	10,520
30	6,026	5,519	6,295	6,932	.....	6,270	6,856	8,952	8,670	11,247	7,735	10,380
31	6,075	.....	6,299	6,685	.....	6,880	.....	6,963	.....	10,657	8,725	.....

NOTE.—Daily discharge records were furnished by S. B. Johnson, hydraulic engineer, Department of Public Works, Canada, and were computed from power-house records.

Monthly discharge of Rainy River at International Falls, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
October	7,170	5,474	6,320
November	7,175	5,242	6,130
December	6,988	4,608	6,310
January	7,140	5,492	6,720
February	7,280	5,967	6,820
March	7,064	5,589	6,710
April	6,998	5,878	6,690
May	8,952	5,988	6,870
June	9,504	6,606	8,470
July	12,775	6,184	10,500
August	10,984	7,730	10,000
September	10,600	4,270	9,750
The year	12,775	4,270	7,610

NOTE.—"Discharge in second-feet per square mile" and "Run-off (depth in inches)" are not published because such estimates do not represent natural flow at station.

VERMILION RIVER BELOW LAKE VERMILION, NEAR TOWER, MINN.

Location.—In sec. 2, T. 63 N., R. 17 W., in St. Louis County, just below dam at outlet of Lake Vermilion, 4 miles above the mouth of Two Mile Creek, which enters from the west.

Records available.—May 17, 1911, to September 30, 1914.

Drainage area.—507 square miles.

Gage.—Vertical staff; read morning and evening to quarter-tenths. Limits of use: Hundredths below 1.0, half-tenths from 1.0 to 2.5, and tenths above 2.5 feet.

Channel and control.—Steep rapids just below gage; bed of stream composed of solid rock and large bowlders; control permanent.

Discharge measurements.—Made from cable just below station; at high stage from boat about a mile below gage.

Winter flow.—Not affected by ice owing to the heavy fall at gage section, amounting to 20 feet in 200 yards.

Regulation.—At the outlet of Vermilion Lake, a few hundred feet above the gage, there is a dam which is used to raise the elevation of the lake for aid in navigation. Dam has no gates but was repaired on July 19, 1912. From April 28 to May 10, 1914, when parts of dam were removed, and for some time subsequent, the flow was above normal.

Accuracy.—Conditions favorable for good results, the only uncertainty being some inaccuracy in the discharge measurements, owing to the very rocky section.

Discharge measurements of Vermilion River below Lake Vermilion, near Tower, 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.*
Oct. 7	B. J. Peterson	0.32	73	May 20	S. B. Soulé	2.91	[a] 1,070
7	do	.32	73	21	do	2.85	[b] 991

[a] Measurement made from boat at a section about 4,000 feet below gage.
[b] Measurement made from boat at a section about 6,000 feet below gage; control clear.

Daily gage height, in feet, of Vermilion River below Lake Vermilion, near Tower, Minn., for the year ending Sept. 30, 1914.

[Mrs. A. E. Shively, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.22	0.48	0.62	0.65	0.62	0.70	0.66	1.65	2.5	1.9	1.8	1.2
2	.22	.48	.65	.65	.62	.70	.66	1.8	2.5	1.9	1.8	1.2
3	.24	.48	.65	.65	.62	.70	.66	2.0	2.5	1.9	1.8	1.2
4	.24	.50	.65	.65	.65	.70	.65	2.05	2.5	1.9	1.7	1.2
5	.27	.52	.68	.65	.65	.70	.65	2.1	2.5	1.9	1.7	1.2
6	.30	.52	.68	.65	.65	.70	.65	2.2	2.5	1.9	1.65	1.15
7	.32	.50	.68	.65	.65	.70	.65	2.4	2.5	1.85	1.6	1.1
8	.32	.50	.68	.65	.65	.70	.64	2.4	2.5	1.85	1.55	1.1
9	.32	.50	.68	.65	.65	.70	.64	2.4	2.45	1.9	1.5	1.2
10	.32	.50	.68	.62	.65	.70	.64	2.4	2.45	1.9	1.5	1.2
11	.32	.50	.65	.62	.68	.70	.62	3.0	2.4	1.9	1.45	1.15
12	.35	.50	.65	.62	.68	.68	.62	3.0	2.4	1.9	1.45	1.2
13	.40	.50	.65	.62	.68	.68	.62	3.0	2.4	1.95	1.4	1.2
14	.45	.50	.65	.62	.68	.68	.61	3.0	2.4	2.0	1.35	1.2
15	.45	.50	.65	.62	.68	.68	.61	3.0	2.4	2.0	1.3	1.2
16	.45	.55	.65	.62	.68	.68	.60	3.0	2.35	2.0	1.3	1.2
17	.48	.....	.65	.62	.68	.68	.61	2.9	2.3	2.0	1.3	1.2
18	.48	.55	.65	.....	.68	.68	.66	2.9	2.25	2.0	1.3	1.2
19	.48	.55	.65	.62	.68	.68	.69	2.9	2.0	2.0	1.3	1.2
20	.48	.55	.65	.62	.68	.68	.73	2.9	2.0	2.0	1.3	1.2
21	.48	.55	.65	.62	.68	.68	.76	2.9	2.0	1.95	1.3	1.2
22	.48	.55	.65	.62	.70	.68	.78	2.8	2.0	1.9	1.3	1.2
23	.48	.55	.65	.62	.70	.68	.78	2.8	2.0	1.9	1.3	1.2
24	.48	.55	.65	.62	.70	.68	.79	2.8	2.0	1.9	1.3	1.2
25	.48	.55	.....	.62	.70	.68	.85	2.8	2.0	1.9	1.3	1.2
26	.48	.55	.65	.62	.....	.68	.91	2.8	1.95	1.9	1.25	1.2
27	.48	.55	.65	.62	.....	.68	.96	2.7	1.95	1.9	1.25	1.15
28	.48	.55	.65	.62	.....	.68	1.15	2.6	1.95	1.9	1.2	1.15
29	.48	.58	.65	.62	.....	.68	1.4	2.6	1.9	1.85	1.2	1.1
30	.48	.60	.65	.62	.....	.68	1.55	2.6	1.9	1.8	1.2	1.1
31	.48	.....	.65	.62	.....	.68	.....	2.5	.....	1.8	1.2	.....

NOTE.—Discharge relation probably not materially affected by ice during the year.

Daily discharge, in second-feet, of Vermilion River below Lake Vermilion, near Tower, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	60	95	117	122	117	130	124	378	810	490	442	231
2	60	95	122	122	117	130	124	442	810	490	442	231
3	63	95	122	122	117	130	124	540	810	490	442	231
4	63	98	122	122	122	130	122	565	810	490	398	231
5	66	101	127	122	122	130	122	590	810	490	398	231
6	70	101	127	122	122	130	122	645	810	490	378	220
7	73	98	127	122	122	130	122	755	810	466	358	208
8	73	98	127	122	122	130	120	755	810	466	340	208
9	73	98	127	122	122	130	120	755	782	490	321	231
10	73	98	127	117	122	130	120	755	782	490	321	231
11	73	98	122	117	127	130	117	1,110	755	490	304	220
12	76	98	122	117	127	127	117	1,110	755	490	304	231
13	83	98	122	117	127	127	117	1,110	755	515	287	231
14	90	98	122	117	127	127	116	1,110	755	540	272	231
15	90	98	122	117	127	127	116	1,110	755	540	257	231
16	90	106	122	117	127	127	114	1,110	728	540	257	231
17	95	[a]106	122	117	127	127	116	1,050	700	540	257	231
18	95	106	122	[a]117	127	127	124	1,050	672	540	257	231
19	95	106	122	117	127	127	128	1,050	540	540	257	231
20	95	106	122	117	127	127	135	1,050	540	540	257	231
21	95	106	122	117	127	127	141	1,050	540	515	257	231
22	95	106	122	117	130	127	144	990	540	490	257	231
23	95	106	122	117	130	127	144	990	540	490	257	231
24	95	106	122	117	130	127	146	990	540	490	257	231
25	95	106	[a]122	117	130	127	158	990	540	490	257	231
26	95	106	122	117	[a]130	127	169	990	515	490	244	231
27	95	106	122	117	[a]130	127	179	930	515	490	244	220
28	95	106	122	117	[a]130	127	220	870	515	490	231	220
29	95	111	122	117	.....	127	287	870	490	466	231	208
30	95	114	122	117	.....	127	334	870	490	442	231	208
31	95	.....	122	117	.....	127	.....	810	.....	442	231	.....

[a] Interpolated.

NOTE.—Daily discharge computed from a well-defined rating curve.

Monthly discharge of Vermilion River below Lake Vermilion, near Tower, Minn., for the year ending Sept. 30, 1914.

[Drainage area 507 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	95	60	83.9	0.165	0.19	B.
November	114	95	102	.201	.22	A.
December	127	117	123	.243	.28	A.
January	122	117	118	.233	.27	A.
February	130	117	125	.247	.26	A.
March	130	127	128	.252	.29	A.
April	334	114	145	.286	.32	A.
May	1,110	378	884	1.74	2.01	A.
June	810	490	674	1.33	1.48	A.
July	540	442	497	.980	1.13	A.
August	442	231	298	.588	.68	A.
September	231	208	226	.446	.50	A.
The year	1,110	60	285	.562	7.63	

LITTLE FORK RIVER AT LITTLE FORK, MINN.

Location.—In sec. 9, T. 68 N., R. 25 W., at the lower of the two highway bridges at Little Fork, Minn., 1½ miles above the mouth of Beaver Brook.

Records available.—June 23, 1909, to September 30, 1914.

Drainage area.—1,720 square miles.

Gage.—Vertical staff; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 5.0, half-tenths from 5.0 to 6.0, and tenths above 6.0 feet.

Channel and control.—Channel practically permanent. No well-defined control.

Discharge measurements.—Made from the bridge.

Winter flow.—River frozen over during the winter; discharge measurements made through the ice.

Regulation.—River used throughout spring and summer for log driving, but there are no logging dams and flow is natural.

Accuracy.—Conditions favorable and records reliable except for short periods during April and May, when there may be occasional backwater from log jams at the railroad bridge below station.

Discharge measurements of Little Fork River at Little Fork, 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.*
Dec. 26	S. B. Soulé	6.82	[a] 233	May 16	S. B. Soulé	11.25	[b] 2,400
Jan. 26	do	6.28	[a] 115	Aug. 14	J. B. Stewart	5.79	276
Feb. 25	do	6.12	[a] 82				

[a] Complete ice cover; measurement made about 160 feet above gage.
[b] Logs running; no log jams noticed.

Daily gage height, in feet, of Little Fork River at Little Fork, Minn., for the year ending Sept. 30, 1914.

[Theo. La Chapelle, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.3	6.9	9.5	6.5	.....	.....	.....	15.5	9.2	8.8	6.5	6.8
2	6.4	6.4	.....	.....	6.2	6.1	6.6	17.3	8.9	9.2	6.2	6.7
3	6.5	6.1	.....	6.5	.....	.....	.....	18.3	8.7	9.6	6.1	6.7
4	7.7	5.7	9.5	.....	.....	.....	6.6	18.7	8.6	9.9	6.0	6.8
5	8.1	5.7	.....	6.4	6.2	6.1	.....	18.3	8.3	9.8	5.85	7.0
6	8.6	5.9	9.0	.....	.....	.....	6.6	18.6	7.9	9.0	5.8	7.2
7	9.2	6.4	.....	.....	6.2	6.1	.....	17.8	7.5	8.2	5.6	7.3
8	9.8	6.6	8.5	6.4	.....	.....	.....	16.9	7.4	7.7	5.5	7.1
9	10.4	6.7	.....	.....	6.2	6.1	6.8	15.8	12.8	7.6	5.7	7.0
10	10.6	6.6	.....	6.4	.....	.....	.....	15.2	14.6	7.8	5.7	6.9
11	10.8	6.4	7.9	.....	.....	.....	7.0	14.4	14.2	8.0	5.8	6.8
12	10.6	6.4	.....	6.4	6.2	6.1	.....	13.6	13.1	8.4	5.9	6.8
13	10.5	6.4	7.1	.....	.....	.....	7.0	13.0	12.0	14.4	6.0	6.5
14	10.1	6.4	.....	.....	6.1	6.2	.....	12.4	11.0	16.4	5.9	6.4
15	9.5	6.4	6.6	6.4	.....	.....	.....	11.7	10.3	16.1	5.75	6.6
16	8.9	6.4	.....	.....	6.1	6.2	10.2	11.2	10.0	15.4	5.7	7.1
17	8.6	6.4	.....	6.4	.....	.....	13.1	10.8	9.6	14.4	5.8	7.5
18	8.3	6.4	6.0	.....	.....	.....	16.3	10.2	9.2	13.6	5.9	7.5
19	8.0	6.4	.....	6.3	6.1	6.2	16.8	10.3	9.5	12.7	6.0	7.6
20	8.0	6.4	5.65	.....	.....	.....	15.8	10.6	8.6	11.8	6.1	7.6
21	7.7	6.6	.....	.....	6.0	6.2	15.2	11.2	7.8	11.0	6.3	7.8
22	7.2	7.4	5.55	6.2	.....	.....	14.6	12.1	7.4	10.0	6.6	8.0
23	7.2	.....	.....	.....	6.1	6.3	14.2	12.6	6.8	9.0	6.7	8.2
24	7.3	7.6	.....	6.2	.....	.....	13.9	12.0	6.4	7.9	6.8	8.2
25	7.6	.....	6.8	.....	.....	.....	12.4	11.1	6.0	7.1	7.0	8.0
26	7.8	.....	6.8	6.2	6.1	6.3	12.0	10.4	6.4	7.4	7.0	7.6
27	8.0	8.2	6.8	.....	.....	.....	11.7	10.9	6.8	7.2	6.9	7.2
28	8.3	.....	.....	.....	6.1	6.3	12.0	10.0	7.4	6.7	6.8	7.0
29	8.2	8.8	6.6	6.2	.....	.....	13.3	10.1	7.8	6.4	6.8	6.7
30	7.8	.....	.....	.....	.....	6.4	14.4	9.8	8.6	6.2	6.8	6.4
31	7.4	.....	.....	6.2	.....	.....	.....	9.5	.....	6.3	6.9	.....

NOTE.—Discharge relation affected by ice about Nov. 7–30 and Dec. 5, 1913, to Apr. 16, 1914, and by backwater from log jam Apr. 17–24 and May 2–3.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	423	612	1,680	.....	.....	.....	.....	4,760	1,540	1,360	482	578
2	452	452	1,680	.....	.....	.....	.....	a5,340	1,410	1,540	395	545
3	482	368	1,680	.....	.....	.....	.....	a5,930	1,320	1,720	368	545
4	909	264	1,680	.....	.....	.....	.....	6,520	1,280	1,860	341	578
5	1,070	264	.....	.....	.....	.....	.....	6,300	1,150	1,820	302	647
6	1,280	315	.....	.....	.....	.....	.....	6,460	989	1,460	289	719
7	1,540	.....	.....	.....	.....	.....	.....	6,020	831	1,110	240	756
8	1,820	.....	.....	.....	.....	.....	.....	5,520	793	909	216	683
9	2,080	.....	.....	.....	.....	.....	.....	4,920	3,270	870	264	647
10	2,180	.....	.....	.....	.....	.....	.....	4,590	4,260	949	264	612
11	2,260	.....	.....	.....	.....	.....	.....	4,150	4,040	1,030	289	578
12	2,180	.....	.....	.....	.....	.....	.....	3,710	3,440	1,190	315	578
13	2,130	.....	.....	.....	.....	.....	.....	3,380	2,860	4,150	341	482
14	1,950	.....	.....	.....	.....	.....	.....	3,060	2,360	5,250	315	452
15	1,680	.....	.....	.....	.....	.....	.....	2,710	2,040	5,080	276	513
16	1,410	.....	.....	.....	.....	.....	.....	2,460	1,900	4,700	264	683
17	1,280	.....	.....	.....	.....	.....	.....	2,260	1,720	4,150	289	831
18	1,150	.....	.....	.....	.....	.....	.....	2,000	1,540	3,710	315	831
19	1,030	.....	.....	.....	.....	.....	.....	2,040	1,680	3,220	341	870
20	1,030	.....	.....	.....	.....	.....	.....	2,180	1,280	2,760	368	870
21	909	.....	.....	.....	.....	.....	.....	2,460	949	2,360	423	949
22	719	.....	.....	.....	.....	.....	.....	2,910	793	1,900	513	1,030
23	719	.....	.....	.....	.....	.....	.....	3,160	578	1,460	545	1,110
24	756	.....	.....	.....	.....	.....	.....	2,860	452	989	578	1,110
25	870	.....	.....	.....	.....	.....	3,060	2,410	341	683	647	1,030
26	949	.....	.....	.....	.....	.....	2,860	2,080	452	793	647	870
27	1,030	.....	.....	.....	.....	.....	2,710	2,310	578	719	612	719
28	1,150	.....	.....	.....	.....	.....	2,860	1,900	793	545	578	647
29	1,110	.....	.....	.....	.....	.....	3,540	1,950	949	452	578	545
30	949	.....	.....	.....	.....	.....	4,150	1,820	1,280	395	578	452
31	793	.....	.....	.....	.....	.....	.....	1,680	.....	423	612	.....

a Estimated.

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Nov. 7–20, 300 second-feet; Nov. 21–30, 930 second-feet; Dec. 5–15, 950 second-feet; Dec. 16–31, 280 second-feet; Jan. 1–15, 150 second-feet; Jan. 16–31, 115 second-feet; Feb. 1–5, 112 second-feet; Feb. 6–8, 97 second-feet; Feb. 9–18, 86 second-feet; Feb. 19–28, 78 second-feet; Mar. 1–11, 78 second-feet; Mar. 12–17, 86 second-feet; Mar. 18–31, 114 second-feet; Apr. 1–16, 383 second-feet; and Apr. 17–24, 2,260 second-feet.

Monthly discharge of Little Fork River at Little Fork, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,720 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	2,260	423	1,240	0.721	0.83	B.
November	.....	.....	526	.306	.34	C.
December	1,680	.....	698	.406	.47	C.
January	.....	.....	132	.077	.09	C.
February	.....	.....	89.0	.052	.05	C.
March	.....	.....	95.8	.056	.06	C.
April	.....	.....	1,450	.843	.94	C.
May	6,520	1,680	3,540	2.06	2.38	B.
June	4,260	341	1,560	.907	1.01	B.
July	5,250	395	1,920	1.12	1.29	B.
August	647	216	406	.236	.27	B.
September	1,110	452	715	.416	.46	B.
The year	6,520	.....	1,040	.605	8.19	

UPPER MISSISSIPPI RIVER DRAINAGE BASIN.

MISSISSIPPI RIVER ABOVE SANDY RIVER, NEAR LIBBY, MINN.

Location.—In sec. 25, T. 50 N., R. 24 W., near Libby post office in Aitkin County, Minn., a short distance above the mouth of Sandy River.

Records available.—September 1, 1895, to September 30, 1914.

Drainage area.—4,510 square miles.

Gage.—Vertical staff located just above mouth of Sandy River, but records are not used in the estimate of discharge, which is based on frequent discharge measurements, the daily estimate being interpolated between dates of measurements.

Discharge measurements.—Made by an employee of the United States Engineer Corps stationed at Sandy Lake dam.

Regulation.—Flow at station controlled in the interest of navigation by three reservoirs, namely, Lake Winnibigoshish, Leech Lake, and Pokegama Falls.

Cooperation.—Station maintained by United States Engineer Corps to determine flow of river above Sandy Lake reservoir.

Daily discharge, in second-feet, of Mississippi River above Sandy River, near Libby, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,420	1,400	1,310	1,000	813	570	708	1,720	1,800	2,300	1,680	2,160
2	1,480	1,390	1,300	997	795	575	720	1,830	1,910	2,290	1,660	2,150
3	1,550	1,390	1,290	993	777	580	731	1,940	2,030	2,280	1,640	2,140
4	1,610	1,380	1,270	990	759	586	742	2,060	2,140	2,270	1,620	2,120
5	1,680	1,380	1,260	986	741	592	754	2,180	2,260	2,260	1,600	2,110
6	1,740	1,380	1,250	982	723	597	765	2,290	2,380	2,250	1,590	2,100
7	1,810	1,370	1,230	978	a 704	a 602	777	2,400	2,490	2,240	a1,570	a 2,080
8	a1,880	1,370	1,220	973	702	602	788	2,520	2,610	a2,230	1,590	2,130
9	1,850	1,370	1,200	a 968	700	602	a 800	2,640	2,720	2,200	1,610	2,180
10	1,820	1,360	1,190	960	698	603	823	a2,750	2,840	2,180	1,630	2,230
11	1,790	1,360	1,180	951	695	603	846	2,680	a2,960	2,150	1,650	2,280
12	1,760	1,350	1,160	942	692	603	869	2,600	2,740	2,120	1,680	2,330
13	1,730	1,350	1,150	932	690	604	892	2,530	2,520	2,100	1,700	2,380
14	1,710	1,350	1,140	920	a 689	604	915	2,460	2,300	a2,070	a1,720	2,430
15	1,680	1,340	1,120	910	678	a 605	938	2,390	2,080	2,020	1,770	2,480
16	1,650	1,340	1,110	900	667	612	a 961	2,320	a1,860	1,980	1,810	a 2,530
17	1,620	1,340	1,090	a 893	656	618	967	2,240	1,870	1,930	1,860	2,480
18	1,590	1,330	1,080	869	646	625	974	2,170	1,880	1,890	1,910	2,440
19	1,560	1,330	1,070	845	636	632	980	2,100	1,880	1,840	1,960	2,390
20	a1,540	1,320	1,050	821	626	638	987	a2,020	1,890	1,800	2,010	2,340
21	1,520	1,320	1,040	797	616	645	994	1,950	1,900	1,750	2,060	2,300
22	1,510	1,320	1,020	773	a 606	652	1,000	1,870	1,900	1,720	2,110	2,250
23	1,500	a1,310	1,010	749	599	659	1,010	1,790	a1,910	1,670	a2,160	a 2,200
24	1,490	1,320	a 995	a 725	592	a 666	a1,010	1,720	1,960	a1,620	2,160	2,210
25	1,480	1,320	997	740	585	670	1,110	1,640	2,020	1,630	2,160	2,230
26	1,470	1,320	998	755	578	675	1,210	a1,560	2,080	1,640	2,160	2,240
27	1,460	1,320	999	770	571	680	1,310	1,580	2,140	1,650	2,170	2,260
28	1,440	1,320	1,000	785	a 564	684	1,400	1,610	2,190	1,660	2,170	2,270
29	1,430	1,320	1,000	800	.....	688	1,500	1,630	2,250	1,680	2,170	2,280
30	1,420	a1,330	1,000	815	.....	692	1,600	1,660	a2,310	1,680	2,180	a 2,300
31	1,400	.....	a1,000	a 831	.....	a 697	.....	a1,690	.....	a1,700	a2,180	.....

a Discharge measurement.

Monthly discharge of Mississippi River above Sandy River, near Libby, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 4,510 square miles[a].]

Month.	Discharge in second-feet.			Run-off (total in millions of cubic feet).
	Maximum.	Minimum.	Mean.	
October	1,880	1,400	1,600	4,280
November	1,400	1,310	1,350	3,500
December	1,310	995	1,120	3,000
January	1,000	725	882	2,360
February	813	564	671	1,620
March	697	570	628	1,680
April	1,600	708	969	2,510
May	2,750	1,560	2,080	5,570
June	2,960	1,800	2,190	5,680
July	2,300	1,620	1,960	5,250
August	2,180	1,570	1,870	5,010
September	2,530	2,080	2,270	5,880
The year	2,960	564	1,470	46,300

[a] Discharge in "Second-feet per square mile" and "Run-off (depth in inches)" not published for this drainage area because the flow at the station is modified by the operation of six reservoirs in the interest of navigation, as noted under "Regulation" in station description.

NOTE.—Computed by engineers of the United States Geological Survey from daily discharge record furnished by the United States Engineer Corps.

MISSISSIPPI RIVER AT ST. PAUL, MINN.

Location.—Near foot of Robert Street, St. Paul, Minn., 6 miles below mouth of Minnesota River.

Records available.—Gage heights by United States Signal Service (later United States Weather Bureau) 1873 to 1914. Many discharge measurements by United States Engineer Corps prior to 1900. Measurements made by United States Geological Survey 1909 to 1914. Daily discharge March 1, 1892, to September 30, 1914.

Drainage area.—35,700 square miles.

Gage.—Chain gage installed May 9, 1913, on Chicago & Great Western Railroad bridge, about 800 feet below vertical staff near foot of Wabasha Street used prior to that date; same datum. Gage read once daily to tenths. Limits of use: Tenths at all stages. Previous to 1911 a vertical staff was located on the Diamond Joe Line wharf at the foot of Jackson Street, about 400 feet below the chain gage. At the lower end of the wharf is the gage of the United States Engineer Corps, the datum of which is 0.5 foot higher than that of the Weather Bureau gage, to which the following data are referred.

Channel and control.—No well-defined control; channel somewhat shifting.

Discharge measurements.—Made from the Omaha Railway bridge, 2 miles above station.

Winter flow.—River frozen from December to March, when monthly estimates of flow are based on records of United States Engineer Corps at Lock and Dam No. 2 below Minneapolis, an allowance being made for the flow of Minnesota River.

Regulation.—Flow regulated somewhat by Government reservoirs on the headwaters at Lake Winnibigoshish, Leech Lake, Pokegama Falls, Sandy Lake, Pine River, and Gull Lake, but the effect of these reservoirs is observable very gradually at St. Paul. It is possible that during extreme low water the shutting of the wheel gates of the power plants at the nearest dam, at Minneapolis, may cause daily fluctuations of stage at St. Paul.

Maximum and minimum flow.—Highest recorded discharge, amounting to 117,000 second-feet, occurred July 22, 1867. Since 1892 highest discharge has been 80,800 second-feet. The winter flow has fallen nearly as low as 1,000 second-feet.

Accuracy.—As the Weather Bureau gage is read once daily the recorded mean gage height for the day may be somewhat in error, although occasional additional readings have shown this was not serious. Up to 1900 the United States Engineer Corps made many discharge measurements at St. Paul, the results of which are published by the Mississippi River Commission. Although the base data for estimating the daily flow of the river are available for years prior to 1892, the reservoir system, which has had a marked influence on the regimen of the river, was not then in complete operation and it is evident that the earlier records have lost much of their value as indications of probable future flow.

Cooperation.—Gage heights furnished by the United States Weather Bureau. Data on which mean monthly flow from January to March has been based furnished by United States Engineer Corps.

Discharge measurements of Mississippi River at St. Paul, 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 4	Soulé and Stewart	5.64	14,300	Sept. 2	Soulé and Stewart	4.00	10,300
June 18	do	9.59	27,200				

Daily gage height, in feet, of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.8	2.4	1.9	0.8	0.9	1.4	2.2	3.8	3.6	11.9	4.2	3.8
2	1.8	2.4	2.0	.8	.4	1.4	2.2	4.2	3.6	12.0	4.2	3.8
3	1.7	2.5	2.0	.5	.9	1.1	2.3	5.2	4.1	12.2	4.0	3.8
4	1.5	2.5	2.1	.5	.3	1.2	2.5	5.4	4.0	12.2	4.0	3.7
5	1.8	2.3	2.1	.4	.8	1.2	2.6	5.7	4.1	12.1	4.0	3.6
6	1.1	2.3	2.0	.4	1.1	1.2	2.7	5.8	4.5	11.9	3.9	3.5
7	1.7	2.2	2.0	.4	.5	1.1	2.7	5.9	4.7	11.6	3.9	3.3
8	1.8	2.1	1.9	.4	1.2	1.0	2.5	6.0	4.8	11.2	3.8	3.2
9	1.8	2.0	1.9	.5	1.7	.9	2.6	5.9	5.4	10.8	3.7	3.2
10	1.8	2.0	1.4	1.3	1.5	.6	2.7	5.8	6.2	10.2	4.0	3.0
11	2.4	2.1	.8	2.1	1.3	.4	2.8	5.7	7.4	9.8	3.7	3.1
12	3.1	2.1	.9	1.3	1.0	.2	2.8	5.8	8.1	9.3	3.5	3.1
13	3.2	2.1	1.1	1.5	1.3	.0	2.5	5.6	8.8	8.9	3.5	3.1
14	3.3	2.0	1.1	1.7	1.1	.0	2.4	5.5	9.4	8.4	3.4	3.5
15	3.5	1.9	.9	2.0	1.1	.0	2.2	5.4	9.7	8.1	3.2	4.0
16	3.8	1.8	1.1	1.9	1.1	−.3	2.2	5.2	9.8	7.7	2.9	4.4
17	3.8	1.8	1.1	1.7	1.1	−.3	2.1	4.9	9.8	7.3	2.9	4.7
18	3.9	1.7	1.0	1.4	1.1	−.2	2.0	4.8	9.6	6.9	3.0	5.0
19	3.9	1.5	1.0	1.2	1.1	.0	2.0	4.4	9.5	6.5	3.1	5.5
20	3.6	1.4	.5	.6	1.1	.3	2.1	4.4	9.5	6.0	3.1	5.8
21	3.5	1.4	.4	1.1	1.1	.2	2.3	4.0	9.4	5.9	3.0	5.8
22	3.4	1.5	.0	1.8	1.1	1.6	2.2	3.9	9.3	5.6	2.9	5.6
23	3.4	1.4	.0	2.0	1.1	1.5	2.2	4.0	9.5	5.6	3.7	5.5
24	3.2	1.4	−.1	1.7	1.2	1.5	2.3	4.0	9.6	5.3	3.4	5.4
25	3.0	1.5	.1	1.4	1.2	1.7	2.8	3.6	9.4	5.0	3.5	5.1
26	2.8	1.5	1.0	1.0	1.2	1.8	2.8	3.5	9.6	4.5	3.5	4.9
27	2.7	1.6	1.8	1.6	1.2	1.8	2.9	3.8	10.0	4.5	3.5	4.7
28	2.6	1.7	1.5	1.7	1.3	1.8	3.3	3.8	10.3	4.3	3.6	4.7
29	2.6	1.8	1.6	1.1	.....	1.7	3.2	3.6	10.9	4.3	3.5	4.4
30	2.5	1.8	1.4	1.1	.....	2.0	3.5	3.6	11.6	4.2	3.5	4.3
31	2.5	.....	1.0	1.2	.....	2.2	.....	3.7	.....	4.3	3.4	.....

NOTE.—Discharge relation affected by ice about Dec. 26, 1913, to Mar. 9, 1914.

Daily discharge, in second-feet, of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5,910	7,010	6,090	.....	.....	.....	6,630	9,920	9,480	38,600	10,800	9,920
2	5,910	7,010	6,270	.....	.....	.....	6,630	10,800	9,480	39,200	10,800	9,920
3	5,730	7,200	6,270	.....	.....	.....	6,820	13,300	10,600	40,500	10,400	9,920
4	5,390	7,200	6,450	.....	.....	.....	7,200	13,800	10,400	40,500	10,400	9,700
5	5,910	6,820	6,450	.....	.....	.....	7,400	14,600	10,600	39,800	10,400	9,480
6	4,720	6,820	6,270	.....	.....	.....	7,600	14,900	11,500	38,600	10,100	9,260
7	5,730	6,630	6,270	.....	.....	.....	7,600	15,200	12,000	36,800	10,100	8,840
8	5,910	6,450	6,090	.....	.....	.....	7,200	15,500	12,200	34,500	9,920	8,630
9	5,910	6,270	6,090	.....	.....	.....	7,400	15,200	13,800	32,500	9,700	8,630
10	5,910	6,270	5,220	.....	.....	4,060	7,600	14,900	16,000	29,800	10,400	8,210
11	7,010	6,450	4,300	.....	.....	3,840	7,800	14,600	19,700	28,200	9,700	8,420
12	8,420	6,450	4,430	.....	.....	3,650	7,800	14,900	22,000	26,300	9,260	8,420
13	8,630	6,450	4,720	.....	.....	3,480	7,200	14,400	24,500	24,800	9,260	8,420
14	8,840	6,270	4,720	.....	.....	3,480	7,010	14,100	26,700	23,000	9,050	9,260
15	9,260	6,090	4,430	.....	.....	3,480	6,630	13,800	27,900	22,000	8,630	10,400
16	9,920	5,910	4,720	.....	.....	3,280	6,630	13,300	28,200	20,600	8,000	11,300
17	9,920	5,910	4,720	.....	.....	3,280	6,450	12,500	28,200	19,300	8,000	12,000
18	10,100	5,730	4,570	.....	.....	3,340	6,270	12,200	27,500	18,100	8,210	12,800
19	10,100	5,390	4,570	.....	.....	3,480	6,270	11,300	27,100	16,900	8,420	14,100
20	9,480	5,220	3,950	.....	.....	3,740	6,450	11,300	27,100	15,500	8,420	14,900
21	9,260	5,220	3,840	.....	.....	3,650	6,820	10,400	26,700	15,200	8,210	14,900
22	9,050	5,390	3,480	.....	.....	5,560	6,630	10,100	26,300	14,400	8,000	14,400
23	9,050	5,220	3,480	.....	.....	5,390	6,630	10,400	27,100	14,400	9,700	14,100
24	8,630	5,220	3,410	.....	.....	5,390	6,820	10,400	27,500	13,600	9,050	13,800
25	8,210	5,390	3,560	.....	.....	5,730	7,800	9,480	26,700	12,800	9,260	13,000
26	7,800	5,390	.....	.....	.....	5,910	7,800	9,260	27,500	11,500	9,260	12,500
27	7,600	5,560	.....	.....	.....	5,910	8,000	9,920	29,000	11,500	9,260	12,000
28	7,400	5,730	.....	.....	.....	5,910	8,840	9,920	30,200	11,000	9,480	12,000
29	7,400	5,910	.....	.....	.....	5,730	8,630	9,480	33,000	11,000	9,260	11,300
30	7,200	5,910	.....	.....	.....	6,270	9,260	9,480	36,800	10,800	9,260	11,000
31	7,200	.....	.....	.....	.....	6,630	.....	9,700	.....	11,000	9,050	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated, because of ice, from records of discharge at lock and dam No. 2 by United States Engineer Corps and flow at Mankato as follows: Dec. 26–31, 3,500 second-feet; Jan, 1–31, 3,800 second-feet; Feb. 1–28, 3,300 second-feet; and Mar. 1–9, 3,700 second-feet.

Monthly discharge of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	10,100	4,720	7,660	B.
November	7,200	5,220	6,080	B.
December	6,450	.....	4,690	B.
January	.....	.....	3,800	D.
February	.....	.....	3,300	D.
March	6,630	3,280	4,340	B.
April	9,260	6,270	7,260	B.
May	15,500	9,260	12,200	A.
June	36,800	9,480	22,200	A.
July	40,500	10,800	23,300	B.
August	10,800	8,000	9,350	B.
September	14,900	8,210	11,100	B.
The year	40,500	.....	9,630	-

SANDY RIVER BELOW SANDY LAKE RESERVOIR, MINN.

Location.—At the Sandy Lake dam near Libby post office, Aitkin County, Minn., 1 mile above mouth of Sandy River.

Records available.—July 7, 1893, to September 30, 1914.

Drainage area.—424 square miles.

Area of reservoir behind dam.—At low stage, 8 square miles; at high stage, 16.5 square miles; these areas, with a range of 9.4 feet, give a capacity of 3,127,900,000 cubic feet.

Discharge.—The discharge over the dam is computed from the flow through the openings and from frequent discharge measurements made by an employee who resides near the dam. At extreme flood stages the Mississippi drowns out the dam and fills Sandy Lake reservoir as much as 3 feet higher than was intended. If the Mississippi is at fairly high stage and the dam is open there is frequently a considerable reverse flow into the reservoir, but the amount has not been computed.

Regulation.—Flow at station is wholly controlled by Sandy Lake reservoir.

Accuracy.—The section available for making discharge measurements is not adapted to measuring low discharge, and records below 200 to 300 second-feet may be subject to an error of 20 to 25 per cent. Discharge records for higher stages good.

Cooperation.—Station maintained by United States Engineer Corps for the purpose of measuring the flow from the Sandy Lake reservoir, which is one unit in the Government reservoir system at the headwaters of the Mississippi.

Daily discharge, in second-feet, of Sandy River below Sandy Lake reservoir, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	500	10	107	17	24	5	47	5	64	1,500	802	5
2	501	10	104	17	24	5	54	5	232	1,500	800	5
3	501	10	104	16	24	5	47	5	269	1,500	800	5
4	500	10	104	17	23	5	5	5	391	1,500	800	39
5	500	10	88	17	23	5	5	5	643	1,500	802	19
6	501	10	53	16	23	5	5	5	694	1,500	802	15
7	490	10	50	17	23	5	5	5	909	1,500	799	77
8	230	10	48	16	23	5	5	5	1,580	1,500	799	5
9	260	10	52	16	23	5	5	5	2,000	1,500	799	166
10	200	10	58	16	23	5	5	5	1,810	1,500	801	5
11	140	10	57	16	23	5	5	5	25	1,500	798	5
12	180	10	58	17	23	5	5	5	25	1,200	801	5
13	170	10	55	25	23	5	5	5	500	1,200	800	5
14	140	10	55	25	23	5	5	5	503	801	799	5
15	140	10	55	25	16	5	5	5	502	803	801	110
16	115	10	53	25	15	5	5	5	502	803	401	5
17	115	10	52	24	16	5	5	5	798	799	399	5
18	121	10	50	23	15	5	5	5	1,200	407	403	5
19	104	10	50	23	15	5	5	5	1,210	290	102	5
20	104	10	45	24	15	5	5	5	1,500	200	100	5
21	109	55	32	24	15	5	5	5	1,500	502	100	5
22	99	93	32	23	15	15	5	5	1,500	500	101	5
23	97	118	33	23	15	15	5	5	1,500	501	5	5
24	10	173	25	24	15	23	5	5	1,500	500	5	99
25	10	176	25	24	15	32	5	5	1,500	503	5	84
26	10	176	16	24	15	40	5	5	1,500	499	5	84
27	10	139	16	24	15	40	5	5	1,500	800	5	70
28	10	122	17	23	15	47	5	5	1,500	802	5	5
29	10	122	17	23	.....	47	5	5	1,500	803	5	5
30	10	126	16	23	.....	47	5	5	1,500	801	5	126
31	10	.....	17	24	.....	47	.....	5	.....	800	5	.....

Monthly discharge of Sandy River below Sandy Lake reservoir, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Run-off (total in millions of cubic feet).
	Maximum.	Minimum.	Mean.	
October	501	10	190	509
November	176	10	50.0	130
December	107	16	49.8	133
January	25	16	21.0	56.2
February	24	15	19.2	46.4
March	47	5	14.8	39.6
April	54	5	9.4	24.4
May	5	5	5.0	13.4
June	2,000	25	1,010	2,620
July	1,500	200	968	2,590
August	802	5	440	1,180
September	166	5	32.8	85.0
The year	2,000	5	236	7,430

NOTE.—Computed by engineers of the United States Geological Survey from the record of daily discharge furnished by the United States Engineer Corps. "Discharge in second-feet per square mile" and "Run-off (depth in inches)" not computed for this drainage area because the flow past the station is affected by the operation (in the interest of navigation) of reservoirs.

PINE RIVER BELOW PINE RIVER RESERVOIR, MINN.

Location.—In T. 137 N., R. 27 W., just below the dam at the outlet of Cross Lake, which is 15 miles above the mouth of the river in the central part of Crow Wing County.

Records available.—March, 1886, to September 30, 1914.

Drainage area.—452 square miles.

Area of reservoir surface above dam.—At low water 18 square miles; at high water 24 square miles. These areas, with a range of 16.15 feet, give a capacity of 7,732,900,000 cubic feet. The dam raises the water level in Cross, Pine, Daggett, Rush, Whitefish, Trout, and Hay lakes by varying amounts.

Discharge.—Determined from daily gage heights representing the head at the dam and from the various-sized openings in the dam. Discharge measurements are made about once a week to check these estimates. Although the discharge of the dam represents the flow from the reservoir it does not represent the entire flow of Pine River at its mouth because between the two points the drainage area is increased from 452 to 691 square miles by Little Pine River and one or two other minor tributaries.

Cooperation.—Station is maintained by the United States Engineer Corps for the purpose of measuring the flow from Pine River reservoir, the lowest in the present system of Government reservoirs on the headwaters of the Mississippi.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	123	115	120	119	122	126	126	63	67	70	a 456	516
2	122	a 115	120	119	122	126	126	a 64	67	70	455	516
3	121	115	120	a 119	123	126	126	64	67	69	453	515
4	a 120	115	120	119	123	126	a 62	64	67	a 68	452	514
5	120	115	119	119	123	126	62	65	67	68	450	512
6	121	115	a 119	119	123	126	62	65	a 68	68	448	508
7	121	115	119	119	a 123	a 126	62	65	69	68	446	a 504
8	122	a 115	120	120	123	126	62	65	69	68	a 444	506
9	122	115	120	120	123	126	62	a 66	69	68	446	508
10	a 122	115	121	a 120	123	126	62	66	70	68	448	510
11	124	116	121	120	123	126	a 63	66	70	140	478	512
12	122	116	121	121	123	127	63	66	70	a 298	480	514
13	120	116	a 122	121	123	127	63	66	a 71	300	482	512
14	118	117	122	122	a 123	a 127	63	66	71	300	484	510
15	116	a 117	122	122	123	127	63	66	70	310	a 486	505
16	116	117	123	123	123	126	63	a 67	69	465	490	500
17	115	118	123	a 123	124	126	63	67	69	465	495	495
18	112	118	123	123	124	126	a 63	67	68	465	500	490
19	112	118	124	123	124	126	63	67	67	400	508	a 487
20	112	119	a 124	123	125	125	63	67	a 66	a 343	515	488
21	113	119	123	123	a 125	a 125	63	67	66	340	528	490
22	113	a 120	123	122	125	125	63	67	67	250	a 535	491
23	113	120	122	122	125	125	63	a 68	67	435	534	492
24	114	120	122	a 122	125	126	63	68	68	436	534	493
25	114	120	121	122	125	126	a 63	68	68	a 437	533	495
26	114	120	120	122	125	126	63	68	69	437	533	a 496
27	114	120	a 119	122	126	127	63	68	a 70	436	532	494
28	114	121	119	122	a 126	127	63	68	70	436	531	492
29	114	a 121	119	122	.....	127	63	68	71	437	530	490
30	114	121	119	122	.....	127	63	a 67	71	438	525	488
31	114	.....	119	a 122	.....	127	.....	67	.....	437	a 518	.....

a Discharge measurement.

Monthly discharge of Pine River below Pine River reservoir, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 452 square miles.] a

Month.	Discharge in second-feet.			Run-off (total in millions of cubic feet).
	Maximum.	Minimum.	Mean.	
October	124	112	117	313
November	121	115	117	303
December	124	119	121	324
January	123	119	121	324
February	126	122	124	300
March	127	125	126	337
April	126	62	69.1	179
May	68	63	66.3	178
June	71	66	68.6	178
July	465	68	280	750
August	535	444	492	1,320
September	516	487	501	1,300
The year	535	62	184	5,810

a "Discharge in second-feet per square mile," and "Run-off (depth in inches)" not computed because flow past the gaging station is regulated in the interest of navigation, as noted in the station description.

NOTE.—Computed by engineers of the United States Geological Survey from record of daily discharge furnished by the United States Engineer Corps.

CROW WING RIVER AT NIMROD, MINN.

Location.—In sec. 32, T. 137 N., R. 33 W., at the steel highway bridge at Nimrod post office, about 12 miles east of Sebeka, the nearest railroad point; 1 mile above the mouth of Cat River, and 1 mile below the mouth of Willow Creek.

Records available.—April 15, 1910, to September 30, 1914, when station was discontinued.

Drainage area.—1,010 square miles.

Gage.—Chain gage, attached to the bridge; read daily, morning and evening, to quarter-tenths. Limits of use: hundredths below 5.5, half-tenths between 5.5 and 6.0, and tenths above 6.0 feet.

Channel and control.—No well-defined control; a decided change took place in the channel during the summer of 1914, as indicated by discharge measurements made during the year.

Discharge measurements.—Made from the bridge.

Winter flow.—Affected by ice; observations discontinued.

Regulation.—River used for log driving. No trouble from log jams since establishment of station. A dam at the outlet of Lower Crow Wing Lake controls the water from that portion of the drainage area. River has considerable fall near station, and 1 mile above makes a descent of 12 feet, known as Western Rapids.

Accuracy.—Discharges above 678 second-feet, published in the following tables, are based upon an extension of the discharge rating curve and should therefore be used with caution. A decided change in the discharge relation as expressed by the rating curve used prior to 1914 has taken place since May 14, 1914, as indicated by the four discharge measurements made in May, June, and August, 1914. Daily discharge estimates subsequent to May 14, 1914, have been computed by the indirect method and are consequently not as accurate as those prior to May, 1914.

Discharge measurements of Crow Wing River at Nimrod, 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 14	S. B. Soulé	5.19	581	June 11	S. B. Soulé	6.41	1,260
June 11	do	6.44	1,320	Aug. 10	J. B. Stewart	5.65	[a] 426

[a] Large amount of heavy moss in channel at the gage.

Daily gage height, in feet, of Crow Wing River at Nimrod, Minn., for the year ending Sept. 30, 1914.

[W. H. Wintermute, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.16	5.48	5.30	.....	.....	.....	.....	5.30	5.18	6.4	5.8	5.7
2	5.15	5.44	5.30	.....	.....	.....	.....	5.34	5.09	6.4	5.8	5.7
3	5.15	5.38	5.30	.....	.....	.....	.....	5.38	5.08	6.3	5.8	5.65
4	5.18	5.35	5.30	.....	.....	.....	.....	5.41	5.19	6.3	5.8	5.65
5	5.6	5.32	5.30	.....	.....	.....	.....	5.42	5.31	6.2	5.8	5.6
6	5.6	5.35	5.28	.....	.....	.....	.....	5.40	5.36	6.2	5.7	5.6
7	5.48	5.35	5.15	.....	.....	.....	5.65	5.40	5.95	6.2	5.7	5.6
8	5.46	5.35	5.10	.....	.....	.....	5.48	5.40	7.1	6.2	5.7	5.55
9	5.42	5.35	5.18	.....	.....	.....	5.38	5.38	7.2	6.1	5.7	5.6
10	5.5	5.35	5.28	.....	.....	.....	5.29	5.34	6.8	6.1	5.7	5.7
11	5.65	5.38	5.30	.....	.....	.....	5.24	5.30	6.4	6.1	5.6	5.65
12	5.7	5.40	5.26	.....	.....	.....	5.20	5.28	6.2	6.0	5.6	5.6
13	5.7	5.42	5.19	.....	.....	.....	5.15	5.25	6.2	6.0	5.6	5.75
14	5.7	5.46	5.15	.....	.....	.....	5.20	5.21	6.2	6.0	5.6	6.2
15	5.7	5.5	5.15	.....	.....	.....	5.20	5.20	6.2	6.0	5.6	6.1
16	5.7	5.26	5.15	.....	.....	.....	5.20	5.18	6.2	6.0	5.6	6. 0
17	5.65	5.22	5.15	.....	.....	.....	5.20	5.15	6.2	6.0	5.6	5.95
18	5.6	5.22	5.15	.....	.....	.....	5.20	5.12	6.3	5.95	5.6	5.9
19	5.6	5.20	5.20	.....	.....	.....	5.20	5.10	6.3	5.9	5.55	5.85
20	5.55	5.20	5.28	.....	.....	.....	5.18	5.10	6.2	5.9	5.65	5.85
21	5.5	5.29	.....	.....	.....	.....	5.15	5.08	6.2	5.9	5.6	5.85
22	5.5	5.32	.....	.....	.....	.....	5.12	5.05	6.1	5.85	5.7	5.8
23	5.5	5.30	.....	.....	.....	.....	5.10	5.01	6.1	5.8	5.65	5.75
24	5.5	5.30	.....	.....	.....	.....	5.10	5.02	6.1	5.8	5.7	5.75
25	5.5	5.32	.....	.....	.....	.....	5.10	5.00	6.1	5.8	5.7	5.7
26	5.5	5.35	.....	.....	.....	.....	5.10	5.00	6.1	5.8	5.7	5.7
27	5.49	5.38	.....	.....	.....	.....	5.12	5.00	6.6	5.8	5.65	5.7
28	5.48	5.35	.....	.....	.....	.....	5.16	5.01	6.5	5.85	5.65	5.7
29	5.48	5.32	.....	.....	.....	.....	5.22	5.08	6.4	5.85	5.7	5.6
30	5.5	5.30	.....	.....	.....	.....	5.30	5.14	6.5	5.8	5.7	5.6
31	5.5	.....	.....	.....	.....	.....	.....	5.15	.....	5.8	5.7	.....

NOTE.—Discharge relation affected by ice about Dec. 20, 1913, to Apr. 6, 1914.

Daily discharge, in second-feet, of Crow Wing River at Nimrod, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	574	822	678	.....	.....	.....	.....	678	395	1,190	530	457
2	567	790	678	.....	.....	.....	.....	710	330	1,190	530	457
3	567	742	678	.....	.....	.....	.....	742	312	1,100	530	422
4	589	718	678	.....	.....	.....	.....	766	369	1,100	530	422
5	923	694	678	.....	.....	.....	.....	774	443	1,010	530	388
6	923	718	663	.....	.....	.....	.....	758	472	1,010	457	388
7	822	718	567	.....	.....	.....	966	758	914	1,010	457	388
8	806	718	530	.....	.....	.....	822	758	1,910	1,010	457	356
9	774	718	589	.....	.....	.....	742	742	2,000	923	457	388
10	838	718	663	.....	.....	.....	671	710	1,640	923	457	457
11	966	742	678	.....	.....	.....	634	678	1,280	923	388	422
12	1,010	758	648	.....	.....	.....	604	663	1,100	838	388	388
13	1,010	774	597	.....	.....	.....	567	641	1,100	758	388	494
14	1,010	806	567	.....	.....	.....	604	611	1,100	758	388	838
15	1,010	838	567	.....	.....	.....	604	589	1,100	758	388	758
16	1,010	648	567	.....	.....	.....	604	567	1,100	758	388	678
17	966	619	567	.....	.....	.....	604	537	1,100	758	388	641
18	923	619	567	.....	.....	.....	604	501	1,190	718	388	604
19	923	604	604	.....	.....	.....	604	472	1,100	678	356	567
20	880	604	.....	.....	.....	.....	589	464	1,010	678	422	567
21	838	671	.....	.....	.....	.....	567	443	1,010	678	388	567
22	838	694	.....	.....	.....	.....	545	409	923	641	457	530
23	838	678	.....	.....	.....	.....	530	369	923	604	422	494
24	838	678	.....	.....	.....	.....	530	369	923	604	457	494
25	838	694	.....	.....	.....	.....	530	350	923	604	457	457
26	838	718	.....	.....	.....	.....	530	337	923	604	457	457
27	830	742	.....	.....	.....	.....	545	324	1,370	604	422	457
28	822	718	.....	.....	.....	.....	574	324	1,280	641	422	457
29	822	694	.....	.....	.....	.....	619	362	1,190	641	457	388
30	838	678	.....	.....	.....	.....	678	388	1,280	604	457	388
31	838	.....	.....	.....	.....	.....	.....	382	.....	604	457	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 160 and 678 second-feet (gage heights 4.5 and 5.3 feet). See "Accuracy" in station description.

Monthly discharge of Crow Wing River at Nimrod, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,010 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,010	567	847	0.839	0.97	A.
November	838	604	711	.704	.79	A.
December 1–19	678	530	619	.613	.43	B.
April 7–30	966	530	619	.613	.55	B.
May	774	324	554	.549	.63	B.
June	2,000	312	1,020	1.01	1.13	B.
July	1,190	604	804	.796	.92	C.
August	530	356	441	.437	.50	B.
September	838	356	492	.487	.54	C.

CROW WING RIVER AT MOTLEY, MINN.

Location.—At highway bridge at north edge of village of Motley, about one-fourth mile north of Northern Pacific Railway station, and about 2 miles above the mouth of Long Prairie River, the nearest tributary.

Records available.—June 10 to November 30, 1909; April 15, 1913, to September 30, 1914.

Drainage area.—2,140 square miles.

Gage.—Vertical staff gage; read twice daily to quarter-tenths. Limits of use: Hundredths below 6.0, half-tenths between 6.0 and 7.5, and tenths above 7.5 feet.

Channel and control.—No well-defined control at station; channel fairly permanent.

Discharge measurements.—Made from upstream side of two-span highway bridge.

Winter flow.—River frozen over during winter; monthly estimates of flow based on discharge measurements made through the ice, climatic data, and gage heights.

Regulation.—Nearest dam above station is over 60 miles upstream and affects flow at the station very slightly.

Accuracy.—Backwater from possible log jams may, at certain periods, affect the discharge relation.

Discharge measurements of Crow Wing River at Motley, 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.*
Oct. 24	W. G. Hoyt	6.90	1,190	May 15	S. B. Soulé	6.87	1,220
Dec. 27	S. B. Soulé	7.15	[a] 468	June 10	do	9.95	[d] 6,280
Jan. 27	do	7.12	[b] 430	26	do	8.43	3,680
Feb. 26	do	7.59	[c] 417	Aug. 10	J. B. Stewart	6.45	768

[a] Measurement made under complete ice cover; partial ice cover at control.
[b] Nearly complete ice cover at control.
[c] Complete ice cover at control.
[d] Velocities for about one-half of the measurement determined by the two-point method; velocities for the balance of the measurement determined by the subsurface method.

Daily gage height, in feet, of Crow Wing River at Motley, Minn., for the year ending Sept. 30, 1914.

[S. W. Jacobs, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.42	7.05	7.0	7.0	.....	7.55	7.5	7.3	6.7	9.3	6.6	6.55
2	6.40	6.95	6.95	.....	7.35	.....	7.75	7.3	6.65	9.0	6.7	6.5
3	6.38	6.9	6.95	7.0	.....	.....	7.85	7.3	6.6	8.8	6.7	6.5
4	6.43	6.9	6.95	.....	7.4	7.55	8.0	7.3	6.65	8.4	6.7	6.46
5	6.65	6.85	6.9	7.0	.....	.....	8.0	7.25	6.8	8.2	6.65	6.45
6	6.75	6.9	6.9	.....	.....	.....	8.2	7.25	7.0	8.1	6.7	6.42
7	6.9	6.9	6.75	.....	7.4	7.55	8.0	7.2	7.2	7.75	6.6	6.40
8	7.1	6.85	6.3	7.0	.....	.....	7.8	7.2	7.7	7.65	6.6	6.37
9	7.15	6.85	6.5	.....	7.45	7.55	7.5	7.2	8.5	7.5	6.55	6.32
10	7.3	6.85	6.8	7.0	.....	.....	7.3	7.15	10.0	7.35	6.47	6.49
11	7.4	6.85	6.9	.....	7.45	7.65	7.05	7.1	10.2	7.3	6.46	6.6
12	7.5	6.9	6.85	7.0	.....	.....	6.75	7.05	9.9	7.15	6.42	6.65
13	7.65	7.0	6.85	.....	.....	7.55	6.6	7.0	9.3	7.05	6.41	6.7
14	7.7	6.8	6.8	6.95	.....	.....	6.65	6.95	8.8	7.0	6.40	6.95
15	7.7	6.8	6.7	.....	.....	.....	6.65	6.85	8.5	6.95	6.38	7.4
16	7.65	6.75	7.9	.....	7.5	7.75	6.65	6.8	8.3	6.9	6.37	7.55
17	7.5	6.65	7.8	7.0	.....	.....	6.65	6.75	8.2	6.95	6.35	7.5
18	7.4	6.65	7.4	.....	7.55	7.95	6.65	6.75	8.2	6.85	6.33	7.45
19	7.3	6.6	7.45	7.0	.....	.....	6.65	6.7	8.2	6.8	6.33	7.4
20	7.2	6.6	7.35	.....	7.55	.....	6.65	6.7	8.2	6.75	6.39	7.3
21	7.15	6.5	7.6	7.05	.....	7.9	6.65	6.7	8.1	6.7	6.42	7.2
22	6.95	6.9	7.75	.....	.....	.....	6.6	6.7	8.1	6.7	6.45	7.15
23	6.9	7.05	7.75	.....	7.55	7.55	6.6	6.6	7.95	6.6	6.48	7.1
24	6.9	7.05	7.55	7.1	.....	.....	6.6	6.6	8.2	6.6	6.45	7.1
25	6.9	7.05	7.5	.....	7.55	7.5	6.6	6.6	8.3	6.6	6.48	7.0
26	7.0	7.05	7.5	.....	.....	.....	6.6	6.6	8.4	6.55	6.5	6.95
27	7.05	7.05	7.35	7.1	.....	.....	6.6	6.55	8.8	6.6	6.5	6.9
28	7.1	7.05	7.25	.....	.....	7.5	6.85	6.55	9.3	6.55	6.48	6.8
29	7.15	7.0	7.15	7.1	.....	.....	7.1	6.65	9.5	6.55	6.5	6.8
30	7.1	7.05	7.0	.....	.....	7.4	7.25	6.65	9.7	6.55	6.55	6.8
31	7.2	.....	7.0	7.25	.....	.....	.....	6.75	.....	6.55	6.6	.....

NOTE.—Discharge relation affected by ice about Dec. 10, 1913, to Apr. 11, 1914.

Daily discharge, in second-feet, of Crow Wing River at Motley, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	762	1,440	1,360	.....	.....	.....	.....	1,810	1,000	5,140	907	864
2	747	1,300	1,300	.....	.....	.....	.....	1,810	955	4,620	1,000	822
3	734	1,240	1,300	.....	.....	.....	.....	1,810	907	4,280	1,000	822
4	770	1,240	1,300	.....	.....	.....	.....	1,810	955	3,600	1,000	792
5	955	1,170	1,240	.....	.....	.....	.....	1,730	1,110	3,280	955	784
6	1,060	1,240	1,240	.....	.....	.....	.....	1,730	1,360	3,110	1,000	762
7	1,240	1,240	1,060	.....	.....	.....	.....	1,660	1,660	2,530	907	747
8	1,510	1,170	680	.....	.....	.....	.....	1,660	2,450	2,370	907	727
9	1,580	1,170	822	.....	.....	.....	.....	1,660	3,770	2,120	864	693
10	1,810	1,170	.....	.....	.....	.....	.....	1,580	6,400	1,880	800	814
11	1,960	1,170	.....	.....	.....	.....	.....	1,510	6,760	1,810	792	907
12	2,120	1,240	.....	.....	.....	.....	1,060	1,440	6,220	1,580	762	955
13	2,370	1,360	.....	.....	.....	.....	907	1,360	5,140	1,440	754	1,000
14	2,450	1,110	.....	.....	.....	.....	955	1,300	4,280	1,360	747	1,300
15	2,450	1,110	.....	.....	.....	.....	955	1,170	3,770	1,300	734	1,960
16	2,370	1,060	.....	.....	.....	.....	955	1,110	3,440	1,240	727	2,200
17	2,120	955	.....	.....	.....	.....	955	1,060	3,280	1,300	714	2,120
18	1,960	955	.....	.....	.....	.....	955	1,060	3,280	1,170	700	2,040
19	1,810	907	.....	.....	.....	.....	955	1,000	3,280	1,110	700	1,960
20	1,660	907	.....	.....	.....	.....	955	1,000	3,280	1,060	740	1,810
21	1,580	822	.....	.....	.....	.....	955	1,000	3,110	1,000	762	1,660
22	1,300	1,240	.....	.....	.....	.....	907	1,000	3,110	1,000	784	1,580
23	1,240	1,440	.....	.....	.....	.....	907	907	2,860	907	807	1,510
24	1,240	1,440	.....	.....	.....	.....	907	907	3,280	907	784	1,510
25	1,240	1,440	.....	.....	.....	.....	907	907	3,440	907	807	1,360
26	1,360	1,440	.....	.....	.....	.....	907	907	3,600	864	822	1,300
27	1,440	1,440	.....	.....	.....	.....	907	864	4,280	907	822	1,240
28	1,510	1,440	.....	.....	.....	.....	1,170	864	5,140	864	807	1,110
29	1,580	1,360	.....	.....	.....	.....	1,510	955	5,500	864	822	1,110
30	1,510	1,440	.....	.....	.....	.....	1,730	955	5,860	864	864	1,110
31	1,660	.....	.....	.....	.....	.....	.....	1,060	.....	864	907	.....

NOTE.—Daily discharge computed from a rating curve well defined between 680 and 6,400 second-feet (gage heights, 6.3 and 10.0 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 10–31, 1913, 700 second-feet; Jan. 1–31, 1914, 440 second-feet; Feb. 1–28, 410 second-feet; Mar. 1–31, 540 second-feet; and Apr. 1–11, 800 second-feet.

Monthly discharge of Crow Wing River at Motley, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 2,140 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	2,450	734	1,550	0.724	0.83	A.
November	1,440	822	1,220	.570	.64	A.
December	1,360	.....	829	.387	.45	B.
January	.....	.....	440	.206	.24	C.
February	.....	.....	410	.192	.20	C.
March	.....	.....	540	.252	.29	D.
April	1,730	.....	942	.440	.49	C.
May	1,810	864	1,280	.598	.69	A.
June	6,760	907	3,450	1.61	1.80	A.
July	5,140	864	1,810	.846	.98	A.
August	1,000	700	829	.387	.45	A.
September	2,200	693	1,250	.584	.65	A.
The year	6,760	.....	1,210	.565	7.71	

LONG PRAIRIE RIVER NEAR MOTLEY, MINN.

Location.—In sec. 19, T. 133 N., R. 31 W., 100 yards above the highway bridge, 1 mile south of Motley, and 2 miles above the mouth of the river.

Records available.—June 10, 1909, to September 30, 1914.

Drainage area.—973 square miles.

Gage.—Vertical staff; read daily, morning and evening, to half-tenths. Limits of use: Hundredths below 5.5, half-tenths between 5.5 and 6.5, and tenths above 6.5 feet.

Channel and control.—Light gravel; practically permanent.

Discharge measurements.—Made from the bridge except at low stages, when measurements are made by wading at a short distance upstream.

Winter flow.—River frozen over at gage; estimates based on discharge measurements made through the ice.

Accuracy.—Conditions at station favorable, and the records should be reliable. Backwater caused by ice gorges in Crow Wing River may possibly affect the discharge relation for a few days in the spring. A decided change in the discharge relation as expressed by the rating curve used prior to 1914 occurred between the discharge measurements of June 10 and August 11, 1914. This change is assumed to have occurred during July and estimates of daily discharge subsequent to July 14, 1914, have been made by the indirect method and are therefore not as accurate as those prior to that date.

On account of using an erroneous estimate for the drainage area, estimates of "Discharge in second-feet per square mile" and "Run-off (depth in inches on drainage area)," as published in Water-Supply Paper 325, are in error, but they have been recomputed and published in Water-Supply Paper 355.

Discharge measurements of Long Prairie River near Motley, 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.*
Oct. 23	W. G. Hoyt	5.18	147	May 14	S. B. Soulé	5.47	254
Dec. 28	S. B. Soulé	5.25	[a] 64	June 10	do	7.05	1,040
Jan. 28	do	5.80	[a] 56	Aug. 11	J. B. Stewart	5.62	206
Feb. 27	do	5.91	[b] 39				

[a] Measurement made under complete ice cover at a section about 200 feet above gage; nearly complete ice cover at the control.

[b] Complete ice cover at the control.

Daily gage height, in feet, of Long Prairie River near Motley, Minn., for the year ending Sept. 30, 1914.

[Mrs. Clem. Thompson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.15	5.3	5.35	.....	.....	.....	5.7	5.6	5.45	8.1	5.85	5.75
2	5.15	5.3	.....	.....	5.9	5.9	5.7	5.6	5.45	8.0	5.85	5.75
3	5.15	5.3	5.3	5.35	.....	.....	5.7	5.65	5.5	7.9	5.85	5.7
4	5.2	5.2	.....	.....	5.9	5.8	5.7	5.65	5.5	7.7	5.8	5.7
5	5.2	5.2	.....	5.35	.....	.....	5.7	5.65	5.55	7.4	5.75	5.65
6	5.2	5.2	5.3	.....	.....	.....	5.65	5.7	5.55	7.2	5.65	5.65
7	5.3	5.2	.....	5.4	5.9	5.8	5.65	5.7	5.85	7.0	5.65	5.65
8	5.3	5.2	5.3	.....	.....	.....	5.6	5.7	6.45	6.8	5.6	5.6
9	5.3	5.2	.....	.....	5.9	5.8	5.6	5.75	7.1	6.8	5.6	5.6
10	5.45	5.25	5.25	5.4	.....	.....	5.6	5.75	7.0	6.6	5.6	5.65
11	5.6	.....	.....	.....	5.9	5.8	5.5	5.8	7.2	6.5	5.6	5.65
12	5.55	5.3	.....	5.6	.....	.....	5.5	5.8	7.2	6.4	5.6	5.75
13	5.55	.....	5.2	.....	.....	.....	5.5	5.45	7.1	6.2	5.6	5.75
14	5.45	.....	.....	5.6	5.8	5.9	5.45	5.45	6.7	6.05	5.55	5.8
15	5.35	5.2	5.1	.....	.....	.....	5.45	5.45	6.8	5.4	5.55	6.3
16	5.35	.....	.....	.....	5.8	6.35	5.4	5.45	6.8	5.2	5.55	6.3
17	5.35	5.2	5.1	5.6	.....	.....	5.4	5.45	6.8	5.1	5.5	6.4
18	5.2	.....	.....	.....	5.8	6.35	5.35	5.45	6.8	5.0	5.5	6.6
19	5.2	5.2	.....	5.6	.....	.....	5.35	5.45	6.8	5.0	5.5	6.6
20	5.15	.....	5.1	.....	.....	.....	5.3	5.4	6.5	5.0	5.5	6.5
21	5.1	.....	.....	5.65	5.9	6.35	5.3	5.4	6.1	4.9	5.5	6.5
22	5.15	5.3	5.1	.....	.....	.....	5.25	5.4	6.1	5.0	5.5	6.6
23	5.2	.....	.....	.....	5.9	5.8	5.25	5.35	5.95	5.0	5.8	6.6
24	5.2	5.4	.....	5.75	.....	.....	5.2	5.35	6.4	.....	5.8	6.7
25	5.3	.....	.....	.....	5.8	5.8	5.2	5.35	6.5	.....	5.9	6.6
26	5.3	5.4	.....	5.8	.....	.....	5.25	5.35	6.6	.....	5.9	6.6
27	5.3	.....	.....	.....	.....	.....	5.3	5.3	7.1	.....	5.85	6.6
28	5.3	.....	5.25	5.8	5.9	5.7	5.35	5.3	7.4	.....	5.75	6.5
29	5.3	5.35	.....	.....	.....	.....	5.5	5.3	7.4	.....	5.85	6.4
30	5.3	.....	5.2	.....	.....	.....	5.5	5.3	7.8	.....	5.85	6.8
31	5.3	.....	.....	5.8	.....	.....	.....	.....	.....	.....	5.85	.....

NOTE.—Discharge relation affected by ice about Dec. 23, 1913, to Mar. 31, 1914.
Observer reported water so low that it did not reach the gage July 24–31. Gage height probably varied from 4.7 to 4.9 feet.

Daily discharge, in second-feet, of Long Prairie River near Motley, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	135	178	195	.....	.....	.....	333	290	231	1,720	312	250
2	135	178	186	.....	.....	.....	333	290	231	1,650	312	250
3	135	178	178	.....	.....	.....	333	312	250	1,580	312	231
4	148	148	178	.....	.....	.....	333	312	250	1,460	290	231
5	148	148	178	.....	.....	.....	333	312	270	1,280	270	212
6	148	148	178	.....	.....	.....	312	333	270	1,160	231	212
7	178	148	178	.....	.....	.....	312	333	405	1,040	212	212
8	178	148	178	.....	.....	.....	290	333	722	920	195	195
9	178	148	170	.....	.....	.....	290	356	1,100	920	195	195
10	231	163	163	.....	.....	.....	290	356	1,040	805	195	212
11	290	170	158	.....	.....	.....	250	380	1,160	750	195	212
12	270	178	153	.....	.....	.....	250	380	1,160	695	195	250
13	270	168	148	.....	.....	.....	250	231	1,100	585	195	250
14	231	158	135	.....	.....	.....	231	231	860	505	178	270
15	195	148	122	.....	.....	.....	231	231	920	195	178	505
16	195	148	122	.....	.....	.....	212	231	920	135	178	505
17	195	148	122	.....	.....	.....	212	231	920	110	163	558
18	148	148	122	.....	.....	.....	195	231	920	90	163	668
19	148	148	122	.....	.....	.....	195	231	920	90	163	668
20	135	158	122	.....	.....	.....	178	212	750	90	163	612
21	122	168	122	.....	.....	.....	178	212	530	72	163	612
22	135	178	122	.....	.....	.....	163	212	530	90	163	668
23	148	195	.....	.....	.....	.....	163	195	455	90	270	668
24	148	212	.....	.....	.....	.....	148	195	695	.....	270	722
25	178	212	.....	.....	.....	.....	148	195	750	.....	312	668
26	178	212	.....	.....	.....	.....	163	195	805	.....	312	668
27	178	206	.....	.....	.....	.....	178	178	1,100	.....	290	668
28	178	200	.....	.....	.....	.....	195	178	1,280	.....	250	612
29	178	195	.....	.....	.....	.....	250	178	1,280	.....	290	558
30	178	195	.....	.....	.....	.....	250	178	1,520	.....	290	778
31	178	.....	.....	.....	.....	.....	.....	204	.....	.....	290	.....

NOTE.—Daily discharge computed from a well-defined rating curve except as noted below.
Estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 23–31, 1913, 100 second-feet; Jan. 1–31, 1914, 55 second-feet; Feb. 1–28, 40 second-feet; Mar. 1–31, 190 second-feet; estimated by comparison with Crow Wing River at Motley, July 24–31, 75 second-feet; interpolated for days on which gage was not read.

Monthly discharge of Long Prairie River near Motley, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 973 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	290	122	177	0.182	0.21	A.
November	212	148	171	.176	.20	B.
December	195	.....	137	.141	.16	C.
January	.....	.....	55	.057	.07	C.
February	.....	.....	40	.041	.04	C.
March	.....	.....	190	.195	.22	C.
April	333	148	240	.247	.28	B.
May	380	178	256	.263	.30	A.
June	1,520	231	778	.800	.89	B.
July	1,720	.....	537	.552	.64	C.
August	312	163	232	.238	.27	B.
September	778	195	444	.456	.51	C.
The year	1,720	.....	272	.280	3.79	

ELK RIVER NEAR BIG LAKE, MINN.

Location.—In sec. 23, T. 33 N., R. 27 W., at the highway bridge, one-half mile north of Bailey station on the Northern Pacific Railway, and 4 miles east of Big Lake; one-half mile above Tibbetts Brook, and 4 miles below mouth of St. Francis River.

Records available.—April 15, 1911, to September 30, 1914.

Drainage area.—615 square miles.

Gage.—Vertical staff gage; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0, half-tenths from 1.0 to 2.0, and tenths above 2.0 feet.

Channel and control.—Gravel; may shift during high water. During low water, channel practically permanent.

Discharge measurements.—Made from highway bridge except at low stages, when wading measurements are made near by.

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

Regulation.—None above station; only dam is near mouth, about 8 miles below.

Accuracy.—Records only fair because of backwater at gage caused by growth of grass in channel.

Discharge measurements of Elk River near Big Lake, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 24	1.03	[a] 196	Apr. 4	1.42	369
24 [b]	1.02	[a] 203	4	1.42	360
Jan. 14	1.04	[c] 96	Aug. 20	.98	[e] 106
Feb. 13	1.21	[d] 68	20	.98	[e] 105

[a] Small quantity of grass at control; measurement made by wading.
[b] Measurement made at a section not as good as that at which the other measurement of this date was made.
[c] Partial ice cover at control; measurement made under complete ice cover about 400 feet below gage.
[d] Complete ice cover at control.
[e] Measurement made by wading; large amount of grass in channel at the control.

Daily gage height, in feet, of Elk River near Big Lake, Minn., for the year ending Sept. 30, 1914.

[Michael Tracy, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.92	0.95	1.0	0.89	1.2	1.4	1.45	1.45	0.78	2.6	1.0	1.05
2	.91	.95	1.0	.....	.....	.....	1.5	1.5	.75	2.8	1.0	1.1
3	.90	.95	1.0	.95	1.2	1.4	1.45	1.7	.76	3.0	1.0	1.05
4	.90	.95	1.0	.....	.....	.....	1.45	1.85	.82	3.2	.96	1.0
5	.90	.95	.99	.....	1.2	1.45	1.4	1.9	.80	3.2	.95	.95
6	.94	.94	.98	.95	.....	.....	1.4	1.9	.86	3.2	.94	.94
7	1.05	.96	1.0	.....	1.25	1.5	1.35	1.95	.82	3.2	.92	.92
8	1.0	1.05	1.05	.98	1.25	1.5	1.3	2.0	.80	3.1	.92	.91
9	.98	1.05	1.1	.....	.....	.....	1.2	2.0	.88	2.9	.92	.90
10	1.05	.91	1.1	1.0	1.25	1.45	1.15	2.0	.85	2.6	.95	.98
11	1.1	.94	1.1	1.05	.....	.....	1.15	2.0	.92	2.4	.94	1.0
12	1.1	1.05	1.05	.....	1.25	1.5	1.1	1.95	.89	2.2	.92	1.0
13	1.15	1.0	.99	1.05	.....	.....	1.1	1.85	.88	2.0	.90	1.2
14	1.15	.99	.94	.....	1.25	1.65	1.05	1.7	.90	1.85	.90	1.4
15	1.15	.96	.....	1.05	.....	1.85	1.05	1.6	.88	1.7	.88	1.4
16	1.15	.94	.82	.....	.....	.....	1.0	1.5	.81	1.6	.88	1.4
17	1.15	.92	.....	1.1	1.25	2.1	1.0	1.35	.74	1.5	.88	1.5
18	1.15	.90	.66	1.1	.....	.....	1.05	1.2	.86	1.4	.98	1.6
19	1.1	.90	.....	.....	1.25	2.4	1.1	1.15	1.05	1.3	1.0	1.8
20	1.1	.88	.72	1.1	.....	.....	1.05	1.05	1.0	1.25	.98	1.9
21	1.1	.88	.71	.....	1.25	2.3	1.05	1.1	1.0	1.2	.98	1.9
22	1.05	.90	.....	1.1	1.25	2.1	1.05	1.05	1.15	1.2	.98	1.8
23	1.05	.89	.76	.....	.....	.....	1.0	1.0	1.15	1.2	1.0	1.75
24	1.0	.88	.....	1.1	1.3	2.6	1.05	.96	1.55	1.15	1.05	1.6
25	1.0	.91	.84	1.1	.....	2.6	1.1	.94	1.6	1.1	1.0	1.5
26	1.0	.96	.....	.....	1.3	2.5	1.1	.90	1.7	1.1	.98	1.4
27	.98	1.0	.82	1.15	.....	2.1	1.15	.86	2.2	1.05	.96	1.3
28	.98	1.0	.84	.....	1.3	1.7	1.3	.84	2.3	1.05	.95	1.2
29	.98	1.0	.....	1.2	.....	1.55	1.35	.86	2.4	1.0	.92	1.15
30	.98	1.0	.82	.....	.....	1.5	1.4	.84	2.4	1.0	.92	1.1
31	.96	.....	.....	1.2	.....	1.5	.....	.81	.....	1.0	.91	.....

NOTE.—Discharge relation affected by ice about Dec. 22, 1913, to Mar. 24, 1914.

Daily discharge, in second-feet, of Elk River near Big Lake, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	169	177	190	.....	.....	.....	350	350	161	665	132	144
2	167	177	190	.....	.....	.....	365	365	154	735	132	156
3	164	177	190	.....	.....	.....	350	426	154	805	132	144
4	164	177	190	.....	.....	.....	350	474	168	885	123	132
5	164	177	187	.....	.....	.....	336	491	161	885	119	121
6	174	174	185	.....	.....	.....	336	491	176	885	117	119
7	204	180	190	.....	.....	.....	322	508	163	885	110	117
8	190	204	204	.....	.....	.....	307	525	158	845	110	115
9	185	204	218	.....	.....	.....	278	525	176	770	108	117
10	204	167	218	.....	.....	.....	264	525	168	665	115	135
11	218	174	218	.....	.....	.....	264	525	184	595	108	144
12	218	204	204	.....	.....	.....	250	508	176	508	104	144
13	232	190	187	.....	.....	.....	250	474	171	442	100	194
14	232	187	174	.....	.....	.....	236	426	173	395	98	250
15	232	180	[a] 159	.....	.....	.....	236	395	168	350	94	250
16	232	174	144	.....	.....	.....	222	365	149	322	92	250
17	232	169	[a] 125	.....	.....	.....	222	322	132	292	92	292
18	232	164	106	.....	.....	.....	236	278	158	264	110	322
19	218	164	[a] 113	.....	.....	.....	250	264	208	236	115	380
20	218	159	120	.....	.....	.....	236	236	194	222	108	410
21	218	159	117	.....	.....	.....	236	250	194	194	108	410
22	204	164	.....	.....	.....	.....	236	236	236	194	106	380
23	204	162	.....	.....	.....	.....	222	222	236	194	110	365
24	190	159	.....	.....	.....	.....	236	211	336	181	121	336
25	190	167	.....	.....	.....	735	250	205	350	168	110	307
26	190	180	.....	.....	.....	700	250	194	380	168	113	278
27	185	190	.....	.....	.....	560	264	184	542	156	108	250
28	185	190	.....	.....	.....	426	307	178	560	156	110	222
29	185	190	.....	.....	.....	380	322	184	595	144	104	208
30	185	190	.....	.....	.....	365	336	178	595	144	104	194
31	180	.....	.....	.....	.....	365	.....	171	.....	144	102	.....

[a] Interpolated.

NOTE.—Daily discharge determined from two fairly well defined rating curves until May 31, 1914; after that date, on account of backwater caused by growth of grass, by indirect method for shifting channels. Discharge estimated because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 22–31, 1913, 120 second-feet; Jan. 1–31, 1914, 98 second-feet; Feb. 1–28, 75 second-feet; Mar. 1–24, 225 second-feet.

Monthly discharge of Elk River near Big Lake, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 615 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	232	164	199	0.324	0.37	B.
November	204	159	178	.289	.32	B.
December	218	.....	156	.254	.29	C.
January	.....	.....	98	.159	.18	C.
February	.....	.....	75	.122	.13	C.
March	735	.....	288	.468	.54	D.
April	365	222	277	.450	.50	B.
May	525	171	345	.561	.65	B.
June	595	132	246	.400	.45	C.
July	885	144	435	.707	.82	C.
August	132	92	110	.179	.21	B.
September	410	115	230	.374	.42	C.
The year	885	.....	221	.359	4.88	

CROW RIVER AT ROCKFORD, MINN.

Location.—At the highway bridge at Rockford, a little more than a mile below the junction of the North and South branches. Two very small streams, the outlets of Rebecca Lake and Lake Sarah, enter between the junction and the station.

Records available.—June 4, 1909, to September 30, 1914.

Drainage area.—2,520 square miles.

Gage.—Vertical staff; read daily, morning and evening, to hundredths. Limits of use: Hundredths below 5.5, half-tenths between 5.5 and 6.5, and tenths above 6.5 feet.

Channel and control.—Practically permanent.

Discharge measurements.—During high and medium stages, made from the bridge; during low stages, by wading at various sections.

Winter flow.—Prior to the winter of 1911–12 very little ice formed and open-water rating curve applied throughout year. During winters of 1911–12 and 1912–13 ice destroyed the discharge relation, making it necessary to base estimates on discharge measurements. Before the dam was destroyed, in 1911, the larger body of water back of the dam had a temperature considerably above freezing and did not freeze quickly when released, but since the destruction of the dam natural conditions prevail and ice forms.

Regulation.—On the North, Middle, and South forks of Crow River are seven smal power plants. Owing to the small amount of storage and the slight flow at these plants no appreciable effect of their operation is observable at the gage. A dam immediately above the gage was partly destroyed May 31, 1911, and has not yet been repaired.

Accuracy.—Conditions favorable and records should be reliable.

Discharge measurements of Crow River at Rockford, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 21	5.61	[a] 324	Mar. 27	5.40	[d] 380
Dec. 18	5.36	[b] 282	27	5.50	432
Feb. 11	5.14	[c] 83	Aug. 28	6.67	973

[a] Considerable quantity of grass in channel at the control.
[b] Small amount of ice at control, probably causing slight amount of backwater.
[c] Complete ice cover at control.
[d] Control clear.

Daily gage height, in feet, of Crow River at Rockford, Minn., for the year ending Sept. 30, 1914.

[Geo. W. Florida, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.1	5.46	5.5	5.22	5.21	5.15	5.55	6.45	5.6	9.2	6.2	6.8
2	6.0	5.48	5.5	5.20	5.20	5.16	5.55	6.5	5.6	9.3	6.15	6.7
3	5.8	5.5	5.49	5.16	5.22	5.18	5.55	6.6	5.95	9.3	6.1	6.7
4	5.75	5.5	5.46	5.20	5.20	5.15	5.55	6.65	6.8	9.2	6.0	6.7
5	5.75	5.48	5.46	.....	5.18	5.16	5.5	6.7	7.5	9.1	5.95	6.6
6	5.75	5.48	5.46	.....	5.15	5.17	5.5	6.8	7.8	8.9	5.9	6.6
7	5.8	5.55	5.5	5.17	5.13	5.18	5.48	6.8	8.0	8.7	5.8	6.6
8	5.75	5.55	5.48	.....	5.12	5.18	5.42	6.7	7.9	8.4	5.8	6.6
9	5.75	5.55	5.44	.....	5.13	5.20	5.41	6.6	7.8	8.2	5.75	6.6
10	6.0	5.5	5.42	5.21	5.14	5.18	5.38	6.55	7.7	7.9	5.75	6.45
11	5.95	5.47	5.42	.....	5.14	5.18	5.38	6.5	7.6	7.8	5.75	6.25
12	5.9	5.48	5.42	5.20	5.16	5.20	5.37	6.4	7.5	7.7	5.7	6.1
13	5.9	5.5	5.40	5.18	5.17	5.22	5.35	6.4	7.4	7.6	5.65	6.1
14	6.0	5.55	5.39	5.18	5.15	5.30	5.34	6.4	7.3	7.4	5.65	6.9
15	5.95	5.6	5.36	.....	5.14	5.40	5.34	6.35	7.2	7.2	5.7	7.2
16	5.9	5.6	5.34	5.16	5.12	5.7	5.34	6.25	7.0	7.2	5.7	7.4
17	5.8	5.6	5.36	.....	5.14	5.9	5.34	6.1	6.9	7.1	5.7	7.6
18	5.7	5.6	5.65	5.16	5.15	6.25	5.38	6.0	6.6	7.1	5.7	7.7
19	5.6	5.6	5.48	5.18	5.20	6.1	5.46	6.0	6.7	7.0	5.75	7.6
20	5.55	5.6	5.6	5.17	5.19	5.8	5.5	5.95	6.8	6.8	5.75	7.6
21	5.6	5.6	5.55	5.15	5.20	5.9	5.5	5.9	6.8	6.7	5.8	7.5
22	5.55	5.6	5.49	5.12	5.20	6.1	5.55	5.9	6.8	6.7	5.9	7.5
23	5.55	5.7	5.34	5.16	5.21	5.9	5.6	5.85	6.9	6.6	6.5	7.4
24	5.5	5.55	5.34	5.19	5.20	5.55	5.65	5.8	7.2	6.5	6.8	7.2
25	5.5	5.6	5.40	5.19	5.20	5.40	5.7	5.8	7.5	6.45	6.8	7.0
26	5.5	5.6	5.36	5.22	5.18	5.36	5.75	5.8	7.9	6.35	6.7	6.8
27	5.5	5.6	5.38	5.20	5.20	5.46	5.75	5.9	8.2	6.3	6.7	6.7
28	5.48	5.6	5.34	5.20	5.18	5.55	6.1	5.85	8.6	6.3	6.7	6.6
29	5.47	5.6	5.31	5.16	.....	5.6	6.3	5.8	8.7	6.25	6.7	6.45
30	5.46	5.55	5.25	5.14	.....	5.6	6.4	5.7	9.2	6.25	6.8	6.35
31	5.46	.....	5.23	5.14	.....	5.6	.....	5.65	.....	6.2	6.8	.....

NOTE.—Discharge relation affected by ice about Dec. 7–8, 18–22, 1913, and Jan. 1, to Feb. 28, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	582	283	345	.....	.....	198	370	875	395	2,950	725	1,100
2	528	291	345	.....	.....	202	370	905	395	3,040	695	1,030
3	420	300	340	.....	.....	209	370	965	582	3,040	665	1,030
4	395	300	327	.....	.....	198	370	998	1,100	2,950	610	1,030
5	395	291	327	.....	.....	202	345	1,030	1,570	2,860	582	965
6	395	291	327	.....	.....	206	345	1,100	1,790	2,680	555	965
7	420	322	325	.....	.....	209	336	1,100	1,950	2,510	500	965
8	395	322	325	.....	.....	209	309	1,030	1,870	2,270	500	965
9	395	322	318	.....	.....	217	304	965	1,790	2,110	472	965
10	528	300	309	.....	.....	209	291	935	1,710	1,870	472	875
11	500	287	309	.....	.....	209	291	905	1,640	1,790	472	755
12	472	291	309	.....	.....	217	287	845	1,570	1,710	445	665
13	472	300	300	.....	.....	225	278	845	1,500	1,640	420	665
14	528	322	296	.....	.....	257	274	845	1,430	1,500	420	1,160
15	500	345	283	.....	.....	300	274	815	1,360	1,360	445	1,360
16	472	370	274	.....	.....	445	274	755	1,220	1,360	445	1,500
17	420	370	283	.....	.....	555	274	665	1,160	1,290	445	1,640
18	370	370	280	.....	.....	755	291	610	965	1,290	445	1,710
19	322	370	280	.....	.....	665	327	610	1,030	1,220	472	1,640
20	300	370	280	.....	.....	500	345	582	1,100	1,100	472	1,640
21	322	370	280	.....	.....	555	345	555	1,100	1,030	500	1,570
22	300	370	280	.....	.....	665	370	555	1,100	1,030	555	1,570
23	300	420	274	.....	.....	555	395	528	1,160	965	905	1,500
24	278	345	274	.....	.....	370	420	500	1,360	905	1,100	1,360
25	278	370	300	.....	.....	300	445	500	1,570	875	1,100	1,220
26	278	370	283	.....	.....	283	472	500	1,870	815	1,030	1,100
27	278	370	291	.....	.....	327	472	555	2,110	785	1,030	1,030
28	270	370	274	.....	.....	370	665	528	2,430	785	1,030	965
29	266	370	261	.....	.....	395	785	500	2,510	755	1,030	875
30	261	345	237	.....	.....	395	845	445	2,950	755	1,100	815
31	261	.....	229	.....	.....	395	.....	420	.....	725	1,100	.....

NOTE.—Daily discharge, except as noted below, computed from a well-defined rating curve. Oct. 1 to Nov. 30, 1913, estimated by the indirect method for shifting channels on account of backwater from grass; Dec. 7–8, and 18–22, 1913, estimated on account of backwater from ice. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 1–31, 190 second-feet; and Feb. 1–28, 110 second-feet.

Monthly discharge of Crow River at Rockford, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 2,520 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	582	261	384	0.152	0.18	B.
November	420	283	337	.134	.15	C.
December	345	229	296	.117	.13	C.
January	.....	.....	190	.075	.09	D.
February	.....	.....	110	.044	.05	D.
March	755	198	348	.138	.16	D.
April	845	274	385	.153	.17	C.
May	1,100	420	741	.294	.34	B.
June	2,950	395	1,480	.587	.65	B.
July	3,040	725	1,610	.639	.74	B.
August	1,100	420	669	.265	.31	A.
September	1,710	665	1,150	.456	.51	B.
The year	3,040	.....	644	.256	3.48	

RUM RIVER AT CAMBRIDGE, MINN.

Location.—At highway bridge half a mile west of Cambridge. No tributary within several miles.

Records available.—June 12, 1909, to March 31, 1914, when station was discontinued.

Drainage area.—1,160 square miles.

Gage.—Vertical staff; read daily to quarter-tenths. Limits of use: Hundredths below 4.0, half-tenths from 4.0 to 5.0, and tenths above 5.0 feet.

Channel and control.—No well-defined control; channel shifting.

Discharge measurements.—Made from the bridge.

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

Regulation.—At St. Francis, 20 miles below Cambridge by river, there is a 10-foot dam and power plant; difference in elevation between crest of dam and water surface at station, about 6 feet. Only dam above Cambridge is at Milaca and is used to form a pool from which water is pumped. Flow at Cambridge, except during periods of low water, controlled by storage in and evaporation from the lakes in the drainage area above Onamia.

Accuracy.—Records poor. During the summer growth of grass in channel causes backwater in varying amount at gage.

Discharge measurements of Rum River at Cambridge, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 25	3.75	[a] 272	Jan. 21	3.53	[c] 105
Dec. 20	3.57	[b] 204	Feb. 21	3.65	[b] 68

[a] Some grass in channel. [b] Partial ice cover. [c] Complete ice cover.

Daily gage height, in feet, of Rum River at Cambridge, Minn., for the year ending Sept. 30, 1914.

[Joseph Lofstrom, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	3.82	3.85	4.1	.....	3.55	.....	16	5.4	3.68	3.55	.....	3.58	4.6
2	3.72	3.81	4.15	.....	.....	3.65	17	5.0	3.64	3.52	3.45	.....	.....
3	3.65	3.85	4.1	3.40	.....	.....	18	4.7	3.68	3.48	.....	3.62	5.3
4	3.55	3.92	4.1	.....	3.55	3.68	19	4.4	3.64	3.45	3.48	.....	5.6
5	3.55	3.91	4.05	3.40	.....	.....	20	4.2	3.62	3.58	.....	.....	5.7
6	3.49	3.94	4.0	.....	.....	.....	21	4.1	3.68	3.45	3.52	3.65	5.6
7	3.60	3.99	3.81	3.45	3.58	3.76	22	3.96	3.70	3.38	.....	.....	5.6
8	3.74	4.10	3.89	.....	.....	.....	23	3.88	3.74	.....	.....	3.65	5.2
9	3.88	4.2	3.75	.....	3.55	.....	24	3.80	3.82	3.35	3.52	.....	4.75
10	4.15	4.1	3.88	3.45	.....	3.78	25	3.76	4.05	.....	.....	3.65	4.65
11	4.45	4.1	3.98	.....	3.55	3.78	26	3.79	4.15	.....	3.50	.....	4.55
12	4.45	4.05	3.81	3.45	.....	.....	27	3.82	4.2	3.28	.....	.....	4.65
13	5.1	4.0	3.72	.....	.....	.....	28	3.84	4.2	.....	3.55	3.68	4.65
14	5.5	3.99	3.65	3.40	3.58	3.95	29	3.95	4.15	3.30	.....	.....	4.7
15	5.6	3.76	3.58	.....	.....	4.25	30	4.05	4.1	.....	.....	.....	4.8
							31	3.99	.....	3.32	3.55	.....	4.8

NOTE.—Discharge relation affected by ice about Dec. 8, 1913, to Mar. 22, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	210	296	358	.....	.....	.....	16	695	257	.....	.....	.....	.....
2	188	287	372	.....	.....	.....	17	575	248	.....	.....	.....	.....
3	173	296	358	.....	.....	.....	18	500	257	.....	.....	.....	.....
4	162	313	358	.....	.....	.....	19	414	248	.....	.....	.....	.....
5	162	310	345	.....	.....	.....	20	358	244	.....	.....	.....	.....
6	149	318	332	.....	.....	.....	21	332	257	.....	.....	.....	.....
7	173	330	287	.....	.....	.....	22	308	262	.....	.....	.....	.....
8	215	358	.....	.....	.....	.....	23	296	271	.....	.....	.....	680
9	246	386	.....	.....	.....	.....	24	278	290	.....	.....	.....	545
10	308	358	.....	.....	.....	.....	25	276	345	.....	.....	.....	515
11	400	358	.....	.....	.....	.....	26	283	372	.....	.....	.....	485
12	400	345	.....	.....	.....	.....	27	290	386	.....	.....	.....	515
13	590	332	.....	.....	.....	.....	28	294	386	.....	.....	.....	515
14	710	330	.....	.....	.....	.....	29	320	372	.....	.....	.....	530
15	755	276	.....	.....	.....	.....	30	345	358	.....	.....	.....	560
							31	330	.....	.....	.....	.....	560

NOTE.—Daily discharge, except as noted below, computed from a fairly well defined rating curve; Oct. 1–24, 1913, determined by indirect method for shifting channels; estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 8–31, 1913, 188 second-feet; Jan. 1–31, 1914, 116 second-feet; Feb. 1–28, 76 second-feet; Mar. 1–22, 213 second-feet.

Monthly discharge of Rum River at Cambridge, Minn., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	755	149	346	C.
November	386	244	315	C.
December	372	.....	223	C.
January	.....	.....	116	C.
February	.....	.....	76	C.
March	.....	.....	309	C.

MINNESOTA RIVER NEAR MONTEVIDEO, MINN.

Location.—In sec. 19, T. 117 N., R. 40 W., at the highway bridge, 1 mile south of Montevideo, a short distance below the mouth of Chippewa River.

Records available.—July 23, 1909, to September 30, 1914.

Drainage area.—6,300 square miles.

Gage.—Chain gage attached to bridge; datum lowered 2 feet September 16, 1909, and 1 foot additional July 29, 1910, to avoid negative readings. All gage heights have been referred to the last datum. Gage read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.0, half-tenths between 2.0 and 3.0, and tenths above 3.0 feet.

Channel and control.—Gravel and rock; practically permanent.

Discharge measurements.—Made from bridge.

Winter flow.—Discharge relation affected by ice. Estimates based on discharge measurements, climatic data, and gage heights.

Regulation.—None above station; nearest dam, at Granite Falls, does not affect flow at station. The discharge of Chippewa River is so much less than that of the Minnesota that the control of the former by a dam at Montevideo has little effect on the gage heights of the Minnesota.

Discharge measurements of Minnesota River near Montevideo, 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.*
Dec. 30	S. B. Soulé	3.04	[a] 130	July 10	S. B. Soulé	11.12	3,070
Jan. 30	do	2.56	[b] 41	24	J. B. Stewart	7.75	1,620
Mar. 6	do	3.76	[b] 107	Sept. 19	S. B. Soulé	4.43	510
Apr. 22	do	3.89	448				

[a] Partial ice cover at control; measurement made under complete ice cover at a section about 100 feet above gage.
[b] Complete ice cover at control and at measuring section.

Daily gage height, in feet, of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1914.

[Ben O. Brown, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.6	2.8	3.2	2.8	.....	.....	3.8	4.5	4.0	11.8	6.9	4.4
2	2.55	2.8	3.3	2.7	3.0	3.8	3.7	4.4	4.0	11.8	6.8	4.2
3	2.6	3.0	3.1	2.95	.....	.....	3.7	4.5	3.8	12.3	6.7	4.1
4	2.75	3.1	3.2	2.9	.....	.....	3.9	4.7	3.6	12.6	6.5	3.9
5	2.7	3.1	3.0	2.9	2.9	3.6	3.8	4.8	3.7	12.4	6.4	3.8
6	2.6	3.0	3.0	2.85	.....	.....	4.4	4.7	4.0	12.0	6.4	3.9
7	2.55	3.0	3.1	2.85	2.85	3.7	4.2	4.8	4.4	11.7	6.1	3.9
8	2.6	3.4	2.75	2.95	.....	.....	4.6	4.8	5.1	11.4	5.8	3.9
9	2.8	2.95	2.3	2.95	2.8	3.7	4.3	4.7	5.2	11.4	5.8	3.6
10	2.9	3.0	2.45	2.5	.....	.....	4.5	4.6	5.8	11.2	5.7	3.8
11	3.1	2.5	2.8	2.6	.....	.....	4.4	4.8	6.1	10.9	5.6	3.9
12	3.0	3.0	3.0	2.55	2.9	3.6	.....	4.9	6.2	10.6	5.5	4.0
13	3.1	3.0	3.4	2.6	.....	.....	.....	4.8	6.3	10.3	5.3	4.0
14	3.1	2.95	3.0	.....	3.0	4.0	.....	4.8	6.5	10.0	5.2	4.4
15	2.9	2.9	3.0	2.8	.....	.....	3.9	4.8	6.8	9.5	5.1	4.4
16	2.9	2.75	2.85	.....	2.9	3.8	3.8	4.8	6.6	9.4	4.9	4.2
17	3.0	2.7	2.9	2.75	.....	3.8	3.8	4.7	6.8	9.0	5.0	4.3
18	3.1	2.95	3.0	.....	.....	4.0	3.7	4.6	6.9	8.8	5.1	4.4
19	3.0	3.0	2.95	2.9	2.8	4.1	3.9	4.5	6.9	8.5	4.9	4.4
20	3.2	3.1	3.0	.....	.....	4.1	4.0	4.4	6.8	8.1	4.7	4.5
21	3.0	3.1	3.0	.....	2.8	4.3	4.0	4.5	6.7	7.7	5.0	4.6
22	3.1	3.2	3.0	2.6	.....	4.2	3.8	4.4	6.8	7.9	5.3	4.7
23	3.0	2.85	3.0	.....	2.9	4.1	3.8	4.4	6.8	8.0	5.2	4.7
24	2.9	3.2	3.0	2.9	.....	4.2	3.9	4.4	7.0	7.7	4.9	4.7
25	2.9	3.1	2.85	.....	.....	4.2	3.8	4.5	7.0	7.8	4.6	4.7
26	2.9	3.2	3.1	3.0	2.9	4.2	3.9	4.2	7.1	7.8	4.6	4.7
27	3.1	3.2	3.2	.....	.....	4.1	4.0	4.1	7.5	7.8	4.5	4.5
28	3.2	3.1	2.9	.....	3.4	4.1	4.0	4.0	7.8	7.6	4.5	4.6
29	2.75	3.1	2.95	2.85	.....	3.9	4.2	4.0	8.7	7.4	4.3	4.6
30	2.45	3.0	3.0	.....	.....	3.8	4.3	4.0	10.3	7.1	4.3	4.6
31	2.3	.....	2.95	2.75	.....	3.8	.....	4.0	.....	7.0	4.4	.....

NOTE.—Discharge relation affected by ice about Dec. 13, 1913, to Mar. 31, 1914.

Daily discharge, in second-feet, of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	162	194	260	.....	.....	.....	374	543	418	3,410	1,310	516
2	155	194	278	.....	.....	.....	354	516	418	3,410	1,280	466
3	162	226	242	.....	.....	.....	354	543	374	3,660	1,240	442
4	186	242	260	.....	.....	.....	396	599	334	3,810	1,170	396
5	178	242	226	.....	.....	.....	374	627	354	3,710	1,140	374
6	162	226	226	.....	.....	.....	516	599	418	3,510	1,140	396
7	155	226	242	.....	.....	.....	466	627	516	3,360	1,030	396
8	162	296	186	.....	.....	.....	571	627	715	3,210	934	396
9	194	218	122	.....	.....	.....	490	599	745	3,210	934	334
10	210	226	141	.....	.....	.....	543	571	934	3,110	902	374
11	242	148	194	.....	.....	.....	516	627	1,030	2,960	870	396
12	226	226	226	.....	.....	.....	[a] 486	656	1,070	2,830	838	418
13	242	226	.....	.....	.....	.....	[a] 456	627	1,100	2,700	776	418
14	242	218	.....	.....	.....	.....	[a] 426	627	1,170	2,560	745	516
15	210	210	.....	.....	.....	.....	396	627	1,280	2,340	715	516
16	210	186	.....	.....	.....	.....	374	627	1,200	2,290	656	466
17	226	178	.....	.....	.....	.....	374	599	1,280	2,120	685	490
18	242	218	.....	.....	.....	.....	354	571	1,310	2,040	715	516
19	226	226	.....	.....	.....	.....	396	543	1,310	1,920	656	516
20	260	242	.....	.....	.....	.....	418	516	1,280	1,770	599	543
21	226	242	.....	.....	.....	.....	418	543	1,240	1,610	685	571
22	242	260	.....	.....	.....	.....	374	516	1,280	1,690	776	599
23	226	202	.....	.....	.....	.....	374	516	1,280	1,730	745	599
24	210	260	.....	.....	.....	.....	396	516	1,350	1,610	656	599
25	210	242	.....	.....	.....	.....	374	543	1,350	1,650	571	599
26	210	260	.....	.....	.....	.....	396	466	1,390	1,650	571	599
27	242	260	.....	.....	.....	.....	418	442	1,540	1,650	543	543
28	260	242	.....	.....	.....	.....	418	418	1,650	1,580	543	571
29	186	242	.....	.....	.....	.....	466	418	2,000	1,500	490	571
30	141	226	.....	.....	.....	.....	490	418	2,700	1,390	490	571
31	122	.....	.....	.....	.....	.....	.....	418	.....	1,350	516	.....

[a] Interpolated.

NOTE.—Daily discharge computed from a rating curve fairly well defined below 685 second-feet (gage height 5.0 feet) and well defined above this point. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records as follows: Dec. 13–31, 1913, 180 second-feet; Jan. 1–31, 1914, 90 second-feet; Feb. 1–28, 65 second-feet; and Mar. 1–31, 235 second-feet.

Monthly discharge of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 6,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	260	122	204	0.032	0.04	B.
November	260	148	227	.036	.04	B.
December	.....	.....	194	.031	.04	C.
January	.....	.....	90	.014	.02	C.
February	.....	.....	65	.010	.01	C.
March	.....	.....	235	.037	.04	C.
April	571	354	425	.067	.07	C.
May	656	418	551	.087	.10	B.
June	2,700	334	1,100	.175	.20	B.
July	3,810	1,350	2,430	.386	.44	A.
August	1,310	490	804	.128	.15	A.
September	599	334	490	.078	.09	B.
The year	3,810	.....	572	.091	1.24	

MINNESOTA RIVER NEAR MANKATO, MINN.

Location.—At Sibley Park, 2 miles above the center of Mankato, a few hundred yards below the mouth of Blue Earth River, the nearest tributary.

Records available.—May 20, 1903, to September 30, 1914.

Drainage area.—14,600 square miles.

Gage.—Chain gage; read once daily to tenths.

Channel and control.—No definite control; channel fairly permanent except during high water.

Discharge measurements.—Made from the highway bridge in center of Mankato; at low stages by wading a short distance below gage.

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

Regulation.—The nearest dam on the river is at Minnesota Falls, 140 miles upstream; no dam below station. A dam on Blue Earth River at Rapidan, a few miles above the mouth, controls the flow of that river, but the water contributed by the Blue Earth forms so small a part of the entire discharge of the Minnesota at the Mankato station that the effect of such regulation is slight.

Maximum and minimum flow.—The highest known stage of the river, which is shown by a well-defined line in Mankato, occurred in 1881 when the stage was approximately 27 feet above the zero of the gage now in use. This figure is corroborated by M. B. Haynes, city engineer of Mankato, who states that the high water occurred after the ice went out and was not caused by backwater. The corresponding discharge was approximately 65,000 second-feet. The highest stage recorded since the establishment of the gage is 21.2 feet on June 26, 1908; the lowest 0.5 foot in 1911 when the flow was about 89 second-feet for some time.

Accuracy.—Measurements made during earlier years indicated changing conditions of flow, and accordingly the discharge records for years previous to 1907 were obtained largely by the indirect method. These results are not as accurate as the later ones, which are based on well-defined rating curves. When the gage was checked with wye level, on April 24, 1914, it was found to read 0.09 foot too high, due to a settlement of the gage, which is assumed to have occurred gradually since the previous checking of the gage with level on April 3, 1913. No corrections due to this source have been applied to the daily gage heights or to the gage heights of discharge measurements made during the year ending September 30, 1913. Any error which may have existed in the gage on September 19, 1913, entered also into the gage height of the discharge measurement made on that date. The low-water part of the rating curve used in computing estimates of daily discharge as published in Water-Supply Paper 355 for the last part of the year ending September 30, 1913, was based on the discharge measurement of that date and is therefore applicable to the gage heights as read by the observer. All gage readings subsequent to September 30, 1913, have been reduced to the correct datum. This accounts for most of the difference between low-water part of the rating curve used during the last part of the year ending September 30, 1913, and that used during the year ending September 30, 1914.

Cooperation.—Since 1906 gage heights have been furnished by the United States Weather Bureau.

Discharge measurements of Minnesota River near Mankato, 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.*
Feb. 10	S. B. Soulé	1.49	[a] 118	June 14	Soulé and Stewart	8.98	[b] 9,140
Apr. 24	do	2.33	904	Aug. 6	J. B. Stewart	3.69	1,810

[a] Measurement made under complete ice cover.
[b] Measurement made from bridge about 2 miles below gage.

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.4	1.6	1.7	1.4	1.2	1.4	2.7	3.3	3.1	8.1	4.2	2.8
2	1.3	1.5	1.7	1.4	1.3	1.4	2.6	3.6	3.0	7.9	4.0	2.7
3	1.2	1.6	1.6	1.4	1.2	1.6	2.5	3.7	3.0	7.7	4.0	2.7
4	1.3	1.5	1.7	1.4	1.3	1.5	2.5	3.4	3.2	7.7	3.9	2.6
5	1.3	1.6	1.6	1.4	1.4	1.6	2.5	3.6	3.2	7.5	3.8	2.6
6	1.4	1.5	1.7	1.3	1.3	2.0	2.4	3.4	3.3	7.3	3.8	2.6
7	1.3	1.5	1.4	1.3	1.2	2.0	2.4	3.3	3.6	7.0	3.5	2.5
8	1.2	1.5	1.3	1.2	1.3	1.8	2.4	3.2	4.4	7.0	3.6	2.3
9	1.3	1.4	1.4	1.2	1.4	1.7	2.3	3.3	5.8	6.9	3.5	2.2
10	1.3	1.6	1.5	1.3	1.5	1.7	2.4	3.1	5.8	6.8	3.6	2.2
11	1.3	1.5	1.6	1.2	1.4	1.9	2.4	3.1	7.1	6.6	3.3	2.1
12	1.4	1.6	1.5	1.3	1.4	1.6	2.4	3.3	6.7	6.5	3.3	2.1
13	1.3	1.5	1.6	1.4	1.4	1.6	2.3	3.2	8.1	6.7	3.2	2.2
14	1.4	1.6	1.5	1.3	.....	2.0	2.1	3.2	9.3	6.0	3.1	2.2
15	1.2	1.6	1.6	1.4	1.6	2.2	2.4	3.1	9.4	6.1	3.1	2.6
16	1.3	1.7	1.5	1.2	1.5	2.3	2.3	3.0	9.7	5.8	3.0	2.7
17	1.3	1.5	1.5	1.3	1.3	2.3	2.3	3.1	9.9	5.4	3.0	3.3
18	1.4	1.6	1.5	1.2	1.4	2.6	2.3	3.2	9.8	5.4	3.1	3.8
19	1.3	1.6	1.3	1.2	1.4	2.7	2.4	2.9	9.7	5.7	2.8	3.7
20	1.3	1.7	1.4	1.3	1.3	2.6	2.4	2.9	9.0	5.2	2.8	3.8
21	1.2	1.6	1.3	1.3	1.3	2.7	2.3	3.0	8.7	5.0	2.7	3.7
22	1.4	1.7	1.4	1.4	1.2	2.9	2.3	3.2	8.2	5.8	2.7	3.6
23	1.4	1.5	1.3	1.4	1.2	2.6	2.3	3.1	8.2	5.6	2.8	3.1
24	1.5	1.6	1.5	1.4	1.3	2.4	2.4	3.2	7.9	4.8	2.9	2.9
25	1.4	1.5	1.4	1.4	1.3	2.6	2.6	3.4	7.9	4.4	3.0	3.0
26	1.5	1.5	1.6	1.6	1.3	2.4	2.4	3.2	8.0	4.4	3.0	2.8
27	1.4	1.7	1.5	1.6	1.5	2.4	2.5	3.3	8.1	4.2	2.9	3.0
28	1.5	1.6	1.5	1.3	1.4	2.5	3.4	3.8	8.0	4.1	2.8	2.9
29	1.4	1.7	1.6	1.4	.....	2.5	3.5	4.0	7.8	4.3	2.9	2.7
30	1.6	1.7	1.5	1.3	.....	2.6	3.4	3.9	7.7	4.4	2.9	2.5
31	1.5	.....	1.5	1.3	.....	2.6	.....	4.0	.....	4.0	2.8	.....

NOTE.—Discharge relation affected by ice about Dec. 23, 1913, to Mar. 12, 1914.

Daily discharge, in second-feet, of Minnesota River near Mankato, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	370	470	525	.....	.....	.....	1,090	1,510	1,370	7,550	2,280	1,160
2	320	420	525	.....	.....	.....	1,030	1,740	1,300	7,200	2,090	1,090
3	270	470	470	.....	.....	.....	970	1,820	1,300	6,860	2,090	1,090
4	320	420	525	.....	.....	.....	970	1,580	1,440	6,860	2,000	1,030
5	320	470	470	.....	.....	.....	970	1,740	1,440	6,520	1,910	1,030
6	370	420	525	.....	.....	.....	910	1,580	1,510	6,200	1,910	1,030
7	320	420	370	.....	.....	.....	910	1,510	1,740	5,730	1,660	970
8	270	420	320	.....	.....	.....	910	1,440	2,460	5,730	1,740	855
9	320	370	370	.....	.....	.....	855	1,510	4,020	5,580	1,660	800
10	320	470	420	.....	.....	.....	910	1,370	4,020	5,430	1,740	800
11	320	420	470	.....	.....	.....	910	1,370	5,880	5,140	1,510	745
12	370	470	420	.....	.....	.....	910	1,510	5,280	4,990	1,510	745
13	320	420	470	.....	.....	470	855	1,440	7,550	5,280	1,440	800
14	370	470	420	.....	.....	690	745	1,440	9,750	4,280	1,370	800
15	270	470	470	.....	.....	800	910	1,370	9,950	4,420	1,370	1,030
16	320	525	420	.....	.....	855	855	1,300	10,600	4,020	1,300	1,090
17	320	420	420	.....	.....	855	855	1,370	11,000	3,520	1,300	1,510
18	370	470	420	.....	.....	1,030	855	1,440	10,800	3,520	1,370	1,910
19	320	470	320	.....	.....	1,090	910	1,230	10,600	3,890	1,160	1,820
20	320	525	370	.....	.....	1,030	910	1,230	9,170	3,290	1,160	1,910
21	270	470	320	.....	.....	1,090	855	1,300	8,620	3,070	1,090	1,820
22	370	525	370	.....	.....	1,230	855	1,440	7,720	4,020	1,090	1,740
23	370	420	.....	.....	.....	1,030	855	1,370	7,720	3,760	1,160	1,370
24	420	470	.....	.....	.....	910	910	1,440	7,200	2,860	1,230	1,230
25	370	420	.....	.....	.....	1,030	1,030	1,580	7,200	2,460	1,300	1,300
26	420	420	.....	.....	.....	910	910	1,440	7,380	2,460	1,300	1,160
27	370	525	.....	.....	.....	910	970	1,510	7,550	2,280	1,230	1,300
28	420	470	.....	.....	.....	970	1,580	1,910	7,380	2,180	1,160	1,230
29	370	525	.....	.....	.....	970	1,660	2,090	7,030	2,370	1,230	1,090
30	470	525	.....	.....	.....	1,030	1,580	2,000	6,860	2,460	1,230	970
31	420	.....	.....	.....	.....	1,030	.....	2,090	.....	2,090	1,160	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 180 and 635 second-feet (gage heights, 1.0 and 1.9 feet), and well defined between 690 and 11,000 second-feet (gage heights 2.0 and 9.9 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 23–31, 1913, 300 second-feet; Jan. 1–31, 1914, 190 second-feet; Feb. 1–28, 135 second-feet; and Mar. 1–12, 300 second-feet.

Monthly discharge of Minnesota River near Mankato, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 14,600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	470	270	347	0.024	0.03	C.
November	525	370	459	.031	.03	C.
December	525	.....	391	.027	.03	C.
January	.....	.....	190	.013	.02	D.
February	.....	.....	135	.0092	.01	C.
March	1,230	.....	695	.048	.06	C.
April	1,660	745	982	.067	.07	B.
May	2,090	1,230	1,540	.105	.12	A.
June	11,000	1,300	6,190	.424	.47	A.
July	7,550	2,090	4,390	.301	.35	A.
August	2,280	1,090	1,480	.101	.12	A.
September	1,910	745	1,180	.081	.09	A.
The year	11,000	.....	1,500	.103	1.40	

LAC QUI PARLE RIVER AT LAC QUI PARLE, MINN.

Location.—In sec. 26, T. 118 N., R. 42 W., at the highway bridge at Lac Qui Parle, in Lac Qui Parle County, a short distance above the mouth of Threemile Creek.

Records available.—April 27, 1910, to September 30, 1914.

Drainage area.—838 square miles.

Gage.—Vertical staff; read daily, in the morning, to quarter-tenths. Limits of use: Hundredths below 1.5, half-tenths between 1.5 and 3.0, and tenths above 3.0 feet.

Channel and control.—Control consists of gravel; channel slightly shifting during flood stages.

Discharge measurements.—At high and medium stages made from bridge; at low stages by wading a short distance below gage.

Winter flow.—Observations discontinued during winter.

Regulation.—At Dawson, Minn., about 10 miles above, a dam about 8 feet high, creating a reservoir impounding considerable water, was constructed during the later part of the summer of 1913. Probably the extreme low stage of the last part of September and the first part of October, 1913, is due to the retention of water to fill this reservoir, but no further regulation is contemplated at this dam and no other dams control flow.

Accuracy.—Records only fair, because of slight shifting of channel and the fact that the rating curves are only fairly well defined.

Discharge measurements of Lac Qui Parle River at Lac Qui Parle, 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.*
Apr. 21	S. B. Soulé	1.17	[a] 34	July 23	J. B. Stewart	1.46	61
21	do	1.17	[a] 33	Sept. 19	S. B. Soulé	.92	19.9
June 11	J. B. Stewart	5.28	638	19	do	.92	19.8

[a] Measurement made by wading.

Daily gage height, in feet, of Lac Qui Parle River at Lac Qui Parle, Minn., for the year ending Sept. 30, 1914.

[Chas. A. Gould, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.30	0.72	0.80	.....	.....	.....	1.7	1.85	1.55	3.0	1.00	0.68
2	.30	.72	.80	.....	.....	.....	1.9	1.8	1.48	2.8	.92	.65
3	.28	.70	.80	.....	.....	.....	1.6	1.8	1.42	2.7	.88	.62
4	.25	.70	.80	.....	.....	.....	1.85	1.75	1.40	2.55	.85	.62
5	.40	.70	.80	.....	.....	.....	1.45	1.7	1.40	2.4	.92	.60
6	.40	.80	.80	.....	.....	.....	1.75	1.7	1.5	2.3	.85	.58
7	.40	.85	.80	.....	.....	.....	3.0	1.7	1.8	2.2	.75	.55
8	.38	.80	.72	.....	.....	.....	2.2	1.6	3.2	2.1	.62	.55
9	.35	.80	.80	.....	.....	.....	1.5	1.6	4.6	2.0	.65	.55
10	.48	.80	.....	.....	.....	.....	1.30	1.5	5.6	2.0	.65	.58
11	.45	.80	.....	.....	.....	.....	1.10	1.55	5.4	1.85	.62	.58
12	.40	.70	.....	.....	.....	.....	1.20	1.55	4.8	1.8	.62	.55
13	.42	.70	.....	.....	.....	.....	1.20	1.55	4.1	1.7	.62	.70
14	.70	.70	.....	.....	.....	.....	1.20	1.7	3.9	1.6	.65	.82
15	.68	.75	.....	.....	.....	.....	1.20	1.7	3.8	1.5	.65	.88
16	.62	.75	.....	.....	.....	.....	1.20	1.6	4.2	1.5	.60	.90
17	.62	.70	.....	.....	.....	.....	1.20	1.55	4.4	1.5	.60	.88
18	.60	.70	.....	.....	.....	.....	1.20	1.45	4.0	1.42	.88	.90
19	.60	.75	.....	.....	.....	.....	1.22	1.35	3.6	1.32	.88	.90
20	.60	.70	.....	.....	.....	.....	1.20	1.28	3.4	1.22	.75	.90
21	.60	.78	.....	.....	.....	.....	1.15	1.25	3.3	1.15	.65	.82
22	.60	.75	.....	.....	.....	.....	1.20	1.20	3.0	1.7	.60	.78
23	.60	.80	.....	.....	.....	.....	1.18	1.40	2.85	1.6	.60	.72
24	.65	.80	.....	.....	.....	.....	1.20	2.5	2.9	1.38	.60	.70
25	.65	.80	.....	.....	.....	.....	1.25	2.2	2.75	1.25	.62	.68
26	.65	.78	.....	.....	.....	.....	1.22	1.9	3.1	1.7	.70	.65
27	.70	.80	.....	.....	.....	.....	1.32	1.8	3.2	1.65	.72	.62
28	.75	.80	.....	.....	.....	.....	1.5	1.7	3.0	1.32	.90	.60
29	.75	.80	.....	.....	.....	.....	1.6	1.7	3.1	1.20	.80	.60
30	.75	.80	.....	.....	.....	.....	1.7	1.6	3.2	1.10	.75	.58
31	.75	.....	.....	.....	.....	.....	.....	1.6	.....	1.05	.70	.....

NOTE.—Discharge relation affected by ice about Dec. 10, 1913, to Mar. 31, 1914.

Daily discharge, in second-feet, of Lac Qui Parle River at Lac Qui Parle, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.3	11	14	.....	.....	.....	81	96	66	253	25	9.2
2	.3	11	14	.....	.....	.....	101	91	60	221	20	8.0
3	.3	10	14	.....	.....	.....	71	91	55	206	18	6.8
4	.2	10	14	.....	.....	.....	96	86	53	184	16	6.8
5	1.0	10	14	.....	.....	.....	58	81	53	162	20	6.0
6	1.0	14	14	.....	.....	.....	86	81	62	149	16	5.3
7	1.0	16	14	.....	.....	.....	253	81	91	136	12	4.2
8	.9	14	11	.....	.....	.....	136	71	285	124	6.8	4.2
9	.6	14	14	.....	.....	.....	62	71	519	112	8.0	4.2
10	2.2	14	.....	.....	.....	.....	45	62	696	112	8.0	5.3
11	1.8	14	.....	.....	.....	.....	31	66	660	96	6.8	5.3
12	1.0	10	.....	.....	.....	.....	38	66	553	91	6.8	4.2
13	1.3	10	.....	.....	.....	.....	38	66	434	81	6.8	10
14	10	10	.....	.....	.....	.....	38	81	400	71	8.0	15
15	9.2	12	.....	.....	.....	.....	38	81	383	62	8.0	18
16	6.8	12	.....	.....	.....	.....	38	71	451	62	6.0	19
17	6.8	10	.....	.....	.....	.....	38	66	485	62	6.0	18
18	6.0	10	.....	.....	.....	.....	38	58	417	55	18	19
19	6.0	12	.....	.....	.....	.....	39	49	349	47	18	19
20	6.0	10	.....	.....	.....	.....	38	44	317	39	12	19
21	6.0	13	.....	.....	.....	.....	34	42	301	34	8.0	15
22	6.0	12	.....	.....	.....	.....	38	38	253	81	6.0	13
23	6.0	14	.....	.....	.....	.....	37	53	229	71	6.0	11
24	8.0	14	.....	.....	.....	.....	38	176	237	51	6.0	10
25	8.0	14	.....	.....	.....	.....	42	136	214	42	6.8	9.2
26	8.0	13	.....	.....	.....	.....	39	101	269	81	10	8.0
27	10	14	.....	.....	.....	.....	47	91	285	76	11	6.8
28	12	14	.....	.....	.....	.....	62	81	253	47	19	6.0
29	12	14	.....	.....	.....	.....	71	81	269	38	14	6.0
30	12	14	.....	.....	.....	.....	81	71	285	31	12	5.3
31	12	.....	.....	.....	.....	.....	.....	71	.....	28	10	.....

NOTE.—Daily discharge computed from a rating curve well defined between 14 and 678 second-feet (gage heights, 0.8 and 5.5 feet) and fairly well defined below 14 second-feet.

Monthly discharge of Lac Qui Parle River at Lac Qui Parle, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 838 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	12	0.2	5.25	0.0063	0.007	B.
November	16	10	12.3	.015	.02	B.
December 1-9	14	11	13.7	.016	.005	B.
April	253	31	61.7	.074	.08	B.
May	176	38	77.4	.092	.11	A.
June	696	53	299	.357	.40	A.
July	253	28	93.7	.112	.13	A.
August	25	6.0	11.5	.014	.02	B.
September	19	4.2	9.89	.012	.01	B.

CHIPPEWA RIVER NEAR WATSON, MINN.

Location.—On line between secs. 10 and 15, T. 118 N., R. 41 W., at highway bridge 2½ miles northeast of Watson; 10 miles above the mouth of the river, and about 2 miles below the mouth of Dry Weather Creek.

Records available.—July 6, 1909, to September 30, 1914.

Drainage area.—1,940 square miles.

Gage.—Chain gage attached to bridge; read daily, in the afternoon, to hundredths. Limits of use: Hundredths below 5.0, half-tenths between 5.0 and 6.0, and tenths above 6.0 feet.

Channel and control.—Channel shifts slightly during flood stages.

Discharge measurements.—Made from bridge and by wading.

Regulation.—Possibly some slight regulation was due to a flour mill working under an 8-foot head, but this dam is now out and the flow is natural. No backwater at station from the dam at Montevideo.

Accuracy.—Rating curve fairly well defined; records good.

Discharge measurements of Chippewa River near Watson, 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.*
Apr. 21	S. B. Soulé	5.65	190	July 10	S. B. Soulé	11.30	1,480
June 10	J. B. Stewart	6.94	393	23	J. B. Stewart	8.65	722
11	do	6.92	397	Sept. 19	S. B. Soulé	6.35	293
July 10	S. B. Soulé	11.31	1,480				

Daily gage height, in feet, of Chippewa River near Watson, Minn., for the year ending Sept. 30, 1914.

[Clifford Bonde, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.80	5.2	5.2	.....	.....	.....	.....	6.2	5.55	12.9	7.5	5.75
2	4.81	5.1	5.2	.....	.....	.....	.....	6.2	5.4	13.5	7.5	5.7
3	4.79	5.1	5.1	.....	.....	.....	.....	6.3	5.4	13.3	7.3	5.7
4	4.76	5.1	5.1	.....	.....	.....	6.5	6.4	5.5	13.1	7.2	5.65
5	4.82	5.0	5.1	.....	.....	.....	6.5	6.3	.....	12.8	7.1	5.7
6	4.85	5.05	5.05	.....	.....	.....	6.9	6.2	6.4	12.5	6.9	.....
7	4.88	5.1	.....	.....	.....	.....	6.5	6.2	6.4	12.1	6.8	5.55
8	4.90	5.1	.....	.....	.....	.....	6.1	6.2	6.7	11.8	6.8	5.6
9	4.88	5.1	.....	.....	.....	.....	6.0	6.2	6.9	11.6	6.8	.....
10	5.05	5.0	.....	.....	.....	.....	5.9	6.2	6.9	11.3	6.5	5.55
11	5.1	5.3	.....	.....	.....	.....	5.65	6.3	6.9	11.0	6.4	5.55
12	5.1	5.0	.....	.....	.....	.....	5.45	6.4	7.0	10.8	6.4	5.55
13	5.0	5.1	.....	.....	.....	.....	5.65	6.4	7.0	10.5	6.3	.....
14	5.05	4.90	.....	.....	.....	.....	5.6	6.3	7.0	10.2	6.1	6.1
15	5.0	5.1	.....	.....	.....	.....	5.6	6.3	7.0	9.9	6.2	6.1
16	5.1	5.05	.....	.....	.....	.....	5.6	6.2	6.9	10.3	6.1	6.2
17	5.1	5.0	.....	.....	.....	.....	5.6	6.2	7.1	9.7	6.0	6.2
18	5.1	5.0	.....	.....	.....	.....	5.6	6.0	7.0	9.1	6.3	6.3
19	5.1	5.0	.....	.....	.....	.....	5.6	6.0	6.8	8.9	6.1	6.4
20	.....	5.0	.....	.....	.....	.....	5.55	.....	6.7	8.8	5.95	6.7
21	4.88	5.1	.....	.....	.....	.....	5.6	5.8	6.7	8.8	5.94	6.7
22	5.1	5.1	.....	.....	.....	.....	.....	5.75	6.6	8.6	6.0	6.7
23	5.0	5.1	.....	.....	.....	.....	5.65	5.7	6.6	8.3	5.95	6.8
24	5.1	5.1	.....	.....	.....	.....	5.7	5.65	6.6	8.5	5.95	6.8
25	5.05	5.1	.....	.....	.....	.....	5.65	5.55	6.6	8.3	5.95	6.7
26	5.05	5.1	.....	.....	.....	.....	5.65	5.55	7.6	8.6	.....	6.7
27	5.05	5.2	.....	.....	.....	.....	5.8	5.45	8.3	8.3	.....	6.6
28	5.15	5.2	.....	.....	.....	.....	5.95	5.5	9.2	8.2	.....	6.6
29	5.3	5.2	.....	.....	.....	.....	6.0	5.6	9.5	8.0	.....	6.5
30	.....	5.2	.....	.....	.....	.....	6.1	5.65	12.0	7.7	.....	6.4
31	.....	.....	.....	.....	.....	.....	.....	5.6	.....	.....	5.75	.....

NOTE.—Discharge relation affected by ice about Nov. 21, 1913, to Apr. 3, 1914.

Daily discharge, in second-feet, of Chippewa River near Watson, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	76	124	.....	.....	.....	.....	.....	272	172	2,100	499	202
2	77	111	.....	.....	.....	.....	.....	272	151	2,360	499	195
3	75	111	.....	.....	.....	.....	.....	288	151	2,280	463	195
4	72	111	.....	.....	.....	.....	321	304	165	2,180	445	188
5	78	99	.....	.....	.....	.....	321	288	a 234	2,060	427	195
6	82	105	.....	.....	.....	.....	391	272	304	1,940	391	a 184
7	85	111	.....	.....	.....	.....	321	272	304	1,780	373	172
8	87	111	.....	.....	.....	.....	256	272	355	1,660	373	180
9	85	111	.....	.....	.....	.....	240	272	391	1,600	373	a 176
10	105	99	.....	.....	.....	.....	225	272	391	1,490	321	172
11	111	137	.....	.....	.....	.....	188	288	391	1,380	304	172
12	111	99	.....	.....	.....	.....	158	304	409	1,320	304	172
13	99	111	.....	.....	.....	.....	188	304	409	1,230	288	a 214
14	105	87	.....	.....	.....	.....	180	288	409	1,140	256	256
15	99	111	.....	.....	.....	.....	180	288	409	1,050	272	256
16	111	105	.....	.....	.....	.....	180	272	391	1,170	256	272
17	111	99	.....	.....	.....	.....	180	272	427	995	240	272
18	111	99	.....	.....	.....	.....	180	240	409	836	288	288
19	111	99	.....	.....	.....	.....	180	240	373	787	256	304
20	a 98	99	.....	.....	.....	.....	172	a 225	355	763	232	355
21	85	.....	.....	.....	.....	.....	180	210	355	763	231	355
22	111	.....	.....	.....	.....	.....	a 184	202	338	718	240	355
23	99	.....	.....	.....	.....	.....	188	195	338	654	232	373
24	111	.....	.....	.....	.....	.....	195	188	338	696	232	373
25	105	.....	.....	.....	.....	.....	188	172	338	654	232	355
26	105	.....	.....	.....	.....	.....	188	172	518	718	a 227	355
27	105	.....	.....	.....	.....	.....	210	158	654	654	a 222	338
28	118	.....	.....	.....	.....	.....	232	165	861	634	a 217	338
29	137	.....	.....	.....	.....	.....	240	180	940	594	a 212	321
30	133	.....	.....	.....	.....	.....	256	188	1,740	537	a 207	304
31	128	.....	.....	.....	.....	.....	.....	180	.....	a 518	202	.....

a Interpolated.

NOTE.—Daily discharge computed from a rating curve well defined between 36 and 1,740 second-feet (gage heights, 4.3 and 12.0 feet).

Discharge estimated, because of ice, from gage heights, climatic records, and discharge of adjacent drainage areas, as follows: Nov. 21–30, 1913, 100 second-feet, and Apr. 1–3, 1914, 200 second-feet.

Monthly discharge of Chippewa River near Watson, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,940 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	137	72	101	0.052	0.06	A.
November	137	.....	105	.054	.06	B.
April	391	.....	217	.112	.12	B.
May	304	158	242	.125	.14	A.
June	1,740	151	434	.224	.25	A.
July	2,360	518	1,200	.619	.71	A.
August	499	202	300	.155	.18	A.
September	373	172	263	.136	.15	A.

REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

Location.—At the first highway bridge above Redwood Falls, 3 miles distant.

Records available.—July 2, 1909, to September 30, 1914.

Drainage area.—703 square miles.

Gage.—Chain gage attached to bridge; read once daily to quarter-tenths. Limits of use: Hundredths below 3.0, half-tenths between 3.0 and 4.0, and tenths above 4.0 feet.

Channel and control.—Well-defined control, consisting of loose and solid rock and coarse gravel, at rapids about 200 feet below; practically permanent.

Discharge measurements.—Made from the bridge; at low stages by wading at different sections about one-fourth mile above gage.

Winter flow.—Affected by ice; observations discontinued during winter.

Regulation.—No dams above station. Below station a dam at Redwood Falls creates a pond extending for some distance upstream, but backwater does not reach station.

Accuracy.—Conditions favorable for excellent results, and records should be reliable.

Discharge measurements of Redwood River near Redwood Falls, Minn., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 23	S. B. Soulé	1.98	[a] 21
June 13	J. B. Stewart	2.70	163

[a] Measurement made by wading at a section about 1,200 feet above gage.

Daily gage height, in feet, of Redwood River near Redwood Falls, Minn., for the year ending Sept. 30, 1914.

[Douglas Stewart, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.65	.....	.....	.....	.....	.....	.....	2.10	2.10	2.90	2.00	1.90
2	1.65	.....	.....	.....	.....	.....	.....	2.10	2.10	2.85	2.00	1.85
3	1.62	.....	.....	.....	.....	.....	.....	2.15	2.10	2.80	1.98	1.80
4	1.62	.....	.....	.....	.....	.....	.....	2.10	2.10	2.75	1.95	1.80
5	1.72	.....	.....	.....	.....	.....	2.10	2.10	2.00	2.70	1.90	1.80
6	1.75	.....	.....	.....	.....	.....	2.10	2.05	2.05	2.60	1.90	1.75
7	1.78	.....	.....	.....	.....	.....	2.10	2.05	2.10	2.55	1.90	1.75
8	1.80	.....	.....	.....	.....	.....	1.95	2.05	2.10	2.40	1.90	1.75
9	1.80	.....	.....	.....	.....	.....	2.00	2.05	2.50	2.35	1.90	1.72
10	1.90	.....	.....	.....	.....	.....	2.10	2.08	2.60	2.30	1.90	1.75
11	2.00	.....	.....	.....	.....	.....	2.10	2.10	2.65	2.30	1.90	1.70
12	2.00	.....	.....	.....	.....	.....	2.10	2.05	2.70	2.25	1.82	1.70
13	2.00	.....	.....	.....	.....	.....	2.05	2.05	2.70	2.25	1.82	1.90
14	2.00	.....	.....	.....	.....	.....	2.05	2.05	2.75	2.25	1.82	2.10
15	2.05	.....	.....	.....	.....	.....	2.10	2.05	2.80	2.20	1.82	2.20
16	2.05	.....	.....	.....	.....	.....	2.10	2.05	2.90	2.15	1.80	2.20
17	2.10	.....	.....	.....	.....	.....	2.05	2.00	2.90	2.15	1.80	2.20
18	2.10	.....	.....	.....	.....	.....	2.00	2.00	3.0	2.15	1.80	2.20
19	.....	.....	.....	.....	.....	.....	2.00	2.00	3.1	2.15	1.75	2.10
20	.....	.....	.....	.....	.....	.....	2.00	2.00	3.3	2.05	1.80	2.10
21	.....	.....	.....	.....	.....	.....	2.00	2.00	3.35	2.05	1.80	2.05
22	.....	.....	.....	.....	.....	.....	2.00	2.00	3.3	2.20	1.80	2.05
23	2.00	.....	.....	.....	.....	.....	2.00	2.05	3.3	2.20	1.80	2.00
24	2.05	.....	.....	.....	.....	.....	2.00	2.10	3.3	2.15	1.80	2.00
25	2.05	.....	.....	.....	.....	.....	2.00	2.05	3.15	2.15	1.80	1.95
26	2.00	.....	.....	.....	.....	.....	2.00	2.10	3.1	2.15	1.80	1.90
27	2.00	.....	.....	.....	.....	.....	2.00	.....	3.0	2.10	1.80	1.80
28	2.02	.....	.....	.....	.....	.....	2.05	.....	3.0	2.08	1.85	1.80
29	2.02	.....	.....	.....	.....	.....	2.05	2.10	3.0	2.00	1.85	1.85
30	2.00	.....	.....	.....	.....	.....	2.10	2.12	2.90	2.00	1.85	1.90
31	2.00	.....	.....	.....	.....	.....	.....	2.10	.....	2.00	1.90	.....

NOTE.—Discharge relation probably not affected by ice during the period of the above records.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4	.....	.....	.....	.....	.....	.....	34	34	237	23	15
2	4	.....	.....	.....	.....	.....	.....	34	34	220	23	12
3	3	.....	.....	.....	.....	.....	.....	42	34	204	21	9
4	3	.....	.....	.....	.....	.....	.....	34	34	188	19	9
5	6	.....	.....	.....	.....	.....	34	34	23	173	15	9
6	7	.....	.....	.....	.....	.....	34	28	28	144	15	7
7	8	.....	.....	.....	.....	.....	34	28	34	130	15	7
8	9	.....	.....	.....	.....	.....	19	28	34	92	15	7
9	9	.....	.....	.....	.....	.....	23	28	117	80	15	6
10	15	.....	.....	.....	.....	.....	34	32	144	69	15	7
11	23	.....	.....	.....	.....	.....	34	34	158	69	15	5
12	23	.....	.....	.....	.....	.....	34	28	173	60	10	5
13	23	.....	.....	.....	.....	.....	28	28	173	60	10	15
14	23	.....	.....	.....	.....	.....	28	28	188	60	10	34
15	28	.....	.....	.....	.....	.....	34	28	204	50	10	50
16	28	.....	.....	.....	.....	.....	34	28	237	42	9	50
17	34	.....	.....	.....	.....	.....	28	23	237	42	9	50
18	34	.....	.....	.....	.....	.....	23	23	272	42	9	50
19	a 32	.....	.....	.....	.....	.....	23	23	308	42	7	34
20	a 30	.....	.....	.....	.....	.....	23	23	383	28	9	34
21	a 27	.....	.....	.....	.....	.....	23	23	402	28	9	28
22	a 25	.....	.....	.....	.....	.....	23	23	383	50	9	28
23	23	.....	.....	.....	.....	.....	23	28	383	50	9	23
24	28	.....	.....	.....	.....	.....	23	34	383	42	9	23
25	28	.....	.....	.....	.....	.....	23	28	326	42	9	19
26	23	.....	.....	.....	.....	.....	23	34	308	42	9	15
27	23	.....	.....	.....	.....	.....	23	a 34	272	34	9	9
28	25	.....	.....	.....	.....	.....	28	a 34	272	32	12	9
29	25	.....	.....	.....	.....	.....	28	34	272	23	12	12
30	23	.....	.....	.....	.....	.....	34	37	237	23	12	15
31	23	.....	.....	.....	.....	.....	.....	34	.....	23	15	.....

a Discharge interpolated.

NOTE.—Daily discharge computed from a fairly well defined rating curve.

Monthly discharge of Redwood River near Redwood Falls, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 703 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	34	3	20.0	0.028	0.03	B.
April 5–30	34	19	27.6	.039	.04	A.
May	42	23	30.0	.043	.05	A.
June	402	23	203.0	.289	.32	B.
July	237	23	78.1	.111	.13	B.
August	23	7	12.5	.018	.02	B.
September	50	5	19.9	.028	.03	B.

ST. CROIX RIVER AT SWISS, WIS.

Location.—At highway bridge near post office at Swiss, Wis., 10 miles northeast of Danbury, Minn., on Minneapolis, St. Paul & Sault Ste. Marie Railway, about 2 miles above point where St. Croix River becomes the boundary line between Wisconsin and Minnesota. Totogatic River enters from left about 3½ miles above station.

Records available.—March 20 to September 30, 1914.

Drainage area.—1,550 square miles.

Gage.—Cast-iron staff gage bolted to iron girder at left end of bridge; read morning and evening to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.0 feet, and tenths above 2.0 feet.

Channel and control.—Gravel, smooth; grass grows in channel to some extent during summer months and causes a small amount of backwater at gage.

Discharge measurements.—Made from upstream side of bridge.

Winter flow.—Discharge relation affected by ice which forms at the gage; estimates based on measurements made through the ice.

Regulation.—None.

Accuracy.—Records excellent except for periods during which grass may grow in channel; open-water rating curve corrected for backwater from grass June 19 to September 30; maximum correction about 16 per cent.

Discharge measurements of St. Croix River at Swiss, 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.*
Mar. 13	G. H. Canfield	.....	[a] 754	Apr. 28	J. B. Stewart	3.25	3,070
20	do	2.52	[a] 875	29	do	3.60	3,450
Apr. 8	do	1.16	[b] 1,120	Aug. 19	do	1.55	[c] 1,250
23	M. F. Rather	2.80	2,650				

[a] Complete ice cover above and below gage.
[b] River clear of ice in vicinity of gage; frozen over a few miles downstream.
[c] Small amount of grass and moss growing on bed of river.

Daily gage height, in feet, of St. Croix River at Swiss, Wis., for the year ending Sept. 30, 1914.

[R. Goldschmidt, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	.....	.....	.....	2.7	3.4	1.65	3.6	1.45	1.6
2	.....	.....	.....	.....	.....	.....	2.8	3.2	1.6	3.6	1.4	1.75
3	.....	.....	.....	.....	.....	.....	2.8	3.2	1.55	3.5	1.35	1.8
4	.....	.....	.....	.....	.....	.....	1.35	3.3	1.55	3.6	1.3	1.8
5	.....	.....	.....	.....	.....	.....	1.3	3.2	1.6	3.3	1.3	1.7
6	.....	.....	.....	.....	.....	.....	1.2	3.0	1.6	3.1	1.3	1.65
7	.....	.....	.....	.....	.....	.....	1.2	3.0	1.6	2.8	1.3	1.5
8	.....	.....	.....	.....	.....	.....	1.1	2.7	1.6	2.6	1.3	1.5
9	.....	.....	.....	.....	.....	.....	1.1	2.8	1.6	2.3	1.3	1.45
10	.....	.....	.....	.....	.....	.....	1.1	2.4	1.6	2.1	1.5	1.45
11	.....	.....	.....	.....	.....	.....	1.1	2.4	1.55	1.9	1.7	1.6
12	.....	.....	.....	.....	.....	.....	1.1	2.3	1.5	2.2	1.75	1.6
13	.....	.....	.....	.....	.....	.....	1.1	2.2	1.4	2.8	1.75	1.6
14	.....	.....	.....	.....	.....	.....	1.2	2.2	1.4	2.9	1.7	1.75
15	.....	.....	.....	.....	.....	.....	1.25	2.0	1.4	2.8	1.65	1.9
16	.....	.....	.....	.....	.....	.....	1.4	1.9	1.35	2.7	1.6	1.9
17	.....	.....	.....	.....	.....	.....	1.5	1.8	1.35	2.6	1.55	1.9
18	.....	.....	.....	.....	.....	.....	1.75	1.7	1.3	2.4	1.6	1.85
19	.....	.....	.....	.....	.....	.....	2.8	1.7	1.3	2.2	1.55	1.95
20	.....	.....	.....	.....	.....	2.5	2.9	1.6	1.35	2.1	1.5	1.9
21	.....	.....	.....	.....	.....	.....	2.6	3.0	1.95	1.35	1.95	1.5	1.9
22	.....	.....	.....	.....	.....	.....	2.5	3.0	2.1	1.6	1.95	1.45	1.95
23	.....	.....	.....	.....	.....	.....	2.4	2.8	2.1	1.95	2.0	1.7	1.9
24	.....	.....	.....	.....	.....	.....	2.4	4.0	2.0	2.2	1.95	1.75	1.9
25	.....	.....	.....	.....	.....	.....	2.6	3.3	1.95	2.2	1.8	1.7	1.8
26	.....	.....	.....	.....	.....	.....	2.6	3.2	2.0	2.3	1.8	1.6	1.7
27	.....	.....	.....	.....	.....	.....	2.6	3.2	1.9	3.1	1.7	1.6	1.6
28	.....	.....	.....	.....	.....	.....	2.8	3.3	1.85	4.1	1.65	1.5	1.55
29	.....	.....	.....	.....	.....	.....	2.8	3.6	1.9	4.0	1.6	1.45	1.45
30	.....	.....	.....	.....	.....	.....	2.8	3.5	1.9	3.7	1.5	1.4	1.4
31	.....	.....	.....	.....	.....	.....	2.7	.....	1.8	.....	1.5	1.4	.....

NOTE.—Discharge relation affected by ice about Mar. 13 to Apr. 3, and by backwater from weeds June 19 to Sept. 30.

Daily discharge, in second-feet, of St. Croix River at Swiss, Wis., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	.....	.....	.....	.....	3,250	1,560	3,350	1,290	1,330
2	.....	.....	.....	.....	.....	.....	.....	3,050	1,510	3,350	1,240	1,460
3	.....	.....	.....	.....	.....	.....	.....	3,050	1,460	3,250	1,200	1,510
4	.....	.....	.....	.....	.....	.....	1,290	3,150	1,460	3,350	1,160	1,510
5	.....	.....	.....	.....	.....	.....	1,240	3,050	1,510	3,050	1,160	1,420
6	.....	.....	.....	.....	.....	.....	1,160	2,850	1,510	2,850	1,160	1,380
7	.....	.....	.....	.....	.....	.....	1,160	2,850	1,510	2,550	1,160	1,240
8	.....	.....	.....	.....	.....	.....	1,080	2,550	1,510	2,350	1,160	1,240
9	.....	.....	.....	.....	.....	.....	1,080	2,650	1,510	2,060	1,160	1,200
10	.....	.....	.....	.....	.....	.....	1,080	2,250	1,510	1,870	1,330	1,200
11	.....	.....	.....	.....	.....	.....	1,080	2,250	1,460	1,690	1,510	1,330
12	.....	.....	.....	.....	.....	.....	1,080	2,160	1,420	1,960	1,560	1,330
13	.....	.....	.....	.....	.....	.....	1,080	2,060	1,330	2,550	1,560	1,330
14	.....	.....	.....	.....	.....	.....	1,160	2,060	1,330	2,650	1,510	1,460
15	.....	.....	.....	.....	.....	.....	1,200	1,870	1,330	2,550	1,460	1,600
16	.....	.....	.....	.....	.....	.....	1,330	1,780	1,290	2,450	1,420	1,600
17	.....	.....	.....	.....	.....	.....	1,420	1,690	1,290	2,350	1,380	1,600
18	.....	.....	.....	.....	.....	.....	1,640	1,600	1,240	2,160	1,420	1,560
19	.....	.....	.....	.....	.....	.....	2,650	1,600	1,160	1,960	1,290	1,640
20	.....	.....	.....	.....	.....	.....	2,750	1,510	1,200	1,870	1,240	1,600
21	.....	.....	.....	.....	.....	.....	2,850	1,820	1,200	1,740	1,240	1,600
22	.....	.....	.....	.....	.....	.....	2,850	1,960	1,420	1,740	1,200	1,640
23	.....	.....	.....	.....	.....	.....	2,650	1,960	1,740	1,780	1,420	1,600
24	.....	.....	.....	.....	.....	.....	3,870	1,870	1,960	1,740	1,460	1,600
25	.....	.....	.....	.....	.....	.....	3,150	1,820	1,960	1,600	1,420	1,510
26	.....	.....	.....	.....	.....	.....	3,050	1,870	2,060	1,600	1,330	1,420
27	.....	.....	.....	.....	.....	.....	3,050	1,780	2,850	1,510	1,330	1,330
28	.....	.....	.....	.....	.....	.....	3,150	1,740	3,870	1,460	1,240	1,290
29	.....	.....	.....	.....	.....	.....	3,450	1,780	3,760	1,420	1,200	1,200
30	.....	.....	.....	.....	.....	.....	3,350	1,780	3,450	1,330	1,160	1,160
31	.....	.....	.....	.....	.....	.....	.....	1,690	.....	1,330	1,160	.....

NOTE.—Daily discharge computed from a rating curve well defined between 1,080 and 3,870 second-feet (gage heights 1.1 and 4.0 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Mar. 13–20, 810 second-feet; Mar. 21–31, 940 second-feet; and Apr. 1–3, 1,030 second-feet. Allowance made for effect of aquatic growth June 19 to Sept. 30.

Monthly discharge, of St. Croix River at Swiss, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 13–31	.....	.....	885	0.571	0.40	D.
April	3,870	.....	1,930	1.25	1.40	A.
May	3,250	1,510	2,170	1.40	1.61	A.
June	3,870	1,160	1,750	1.13	1.26	B.
July	3,350	1,330	2,180	1.41	1.63	B.
August	1,560	1,160	1,310	.845	.97	B.
September	1,640	1,160	1,430	.923	1.03	B.

ST. CROIX RIVER NEAR ST. CROIX FALLS, WIS.

Location.—At the power plant of the Minneapolis General Electric Co., on the Wisconsin side of St. Croix River near St. Croix Falls, Wis., about 50 miles above the confluence of St. Croix and Mississippi rivers near Hastings, Minn. Apple River, draining an area wholly in Wisconsin, enters from the left about 20 miles below the station; Snake River, draining an area in Minnesota, enters from the right, about 35 miles above the station.

Records available.—January 10, 1902, to June 30, 1905; January 1, 1910, to September 30, 1914. Data for 1903 published in Water-Supply Paper No. 98, pages 176–177, under St. Croix near Taylors Falls, Minn.; daily and monthly discharge January 10, 1902, to June 30, 1905, and January 1, 1910, to October 31, 1912, and monthly discharge for July, 1905, to December, 1909, with the exception of nine months, published also in report on water resources of Minnesota by the State Drainage Commission.

Drainage area.—5,930 square miles.

Discharge.—Determination of discharge based on kilowatt output of dynamo and exciters plus flow over dam and spillway, considered as a weir.

Accuracy.—Records have not been checked nor have discharge measurements been made by engineers of the United States Geological Survey; probably reliable.

Cooperation.—Records furnished by the Minneapolis General Electric Co.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,910	3,330	3,500	2,110	1,030	1,090	3,310	12,000	8,380	15,000	3,540	3,220
2	2,460	1,940	3,690	1,560	1,760	1,720	3,480	12,300	6,510	14,500	1,640	3,420
3	2,340	3,760	3,620	1,740	1,740	1,460	3,400	11,300	6,310	13,100	2,260	3,350
4	2,390	3,650	3,850	1,680	1,560	1,650	3,460	11,400	4,810	11,500	2,240	3,450
5	1,610	3,510	3,870	1,540	1,700	1,630	3,910	12,000	4,480	8,840	2,140	3,970
6	2,610	3,650	3,460	1,680	1,920	1,700	5,600	11,900	4,340	6,820	2,080	3,270
7	2,790	3,740	1,900	1,820	1,880	3,050	4,470	12,000	7,100	4,680	2,110	3,120
8	2,660	3,400	3,420	1,780	1,280	1,180	3,950	11,300	5,670	4,260	2,410	3,370
9	2,960	1,800	2,030	2,460	1,670	1,860	3,440	10,400	5,940	4,930	1,810	3,480
10	3,130	3,560	1,490	2,090	1,410	1,720	3,460	9,750	6,000	6,230	2,230	3,580
11	4,500	3,480	1,830	1,650	1,430	1,700	3,320	7,390	6,950	5,610	3,040	3,250
12	6,120	3,510	2,720	1,870	1,920	2,110	1,760	6,990	5,750	4,960	3,340	3,050
13	6,420	3,520	3,210	1,670	1,450	2,160	3,250	6,930	5,540	4,140	3,340	1,790
14	7,440	3,660	1,810	1,510	1,500	2,040	3,580	6,370	5,120	5,020	3,590	3,840
15	7,120	3,730	2,660	1,790	1,390	1,500	3,630	6,210	3,900	5,280	3,430	4,350
16	6,810	1,970	2,700	1,660	1,540	2,650	3,630	5,150	4,720	6,200	1,690	5,820
17	6,330	3,320	2,620	2,230	1,460	2,750	3,560	5,300	4,470	4,530	3,210	5,680
18	5,990	3,910	2,520	1,670	1,450	2,880	3,610	4,320	3,940	3,640	3,600	6,510
19	5,280	3,940	2,000	1,430	1,490	2,440	1,680	4,100	3,760	3,270	3,430	6,300
20	5,070	3,710	2,120	1,880	1,300	2,200	4,680	4,160	3,570	3,980	3,510	4,800
21	4,030	3,640	1,430	1,510	1,930	2,770	7,030	3,680	4,450	4,190	3,440	5,660
22	4,090	3,660	2,000	1,660	1,070	1,520	6,900	3,980	4,780	3,930	2,780	5,210
23	4,400	2,020	1,560	2,420	1,550	2,680	7,400	5,840	4,220	3,820	1,540	5,210
24	6,860	3,360	1,690	2,670	1,450	2,480	7,130	5,560	8,690	3,790	2,930	5,520
25	3,640	3,760	1,610	1,540	1,530	2,300	7,290	5,880	12,600	3,730	3,190	4,260
26	1,820	3,870	1,780	1,350	1,490	2,570	9,410	4,990	11,400	2,150	3,180	4,610
27	3,460	2,510	2,130	1,390	1,580	2,550	9,590	4,550	11,800	3,670	3,220	3,750
28	3,630	3,560	1,670	1,530	1,310	2,270	10,200	4,720	14,300	3,100	3,130	3,670
29	3,570	4,000	1,510	1,810	.....	1,630	11,600	5,000	15,300	1,920	2,860	3,700
30	3,520	1,990	1,580	1,710	.....	3,170	11,600	8,140	15,200	2,190	1,440	3,280
31	3,550	.....	1,680	2,070	.....	3,320	.....	7,920	.....	2,540	2,630	.....

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

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	7,440	1,610	4,150	0.700	0.81
November	4,000	1,800	3,320	.560	.62
December	3,870	1,430	2,380	.401	.46
January	2,670	1,350	1,790	.302	.35
February	1,930	1,030	1,530	.258	.27
March	3,320	1,090	2,150	.363	.42
April	11,600	1,680	5,310	.895	1.00
May	12,300	3,680	7,470	1.26	1.45
June	15,300	3,570	7,000	1.18	1.32
July	15,000	1,920	5,530	.993	1.08
August	3,600	1,440	2,740	.462	.53
September	6,510	1,790	4,150	.700	.78
The year	15,300	1,030	3,970	.669	9.09

NOTE.—Computed by engineers of the United States Geological Survey from records of daily discharge furnished by the Minneapolis General Electric Co.

NAMAKAGON RIVER AT TREGO, WIS.

Location.—At Chicago & North Western Railway bridge at Trego, Wis., about 20 miles above confluence of Namakagon and Totogatic rivers.

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

Drainage area.—481 square miles.

Gage.—Enameled staff fastened to retaining wall, left bank of river, just above railroad bridge; read once daily, in the morning, to quarter-tenths. Limits of use: Hndredths below 1.0 foot, half-tenths between 1.0 and 2.5 feet, and tenths above 2.5 feet.

Channel and control.—Heavy gravel; probably permanent.

Discharge measurements.—Made from lower chords of railroad bridge.

Winter flow.—Discharge relation affected by ice; estimates of flow based on discharge measurements made through ice.

Regulation.—None; natural storage large; yearly fluctuation small.

Accuracy.—Rating curve well defined; records excellent.

Discharge measurements of Namakagon River at Trego, 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.*
Mar. 11	G. H. Canfield	(a)	[b] 264	May 4	M. F. Rather	2.15	692
23	do	1.56	[c] 353	June 10	do	1.72	476
Apr. 10	do	1.64	383	Aug. 5	do	1.80	472
22	F. M. Rather	2.10	673				

[a] Gage not installed until Mar. 23.
[b] Measurement made under complete ice cover.
[c] Measurement made from bridge 150 feet below gage; very little ice near gage.

Daily gage height, in feet, of Namakagon River at Trego, Wis., for the year ending Sept. 30 1914.

[R. A. Krenz, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.65	2.25	1.7	2.6	1.75	1.8
2	.....	1.7	2.25	1.7	2.6	1.75	1.85
3	.....	1.65	2.15	1.7	2.6	1.7	2.0
4	.....	1.6	2.15	1.8	2.4	1.8	2.0
5	.....	1.6	2.1	1.8	2.3	1.8	1.8
6	.....	1.55	2.1	1.75	2.3	1.75	1.75
7	.....	1.6	2.1	1.8	2.1	1.75	1.75
8	.....	1.6	2.15	1.75	2.0	1.75	1.75
9	.....	1.55	2.2	1.8	1.6	1.75	1.75
10	.....	1.55	2.15	1.75	1.6	1.75	1.75
11	.....	1.55	2.15	1.75	1.3	1.75	2.0
12	.....	1.6	2.1	1.7	2.0	1.8	1.8
13	.....	1.55	2.05	1.65	2.5	1.85	1.8
14	.....	1.6	2.0	1.7	2.5	1.8	1.9
15	.....	1.65	2.0	1.65	2.4	1.8	1.75
16	.....	1.65	.....	1.75	2.35	1.8	1.75
17	.....	1.7	1.9	1.7	2.35	1.8	2.0
18	.....	1.7	1.9	1.75	2.35	1.8	2.0
19	.....	2.0	1.9	1.75	2.3	1.8	2.0
20	.....	2.0	1.9	1.75	2.3	1.8	2.1
21	.....	2.1	2.0	1.7	2.3	1.8	2.0
22	.....	2.1	2.15	1.75	2.0	1.8	2.1
23	1.55	2.1	2.15	1.7	1.7	1.8	2.1
24	2.0	2.0	2.1	2.1	1.7	1.9	2.0
25	1.55	2.1	2.0	2.3	1.75	1.9	2.0
26	1.5	2.1	1.95	2.3	2.0	1.8	1.8
27	1.1	2.15	1.9	2.35	2.0	1.85	1.75
28	1.5	2.2	1.8	2.6	1.75	1.8	1.75
29	1.55	2.3	1.95	2.6	1.7	1.8	1.7
30	1.7	2.3	1.8	2.55	1.7	1.75	1.7
31	1.65	.....	1.8	.....	1.6	1.8	.....

NOTE.—Discharge relation affected by ice about Mar. 23–31.

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

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	393	768	417	1,020	444	472	16	393	a564	444	838	472	444
2	417	768	417	1,020	444	502	17	417	532	417	838	472	597
3	393	698	417	1,020	417	597	18	417	532	444	838	472	597
4	369	698	472	873	472	597	19	597	532	444	803	472	597
5	369	664	472	803	472	472	20	597	532	444	803	472	664
6	350	664	444	803	444	444	21	664	597	417	803	472	597
7	369	664	472	664	444	444	22	664	698	444	597	472	664
8	369	698	444	597	444	444	23	664	698	417	417	472	664
9	350	733	472	369	444	444	24	597	664	664	417	532	597
10	350	698	444	369	444	444	25	664	597	803	444	532	597
11	350	698	444	298	444	597	26	664	564	803	597	472	472
12	369	664	417	597	472	472	27	698	532	838	597	502	444
13	350	630	393	944	502	472	28	733	472	1,020	444	472	444
14	369	597	417	944	472	532	29	803	502	1,020	417	472	417
15	393	597	393	873	472	444	30	803	472	980	417	444	417
							31	.....	472	.....	369	472	.....

a Interpolated.

NOTE.—Daily discharge computed from a rating curve well defined between 332 and 733 second-feet (gage heights 1.5 and 2.2 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Mar. 11–20, 310 second-feet; and Mar. 21–31, 375 second-feet.

Monthly discharge of Namakagon River at Trego, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 481 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 11–31	.....	.....	344	0.715	0.56	B.
April	803	350	498	1.04	1.16	A.
May	768	472	619	1.29	1.49	A.
June	1,020	393	538	1.12	1.25	B.
July	1,020	298	672	1.40	1.61	A.
August	532	417	468	.973	1.12	A.
September	664	417	520	1.08	1.20	A.

YELLOW RIVER AT WEBSTER, WIS.

Location.—At Minneapolis, St. Paul & Sault Ste. Marie Railroad bridge, 1 mile north of Webster, Wis.; about 2 miles above Yellow Lake, and 10 miles above mouth of river.

Records available.—March 21 to September 30, 1914.

Drainage area.—228 square miles.

Gage.—Vertical staff fastened to piles supporting timber bed and trestle, left bank of the river; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.0 feet, half-tenths between 3.0 and 4.0 feet, and tenths above 4.0 feet.

Channel and control.—Bed of river consists of gravel. Grass grows during open-water season.

Discharge measurements.—Made from one-span highway bridge about 600 feet below railroad bridge; low-water measurements can be made by wading.

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

Regulation.—None.

Accuracy.—Gage-height record reliable; discharge relation affected during summer by growth of grass in the river.

Data insufficient for estimates of discharge.

Discharge measurements of Yellow River at Webster, 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.*
Mar. 12	G. H. Canfield		[a]153	Apr. 23	M. F. Rather	1.00	283
21	do	1.92	[b]198	29	J. B. Stewart	1.42	305
Apr. 7	do	.68	184	Aug. 19	do	1.20	[c]157

[a] Measurements made under complete ice cover. Gage not installed until Mar. 21.
[b] Partly open at bridge, complete ice cover 100 feet below gage.
[c] Measurement made by wading at a section about 100 feet below gage; large amount of grass growing in river.

Daily gage height, in feet, of Yellow River at Webster, Wis., for the year ending Sept. 30, 1914.

[Hans Wester, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	0.85	1.24	0.55	2.32	1.06	1.61
2	.....	.80	1.15	.52	2.31	1.02	1.76
3	.....	.82	1.14	.55	2.24	1.00	1.78
4	.....	.80	1.20	.70	2.21	.98	1.75
5	.....	.78	1.14	.72	2.15	.94	1.75
6	.....	.72	1.02	.78	2.05	.95	1.74
7	.....	.68	.96	.76	1.94	.92	1.71
8	.....	.66	.92	.76	1.77	.91	1.69
9	.....	.64	.86	.76	1.60	.96	1.66
10	.....	.62	.82	.72	1.45	1.00	1.72
11	.....	.64	.80	.70	1.32	1.00	1.68
12	.....	.62	.78	.65	1.24	1.00	1.65
13	.....	.62	.75	.62	1.19	1.14	1.68
14	.....	.60	.70	.72	1.12	1.09	1.70
15	.....	.60	.68	.82	1.09	1.09	1.70
16	.....	.64	.65	.78	1.12	1.12	1.68
17	.....	.64	.62	.75	1.08	1.12	1.65
18	.....	.70	.58	.74	1.05	1.20	1.65
19	.....	1.08	.55	.82	1.06	1.20	1.64
20	.....	1.04	.56	.88	1.08	1.28	1.62
21	1.92	1.05	.70	.88	1.06	1.24	1.60
22	1.92	1.02	.78	.92	1.10	1.24	1.61
23	1.92	.98	.75	.88	1.18	1.35	1.61
24	1.82	1.05	.72	1.58	1.20	1.39	1.62
25	1.20	1.16	.72	1.72	1.20	1.45	1.60
26	1.25	1.12	.66	1.84	1.18	1.50	1.59
27	1.00	1.10	.62	2.28	1.19	1.49	1.55
28	.95	1.28	.62	2.38	1.16	1.52	1.52
29	.90	1.42	.68	2.28	1.10	1.50	1.49
30	.88	1.35	.62	2.18	1.05	1.58	1.41
31	.85	.....	.56	.....	1.08	1.59	.....

NOTE.—Discharge relation affected by ice about Mar. 21–27.

KETTLE RIVER NEAR SANDSTONE, MINN.

Location.—At the quarries of the Barber Asphalt Co. at Banning, Minn., 3 miles above Sandstone; no tributaries within several miles.

Records available.—October 18, 1908, to September 30, 1914.

Drainage area.—825 square miles.

Gage.—Staff gage in two sections fastened to vertical rock wall; read once daily to quarter-tenths. Limits of use: Hundredths below 0.0, half-tenths between 0.0 and 3.5, and tenths above 3.5 feet. Gage datum subsequent to April 25, 1912, may differ not more than about 0.02 feet from datum used in previous years.

Channel and control.—Bedrock; permanent.

Winter flow.—The gage is 50 feet above decided rapids which freeze during extremely cold weather and cause backwater. The published discharge for period when rapids were frozen has been based on gage heights, climatic data, and a comparison of records of flow of the Rum and the Snake.

Regulation.—Nearest dam, which is at Sandstone, 3 miles below, does not affect flow at station.

Cooperation.—Station maintained in cooperation with Kettle River Co.

Discharge measurements of Kettle River near Sandstone, 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 5	S. B. Soulé	4.8	2,820	June 29	J. B. Stewart	6.4	5,290
June 25	do	3.62	1,390	30	do	6.2	4,840

NOTE.—Measurements made from bridge about one-half mile above gage.

Daily gage height, in feet, of Kettle River near Sandstone, Minn., for the year ending Sept. 30, 1914.

[F. L. Betts, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.9	2.3	2.3	.....	1.4	.....	2.0	4.5	4.4	6.1	1.6	2.3
2	1.9	2.3	2.3	1.2	1.4	1.4	2.05	4.5	4.0	6.0	1.6	2.3
3	1.9	2.25	2.25	1.2	.....	.....	2.1	4.5	3.6	5.8	1.5	2.3
4	1.9	2.25	2.25	.....	1.4	1.2	2.2	4.5	3.3	5.3	1.5	2.3
5	1.9	2.2	2.2	1.3	.....	.....	2.3	4.8	3.7	4.8	1.5	2.3
6	1.9	2.2	2.2	.....	1.35	1.2	2.2	4.6	4.1	4.3	1.5	2.2
7	1.9	2.2	2.1	1.35	1.35	1.2	2.15	4.5	4.1	3.9	1.4	.....
8	2.2	2.25	2.1	.....	.....	.....	2.1	4.3	4.3	3.3	1.4	.....
9	3.0	2.3	2.0	1.4	1.35	1.25	2.1	4.2	4.4	3.1	1.4	2.0
10	3.0	2.3	2.0	2.4	.....	.....	2.0	4.0	4.5	2.85	2.5	1.9
11	3.0	2.25	1.9	2.6	1.4	1.25	2.0	3.8	4.3	2.8	2.7	1.8
12	3.0	2.25	1.9	2.6	.....	.....	2.05	3.6	4.0	2.65	2.6	1.8
13	3.0	2.2	1.8	2.5	1.4	1.3	2.1	3.5	3.8	2.55	2.4	1.8
14	3.0	2.2	1.8	2.4	1.4	1.3	2.3	3.35	3.45	2.55	2.3	2.2
15	3.0	2.15	1.8	1.6	.....	.....	2.45	3.2	3.5	2.5	2.2	2.6
16	3.0	2.1	1.8	1.3	1.4	1.4	2.55	3.1	3.5	2.5	2.0	2.7
17	2.9	2.1	1.8	1.5	.....	.....	2.75	2.9	3.2	2.4	2.1	2.8
18	2.9	2.1	1.8	1.3	1.35	2.3	2.8	2.6	3.2	2.3	2.4	3.0
19	2.8	2.0	1.8	1.3	.....	.....	3.0	2.55	3.2	2.2	2.4	3.0
20	2.7	2.0	1.8	.....	1.4	2.1	3.2	2.6	3.3	2.1	2.3	3.0
21	2.6	2.0	.....	2.7	1.4	2.0	3.2	3.6	4.0	2.0	2.2	2.9
22	2.5	2.1	1.6	3.3	.....	.....	3.1	3.6	3.8	2.0	2.1	2.9
23	2.5	2.3	.....	3.3	1.3	1.6	3.15	3.5	3.6	2.0	1.9	2.8
24	2.4	2.3	1.5	2.2	.....	.....	3.2	3.4	3.6	2.0	1.8	2.6
25	2.4	2.3	.....	.....	1.3	1.6	3.3	3.45	3.7	1.9	1.7	2.4
26	2.4	2.25	1.3	1.8	.....	.....	3.4	3.35	3.6	1.9	1.9	2.2
27	2.4	2.25	1.3	.....	1.25	1.65	3.4	4.0	3.6	1.9	1.9	2.2
28	2.4	2.3	.....	1.5	1.25	1.65	3.6	4.0	6.4	1.9	2.0	2.2
29	2.3	2.3	1.2	.....	.....	.....	4.4	4.8	6.7	1.8	2.0	2.15
30	2.3	2.3	.....	1.8	.....	..1.7	4.5	4.7	6.2	1.8	2.2	2.15
31	2.3	.....	1.2	1.8	.....	1.75	.....	4.7	.....	1.7	2.2	.....

NOTE.—Discharge relation affected by ice about Jan. 1 to Mar. 8.

Daily discharge, in second-feet, of Kettle River near Sandstone, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	288	465	465	.....	.....	.....	330	2,200	2,090	4,660	186	465
2	288	465	465	.....	.....	.....	352	2,200	1,700	4,480	186	465
3	288	442	442	.....	.....	.....	375	2,200	1,340	4,120	160	465
4	288	442	442	.....	.....	.....	420	2,200	1,090	3,300	160	465
5	288	420	420	.....	.....	.....	465	2,580	1,430	2,580	160	465
6	288	420	420	.....	.....	.....	420	2,320	1,800	1,990	160	420
7	288	420	375	.....	.....	.....	398	2,200	1,800	1,610	136	390
8	420	442	375	.....	.....	.....	375	1,990	1,990	1,090	136	360
9	865	465	330	.....	.....	101	375	1,890	2,090	935	136	330
10	865	465	330	.....	.....	101	330	1,700	2,200	768	565	288
11	865	442	288	.....	.....	101	330	1,520	1,990	735	675	250
12	865	442	288	.....	.....	106	352	1,340	1,700	648	620	250
13	865	420	250	.....	.....	112	375	1,260	1,520	592	515	250
14	865	420	250	.....	.....	112	465	1,130	1,210	592	465	420
15	865	398	250	.....	.....	124	540	1,010	1,260	565	420	620
16	865	375	250	.....	.....	136	592	935	1,260	565	330	675
17	800	375	250	.....	.....	300	705	800	1,010	515	375	735
18	800	375	250	.....	.....	465	735	620	1,010	465	515	865
19	735	330	250	.....	.....	420	865	592	1,010	420	515	865
20	675	330	250	.....	.....	375	1,010	620	1,090	375	465	865
21	620	330	218	.....	.....	330	1,010	1,340	1,700	330	420	800
22	565	375	186	.....	.....	258	935	1,340	1,520	330	375	800
23	565	465	173	.....	.....	186	972	1,260	1,340	330	288	735
24	515	465	160	.....	.....	186	1,010	1,170	1,340	330	250	620
25	515	465	136	.....	.....	186	1,090	1,210	1,430	288	216	515
26	515	442	112	.....	.....	194	1,170	1,130	1,340	288	288	420
27	515	442	112	.....	.....	201	1,170	1,700	1,340	288	288	420
28	515	465	101	.....	.....	201	1,340	1,700	5,200	288	330	420
29	465	465	90	.....	.....	208	2,090	2,580	5,770	250	330	398
30	465	465	90	.....	.....	216	2,200	2,440	4,840	250	420	398
31	465	.....	90	.....	.....	233	.....	2,440	.....	216	420	.....

NOTE.—Daily discharge, except as noted below, computed from a rating curve well defined between 90 and 5,960 second-feet (gage heights, 1.2 and 6.8 feet). Discharge estimated, because of ice, from gage heights, climatic records, and discharge of Rum and Snake rivers, as follows: Jan. 1–31, 90 second-feet; Feb. 1–28, 75 second-feet; Mar. 1–8, 90 second-feet. For days when gage was not read, discharge was interpolated.

Monthly discharge of Kettle River near Sandstone, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 825 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	865	288	583	0.707	0.82	B.
November	465	330	424	.514	.57	A.
December	465	90	262	.318	.37	B.
January	.....	.....	90	.109	.13	D.
February	.....	.....	75	.091	.09	D.
March	465	.....	180	.218	.25	C.
April	2,200	330	760	.921	1.03	B.
May	2,580	592	1,600	1.94	2.24	B.
June	5,770	1,010	1,880	2.28	2.54	A.
July	4,660	216	1,100	1.33	1.53	A.
August	675	136	339	.411	.47	A.
September	865	250	514	.623	.70	A.
The year	5,770	.....	653	.792	10.74	

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SNAKE RIVER NEAR PINE CITY, MINN.

Location.—At the Changwatana power station, of the Eastern Minnesota Power Co., 2 miles below Pine City.

Records available.—June 26, 1913, to September 30, 1914.

Drainage area.—915 square miles.

Gage.—Staff gage attached to stone retaining wall in front of power plant; read about eight times daily to hundredths. Also staff gages in the fore bay and tailrace read every few hours to determine the head on the wheels in the power plant.

Channel and control.—Practically permanent.

Discharge measurements.—At low and medium stages made by wading at various points near by; at high stages from bridge about 1,800 feet above gage.

Determination of flow.—Made by adding to the flow through the turbine the flow over the crest of the dam as determined from readings of the staff gage. The flow through the turbines is computed from hourly record of gate openings and head.

Winter flow.—During the winter the volume of flow is so small that all the water goes through the wheels and is estimated from gate openings and head.

Regulation.—Power plant at station is operated with a varying light and power load, causing some fluctuation in discharge at low stages. No appreciable regulation above plant.

Accuracy.—Conditions favorable for estimating the waste by means of the river gage, but estimates of flow through the wheels are probably not so good. However, in view of the fact that they are based upon 24 readings of the gate opening daily, the records should be fair to good, the accuracy increasing with the stage.

Cooperation.—The station is maintained in cooperation with the Eastern Minnesota Power Co.

Daily discharge, in second-feet, of Snake River near Pine City, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	229	364	428	77	55	62	578	1,660	709	4,100	193	399
2	221	320	419	112	83	73	637	1,700	683	4,140	148	390
3	191	403	420	117	89	82	664	1,710	653	4,040	205	379
4	187	365	432	62	83	85	675	1,770	570	3,840	156	340
5	137	347	404	77	73	101	703	1,820	522	3,480	186	329
6	204	339	405	68	66	101	815	1,980	529	3,060	192	281
7	224	384	296	92	54	103	782	2,070	524	2,520	174	274
8	184	402	224	115	52	69	748	2,180	593	2,030	173	292
9	255	344	276	121	42	103	696	2,170	632	1,680	132	276
10	433	376	288	115	45	103	635	2,020	593	1,380	206	264
11	532	379	279	59	33	101	597	1,470	581	1,150	189	275
12	540	382	273	98	41	102	487	1,680	570	964	202	221
13	722	396	261	112	41	100	495	1,480	541	839	250	204
14	846	376	162	109	42	105	478	1,300	468	734	263	333
15	937	347	238	119	41	72	472	1,150	500	592	215	456
16	932	316	230	115	43	132	446	1,000	492	539	200	609
17	916	312	214	111	35	193	456	883	427	475	226	945
18	858	290	207	66	44	235	532	797	417	406	270	1,030
19	721	283	208	102	46	265	515	731	406	363	274	1,260
20	703	256	215	102	47	338	633	625	381	370	237	1,200
21	648	283	77	110	52	356	742	593	311	320	244	1,190
22	569	285	178	115	49	409	788	557	333	291	264	1,110
23	512	255	201	115	50	393	824	617	446	308	231	937
24	460	336	201	111	58	352	825	585	804	287	253	858
25	421	358	71	83	60	350	896	647	924	261	238	775
26	361	367	122	94	68	332	881	637	1,300	185	260	667
27	391	387	142	110	67	350	926	569	1,970	241	267	563
28	398	401	66	106	69	402	982	519	2,630	235	289	556
29	396	410	114	85	.....	357	1,130	655	3,220	203	289	512
30	407	349	123	69	.....	503	1,340	614	3,780	207	257	452
31	393	.....	123	86	.....	563	.....	628	.....	187	339	.....

Monthly discharge of Snake River near Pine City, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 915 square miles.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	937	137	482	0.527	0.61	B.
November	410	255	347	.379	.42	B.
December	432	66	235	.257	.30	B.
January	121	59	97.8	.107	.12	B.
February	89	33	54.6	.060	.06	B.
March	563	62	222	.243	.28	B.
April	1,340	446	713	.779	.87	B.
May	2,180	519	1,190	1.30	1.50	B.
June	3,780	311	884	.966	1.08	B.
July	4,140	185	1,270	1.39	1.60	B.
August	339	132	227	.248	.29	B.
September	1,260	204	579	.633	.71	B.
The year	4,140	33	528	.577	7.84	

APPLE RIVER NEAR SOMERSET, WIS.

Location.—At the power plant of the St. Croix Power Co., 3½ miles below Somerset, Wis., and 2 miles above the mouth of the river.

Records available.—January, 1901, to June 30, 1914, estimate of monthly discharge; July 12 to September 30, 1914, daily discharge.

Drainage area.—550 square miles.

Gage.—Vertical staff; not used in determination of flow.

Discharge.—The discharge of the turbines in second-feet corresponding to the number of kilowatts is determined for each hour during the day from a record of the number of wheels in operation and the load; the sum of the discharges divided by 24 gives the average discharge through the turbines. To this quantity is added the leakage through the average number of wheels idle each day, the sum giving the daily flow through the power house. Water is seldom wasted over the spillway of the dam, but when it is so wasted the quantity is computed from weir formulas and added to the flow through the plant. There is a constant leakage through the gate and flashboards amounting to about 3 second-feet. This quantity has not been taken into consideration in computing the published records.

Regulation.—There are a number of power plants on Apple River above station. The pondage at these plants is small, and though the daily flow may be controlled to some extent, the mean monthly flow probably corresponds closely to the natural flow.

Accuracy.—From 1901 to 1909 the discharge through the plant was determined from tables computed from data collected at tests on one of the turbines made at the flume of the Holyoke Water Power Co., Holyoke, Mass. During the summer of 1909 engineers of the St. Croix Power Co. made tests on the water flowing through all the wheels as actually installed, by means of a sharp-crested weir 710 inches long located about 60 feet below the power house. These tests gave results about 3 per cent larger than the Holyoke tests, and tables based on them have been used in determining the discharge through the plant from 1909 to date. During June, 1914, a series of current-meter measurements were made by the Wisconsin Railroad Commission and the United States Geological Survey and a rating curve for the tailrace was developed. Twelve tests were then run with different wheels and loads. It was found that the discharge as determined by the current meter and the discharge as computed by the company agreed very closely, the percentage difference for the twelve tests ranging from −6.4 per cent to +1.8 per cent, with an average of −2 per cent, the discharge as determined by the company being 2 per cent less than that determined by the current meter.

Cooperation.—Records furnished by the St. Paul Gas Light Co., of St. Paul, Fred A. Otto, superintendent.

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

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1		252	242	16	316	120	433
2		130	319	17	289	250	337
3		264	271	18	325	190	411
4		197	274	19	258	216	430
5		256	244	20	334	176	372
6		208	306	21	276	234	279
7		265	257	22	265	185	285
8		196	281	23	224	249	279
9		273	239	24	245	304	372
10		252	311	25	257	267	337
11		286	294	26	289	198	335
12	373	197	273	27	245	245	252
13	319	277	299	28	274	177	286
14	348	195	309	29	212	221	262
15	270	254	283	30	276	219	298
				31	204	250	

Monthly discharge of Apple River near Somerset, Wis., for the years ending Sept. 30, 1901–1914.

[Drainage area, 550 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1901.						
January			340	0.618	0.71	
February			330	.600	.62	
March			448	.815	.94	
April			837	1.52	1.70	
May			510	.927	1.07	
June			380	.691	.77	
July			400	.727	.84	
August			250	.455	.52	
September			270	.491	.55	
1901–2.						
October			330	.600	.69	
November			330	.600	.67	
December			230	.418	.48	
January			233	.424	.49	
February			307	.558	.58	
March			360	.655	.76	
April			430	.782	.87	
May			480	.873	1.01	
June			360	.655	.73	
July			480	.873	1.01	
August			340	.618	.71	
September			233	.424	.47	
The year			343	.624	8.47	
1902–3.						
October			307	.558	.64	
November			360	.654	.73	
December			276	.502	.58	
January			259	.471	.54	
February			240	.436	.45	
March			599	1.09	1.26	
April			554	1.01	1.13	
May			860	1.56	1.80	
June			468	.851	.95	
July			482	.876	1.01	
August			366	.665	.77	
September			674	1.23	1.37	
The year			454	.825	11.23	

Monthly discharge of Apple River near Somerset, Wis., for the years ending Sept. 30, 1901–1914—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1903–4.						
October			623	1.13	1.30	
November			360	.655	.73	
December			317	.576	.66	
January			392	.713	.82	
February			314	.571	.62	
March			406	.738	.85	
April			729	1.33	1.48	
May			633	1.15	1.33	
June			593	1.08	1.20	
July			450	.818	.94	
August			316	.575	.66	
September			508	.924	1.03	
The year			470	.855	11.62	
1904–5.						
October			550	1.00	1.15	
November			459	.835	.93	
December			321	.584	.67	
January	387	227	328	.596	.69	
February	383	284	319	.580	.60	
March	649	309	406	.738	.85	
April	464	300	443	.805	.90	
May	578	326	420	.764	.88	
June	2,280	312	1,030	1.87	2.09	
July	963	313	532	.967	1.12	
August	684	302	424	.771	.89	
September	884	358	545	.991	1.11	
The year			481	.875	11.88	
1905–6.						
October	590	361	490	.891	1.03	
November	597	272	425	.773	.86	
December	507	185	392	.713	.82	
January	406	242	348	.633	.73	
February	437	150	327	.595	.62	
March	479	231	367	.667	.77	
April	1,300	486	881	1.60	1.78	
May	2,250	458	1,000	1.82	2.10	
June	1,360	480	732	1.33	1.48	
July	667	359	452	.822	.95	
August	1,170	275	506	.920	1.06	
September	692	253	501	.911	1.02	
The year	2,250	150	535	.973	13.22	
1906–7.						
October	883	246	463	.842	.97	
November	750	306	536	.975	1.09	
December	592	276	436	.793	.91	
January	443	261	354	.644	.74	
February	446	269	350	.636	.66	
March	1,640	252	706	1.28	1.48	
April	1,070	376	657	1.19	1.33	
May	479	283	418	.760	.88	
June	631	230	382	.695	.78	
July	1,430	217	520	.945	1.09	
August	404	240	322	.585	.67	
September	1,120	178	416	.756	.84	
The year	1,640	178	463	.842	11.44	
1907–8.						
October	468	178	343	.624	.72	
November	399	199	312	.567	.63	
December	342	147	272	.495	.57	
January	302	214	262	.476	.55	
February	335	239	277	.504	.54	
March	655	251	373	.678	.78	
April	968	329	478	.869	.97	
May	1,380	266	688	1.25	1.44	
June	1,050	564	784	1.43	1.60	
July	835	252	435	.791	.91	
August	320	138	255	.464	.53	
September	274	144	226	.411	.46	
The year	1,380	138	392	.713	9.70	

Monthly discharge of Apple River near Somerset, Wis., for the years ending Sept. 30, 1901–1914—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area.)	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1908–9.						
October	428	210	291	.529	.61	
November	367	241	261	.475	.53	
December	316	166	257	.467	.54	
January	300	187	251	.456	.53	
February	283	198	252	.458	.48	
March	431	248	301	.547	.63	
April	803	254	503	.915	1.02	
May	841	353	530	.964	1.11	
June	1,060	272	469	.853	.95	
July	281	176	246	.447	.52	
August	449	229	285	.518	.60	
September	483	232	313	.569	.63	
The year	1,060	166	330	.600	8.15	
1909–10.						
October	427	241	317	.576	.66	
November	595	331	448	.815	.91	
December	603	219	381	.693	.80	
January	352	260	313	.569	.66	
February	398	207	285	.518	.54	
March	549	270	409	.744	.86	
April	398	181	279	.507	.57	
May	364	38	233	.424	.49	
June	257	131	202	.367	.41	
July	219	56	150	.273	.31	
August	211	60	151	.275	.32	
September	266	71	166	.302	.34	
The year	603	38	278	.505	6.87	
1910–11.						
October	294	141	211	.384	.44	
November	306	112	197	.358	.40	
December	258	136	187	.340	.39	
January	250	150	201	.365	.42	
February	285	195	224	.407	.42	
March	300	120	245	.445	.51	
April	540	210	285	.518	.58	
May	320	180	240	.436	.50	
June	290	140	224	.407	.45	
July	220	120	165	.300	.35	
August	205	140	178	.324	.37	
September	290	160	226	.411	.46	
The year	540	112	215	.391	5.29	
1911–12.						
October	890	240	472	.858	.99	
November	350	190	260	.473	.53	
December	310	190	327	.595	.69	
January	255	145	215	.391	.45	
February	250	175	208	.378	.41	
March	485	135	240	.436	.50	
April	640	275	450	.818	.91	
May	930	340	615	1.12	1.29	
June	550	240	335	.609	.68	
July	355	50	238	.433	.50	
August	415	50	248	.451	.52	
September	440	170	300	.545	.61	
The year	930	50	326	.593	8.08	
1912–13.						
October	320	170	266	.484	.56	
November	300	100	230	.418	.47	
December	280	100	230	.418	.48	
January	280	90	208	.378	.44	
February	250	160	202	.367	.38	
March	830	160	344	.625	.72	
April	910	320	590	1.07	1.19	
May	610	280	382	.695	.80	
June	450	160	264	.480	.54	
July	350	50	237	.431	.50	
August	420	60	245	.445	.51	
September	280	130	233	.424	.47	
The year	910	50	286	.520	7.06	

Monthly discharge of Apple River near Somerset, Wis., for the years ending Sept. 30, 1901–1914—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1913–14.						
October	315	140	247	.449	.52	
November	290	195	242	.440	.49	
December	370	170	232	.422	.49	
January	300	150	216	.393	.45	
February	260	150	200	.364	.38	
March	310	150	240	.436	.50	
April	540	200	314	.571	.64	
May	520	180	314	.571	.66	
June	870	200	376	.684	.76	
July	708	204	328	.596	.69	
August	304	120	226	.411	.47	A.
September	433	242	306	.556	.62	A.
The year	870	120	270	.491	6.67	

NOTE.—Records furnished by the St. Paul Gas Light Co. Maximum and minimum discharge from January, 1901, to December, 1904, not available. Records from Jan. 1, 1911, to July 31, 1914, obtained from monthly hydrographs furnished by the St. Paul Gas Light Co. Estimates for August and September, 1914, were obtained from daily records taken at the power house. See "Discharge" and "Accuracy" in station description.

CANNON RIVER AT WELCH, MINN.

Location.—At highway bridge at Welch just below a very small tributary and 3 miles above the mouth of Belle Creek.

Records available.—June 7, 1909, to January 14, 1914, when station was discontinued.

Drainage area.—1,290 square miles.

Gage.—Chain gage attached to bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 5.5, half-tenths between 5.5 and 7.0, and tenths above 7.0 feet.

Channel and control.—Practically permanent.

Winter flow.—Discharge relations affected by ice during winter months.

Regulation.—Flow regulated more or less by each of the 11 power plants above and also by a dam at the outlet of Cannon Lake.

Maximum flow.—In April, 1888, the high water reached the eaves of the wheel house at the mill, 20.1 feet above the datum of the present gage. It is said that this high water was not caused by ice gorging.

Accuracy.—The angle made by the current at the station necessitates a correction, and owing to the daily fluctuation during low stages caused by artificial regulation records are only fair.

No discharge measurements were made during the year.

Daily gage height, in feet, of Cannon River at Welch, Minn., for the period Oct. 1, 1913, to Jan. 14, 1914.

[Esther Norell, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1	5.55	5.55	4.98	5.05	16	5.20	5.13	5.04	.....
2	5.42	5.24	5.08	5.09	17	5.27	4.95	4.84	.....
3	5.22	5.09	5.27	5.79	18	5.25	5.13	4.83	.....
4	5.39	4.95	5.31	4.76	19	5.18	5.14	5.32	.....
5	5.33	5.01	5.38	5.01	20	5.14	5.18	5.46	.....
6	5.17	5.27	5.31	4.91	21	5.17	5.19	5.55	.....
7	5.33	5.21	5.33	5.23	22	5.31	5.13	5.22	.....
8	5.36	5.15	4.98	5.28	23	5.17	5.19	5.07	.....
9	5.32	5.25	5.24	5.35	24	5.20	4.94	5.28	.....
10	5.35	4.95	5.18	5.24	25	5.16	5.14	4.81	.....
11	5.39	4.95	5.10	5.24	26	5.16	5.22	4.73	.....
12	5.21	5.23	5.17	5.01	27	5.06	5.08	5.03	.....
13	5.18	5.13	5.16	5.39	28	5.10	4.93	5.00	.....
14	5.27	5.02	5.07	5.40	29	5.15	4.97	5.03	.....
15	5.17	5.10	4.96	.....	30	5.15	4.98	4.96	.....
					31	5.10	.....	5.16	.....

NOTE.—Discharge relation probably affected by ice Jan. 3, 13, and 14.

Daily discharge, in second-feet, of Cannon River at Welch, Minn., for the period Oct. 1, 1913, to Jan. 14, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1	195	195	70	72	16	110	96	80	.....
2	161	119	87	88	17	125	66	51	.....
3	114	88	125	*a* 60	18	121	96	50	.....
4	154	66	134	42	19	106	98	137	.....
5	139	75	151	75	20	98	106	172	.....
6	104	125	134	60	21	104	108	195	.....
7	139	112	139	117	22	134	96	114	.....
8	146	100	70	128	23	104	108	85	.....
9	137	121	119	144	24	110	64	128	.....
10	144	66	106	119	25	102	98	47	.....
11	154	66	90	119	26	102	114	40	.....
12	112	117	104	75	27	83	87	78	.....
13	106	96	102	*a* 75	28	90	62	73	.....
14	125	76	85	*a* 75	29	100	68	78	.....
15	104	90	67	.....	30	100	70	67	.....
					31	90	.....	102	.....

a Estimated.

NOTE.—Daily discharge computed from a fairly well defined rating curve. See "Accuracy" in station description.

Monthly discharge of Cannon River at Welch, Minn., for the period Oct. 1, 1913, to Jan. 14, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	195	83	120	B.
November	195	62	95.0	B.
December	195	40	99.4	B.
January 1–14	144	42	89.2	C.

CHIPPEWA RIVER AT BISHOP'S BRIDGE, NEAR WINTER, WIS.

Location.—Near highway bridge about 3 miles downstream from the East Fork of Chippewa River (coming in from the left) and 4 miles by road northwest of Winter, Wis.

Records available.—February 23, 1912, to September 30, 1914.

Drainage area.—775 square miles.

Gage.—Metal staff gage fastened to a wooden pier on the right bank immediately above the bridge installed on January 27, 1914; zero 3.44 feet below the zero of the wooden staff gage used February 23, 1912, to January 27, 1914. Gage read once daily prior to January 27, 1914; after that date daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 4.0 feet, half-tenths between 4.0 and 6.5 feet, and tenths above 6.5 feet.

Discharge measurements.—Made from upstream side of highway bridge immediately below gage.

Winter flow.—Determined from discharge measurements made through the ice.

Regulation.—No dams for storing water are now in operation above station.

Accuracy.—See footnotes to tables of daily gage height and daily discharge.

Cooperation.—Records from February 23, 1912, to January 27, 1914, furnished through the courtesy of the Chippewa & Flambeau Improvement Co., which has also paid the gage reader to date.

Discharge measurements of Chippewa River at Bishop's bridge, near Winter, Wis., during the years ending Sept. 30, 1912–1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1911–12.		*Feet.*	*Sec.-ft.*	1913–14.		*Feet.*	*Sec.-ft.*
Feb. 23	J. A. Cutler [a]	5.64	[b] 200	Dec. 4	Stewart and Hoyt	5.62	1,040
July 9	C. B. Stewart [a]	4.44	358	Jan. 27	H. C. Beckman	5.50	[b] 342
				Mar. 6	O. A. Steller	5.57	[b] 244
1912–13.				May 2	M. F. Rather	7.65	[d] 3,190
May 4	C. B. Stewart [a]	6.29	[c] 1,820	June 2	do	5.70	1,110
July 6	do [a]	6.17	1,650	Sept. 16	do	5.65	1,060

[a] Measurements made for Chippewa & Flambeau Improvement Co. by and under direction of C. B. Stewart, consulting engineer, Madison, Wis.
[b] Complete ice cover.
[c] Open channel; results approximate only.
[d] Logs on control.

Daily gage height, in feet, of Chippewa River at Bishop's bridge, near Winter, Wis., for the years ending Sept. 30, 1912–1914.

[John Edberg, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1						5.55	5.9	6.15	5.95	4.7	4.25	5.15
2						5.55	5.9	6.1	5.9	4.65	4.25	5.15
3						5.55	5.9	6.2	5.9	4.65	4.2	5.15
4						5.55	5.95	6.6	5.75	4.6	4.2	5.15
5						5.6	[a] 5.02	6.8	5.7	4.5	4.25	5.2
6						5.6	5.95	6.9	5.55	4.4	4.3	5.15
7						5.6	5.95	6.9	5.5	4.4	4.35	5.1
8						5.6	5.7	6.9	5.45	4.45	4.35	5.05
9						5.65	5.85	6.9	5.4	4.45	4.6	5.0
10						5.6	5.9	6.7	5.3	4.45	5.0	5.0
11						5.6	5.95	6.7	5.2	4.45	5.1	4.95
12						5.6	6.0	6.6	5.15	4.45	5.35	4.85
13						5.6	6.05	6.3	5.1	4.4	5.4	4.85
14						5.55	6.1	6.05	5.05	4.4	5.4	4.85
15						5.55	6.2	6.0	5.25	4.4	5.35	4.85
16						5.55	6.2	5.9	5.45	4.35	5.45	4.9
17						5.6	6.2	5.8	5.5	4.35	5.6	4.9
18						5.6	6.15	5.7	5.5	4.3	5.55	4.95
19						5.65	6.15	5.6	5.55	4.3	5.45	4.95
20						5.65	6.05	5.6	5.55	4.25	5.25	4.9

Daily gage height, in feet, of Chippewa River at Bishop's bridge, near Winter, Wis., for the years ending Sept. 30, 1912–1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
21	.....	.....	.....	.....	.....	5.6	6.05	5.6	5.6	4.25	5.2	4.9
22	.....	.....	.....	.....	.....	5.55	6.05	5.65	5.65	4.4	5.2	4.9
23	.....	.....	.....	.....	5.65	5.55	6.05	5.65	5.55	4.45	5.15	4.9
24	.....	.....	.....	.....	5.65	5.55	6.05	5.7	5.45	4.5	5.1	4.9
25	.....	.....	.....	.....	5.6	5.55	6.05	5.7	5.3	4.55	5.05	4.85
26	.....	.....	.....	.....	5.55	5.6	6.05	5.7	5.15	4.5	5.05	4.85
27	.....	.....	.....	.....	5.55	5.65	6.05	5.85	5.0	4.4	5.05	4.85
28	.....	.....	.....	.....	5.6	5.7	6.1	6.0	4.9	4.4	5.0	4.85
29	.....	.....	.....	.....	5.6	5.75	6.1	6.0	4.85	4.35	5.0	4.8
30	.....	.....	.....	.....	.....	5.8	6.1	6.0	4.8	4.35	5.05	4.8
31	.....	.....	.....	.....	.....	5.85	.....	5.95	.....	4.3	5.1	.....
1912–13.												
1	4.8	4.75	4.45	5.3	5.4	5.6	5.35	6.9	6.35	4.9	5.5	5.1
2	4.75	4.7	4.45	5.25	5.4	5.6	6.8	6.7	6.45	4.85	5.5	5.05
3	4.75	4.65	4.5	5.25	5.4	5.6	7.3	6.45	6.4	5.0	5.4	5.15
4	4.75	4.6	4.55	5.25	5.4	5.6	7.6	6.3	6.35	5.55	5.35	5.25
5	4.7	4.6	4.5	5.25	5.35	5.6	7.7	6.1	6.25	5.8	5.25	5.2
6	4.65	4.55	4.55	5.2	5.35	5.6	7.8	6.0	6.7	6.05	5.2	5.15
7	4.65	4.55	4.95	5.2	5.4	5.65	8.0	5.9	6.9	6.3	5.1	5.1
8	4.6	4.55	6.05	5.2	5.4	5.65	8.0	5.75	7.0	6.5	5.05	5.05
9	4.6	4.55	6.0	5.2	5.4	5.65	8.0	5.65	7.0	6.7	5.05	5.0
10	4.6	4.55	5.65	5.15	5.4	5.65	7.1	5.55	6.9	6.9	4.95	5.0
11	4.55	4.55	5.35	5.15	5.45	5.7	8.2	5.45	6.8	7.0	4.9	5.0
12	4.65	4.5	5.35	5.2	5.45	5.7	7.1	5.4	6.6	7.1	4.85	4.95
13	4.85	4.5	5.3	5.2	5.4	5.75	6.15	5.3	6.4	7.0	4.8	4.9
14	4.95	4.5	5.3	5.2	5.35	5.7	6.25	5.25	6.25	6.8	4.8	4.9
15	5.05	4.5	5.35	5.2	5.4	5.65	6.5	5.25	6.15	6.7	4.8	4.85
16	5.1	4.5	5.35	5.2	5.45	5.65	6.6	5.35	6.1	6.6	4.9	4.8
17	5.1	4.45	5.35	5.2	5.45	5.65	7.2	5.5	5.9	6.45	5.0	4.8
18	5.1	4.45	5.4	5.2	5.5	5.6	7.6	5.6	5.65	6.35	5.3	4.75
19	5.05	4.45	5.4	5.25	5.5	5.6	7.6	5.7	5.55	6.25	5.5	4.7
20	5.05	4.45	5.35	5.25	5.5	5.65	7.6	5.9	5.5	6.1	5.5	5.05
21	5.0	4.45	5.35	5.25	5.5	5.7	7.6	6.15	5.6	6.0	5.55	5.1
22	4.95	4.45	5.35	5.25	5.55	5.7	7.8	6.3	5.55	5.9	5.6	5.1
23	4.9	4.45	5.35	5.3	5.55	5.75	7.8	6.35	5.55	5.8	5.65	5.15
24	4.9	4.4	5.3	5.3	5.55	5.8	7.8	6.45	5.45	5.65	5.65	5.2
25	4.85	4.4	5.3	5.3	5.55	5.85	7.7	6.45	5.15	5.55	5.6	5.3
26	4.85	4.45	5.3	5.35	5.55	5.95	7.6	6.4	5.15	5.65	5.6	5.4
27	4.85	4.55	5.25	5.35	5.55	5.95	7.5	6.3	5.15	5.55	5.55	5.5
28	4.8	4.95	5.25	5.35	5.6	6.0	7.4	6.25	5.1	5.6	5.45	5.5
29	4.8	5.15	5.25	5.35	.....	6.0	7.2	6.2	4.95	5.65	5.4	5.5
30	4.8	5.25	5.3	5.35	.....	6.05	7.2	6.15	4.9	5.6	5.25	5.5
31	4.8	.....	5.3	5.35	.....	6.15	.....	6.25	.....	5.6	5.2	.....
1913–14.												
1	5.5	5.55	5.65	6.35	5.5	5.3	4.75	7.5	5.8	6.45	5.4	5.3
2	5.5	5.5	5.65	6.4	5.55	5.5	4.75	7.6	5.7	5.5	5.3	5.45
3	5.45	5.5	5.65	6.4	5.6	5.5	4.8	7.7	5.75	6.4	5.2	5.5
4	5.45	5.45	5.6	6.3	5.5	5.5	4.8	7.7	5.75	6.35	5.1	5.5
5	5.5	5.4	5.6	6.15	5.5	5.5	4.75	7.6	5.7	6.25	5.0	5.5
6	5.6	5.4	5.55	6.15	5.5	5.55	4.7	7.3	5.7	6.15	4.95	5.55
7	5.65	5.35	5.45	6.15	5.5	5.55	4.7	7.1	5.75	6.0	4.85	5.5
8	5.7	5.4	5.4	6.05	5.5	5.6	4.65	6.9	5.7	5.85	4.8	5.45
9	5.75	5.5	5.3	6.0	5.5	5.6	4.7	6.7	5.65	5.75	4.8	5.4
10	5.75	5.55	5.25	5.9	5.5	5.6	4.65	6.6	5.6	5.6	4.85	5.4
11	5.75	5.65	5.25	5.9	5.45	5.6	4.7	6.5	5.5	5.5	4.85	5.4
12	5.7	5.7	5.3	5.9	5.4	5.6	4.6	6.3	5.4	5.5	4.9	5.35
13	5.6	5.65	5.3	5.9	5.4	5.6	4.65	6.2	5.3	5.55	4.95	5.45
14	5.6	5.6	5.2	5.85	5.4	5.6	4.7	6.1	5.2	5.6	5.15	5.55
15	5.55	5.55	5.15	5.8	5.45	5.65	4.85	6.0	5.2	5.6	5.25	5.6
16	5.5	5.45	5.1	5.8	5.45	5.7	4.9	5.9	5.1	5.65	5.3	5.65
17	5.4	5.4	5.05	5.75	5.45	5.8	5.15	5.75	5.0	5.6	5.35	5.8
18	5.4	5.35	5.0	5.7	5.5	5.7	5.4	5.7	5.0	5.6	5.45	5.85
19	5.35	5.35	5.0	5.65	5.45	5.65	5.7	5.6	5.05	5.6	5.5	5.9
20	5.3	5.4	4.95	5.6	5.5	5.6	5.8	5.55	5.1	5.55	5.45	5.95
21	5.2	5.4	4.9	5.6	5.5	5.65	5.9	5.6	5.0	5.5	5.45	5.9
22	5.2	5.45	4.85	5.6	5.45	5.6	5.95	5.6	5.0	5.5	5.4	6.25
23	5.15	5.55	5.0	5.55	5.5	5.6	6.0	5.65	5.0	5.5	5.75	6.3
24	5.15	5.65	5.05	5.55	5.5	5.55	6.1	5.7	5.6	5.6	5.6	6.35
25	5.25	5.65	5.1	5.5	5.5	5.7	6.25	5.75	5.8	5.65	5.5	6.3

Daily gage height, in feet, of Chippewa River at Bishop's bridge, near Winter, Wis., for the years ending Sept. 30, 1912–1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
26	5.3	5.65	5.25	5.5	5.5	5.6	6.3	5.8	5.9	5.7	5.45	6.25
27	5.4	5.7	5.35	5.5	5.5	5.85	6.4	5.75	6.2	5.7	5.4	6.2
28	5.45	5.7	5.65	5.55	5.5	5.8	6.7	5.75	6.25	5.65	5.35	6.15
29	5.5	5.7	5.95	5.6	.....	5.8	7.1	6.0	6.3	5.6	5.3	6.05
30	5.55	5.7	6.15	5.6	.....	5.5	7.3	6.0	6.35	5.55	5.25	5.95
31	5.6	.....	6.35	5.55	.....	4.75	.....	5.9	.....	5.5	5.2	.....

[a] Drop caused by going out of ice.

NOTE.—Discharge relation probably affected by ice about Feb. 23 to Apr. 7, 1912, Nov. 28, 1912, to Apr. 12, 1913, and Dec. 21, 1913, to Apr. 10, 1914. Discharge relation affected by backwater from a log jam about Apr. 29 to May 12, 1914.

Daily discharge, in second-feet, of Chippewa River at Bishop's bridge, near Winter, Wis., for the years ending Sept. 30, 1912–1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	.....	.....	.....	.....	.....	.....	.....	1,630	1,380	454	315	682
2	.....	.....	.....	.....	.....	.....	.....	1,560	1,320	435	315	682
3	.....	.....	.....	.....	.....	.....	.....	1,690	1,320	435	305	682
4	.....	.....	.....	.....	.....	.....	.....	2,300	1,170	416	305	682
5	.....	.....	.....	.....	.....	.....	.....	2,640	1,120	382	315	713
6	.....	.....	.....	.....	.....	.....	.....	2,820	978	350	325	682
7	.....	.....	.....	.....	.....	.....	.....	2,820	935	350	338	651
8	.....	.....	.....	.....	.....	.....	1,120	2,820	895	366	338	622
9	.....	.....	.....	.....	.....	.....	1,270	2,820	855	366	416	594
10	.....	.....	.....	.....	.....	.....	1,320	2,470	781	366	594	594
11	.....	.....	.....	.....	.....	.....	1,380	2,470	713	366	651	568
12	.....	.....	.....	.....	.....	.....	1,440	2,300	682	366	818	519
13	.....	.....	.....	.....	.....	.....	1,500	1,830	651	350	855	519
14	.....	.....	.....	.....	.....	.....	1,560	1,500	622	350	855	519
15	.....	.....	.....	.....	.....	.....	1,690	1,440	747	350	818	519
16	.....	.....	.....	.....	.....	.....	1,690	1,320	895	338	895	542
17	.....	.....	.....	.....	.....	.....	1,690	1,220	935	338	1,020	542
18	.....	.....	.....	.....	.....	.....	1,630	1,120	935	325	978	568
19	.....	.....	.....	.....	.....	.....	1,630	1,020	978	325	895	568
20	.....	.....	.....	.....	.....	.....	1,500	1,020	978	315	747	542
21	.....	.....	.....	.....	.....	.....	1,500	1,020	1,020	315	713	542
22	.....	.....	.....	.....	.....	.....	1,500	1,070	1,070	350	713	542
23	.....	.....	.....	.....	.....	.....	1,500	1,070	978	366	682	542
24	.....	.....	.....	.....	.....	.....	1,500	1,120	895	382	651	542
25	.....	.....	.....	.....	.....	.....	1,500	1,120	781	399	622	519
26	.....	.....	.....	.....	.....	.....	1,500	1,120	682	382	622	519
27	.....	.....	.....	.....	.....	.....	1,500	1,270	594	350	622	519
28	.....	.....	.....	.....	.....	.....	1,560	1,440	542	350	594	519
29	.....	.....	.....	.....	.....	.....	1,560	1,440	519	338	594	496
30	.....	.....	.....	.....	.....	.....	1,560	1,440	496	338	622	496
31	.....	.....	.....	.....	.....	.....	.....	1,380	.....	325	651	.....
1912–13.												
1	496	475	.....	.....	.....	.....	.....	2,820	1,900	542	935	651
2	475	454	.....	.....	.....	.....	.....	2,470	2,060	519	935	622
3	475	435	.....	.....	.....	.....	.....	2,060	1,980	594	855	682
4	475	416	.....	.....	.....	.....	.....	1,830	1,900	978	818	747
5	454	416	.....	.....	.....	.....	.....	1,560	1,760	1,220	747	713
6	435	399	.....	.....	.....	.....	.....	1,440	2,470	1,500	713	682
7	435	399	.....	.....	.....	.....	.....	1,320	2,820	1,830	651	651
8	416	399	.....	.....	.....	.....	.....	1,170	3,000	2,140	622	622
9	416	399	.....	.....	.....	.....	.....	1,070	3,000	2,470	622	594
10	416	399	.....	.....	.....	.....	.....	978	2,820	2,820	568	594
11	399	399	.....	.....	.....	.....	.....	895	2,640	3,000	542	594
12	435	382	.....	.....	.....	.....	.....	855	2,300	3,190	519	568
13	519	382	.....	.....	.....	.....	1,630	781	1,980	3,000	496	542
14	568	382	.....	.....	.....	.....	1,760	747	1,760	2,640	496	542
15	622	382	.....	.....	.....	.....	2,140	747	1,630	2,470	496	519

Daily discharge, in second-feet, of Chippewa River at Bishop's bridge, near Winter, Wis., for the years ending Sept. 30, 1912–1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
16	651	382	.....	.....	.....	.....	2,300	818	1,560	2,300	542	496
17	651	366	.....	.....	.....	.....	3,380	935	1,320	2,060	594	496
18	651	366	.....	.....	.....	.....	4,160	1,020	1,070	1,900	781	475
19	622	366	.....	.....	.....	.....	4,160	1,120	987	1,760	935	454
20	622	366	.....	.....	.....	.....	4,160	1,320	935	1,560	935	622
21	594	366	.....	.....	.....	.....	4,160	1,630	1,020	1,440	978	651
22	568	366	.....	.....	.....	.....	4,570	1,830	978	1,320	1,020	651
23	542	366	.....	.....	.....	.....	4,570	1,900	978	1,220	1,070	682
24	542	350	.....	.....	.....	.....	4,570	2,060	895	1,070	1,070	713
25	519	350	.....	.....	.....	.....	4,360	2,060	682	978	1,020	781
26	519	366	.....	.....	.....	.....	4,160	1,980	682	1,070	1,020	855
27	519	399	.....	.....	.....	.....	3,960	1,830	682	978	978	935
28	496	[a] 380	.....	.....	.....	.....	3,760	1,760	651	1,020	895	935
29	496	[a] 380	.....	.....	.....	.....	3,380	1,690	568	1,070	855	935
30	496	[a] 380	.....	.....	.....	.....	3,380	1,630	542	1,020	747	935
31	496	.....	.....	.....	.....	.....	.....	1,760	.....	1,020	713	.....
1913–14.												
1	935	978	1,070	.....	.....	.....	.....	3,000	1,220	2,060	855	781
2	935	935	1,070	.....	.....	.....	.....	3,190	1,120	2,140	781	895
3	895	935	1,070	.....	.....	.....	.....	3,280	1,170	1,980	713	935
4	895	895	1,020	.....	.....	.....	.....	3,280	1,170	1,900	651	935
5	935	855	1,020	.....	.....	.....	.....	3,190	1,120	1,760	594	935
6	1,020	855	978	.....	.....	.....	.....	2,820	1,120	1,630	568	978
7	1,070	818	895	.....	.....	.....	.....	2,640	1,170	1,440	519	935
8	1,120	855	855	.....	.....	.....	.....	2,300	1,120	1,270	496	895
9	1,170	935	781	.....	.....	.....	.....	2,140	1,070	1,170	496	855
10	1,170	978	747	.....	.....	.....	.....	1,980	1,020	1,020	519	855
11	1,170	1,070	747	.....	.....	.....	454	1,830	935	935	519	855
12	1,120	1,120	781	.....	.....	.....	416	1,690	855	935	542	818
13	1,020	1,070	781	.....	.....	.....	435	1,690	781	978	568	895
14	1,020	1,020	713	.....	.....	.....	454	1,560	713	1,020	682	978
15	978	978	682	.....	.....	.....	519	1,440	713	1,020	747	1,020
16	935	895	651	.....	.....	.....	542	1,320	651	1,070	781	1,070
17	855	855	622	.....	.....	.....	682	1,170	594	1,020	818	1,220
18	855	818	594	.....	.....	.....	855	1,120	594	1,020	895	1,270
19	818	818	594	.....	.....	.....	1,120	1,020	622	1,020	935	1,320
20	781	855	568	.....	.....	.....	1,220	978	651	978	895	1,380
21	713	855	.....	.....	.....	.....	1,320	1,020	594	935	895	1,320
22	713	895	.....	.....	.....	.....	1,380	1,020	594	935	855	1,760
23	682	978	.....	.....	.....	.....	1,440	1,070	594	935	1,170	1,830
24	682	1,070	.....	.....	.....	.....	1,560	1,120	1,020	1,020	1,020	1,900
25	747	1,070	.....	.....	.....	.....	1,760	1,170	1,220	1,070	935	1,830
26	781	1,070	.....	.....	.....	.....	1,830	1,220	1,320	1,120	895	1,760
27	855	1,120	.....	.....	.....	.....	1,980	1,170	1,690	1,120	855	1,690
28	895	1,120	.....	.....	.....	.....	2,470	1,170	1,760	1,070	818	1,630
29	935	1,120	.....	.....	.....	.....	2,820	1,440	1,830	1,020	781	1,500
30	978	1,120	.....	.....	.....	.....	3,000	1,440	1,900	978	747	1,380
31	1,020	.....	.....	.....	.....	.....	.....	1,320	.....	935	713	.....

[a] Estimated on account of ice.

NOTE.—Daily discharge computed from a rating curve well defined between 350 and 2,140 second-feet (gage heights 4.4 and 6.5 feet). Daily discharge, Apr. 29 to May 12, 1914, estimated on account of backwater from log jam.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records as follows: Dec. 21–31, 1913, 530 second-feet; Jan. 1–10, 1914, 507 second-feet; Jan. 11–20, 399 second-feet; Jan. 21–31, 353 second-feet; Feb. 1–10, 280 second-feet; Feb. 11–20, 238 second-feet; Feb. 21–28, 240 second-feet; Mar. 1–10, 245 second-feet; Mar. 11–20, 265 second-feet; Mar. 21–31, 329 second-feet and Apr. 1–10, 1914, 406 second-feet.

Monthly discharge of Chippewa River at Bishops bridge, near Winter, Wis., for the year ending Sept. 30, 1912–1914.

[Drainage area, 775 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1911–12.						
April 8–30	1,690	1,120	1,500	1.94	1.66	A.
May	2,820	1,020	1,690	2.18	2.51	B.
June	1,380	496	882	1.14	1.27	A.
July	454	315	363	.468	.54	A.
August	1,020	305	619	.799	.92	B.
September	713	496	574	.741	.83	B.
1912–13.						
October	651	399	517	.667	.77	B.
November			389	.502	.56	B.
December						
January						
February						
March						
April 13–30	4,570	1,630	3,590	4.63	3.10	C.
May	2,820	747	1,490	1.92	2.21	A.
June	3,000	542	1,590	2.05	2.29	A.
July	3,190	519	1,640	2.12	2.44	A.
August	1,070	496	780	1.01	1.16	B.
September	935	454	665	.858	.96	B.
1913–14.						
October	1,170	682	926	1.19	1.37	A.
November	1,120	818	965	1.25	1.40	A.
December			712	.919	1.06	
January			418	.539	.62	
February			254	.328	.34	
March			281	.363	.42	
April	3,000		1,010	1.30	1.45	C.
May	3,280	978	1,770	2.28	2.63	C.
June	1,900	594	1,030	1.33	1.48	B.
July	2,140	935	1,210	1.56	1.80	A.
August	1,170	496	750	.968	1.12	B.
September	1,900	781	1,210	1.56	1.74	A.
The year	3,280		881	1.14	15.43	

CHIPPEWA RIVER NEAR BRUCE, WIS.

Location.—At the Minneapolis, St. Paul & Sault Ste. Marie Railroad bridge 1 mile east of Bruce, Wis. Thornapple River enters from the right immediately above the station and Flambeau River from the right about 21 miles below.

Records available.—December 31, 1913, to September 30, 1914.

Drainage area.—1,380 square miles.

Gage.—Chain gage attached to downstream side of Minneapolis, St. Paul & Sault Ste. Marie Railroad bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.0 feet, half-tenths between 3.0 and 4.0 feet, and tenths above 4.0 feet.

Channel and control.—Bed of river hard sand, free from vegetation; probably shifts only in high water.

Discharge measurements.—Made from downstream side of bridge to which gage is attached.

Winter flow.—Determined from measurements made through the ice.

Regulation.—Practically none; no large power plants above station, and at present no logging operation of sufficient magnitude to affect flow of river at this point.

Accuracy.—Records excellent.

Discharge measurements of Chippewa River near Bruce, 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.*
Dec. 31	H. C. Beckman	2.48	[a] 597	Apr. 21	M. F. Rather	4.90	3,620
Jan. 29	do	2.75	[a] 549	May 5	do	6.97	5,820
Mar. 5	O. A. Steller	2.73	[a] 405	June 9	do	3.41	2,170
Apr. 11	G. H. Canfield	2.21	[b] 1,050	Sept. 15	do	5.06	3,600

[a] Measurement made under complete ice cover.
[b] River clear of ice.

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

[H. C. Gardner, observer.]

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	2.48	2.68	2.75	3.85	8.8	3.5	5.8	2.76	2.78
2	.....	.....	.....	2.48	2.68	2.75	3.95	7.8	3.25	5.6	2.58	2.99
3	.....	.....	.....	2.48	2.68	2.78	3.85	7.1	3.3	5.1	2.51	2.99
4	.....	.....	.....	2.50	2.60	2.78	3.55	7.0	5.0	4.7	2.32	2.96
5	.....	.....	.....	2.48	2.60	2.80	3.2	7.0	6.1	4.3	2.22	2.90
6	.....	.....	.....	2.48	2.60	2.80	2.82	6.6	5.1	3.8	2.14	2.85
7	.....	.....	.....	2.48	2.60	2.80	2.62	6.2	4.6	3.75	2.06	2.76
8	.....	.....	.....	2.52	2.62	2.82	2.45	5.8	4.0	3.5	2.01	2.69
9	.....	.....	.....	2.55	2.65	2.85	2.30	5.4	3.6	3.2	1.96	2.68
10	.....	.....	.....	2.52	2.65	2.85	2.26	5.0	3.3	3.0	1.98	2.68
11	.....	.....	.....	2.50	2.65	2.85	2.26	4.8	2.98	2.84	1.99	2.82
12	.....	.....	.....	2.48	2.65	2.85	2.25	4.5	2.72	2.79	1.94	2.90
13	.....	.....	.....	2.40	2.65	2.88	2.45	4.2	2.62	3.75	1.99	2.94
14	.....	.....	.....	2.40	2.65	2.92	2.70	4.0	2.42	4.0	2.10	3.8
15	.....	.....	.....	2.45	2.65	2.98	3.05	3.75	2.64	3.55	2.15	5.0
16	.....	.....	.....	2.45	2.65	3.08	3.4	3.55	2.56	3.3	2.22	4.7
17	.....	.....	.....	2.48	2.65	3.18	3.65	3.35	2.35	3.1	2.32	4.3
18	.....	.....	.....	2.50	2.65	3.18	3.8	3.2	2.20	2.95	2.56	4.2
19	.....	.....	.....	2.55	2.65	3.08	4.2	3.05	2.34	3.05	2.82	4.0
20	.....	.....	.....	2.58	2.65	3.00	5.0	2.88	2.36	2.98	2.82	3.8
21	.....	.....	.....	2.52	2.65	2.95	5.0	3.05	2.30	2.82	2.82	3.65
22	.....	.....	.....	2.52	2.65	2.90	4.9	3.2	2.40	2.72	2.76	4.2
23	.....	.....	.....	2.52	2.68	2.88	4.7	3.3	3.45	2.85	3.1	5.2
24	.....	.....	.....	2.50	2.70	2.90	4.5	3.2	4.8	3.0	3.8	5.0
25	.....	.....	.....	2.48	2.70	3.05	5.3	3.2	6.7	2.94	3.45	4.7
26	.....	.....	.....	2.48	2.70	3.15	5.8	3.15	6.4	2.91	2.85	4.5
27	.....	.....	.....	2.52	2.70	3.15	6.0	3.1	7.4	2.95	2.66	4.2
28	.....	.....	.....	2.55	2.75	3.40	6.7	3.1	8.8	3.5	2.65	3.9
29	.....	.....	.....	2.75	.....	3.70	8.5	3.8	7.9	3.3	2.64	3.65
30	.....	.....	.....	2.72	.....	3.92	9.3	4.6	6.4	3.05	2.50	3.55
31	.....	.....	2.48	2.72	.....	4.10	.....	4.1	.....	2.92	2.46	.....

NOTE.—Discharge relation affected by ice about Dec. 31, 1913, to Apr. 5, 1914.

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

Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	8,000	2,210	4,530	1,530	1,550
2	.....	6,800	1,970	4,310	1,370	1,740
3	.....	6,000	2,020	3,760	1,300	1,740
4	.....	5,880	3,660	3,360	1,140	1,710
5	.....	5,880	4,860	2,970	1,060	1,660
6	1,580	5,420	3,760	2,500	1,000	1,610
7	1,400	4,970	3,260	2,450	935	1,530
8	1,250	4,530	2,680	2,210	898	1,470
9	1,120	4,090	2,300	1,920	862	1,460
10	1,090	3,660	2,020	1,740	876	1,460
11	1,090	3,460	1,730	1,600	883	1,580
12	1,080	3,160	1,490	1,560	848	1,660
13	1,250	2,880	1,400	2,450	883	1,690
14	1,480	2,680	1,230	2,680	965	2,500
15	1,790	2,450	1,420	2,260	1,000	3,660
16	2,120	2,260	1,340	2,020	1,060	3,360
17	2,350	2,070	1,170	1,840	1,140	2,970
18	2,500	1,920	1,040	1,700	1,350	2,880
19	2,880	1,790	1,160	1,790	1,580	2,680
20	3,660	1,640	1,180	1,730	1,580	2,500
21	3,660	1,790	1,120	1,580	1,580	2,350
22	3,560	1,920	1,210	1,490	1,530	2,880
23	3,360	2,020	2,160	1,610	1,840	3,870
24	3,160	1,920	3,460	1,740	2,500	3,660
25	3,980	1,920	5,540	1,690	2,160	3,360
26	4,530	1,880	5,190	1,660	1,610	3,160
27	4,750	1,840	6,340	1,700	1,440	2,880
28	5,540	1,840	8,000	2,210	1,430	2,590
29	7,640	2,500	6,920	2,020	1,420	2,350
30	8,600	3,260	5,190	1,790	1,300	2,260
31	.....	2,780	.....	1,670	1,260	.....

NOTE.—Daily discharge computed from a rating curve well defined between 890 and 5,880 second-feet (gage heights, 2.0 and 7.0 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 31, 1913, 597 second-feet; Jan. 1–10, 593 second-feet; Jan. 11–20, 577 second-feet; Jan. 21–31, 553 second-feet; Feb. 1–10, 472 second-feet; Feb. 11–20, 352 second-feet; Feb. 21–28, 358 second-feet; Mar. 1–10, 411 second-feet; Mar. 11–20, 554 second-feet; Mar. 21–31, 740 second-feet; and Apr. 1–5, 1914, 1,200 second-feet.

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

[Drainage area, 1,380 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	574	0.416	0.48	C.
February	.....	.....	397	.288	.30	C.
March	.....	.....	574	.416	.48	D.
April	8,600	1,080	2,710	1.96	2.19	B.
May	8,000	1,640	3,330	2.41	2.78	A.
June	8,000	1,040	2,900	2.10	2.34	A.
July	4,530	1,490	2,210	1.60	1.84	A.
August	2,500	848	1,300	.942	1.09	A.
September	3,870	1,460	2,360	1.71	1.91	A.

CHIPPEWA RIVER AT CHIPPEWA FALLS, WIS.

Location.—At the highway bridge at Chippewa Falls, Wis., 2,500 feet below the mouth of Duncan Creek coming in from the right.

Records available.[1]—June 22, 1888, to September 30, 1914. Chippewa Lumber & Boom Co. has kept a continuous record since 1889. Since 1904 the United States Weather Bureau has obtained gage heights during the flood season of each year. On June 1, 1906, the United States Geological Survey began making discharge measurements and obtained gage heights when no record was obtained by the Weather Bureau. The gage heights as they have been published have been obtained from the following sources: June 22, 1888, to November 21, 1899, from certified blue-print copies of gage heights as kept by the Chippewa Lumber & Boom Co., furnished by Fargo Engineering Co.; March to September, 1905, 1907, and 1908, United States Weather Bureau; April to July, 1909, Chippewa Lumber & Boom Co.; October 1 to December 31, 1911, United States Geological Survey; January to June, 1912, Chippewa Lumber & Boom Co.; March to July, 1912, United States Weather Bureau; December, 1912, Chippewa Valley Railway, Light & Power Co.; January 1, 1913, to September 30, 1914, United States Geological Survey.

Drainage area.—5,600 square miles.

Gage.—Friez water-stage recorder installed during January, 1914, fastened to the web between the two piers supporting first right-hand span and about 10 feet upstream from the former United States Weather Bureau gage; gage referred to the original datum. Prior to installation of this recording gage the readings were taken from a painted staff gage on the cylindrical pier at the right end of bridge. On August 19, 1913, the gage was found in error by the following amounts:

Point of gage.	Error.
Ft. *in.*	*Feet.*
27 3.1	+0.03
26 4.2	+ .03
16 10.2	+ .12
12 0	+ .15
7 1	+ .12
2 2	+ .12

Error has probably existed since the gage was painted on the pier, but the precise date can not be determined. It should be noted that any error in the gage on the pier enters into the gage heights of discharge measurements as well as the daily gage heights.

Channel and control.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—On December 6, 1896, the river reached a stage of 26.03 feet; on September 10, 1884, a stage of 26.94 feet, according to high-water marks on the door of the office of the Chippewa Lumber & Boom Co.

Winter flow.—Discharge relation at times affected by ice; flow during such periods determined by discharge measurements.

Regulation.—Some fluctuation is caused by the operation of a power plant about one-half mile above the gage. The greatest fluctuation is, however, caused by the operation of larger plants above, notably that of the Brunet Falls Manufacturing Co., at Cornell, Wis.

[1] Records from June 22, 1888, to September 30, 1899, published in Water-Supply Paper 355.

Accuracy.—Records for 1914 excellent; those for previous years, owing to fluctuations in stage, possible error in gage datum, and little supervision of gage readings, less accurate, but as the discharge relation is permanent, all records are probably good.

Cooperation.—The Wisconsin & Minnesota Light & Power Co. has assisted in the installation and maintenance of the recording gage installed during January, 1914. Note other cooperation under "Records available."

Discharge measurements of Chippewa River at Chippewa Falls, Wis., auring 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. 20	G. H. Canfield	0.99	[a] 2,340	May 6	M. F. Rather	5.54	15,500
Jan. 27	Hoyt and Steller	.85	[a] 2,040	June 7	Canfield and Rather	7.48	21,700
Mar. 15	G. H. Canfield	1.35	[b] 2,350	Sept. 7	H. C. Beckman	2.21	5,380
Apr. 22	W. G. Hoyt	4.91	12,700	8	.....do	2.01	4,710

[a] Measurement made at bridge section, partly from bridge and partly from ice; partial ice cover at the control.
[b] Measurement made under complete ice cover about 1 mile below gage.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the year ending Sept. 30, 1914.

[Friez recording gage.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.8	2.3	3.0	0.7	0.85	0.9	2.75	9.8	3.8	7.5	1.47	2.05
2	1.9	2.6	3.1	.8	.95	.95	2.8	8.7	3.0	6.3	1.5	2.4
3	1.7	2.4	2.7	.8	.9	.95	2.8	7.5	2.7	5.4	1.49	2.5
4	1.6	1.7	2.9	.8	.95	.85	2.8	6.7	6.0	4.9	1.05	2.55
5	1.6	1.6	2.3	.6	.95	.75	2.75	6.1	9.6	4.1	1.09	2.35
6	1.9	1.9	2.7	.85	.8	.8	2.45	5.6	8.8	3.5	1.05	2.6
7	2.2	1.9	2.6	.8	.85	1.0	2.2	5.4	7.5	3.1	.98	2.25
8	2.7	1.9	2.1	.8	.8	.75	2.1	4.9	6.2	2.6	.99	2.05
9	2.6	2.1	2.1	.75	1.1	.7	2.0	4.6	5.2	2.6	.90	1.9
10	2.3	2.1	1.3	.75	1.3	.75	1.65	4.3	3.9	2.25	.93	1.75
11	2.4	1.9	1.7	.8	1.3	.85	1.75	3.9	3.5	2.05	.89	1.8
12	2.6	1.9	1.6	.9	1.3	.85	1.75	3.8	2.65	2.35	.82	2.0
13	2.9	1.9	1.7	.85	1.0	.95	1.8	3.6	2.25	4.1	.92	2.1
14	2.6	1.9	1.4	.75	1.2	1.2	1.95	3.3	2.0	4.1	1.03	2.5
15	2.0	1.8	1.3	.6	.9	1.5	2.3	2.95	2.3	3.7	1.17	3.6
16	2.1	1.6	1.0	.7	.9	1.6	2.8	2.75	2.2	3.4	1.25	4.7
17	2.2	1.7	1.0	.75	1.1	1.6	3.1	2.6	2.15	3.2	1.39	4.9
18	1.7	1.7	.9	.55	1.2	1.4	3.7	2.45	1.75	2.3	1.50	4.5
19	1.7	1.6	.9	.6	.85	1.2	4.0	2.25	1.75	2.2	1.45	4.1
20	1.6	1.3	.8	.7	.85	1.0	5.0	1.95	1.65	2.1	2.0	3.6
21	1.6	1.6	.75	.8	.9	.9	4.8	2.15	1.95	1.75	2.0	3.4
22	1.7	2.1	.75	.85	.95	1.0	4.8	2.75	1.85	1.85	1.95	2.95
23	1.6	2.4	.9	.7	.95	.75	4.4	3.5	1.7	1.6	2.25	3.4
24	1.6	2.4	.9	.8	1.3	.85	4.1	3.5	2.4	1.55	3.7	4.0
25	1.5	2.5	.65	.7	1.2	.76	4.6	3.2	5.5	1.55	4.0	3.8
26	1.7	2.6	.75	.9	.8	.95	6.2	2.9	7.4	1.9	3.7	3.3
27	1.9	2.4	.9	.9	.65	1.09	6.5	2.9	8.3	1.8	3.1	3.2
28	2.7	2.2	.75	.8	.85	.85	7.2	3.0	10.0	1.6	2.6	3.0
29	2.6	2.2	.75	.9	.....	1.55	10.1	3.9	9.9	2.1	2.25	2.6
30	2.6	2.3	.6	.95	.....	2.6	10.7	5.0	8.8	1.85	2.1	2.25
31	2.4	.....	.75	.9	.....	2.8	.....	4.2	.....	1.7	2.05	.....

NOTE.—Discharge relation affected by ice about Dec. 1, 1913, to Mar. 22, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,200	5,480	.....	.....	.....	.....	6,700	30,400	9,720	21,800	3,400	4,830
2	4,450	6,280	.....	.....	.....	.....	6,840	26,300	7,400	17,600	3,470	5,740
3	3,950	5,740	.....	.....	.....	.....	6,840	21,800	6,560	14,700	3,450	6,010
4	3,710	3,950	.....	.....	.....	.....	6,840	19,000	16,600	13,100	2,440	6,140
5	3,710	3,710	.....	.....	.....	.....	6,700	16,900	29,700	10,600	2,530	5,610
6	4,450	4,450	.....	.....	.....	.....	5,880	15,300	26,700	8,850	2,440	6,280
7	5,220	4,450	.....	.....	.....	.....	5,220	14,700	21,800	7,690	2,300	5,350
8	6,560	4,450	.....	.....	.....	.....	4,960	13,100	17,300	6,280	2,320	4,830
9	6,280	4,960	.....	.....	.....	.....	4,700	12,200	14,000	6,280	2,1:0	4,450
10	5,480	4,960	.....	.....	.....	.....	3,830	11,200	10,000	5,350	2,190	4,080
11	5,740	4,450	.....	.....	.....	.....	4,080	10,000	8,850	4,830	2,110	4,200
12	6,280	4,450	.....	.....	.....	.....	4,080	9,720	6,420	5,610	1,980	4,700
13	7,120	4,450	.....	.....	.....	.....	4,200	9,140	5,350	10,600	2,170	4,960
14	6,280	4,450	.....	.....	.....	.....	4,580	8,270	4,700	10,000	2,400	6,010
15	4,700	4,200	.....	.....	.....	.....	5,480	7,260	5,480	9,430	2,700	9,140
16	4,960	3,710	.....	.....	.....	.....	6,840	6,700	5,220	8,560	2,880	12,500
17	5,220	3,950	.....	.....	.....	.....	7,690	6,280	5,090	7,980	3,210	13,100
18	3,950	3,950	.....	.....	.....	.....	9,430	5,880	4,080	5,480	3,470	11,800
19	3,950	3,710	.....	.....	.....	.....	10,300	5,350	4,080	5,220	3,350	10,600
20	3,710	3,000	.....	.....	.....	.....	13,400	4,580	3,830	4,960	4,700	9,140
21	3,710	3,710	.....	.....	.....	.....	12,800	5,090	4,580	4,080	4,700	8,560
22	3,950	4,960	.....	.....	.....	.....	12,800	6,700	4,320	4,320	4,580	7,260
23	3,710	5,740	.....	.....	.....	1,850	11,500	8,850	3,950	3,710	5,350	8,560
24	3,710	5,740	.....	.....	.....	2,040	10,600	8,850	5,740	3,590	9,430	10,300
25	3,470	6,010	.....	.....	.....	1,870	12,200	7,980	15,000	3,590	10,300	9,720
26	3,950	6,280	.....	.....	.....	2,240	17,300	7,120	21,500	4,450	9,430	8,270
27	4,450	5,740	.....	.....	.....	2,530	18,300	7,120	24,800	4,200	7,690	7,980
28	6,560	5,220	.....	.....	.....	2,040	20,800	7,400	31,200	3,710	6,280	7,400
29	6,280	5,220	.....	.....	.....	3,590	31,600	10,000	30,800	4,960	5,350	6,280
30	6,280	5,480	.....	.....	.....	6,280	33,900	13,400	26,700	4,320	4,960	5,350
31	5,740	.....	.....	.....	.....	6,840	.....	10,900	.....	3,950	4,830	.....

NOTE.—Daily discharge computed from a rating curve well defined between 1,940 and 23,700 second-feet (gage heights 0.8 and 8.0 feet).

Discharge estimated, because of ice, from gage heights, observer's notes discharge measurements, and climatic records, as follows: Dec. 1-10, 1913, 6,160 second-feet; Dec. 11-20, 2,800 second-feet; Dec. 21-31, 1913, 1,700 second-feet; Jan. 1-10, 1,690 second-feet; Jan. 11-20, 1,590 second-feet; Jan. 21-31, 1,850 second-feet; Feb. 1-10, 1,920 second-feet; Feb. 11-20, 1,580 second-feet; Feb. 21-28, 1,630 second-feet; Mar. 1-10, 1,700 second-feet; and Mar. 11-22, 1914, 1,680 second-feet.

Monthly discharge of Chippewa River at Chippewa Falls, Wis., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	7,120	3,470	4,890	B.
November	6,280	3,000	4,760	B.
December	.....	.....	3,490	C.
January	.....	.....	1,710	D.
February	.....	.....	1,720	D.
March	6,840	.....	2,140	C.
April	33,900	3,830	10,300	A.
May	30,400	4,580	11,200	A.
June	31,200	3,830	12,700	A.
July	21,800	3,590	7,430	A.
August	10,300	1,980	4,150	B.
September	13,100	4,080	7,300	A.
The year	33,900	.....	5,990	

WEST FORK OF CHIPPEWA RIVER AT LESSARDS, NEAR WINTER, WIS.

Location.—At Lessards, about 1 mile above mouth of East Fork, coming in from the right, and 8 miles by road northwest of the post office of Winter.

Records available.—December 22, 1911, to September 30, 1914.

Drainage area.—485 square miles.

Gage.—Metal staff attached to log boom on right bank of river, installed January 27, 1914; zero 3.75 feet below zero of wooden staff gage, maintained December 22, 1911, to January 27, 1914. Prior to January 27, 1914, the gage was read once daily to nearest half inch; after this date, once daily to nearest half-tenths of a foot. Limits of use: Half-tenths below 6.5 feet and tenths above 6.5 feet.

Channel and control.—Heavy gravel; not likely to shift.

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

Regulation.—No dams used for storing water are now in operation above station.

Accuracy.—Records good except during the summer of 1914, when logs lodged on the control and caused backwater at the gage. Estimates of flow during this period based on three measurements made May 3, June 8, and September 16, 1914.

Cooperation.—Records December 22, 1911, to January 27, 1914, furnished through the courtesy of the Chippewa & Flambeau Improvement Co., which has also paid the gage reader to date.

Discharge measurements of West Fork of Chippewa River at Lessards, near Winter, Wis., during the years ending Sept. 30, 1912–1914.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1911–12.		*Feet.*	*Sec.-ft.*	1914.		*Feet.*	*Sec.-ft.*
Oct. 21	C. B. Stewart	5.92	[a] 700	Jan. 28	H. C. Beckman	5.53	[d] 191
Feb. 23	J. C. Cutler	5.67	[b] 127	Mar. 7	O. A. Steller	5.75	[e] 143
Apr. 19	do	6.04	782	May 3	M. F. Rather	6.84	[f] 1,310
July 8	C. B. Stewart	4.92	193	3	do	6.83	[f] 1,340
				June 8	do	6.10	[f] 719
1912–13.				Sept. 16	do	6.17	[f] 644
May 4	C. B. Stewart	6.23	1,040				
July 7	do	6.12	862				
1913–14.							
Dec. 5	Stewart and Hoyt	5.81	[c] 599				

[a] Velocity determined by means of rod floats.
[b] Complete ice cover.
[c] No ice; control clear.
[d] Complete ice cover at measuring section; partly open at control.
[e] Complete ice cover at control.
[f] Logs and brush on control.

NOTE.—Measurements from Oct. 21, 1911, to July 7, 1913, made for Chippewa & Flambeau Improvement Co. by and under direction of C. B. Stewart, consulting engineer, Madison, Wis.

Daily gage height, in feet, of West Fork of Chippewa River at Lessards, near Winter, Wis., for the years ending Sept. 30, 1912–1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	.....	.....	.....	5.65	5.6	5.7	5.85	6.1	5.75	5.25	4.75	5.5
2	.....	.....	.....	5.65	5.6	5.7	5.65	6.0	5.75	5.15	4.85	5.5
3	.....	.....	.....	5.65	5.6	5.7	5.65	6.1	5.75	5.1	4.85	5.45
4	.....	.....	.....	5.65	5.6	5.7	5.65	6.1	5.75	5.1	4.9	5.4
5	.....	.....	.....	5.65	5.6	5.7	5.7	6.15	5.75	5.0	4.9	5.4
6	.....	.....	.....	5.65	5.6	5.7	5.7	6.15	5.9	5.0	5.0	5.5
7	.....	.....	.....	5.65	5.65	5.7	5.7	6.35	5.9	4.95	5.0	5.55
8	.....	.....	.....	5.65	5.65	5.7	5.7	6.6	5.9	4.95	5.1	5.55
9	.....	.....	.....	5.65	5.75	5.65	5.7	6.6	5.85	4.9	5.1	5.6
10	.....	.....	.....	5.65	5.75	5.65	5.75	6.6	5.85	4.9	5.1	5.65
11	.....	.....	.....	5.6	5.75	5.65	5.75	6.6	5.85	4.9	5.25	5.65
12	.....	.....	.....	5.6	5.75	5.7	6.0	6.6	5.85	4.9	5.35	5.65
13	.....	.....	.....	5.6	5.75	5.7	6.1	6.4	5.85	4.9	5.7	5.6
14	.....	.....	.....	5.6	5.7	5.7	6.1	6.25	5.85	4.9	5.7	5.55
15	.....	.....	.....	5.6	5.65	5.7	6.25	6.1	5.9	4.8	5.7	5.55
16	.....	.....	.....	5.6	5.65	5.7	6.25	6.1	5.9	4.8	5.7	5.4
17	.....	.....	.....	5.6	5.65	5.7	6.35	6.0	5.75	4.8	5.75	5.4
18	.....	.....	.....	5.6	5.65	5.7	6.1	6.0	5.75	4.8	5.75	5.4
19	.....	.....	.....	5.6	5.65	5.7	6.0	6.0	5.75	4.75	5.75	5.35
20	.....	.....	.....	5.6	5.7	5.7	6.0	6.0	5.75	4.75	5.75	5.35
21	.....	.....	.....	5.6	5.7	5.7	6.0	5.9	5.75	4.75	5.85	5.35
22	.....	.....	5.65	5.6	5.7	5.7	6.1	5.9	5.65	4.75	5.85	5.35
23	.....	.....	5.7	5.6	5.65	5.7	6.1	5.9	5.6	4.9	5.75	5.3
24	.....	.....	5.65	5.65	5.7	5.7	6.1	5.85	5.6	4.9	5.75	5.3
25	.....	.....	5.65	5.65	5.7	5.7	6.0	5.85	5.5	4.9	5.75	5.25
26	.....	.....	5.65	5.65	5.7	5.7	6.0	5.85	5.5	5.1	5.75	5.25
27	.....	.....	5.65	5.6	5.7	5.75	6.0	5.85	5.4	5.1	5.7	5.25
28	.....	.....	5.65	5.6	5.7	5.75	6.0	5.85	5.35	5.0	5.7	5.25
29	.....	.....	5.65	5.6	5.7	5.75	6.1	5.85	5.25	4.85	5.65	5.25
30	.....	.....	5.65	5.6	.....	5.75	6.1	5.85	5.25	4.85	5.6	5.25
31	.....	.....	5.65	5.6	.....	5.75	.....	5.75	.....	4.75	5.6	.....
1912–13.												
1	5.2	5.0	5.2	5.6	5.55	5.7	6.15	6.35	6.35	5.7	5.9	5.8
2	5.2	5.0	5.2	5.6	5.55	5.7	6.15	6.25	6.35	5.7	5.9	5.8
3	5.2	5.0	5.2	5.6	5.6	5.7	6.2	6.25	6.35	5.85	5.9	5.8
4	5.2	5.0	5.2	5.6	5.6	5.75	6.2	6.25	6.4	6.0	5.9	5.8
5	5.2	5.0	5.25	5.6	5.6	5.75	6.15	6.25	6.4	6.1	5.85	5.8
6	5.2	5.05	5.15	5.6	5.6	5.75	6.15	6.15	6.6	6.1	5.85	5.8
7	5.2	5.05	5.1	5.6	5.6	5.7	6.15	6.1	6.6	6.15	5.75	5.75
8	5.15	5.05	5.1	5.6	5.6	5.7	6.15	6.0	6.6	6.15	5.75	5.65
9	5.15	5.1	5.25	5.6	5.6	5.7	6.15	6.0	6.8	6.25	5.75	5.65
10	5.15	5.15	5.35	5.6	5.6	5.7	6.15	5.9	6.8	6.25	5.65	5.65
11	5.15	5.1	5.4	5.5	5.6	5.7	6.2	5.85	6.8	6.35	5.55	5.7
12	5.15	5.1	5.6	5.5	5.6	5.75	6.2	5.85	6.6	6.35	5.55	5.6
13	5.15	5.05	5.6	5.5	5.6	5.75	6.25	5.75	6.6	6.35	5.55	5.6
14	5.15	5.05	5.5	5.5	5.55	5.75	6.3	5.65	6.6	6.35	5.45	5.6
15	5.15	5.05	5.5	5.5	5.55	5.75	6.35	5.65	6.6	6.25	5.4	5.6
16	5.2	5.1	5.4	5.4	5.6	5.75	6.4	5.6	6.5	6.25	5.3	5.55
17	5.2	5.15	5.35	5.5	5.6	5.75	6.45	5.6	6.5	6.25	5.3	5.55
18	5.2	5.15	5.35	5.5	5.6	5.85	6.6	5.6	6.4	6.35	5.3	5.55
19	5.2	5.15	5.35	5.5	5.6	5.85	6.6	5.65	6.35	6.35	5.4	5.45
20	5.2	5.15	5.4	5.5	5.6	5.85	6.7	5.75	6.25	6.35	5.5	5.45
21	5.2	5.15	5.45	5.5	5.65	5.85	6.8	5.85	6.15	6.25	5.55	5.45
22	5.2	5.15	5.5	5.5	5.65	5.85	6.8	5.9	6.15	6.15	5.65	5.45
23	5.2	5.15	5.55	5.5	5.65	5.85	6.8	6.05	6.1	6.1	5.85	5.45
24	5.25	5.15	5.6	5.5	5.7	5.75	6.8	6.1	6.0	6.1	6.05	5.4
25	5.25	5.2	5.6	5.5	5.7	5.75	6.8	6.1	5.9	6.0	6.0	5.5
26	5.25	5.25	5.6	5.5	5.7	5.85	6.8	6.15	5.85	6.0	5.95	5.55
27	5.25	5.25	5.6	5.5	5.7	5.85	6.6	6.15	5.75	6.0	5.95	5.6
28	5.25	5.25	5.6	5.5	5.7	5.9	6.6	6.25	5.65	6.0	5.9	5.65
29	5.25	5.2	5.6	5.5	.....	5.95	6.5	6.25	5.6	6.0	5.85	5.75
30	5.25	5.0	5.6	5.5	.....	6.0	6.4	6.25	5.6	5.95	5.85	5.75
31	5.2	.....	5.6	5.5	.....	.....	.....	6.35	.....	5.85	5.8	.....
1913–14.												
1	5.75	5.75	5.75	5.5	.....	5.8	.....	6.8	6.1	6.6	5.9	6.0
2	5.75	5.75	5.75	5.5	.....	5.7	5.2	6.8	6.1	6.6	5.85	6.0
3	5.75	5.75	5.8	5.4	.....	5.7	5.2	6.8	6.1	6.5	5.85	6.1
4	5.75	5.75	5.8	5.4	6.7	5.7	5.25	6.8	6.1	6.45	5.85	6.1
5	5.75	5.75	5.85	5.35	6.7	5.7	5.25	6.8	6.15	6.45	5.85	6.1

Daily gage height, in feet, of West Fork of Chippewa River at Lessards, near Winter, Wis., for the years ending Sept. 30, 1912–1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
6	5.75	5.75	5.65	5.35	6.7	5.7	5.25	6.8	6.15	6.45	5.85	6.1
7	5.65	5.75	5.65	5.4	5.8	5.7	5.25	6.8	6.15	6.35	5.7	6.1
8	5.65	5.75	5.65	5.4	5.8	5.75	5.25	6.8	6.1	6.3	5.7	6.1
9	5.75	5.75	5.65	5.4	5.5	5.75	5.3	6.7	6.15	6.2	5.7	6.1
10	5.75	5.75	5.65	5.4	5.65	5.75	5.3	6.7	6.25	6.2	5.7	6.1
11	5.75	5.75	5.65	5.5	5.6	5.75	5.3	6.7	6.0	6.3	5.7	6.0
12	5.75	5.75	5.65	5.35	5.65	5.75	5.3	6.6	5.9	6.3	5.65	6.0
13	5.65	5.75	5.65	5.35	5.65	5.8	5.3	6.6	5.8	6.2	5.65	6.1
14	5.65	5.75	5.5	5.35	5.6	5.85	5.3	6.3	5.75	6.2	5.6	6.1
15	5.65	5.75	5.5	5.35	5.7	5.85	5.4	6.25	5.75	6.2	5.6	6.1
16	5.6	5.75	5.5	5.35	5.65	5.85	5.4	6.25	5.7	6.2	5.6	6.15
17	5.55	5.75	5.5	5.4	5.6	5.85	5.45	6.25	5.7	6.2	5.6	6.2
18	5.6	5.75	5.4	5.4	5.65	5.9	5.5	6.2	5.65	6.2	5.65	6.2
19	5.65	5.65	5.4	5.4	5.7	5.9	5.6	6.2	5.7	6.15	5.7	6.2
20	5.65	5.65	5.4	5.4	.....	5.8	5.6	6.1	5.65	6.15	5.8	6.2
21	5.65	5.65	5.4	5.35	5.65	5.8	5.65	5.9	5.6	6.15	5.8	6.3
22	5.5	5.65	5.4	5.35	5.65	5.5	5.6	5.9	5.65	6.15	5.8	6.3
23	5.5	5.65	6.0	5.35	5.6	5.5	5.8	5.9	5.7	6.15	5.8	6.3
24	5.5	5.65	5.75	5.4	5.7	5.4	5.9	5.95	5.75	6.15	5.8	6.3
25	5.5	5.75	5.85	5.5	5.7	5.4	5.95	6.0	5.75	6.15	5.8	6.3
26	5.5	5.75	5.4	5.5	5.7	5.5	6.0	6.1	5.85	6.15	5.8	6.3
27	5.6	5.75	5.6	5.6	5.7	5.5	6.2	6.0	6.2	6.1	5.85	6.3
28	5.65	5.7	5.75	5.55	5.8	5.5	6.4	6.0	6.3	6.1	5.85	6.3
29	5.75	5.7	5.5	5.6	.....	5.3	6.7	6.1	6.5	6.1	5.85	6.3
30	5.75	5.75	5.65	.....	.....	5.3	6.8	6.1	6.5	6.1	6.1	6.3
31	5.75	.....	5.4	.....	.....	5.3	.....	6.1	.....	6.0	6.0	.....

NOTE.—Discharge relation probably affected by ice Dec. 22, 1911, to Mar. 31, 1912, Jan. 1 to Mar. 31, 1913, and Dec. 23, 1913, to Apr. 5, 1914.

Daily discharge, in second-feet, of West Fork of Chippewa River at Lessards, near Winter, Wis., for the years ending Sept. 30, 1912–1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	.....	.....	.....	.....	.....	.....	632	840	562	300	156	415
2	.....	.....	.....	.....	.....	.....	500	750	562	262	178	415
3	.....	.....	.....	.....	.....	.....	500	840	562	245	178	390
4	.....	.....	.....	.....	.....	.....	500	840	562	245	190	365
5	.....	.....	.....	.....	.....	.....	530	892	562	215	190	365
6	.....	.....	.....	.....	.....	.....	530	892	670	215	215	415
7	.....	.....	.....	.....	.....	.....	530	1,140	670	202	215	442
8	.....	.....	.....	.....	.....	.....	530	1,580	670	202	245	442
9	.....	.....	.....	.....	.....	.....	530	1,580	632	190	245	470
10	.....	.....	.....	.....	.....	.....	562	1,580	632	190	245	500
11	.....	.....	.....	.....	.....	.....	562	1,580	632	190	300	500
12	.....	.....	.....	.....	.....	.....	750	1,580	632	190	342	500
13	.....	.....	.....	.....	.....	.....	840	1,220	632	190	530	470
14	.....	.....	.....	.....	.....	.....	840	1,010	632	190	530	442
15	.....	.....	.....	.....	.....	.....	1,010	840	670	167	530	442
16	.....	.....	.....	.....	.....	.....	1,010	840	670	167	530	365
17	.....	.....	.....	.....	.....	.....	1,140	750	562	167	562	365
18	.....	.....	.....	.....	.....	.....	840	750	562	167	562	365
19	.....	.....	.....	.....	.....	.....	750	750	562	156	562	342
20	.....	.....	.....	.....	.....	.....	750	750	562	156	562	342
21	.....	.....	.....	.....	.....	.....	750	670	562	156	632	342
22	.....	.....	.....	.....	.....	.....	840	670	500	156	632	342
23	.....	.....	.....	.....	.....	.....	840	670	470	190	562	320
24	.....	.....	.....	.....	.....	.....	840	632	470	190	562	320
25	.....	.....	.....	.....	.....	.....	750	632	415	190	562	300
26	.....	.....	.....	.....	.....	.....	750	632	415	245	562	300
27	.....	.....	.....	.....	.....	.....	750	632	365	245	530	300
28	.....	.....	.....	.....	.....	.....	750	632	342	215	530	300
29	.....	.....	.....	.....	.....	.....	840	632	300	178	500	300
30	.....	.....	.....	.....	.....	.....	840	632	300	178	470	300
31	.....	.....	.....	.....	.....	.....	.....	562	.....	156	470	.....

Daily discharge, in second-feet, of West Fork of Chippewa River at Lessards, near Winter, Wis., for the years ending Sept. 30, 1912–1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	280	215	280	.....	.....	.....	892	1,140	1,140	530	670	595
2	280	215	280	.....	.....	.....	892	1,010	1,140	530	670	595
3	280	215	280	.....	.....	.....	945	1,010	1,140	632	670	595
4	280	215	280	.....	.....	.....	945	1,010	1,220	750	670	595
5	280	215	300	.....	.....	.....	892	1,010	1,220	840	632	595
6	280	230	262	.....	.....	.....	892	892	1,580	840	632	595
7	280	230	245	.....	.....	.....	892	840	1,580	892	562	562
8	262	230	245	.....	.....	.....	892	750	1,580	892	562	500
9	262	245	300	.....	.....	.....	892	750	1,960	1,010	562	500
10	262	262	342	.....	.....	.....	892	670	1,960	1,010	500	500
11	262	245	365	.....	.....	.....	945	632	1,960	1,140	442	530
12	262	245	470	.....	.....	.....	945	632	1,580	1,140	442	470
13	262	230	470	.....	.....	.....	1,010	562	1,580	1,140	442	470
14	262	230	415	.....	.....	.....	1,070	500	1,580	1,140	390	470
15	262	230	415	.....	.....	.....	1,140	500	1,580	1,010	365	470
16	280	245	365	.....	.....	.....	1,220	470	1,400	1,010	320	442
17	280	262	342	.....	.....	.....	1,310	470	1,400	1,010	320	442
18	280	262	342	.....	.....	.....	1,580	470	1,220	1,140	320	442
19	280	262	342	.....	.....	.....	1,580	500	1,140	1,140	365	390
20	280	262	365	.....	.....	.....	1,770	562	1,010	1,140	415	390
21	280	262	390	.....	.....	.....	1,960	632	892	1,010	442	390
22	280	262	415	.....	.....	.....	1,960	670	892	892	500	390
23	280	262	442	.....	.....	.....	1,960	795	840	840	632	390
24	300	262	470	.....	.....	.....	1,960	840	750	840	795	365
25	300	280	470	.....	.....	.....	1,960	840	670	750	750	415
26	300	300	470	.....	.....	.....	1,960	892	632	750	710	442
27	300	300	470	.....	.....	.....	1,580	892	562	750	710	470
28	300	300	470	.....	.....	.....	1,580	1,010	500	750	670	500
29	300	280	470	.....	.....	.....	1,400	1,010	470	750	632	562
30	300	215	470	.....	.....	.....	1,220	1,010	470	710	632	562
31	280	.....	470	.....	.....	.....	.....	1,140	.....	632	595	.....
1913–14.												
1	562	562	562	.....	.....	.....	.....	1,260	720	1,120	470	530
2	562	562	562	.....	.....	.....	.....	1,260	720	1,120	445	530
3	562	562	595	.....	.....	.....	.....	1,260	720	990	445	600
4	562	562	595	.....	.....	.....	.....	1,260	720	930	445	600
5	562	562	632	.....	.....	.....	.....	1,260	765	930	445	600
6	562	562	500	.....	.....	.....	300	1,260	765	930	445	600
7	500	562	500	.....	.....	.....	300	1,260	765	820	370	600
8	500	562	500	.....	.....	.....	300	1,260	720	770	370	600
9	562	562	500	.....	.....	.....	320	1,100	765	680	370	600
10	562	562	500	.....	.....	.....	320	1,100	865	680	370	600
11	562	562	500	.....	.....	.....	320	1,100	630	770	370	530
12	562	562	500	.....	.....	.....	320	960	560	770	345	530
13	500	562	500	.....	.....	.....	320	960	495	680	345	600
14	500	562	415	.....	.....	.....	320	920	468	680	320	600
15	500	562	415	.....	.....	.....	365	865	468	680	320	600
16	470	562	415	.....	.....	.....	365	865	440	680	320	640
17	442	562	415	.....	.....	.....	390	865	440	680	320	680
18	470	562	365	.....	.....	.....	415	810	412	680	345	680
19	500	500	365	.....	.....	.....	470	810	440	640	370	680
20	500	500	365	.....	.....	.....	470	720	412	640	420	680
21	500	500	365	.....	.....	.....	500	560	385	640	420	770
22	415	500	365	.....	.....	.....	470	560	412	640	420	770
23	415	500	.....	.....	.....	.....	595	560	440	640	420	770
24	415	500	.....	.....	.....	.....	670	595	468	640	420	770
25	415	562	.....	.....	.....	.....	710	630	468	640	420	770
26	415	562	.....	.....	.....	.....	750	720	528	640	420	770
27	470	562	.....	.....	.....	.....	760	630	810	600	445	770
28	500	530	.....	.....	.....	.....	760	630	920	600	445	770
29	562	530	.....	.....	.....	.....	1,100	720	1,180	600	445	770
30	562	562	.....	.....	.....	.....	1,260	720	1,180	600	600	770
31	562	.....	.....	.....	.....	.....	.....	720	.....	530	530	.....

NOTE.—Daily discharge Apr. 1, 1912, to Apr. 23, 1914, computed from a rating curve well defined between 190 and 1,220 second-feet (gage heights, 4.9 and 6.4 feet). Daily discharge, Apr. 27 to Sept. 30, 1914, estimated, on account of log jams, from discharge measurements made on May 3, June 8, and Sept. 16, 1914.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements and climatic records as follows: Dec. 23–31, 1913, 240 second feet; Jan. 1–31, 230 second-feet; Feb. 1–10, 174 second-feet; Feb. 11–20, 134 second-feet; Feb. 21–28, 135 second-feet; Mar. 1–10, 143 second-feet; Mar. 11–20, 173 second-feet; Mar. 21–31, 221 second-feet; and April 1–5, 1914, 270 second-feet.

Monthly discharge of West Fork of Chippewa River at Lessards, near Winter, Wis., for the years ending Sept. 30, 1912–1914.

[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.		
1911–12.						
April	1,140	500	726	1.50	1.67	A.
May	1,580	562	903	1.86	2.14	A.
June	670	300	545	1.12	1.25	B.
July	300	156	197	.406	.47	B.
August	632	156	422	.870	1.00	B.
September	500	300	383	.790	.88	B.
1912–13.						
October	300	262	280	.577	.67	B.
November	300	215	249	.513	.57	B.
December	470	245	378	.779	.90	C.
January						
February						
March						
April	1,960	892	1,300	2.68	2.99	B.
May	1,140	470	778	1.60	1.84	B.
June	1,960	470	1,190	2.45	2.73	B.
July	1,140	530	891	1.84	2.12	A.
August	795	320	549	1.13	1.30	A.
September	595	365	488	1.01	1.13	A.
1913–14.						
October	562	415	508	1.05	1.21	B.
November	562	500	547	1.13	1.26	A.
December	632		406	.837	.96	C.
January			230	.474	.55	C.
February			149	.307	.32	D.
March			180	.371	.43	C.
April	1,200		474	.977	1.09	C.
May	1,200	500	910	1.88	2.17	C.
June	1,180	385	636	1.31	1.46	C.
July	1,120	530	730	1.51	1.74	C.
August	600	320	408	.841	.97	C.
September	770	530	659	1.36	1 52	C.
The year	1,260		488	1.01	13.68	

FLAMBEAU RIVER NEAR BUTTERNUT, WIS.

Location.—About 6 miles east of Butternut, Wis., and 7 miles upstream from Park Falls, Wis.

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

Drainage area.—660 square miles.

Gage.—Vertical cast-iron staff gage attached to posts driven into the right bank of river; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.0 feet, half-tenths between 3.0 and 4.0 feet, and tenths above 4.0 feet.

Channel and control.—Head of Schultz Rapids about 1,700 feet below the gage is the control; probably permanent.

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

Winter flow.—Discharge relation affected by ice during the winter months.

Regulation.—Flow at station controlled by storage in reservoirs of the Chippewa & Flambeau Improvement Co, of which the one at Rest Lake is the largest.

Data insufficient for estimates of discharge.

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

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 30	H. C. Beckman	2.68	[a] 730
Sept. 17	M. F. Rather	3.68	1,210

[a] Measurement made from boat.

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

[Mathilda Schultz, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	2.62	3.15	11	.....	3.1	2.80	21	.....	3.2	3.5
2	.....	2.50	3.15	12	.....	3.1	2.82	22	.....	3.1	3.85
3	.....	2.38	3.1	13	.....	3.25	2.81	23	.....	3.25	3.7
4	.....	2.36	3.1	14	.....	3.25	3.0	24	.....	3.35	3.7
5	.....	2.36	3.1	15	.....	3.15	3.45	25	.....	3.3	3.6
6	.....	2.26	3.05	16	.....	3.3	3.5	26	.....	3.3	3.55
7	.....	2.26	3.05	17	.....	3.4	3.7	27	.....	3.35	3.45
8	.....	2.18	2.92	18	.....	3.45	3.7	28	.....	3.2	3.35
9	.....	2.10	2.86	19	.....	3.35	3.7	29	.....	3.15	3.3
10	.....	2.88	2.70	20	.....	3.2	3.6	30	2.71	2.99	3.1
								31	2.73	2.92	.....

FLAMBEAU RIVER NEAR LADYSMITH, WIS.

Location.—At H. J. Cornelissen's farm about 6 miles by road northeast of Ladysmith, 20 miles above the mouth of the river and 19 miles below the mouth of Dore Flambeau River, coming in from the right.

Records available.—January 2 to September 30, 1914.

Drainage area.—1,940 square miles.

Gage.—Chain, fastened to a cantilever arm supported by two trees on the left bank of the river on the farm of H. J. Cornelissen. Gage read daily, morning and afternoon, to quarter-tenths. Limits of use: Hundredths below 4.0 feet, half-tenths between 4.0 and 5.0 feet, and tenths above 5.0 feet.

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

Discharge measurements.—Made from a car and cable across the river about 200 feet below the gage.

Winter flow.—Discharge relation affected by ice; estimates of flow based on discharge measurements made through the ice.

Regulation.—The Chippewa & Flambeau Improvement Co. operates storage reservoirs on Rest Lake; also smaller reservoirs on Manitowish and Turtle rivers and Bear Creek. Weekly fluctuations at the gage, are caused by the operation of power plants at Park Falls and by the storage reservoirs; no daily fluctuation has been observed.

Accuracy.—Gage-height records reliable.

Data insufficient for estimates of discharge.

Discharge measurements of Flambeau River near Ladysmith, 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. 16	Hoyt and Canfield	5.0	[a] 836	Apr. 13	G. H. Canfield	5.18	[c] 1,350
16	do	5.0	[b] 752	July 13	H. C. Beckman	3.38	2,100
Mar. 10	O. A. Steller	4.56	[b] 594	Sept. 12	do	3.33	2,090

[a] Measurement made under complete ice cover about one-fourth mile below paper mill at Ladysmith.
[b] Measurement made under complete ice cover about 2 miles below gage.
[c] Measurement made at gage section under complete ice cover.

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

[H. J. Cornelissen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	5.2	4.5	5.4	6.9	3.90	5.6	2.80	3.32
2	5.3	5.4	4.9	5.4	6.2	3.58	5.2	2.61	3.51
3	5.6	4.8	4.7	5.5	6.1	3.35	5.1	2.61	3.70
4	5.6	5.4	4.85	5.5	5.6	4.2	4.8	2.59	3.68
5	5.2	5.2	4.85	5.4	5.3	4.15	4.4	2.40	3.55
6	5.2	5.2	4.8	5.4	5.2	4.35	4.3	2.32	3.46
7	5.0	4.9	4.9	5.2	4.8	4.0	4.2	2.35	3.38
8	5.5	5.0	4.8	5.2	4.85	3.90	3.44	2.41	3.29
9	5.5	5.4	5.0	5.0	4.85	3.62	3.22	2.29	3.18
10	5.3	4.7	4.6	5.0	4.9	3.40	3.11	2.34	3.05
11	5.3	5.0	4.3	4.90	4.7	3.16	2.99	2.39	3 16
12	5.0	5.1	5.0	4.75	4.65	2.90	2.96	2.72	3.30
13	4.7	4.95	5.1	5.0	4.65	2.78	3.42	2.95	3.42
14	5.3	5.0	4.7	4.9	4.5	2.68	3.65	3.00	3.51
15	5.0	4.8	5.0	5.4	4.4	2.60	3.76	3.09	3.90
16	4.9	5.0	5.2	5.5	4.5	2.70	3.74	3.18	4.4
17	5.0	4.6	4.85	4.75	4.5	2.46	3.63	3.22	4.45
18	5.3	4.75	5.0	3.85	4.5	2.50	3.38	3.30	4.7
19	5.4	5.0	5.0	4.5	4.2	2.56	3.28	3.16	4.65
20	5.3	4.9	5.2	4.3	4.7	2.70	3.15	3.72	4.25
21	4.85	4.6	5.0	4.4	4.35	2.60	3.04	3.70	4.15
22	5.4	4.85	4.8	4.5	4.4	2.44	2.94	3.50	4.05
23	5.1	5.0	4.75	4.0	3.55	2.54	2.86	3.56	4.4
24	5.1	4.4	4.5	3.95	3.46	3.44	2.81	3.86	4.4
25	5.0	4.8	4.95	4.7	3.48	5.0	3.29	4.05	4.3
26	5.2	5.1	4.9	4.85	3.38	5.4	2.95	3.89	4.05
27	5.2	4.75	4.8	5.3	3.22	5.7	3.22	3.78	3.89
28	5.0	5.0	4.9	6.3	3.20	6.0	3.08	3.69	3.72
29	5.4	.....	5.0	7.8	4.7	5.9	2.94	3.54	3.64
30	5.4	.....	5.2	7.6	4.4	5.7	2.82	3.48	3.40
31	5.4	.....	5.2	.....	4.05	.....	.....	3.34	.....

NOTE.—Discharge relation affected by ice about Jan. 2 to Apr. 17.

EAU CLAIRE RIVER NEAR AUGUSTA, WIS.

Location.—At Trouble Water bridge, about 7 miles northeast of Augusta. South Fork of Eau Claire River enters from the left about 4 miles above the station.

Records available.—July 16 to September 30, 1914.

Drainage area.—500 square miles.

Gage.—Standard gage on downstream side of Trouble Water bridge, read daily in the morning to quarter-tenths. Limits of use: Hundredths below 2.0 feet, half-tenths between 2.0 and 3.0 feet, and tenths above 3.0 feet.

Channel and control.—Channel consists of sand; control, rock and sand; probably shifting.

Discharge measurements.—Made from downstream side of bridge.

Data insufficient for estimates of discharge.

Discharge measurements of Eau Claire River near Augusta, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 16	H. C. Beckman	1.75	451
Sept. 19	M. F. Rather	3.20	1,000

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

[Albert Wagner, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	0.60	0.68	11	.....	0.50	1.65	21	0.85	0.90	1.90
2	.....	.60	.85	12	.....	.48	1.98	22	.80	.90	2.0
3	.....	.60	.85	13	.....	.45	1.80	23	.85	1.10	2.9
4	.....	.58	.75	14	.....	.45	2.3	24	.90	1.20	2.5
5	.....	.55	.78	15	.....	.40	4.8	25	.82	1.10	2.3
6	.....	.50	3.3	16	1.75	.45	6.1	26	.75	.90	1.95
7	.....	.50	3.1	17	1.50	.85	4.5	27	.70	.80	1.60
8	.....	.50	2.0	18	1.22	.90	4.2	28	.70	.75	1.40
9	.....	.50	1.50	19	1.08	1.10	3.2	29	.65	.68	1.28
10	.....	.50	1.30	20	.85	1.05	2.5	30	.65	.60	1.15
								31	.65	.55	.....

EAU CLAIRE RIVER AT EAU CLAIRE, WIS.

Location.—At footbridge at old dam located about 1 mile above the mouth of the river near the McDonough Manufacturing Co., Eau Claire, Wis.

Records available.—December 27, 1913, to July 17, 1914. (See Eau Claire River near Augusta.)

Drainage area.—873 square miles.

Gage.—Chain gage attached to downstream railing of footbridge; read daily, morning and evening, to half-tenths. Limits of use: Hundredths below 1.5 feet, half-tenths between 1.5 and 2.5 feet, and tenths above 2.5 feet.

Channel and control.—A rock outcrop about 600 feet below the gage forms the control.

Discharge measurements.—During low stages made from footbridge to which gage is attached; during medium and high stages from the Madison Street Bridge, one-half mile below gage.

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

Regulation.—None.

Accuracy.—During high water in Chippewa River there was apparently backwater at the gage; records for such periods only approximate.

Discharge measurements of Eau Claire River at Eau Claire, 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.*
Dec. 27	G. H. Canfield	1.27	[a] 198	Apr. 4	G. H. Canfield	1.75	1,260
Jan. 26	O. A. Steller	1.71	[a] 192	4	do	1.72	1,300
Mar. 3	do	1.25	[b] 146	21	W. G. Hoyt	2.16	1,360
10	G. H. Canfield	1.40	[b] 174	June 8	G. H. Canfield	4.52	5,880
17	do	1.89	[c] 985	July 16	H. C. Beckman	1.48	1,030

[a] Control partly frozen over. [b] Complete ice cover. [c] Ice nearly out.

Daily gage height, in feet, of Eau Claire River at Eau Claire, Wis., for the year ending Sept. 30, 1914.

[John McDonough, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	.....	1.7	1.20	2.9	4.6	1.7	2.8
2	.....	1.65	1.21	2.1	3.2	1.30	2.45
3	.....	1.7	1.26	2.0	2.3	1.28	2.1
4	.....	1.55	1.25	1.8	2.0	1.7	1.8
5	.....	1.48	1.35	1.7	1.6	3.4	1.40
6	.....	1.36	1.46	1.42	1.48	4.4	1.18
7	.....	.....	1.49	1.32	1.35	4.6	.98
8	.....	.....	1.45	1.20	1.22	.....	.88
9	.....	.....	1.39	1.12	1.18	4.6	.88
10	.....	.....	1.40	1.12	1.05	.....	.72
11	.....	.....	1.32	1.02	1.02	.....	.68
12	.....	.....	1.45	1.10	1.12	1.5	.75
13	.....	.....	1.52	1.12	1.40	1.32	.98
14	.....	.....	2.5	1.20	1.40	1.05	1.8
15	.....	.....	3.4	1.28	1.18	1.02	1.9
16	.....	.....	2.2	1.30	1.00	1.02	1.48
17	.....	.....	1.95	1.38	.88	.92	.....
18	.....	.....	1.8	1.45	.78	.78	.....
19	.....	.....	2.3	1.5	.72	.75	.....
20	.....	.....	1.45	1.9	.50	.68	.....
21	.....	.....	1.30	2.2	.65	.82	.....
22	.....	.....	1.05	2.0	.80	1.08	.....
23	.....	.....	.85	1.85	2.3	1.5	.....
24	.....	.....	.75	1.7	2.6	1.42	.....
25	.....	.....	.82	2.0	2.0	1.65	.....
26	1.75	.....	.72	3.6	1.65	1.9	.....
27	1.7	.....	.68	3.0	3.2	2.6	.....
28	.....	.....	.88	3.5	3.4	4.4	.....
29	.....	.....	1.6	3.4	3.0	5.0	.....
30	2.0	.....	2.9	4.8	2.7	3.8	.....
31	1.85	.....	3.3	.....	2.25	.....	.....

NOTE.—Discharge relation affected by ice about Jan. 1 to Mar. 25 and by backwater about Apr. 20 to May 5 and June 27 to July 2. See "Accuracy" in station description.

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

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	.....	2,990	.....	1,250	.....	16	.....	890	740	748	1,020
2	.....	1,770	.....	890	.....	17	.....	942	704	716	.....
3	.....	1,630	.....	878	1,770	18	.....	998	674	674	.....
4	.....	1,370	.....	1,250	1,370	19	.....	1,040	656	665	.....
5	.....	1,250	.....	3,830	955	20	.....	.....	610	646	.....
6	.....	972	1,020	5,660	820	21	.....	.....	640	686	.....
7	.....	903	922	6,040	734	22	.....	.....	680	772	.....
8	.....	830	842	6,040	704	23	.....	.....	2,050	1,040	.....
9	.....	790	820	6,040	704	24	.....	.....	2,510	972	.....
10	.....	790	760	4,370	656	25	.....	.....	1,630	1,200	.....
11	.....	748	748	2,710	646	26	.....	656	1,200	1,500	.....
12	.....	780	790	1,040	665	27	.....	646	3,490	.....	.....
13	.....	790	955	903	734	28	.....	704	3,830	.....	.....
14	.....	830	955	760	1,370	29	.....	1,140	3,150	.....	.....
15	.....	878	820	748	1,500	30	.....	2,990	2,670	.....	.....
						31	.....	3,660	1,980	.....	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 955 and 6,040 second-feet (gage heights, 1.4 and 4.6 feet). Mean discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatologic records, as follows: Jan. 1–15, 210 second feet; Jan. 16–31, 190 second-feet; Feb. 1–28, 175 second-feet; Mar. 1–15, 320 second-feet; and Mar. 16–25, 850 second-feet. Discharge Apr. 20 to May 5 and June 27 to July 2, estimated because of backwater, as follows: Apr. 20–30, 2,100 second-feet; May 1–5, 2,100 second-feet; June 27–30, 3,900 second-feet; and July 1–2, 2,280 second feet.

Monthly discharge of Eau Claire River at Eau Claire, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 873 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	200	0.229	0.26	C.
February	.....	.....	175	.200	.21	C.
March	.....	.....	745	.853	.98	C.
April	.....	748	1,480	1.70	1.90	C.
May	.....	610	1,500	1.72	1.98	D.
June	.....	646	2,250	2.58	2.88	C.
July 1-16	2,280	646	1,140	1.31	.78	C.

NOTE.—See footnote to table of daily discharge.

RED CEDAR RIVER NEAR COLFAX, WIS.

Location.—At a highway bridge about 5 miles north of Colfax, Wis. Hay River enters from the right about 11 miles below and Trout Creek, also from the right, 3½ miles above the station.

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

Drainage area.—1,100 square miles.

Gage.—Chain gage attached to the downstream side of bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Half-tenths below 1.0 foot, and tenths above 1.0 foot.

Channel and control.—Control is a rock ledge; permanent. During summer months discharge relation is affected by growth of grass.

Discharge measurements.—Made from downstream side of bridge to which gage is attached.

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

Regulation.—Storage reservoirs at headwaters control flow to some extent. Estimates of discharge in "Second-feet per square mile" and "Run-off, depth in inches on drainage area" should be used with caution.

Accuracy.—Rating curve well defined; records probably excellent except for period from July 26 to September 30 when discharge relation is believed to have been affected by backwater due to grass in channel; discharge for this period determined by applying corrections to the open-water rating curve.

Cooperation.—Gage reader at this station paid by the Wisconsin & Minnesota Light & Power Co.

Discharge measurements of Red Cedar River at Colfax, 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.*
Mar. 19	J. H. Canfield	2.45	[a]1,080	May 6	M. F. Rather	1.99	986
Apr. 6	Do	1.70	[b]816	June 5	do	4.90	4,300
Apr. 21	W. G. Hoyt	2.60	1,580	Aug. 14	S. B. Soulé	1.41	[c]597

[a] Very little ice in river. [b] Control clear of ice. [c] Grass growing in stream about 20 feet from each bank.

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

[Andrew Lundeguam, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.8	2.4	2.0	3.8	1.7	1.6
2	.....	2.2	2.0	1.8	3.0	1.6	1.7
3	.....	2.1	1.8	1.7	2.8	1.4	1.6
4	.....	2.2	2.1	4.0	2.7	1.5	1.4
5	.....	2.0	2.0	4.7	2.7	1.5	1.4
6	.....	1.8	1.9	4.1	2.2	1.5	1.4
7	.....	1.8	1.9	3.6	2.0	1.5	1.4
8	.....	1.7	1.9	3.1	2.1	1.4	1.5
9	.....	1.6	1.9	2.7	2.0	1.4	1.7
10	.....	1.6	1.8	3.0	1.6	1.4	1.8
11	.....	1.7	1.6	2.2	1.6	1.4	1.8
12	.....	1.6	1.5	2.0	1.8	1.4	1.6
13	.....	1.4	1.4	1.8	2.3	1.4	1.6
14	.....	1.6	1.4	1.8	2.6	1.4	1.9
15	.....	1.6	1.3	1.8	2.3	1.4	2.3
16	.....	1.6	1.3	1.8	2.6	1.4	1.4
17	.....	1.5	1.4	1.7	2.6	1.4	2.8
18	.....	1.5	1.2	1.6	2.3	1.5	2.5
19	2.4	2.1	1.3	1.6	2.3	1.5	2.1
20	2.0	2.6	1.2	1.6	1.8	1.4	2.2
21	2.0	2.5	1.4	1.6	1.6	1.4	2.1
22	1.8	2.3	1.4	1.6	1.6	1.4	2.6
23	1.6	2.2	1.4	2.0	1.6	1.9	2.8
24	1.8	2.0	1.4	2.6	1.8	1.8	2.7
25	1.8	2.2	1.3	2.7	1.8	1.7	1.9
26	1.9	[a] 1.5	1.4	3.0	1.6	1.6	1.8
27	1.9	2.2	1.5	4.4	1.5	1.5	1.7
28	1.9	2.4	1.6	4.8	1.5	1.4	1.8
29	2.4	2.8	2.4	4.7	1.6	1.4	1.6
30	2.9	2.8	1.8	3.8	1.6	1.4	1.8
31	3.3	.....	1.7	.....	1.8	1.4	.....

[a] Gage height evidently 1 foot too low.

NOTE.—Discharge relation affected by ice about Mar. 19–31, and by backwater caused by grass in channel about July 26 to Sept. 30.

Daily aischarge, in second-feet, of Red Cedar River near Colfax, Wis., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,760	1,370	1,010	2,880	760	670	16	760	630	870	1,560	600	600
2	1,190	1,010	870	1,980	710	710	17	710	670	810	1,560	600	1,560
3	1,100	870	810	1,760	630	670	18	710	600	730	1,280	630	1,280
4	1,190	1,100	3,120	1,660	670	600	19	1,100	630	760	1,280	630	930
5	1,010	1,010	4,030	1,660	670	600	20	1,560	600	760	870	600	1,010
6	870	930	3,250	1,190	630	600	21	1,460	670	760	760	600	930
7	870	930	2,640	1,010	630	600	22	1,280	670	760	760	600	1,370
8	810	930	2,090	1,100	600	630	23	1,190	670	1,010	760	810	1,560
9	760	930	1,660	1,010	600	710	24	1,010	670	1,560	870	760	1,460
10	760	870	1,980	760	600	760	25	1,190	630	1,660	870	710	810
11	810	760	1,190	760	600	760	26	1,460	670	1,980	710	670	760
12	760	710	1,010	870	600	670	27	1,190	710	3,640	670	630	710
13	670	670	870	1,280	600	670	28	1,370	760	4,170	670	600	760
14	760	670	870	1,560	600	810	29	1,760	1,370	4,030	710	600	670
15	760	630	870	1,280	600	1,100	30	1,760	870	2,880	710	600	760
							31	.....	810	.....	810	600	.....

NOTE.—Daily discharge computed from a rating curve well defined between 760 and 4,450 second-feet (gage heights, 1.6 and 5.0 feet).

Mean discharge Mar. 19–31 estimated, because of ice, from gage heights, observer's notes, discharge measurement and climatologic records, at 968 second-feet.

See "Accuracy" in station description.

Monthly discharge of Red Cedar River near Colfax, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 19–31	.....	.....	968	0.880	0.43	D.
April	1,760	670	1,090	.991	1.11	A.
May	1,370	600	807	.734	.85	B.
June	4,170	760	1,760	1.60	1.78	A.
July	2,880	670	1,150	1.05	1.21	B.
August	810	600	637	.579	.67	B
September	1,560	600	858	.780	.87	B.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

RED CEDAR RIVER AT CEDAR FALLS, WIS.

Location.—At the highway bridge in the vicinity of Cedar Falls, Wis., 4½ miles above the crossing of the Chicago, St. Paul, Minneapolis & Omaha Railway.

Records available.—April 1, 1909, to September 30, 1914.

Drainage area.—Not measured.

Gage.—Staff gage fastened to bridge pier; read daily, morning and evening, to tenths.

Channel and control.—Probably permanent.

Discharge measurements.—No discharge measurements have been made at this station. The station is maintained for the purpose of determining the fluctuation in stage.

Winter flow.—Winters are severe in this locality, but the discharge relation is apparently not greatly affected by ice, probably because of the rapids a short distance below the station which ordinarily do not entirely freeze over.

Regulation.—The operation of small storage reservoirs at the headwaters of the river, together with storage at the power plants above the gaging station, modifies the flow to such an extent that it can not be considered natural.

Cooperation.—Gage heights furnished by the Wisconsin & Minnesota Light & Power Co.

Daily gage height, in feet, of Red Cedar River at Cedar Falls, Wis., for the year ending Sept. 30, 1914.

[Albert Malhus, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.4	2.55	2.75	2.6	2.2	2.3	3.95	3.7	3.0	4.45	2.5	2.8
2	2.4	1.6	2.85	2.7	2.4	2.4	3.8	3.5	3.05	4.15	2.5	2.7
3	2.5	2.5	3.0	2.7	2.4	2.5	3.45	3.1	3.25	3.8	2.45	2.75
4	2.5	2.5	2.8	2.6	2.4	2.5	3.2	3.1	3.9	3.6	2.5	2.7
5	2.4	2.5	2.7	2.65	2.4	2.5	3.1	3.0	5.05	3.35	2.5	2.7
6	2.5	2.4	2.65	2.7	2.4	2.5	3.1	2.95	4.9	3.1	2.5	2.7
7	2.6	2.45	2.6	2.7	2.45	2.5	3.0	2.9	4.6	3.1	2.55	2.7
8	2.5	2.5	2.6	2.7	2.2	2.3	3.0	2.9	4.4	2.8	2.6	2.65
9	2.5	2.1	2.55	2.6	2.4	2.5	2.85	2.75	3.8	2.8	2.6	2.7
10	2.5	2.65	2.6	2.5	2.4	2.5	2.75	2.7	3.65	2.7	2.5	2.8
11	2.5	2.6	2.6	2.4	2.4	2.5	2.7	2.7	3.6	2.7	2.3	2.7
12	2.5	2.6	2.6	2.5	2.4	2.55	2.75	2.7	3.45	2.8	2.3	2.7
13	2.5	2.6	2.7	2.5	2.35	2.2	2.7	2.6	3.4	3.0	2.2	2.85
14	2.5	2.55	2.7	2.5	2.3	2.5	2.75	2.6	3.25	3.05	2.25	2.95
15	2.4	2.55	2.7	2.5	2.3	2.4	2.7	2.6	3.0	3.1	2.2	3.2
16	2.4	2.0	2.7	2.5	2.4	2.7	2.7	2.6	2.95	3.1	2.1	3.3
17	2.4	2.4	2.7	2.5	2.4	3.15	2.7	2.5	2.95	3.1	2.1	3.4
18	2.45	2.4	2.7	2.4	2.45	3.6	2.7	2.6	2.85	2.9	2.2	3.3
19	1.5	2.35	2.6	2.5	2.45	3.5	3.0	2.6	2.8	2.75	2.25	3.2
20	2.8	2.5	2.6	2.5	2.4	3.2	3.35	2.6	2.7	2.8	2.3	3.1
21	2.9	2.5	2.6	2.45	2.4	2.85	3.5	2.55	2.6	2.7	2.5	2.95
22	2.7	2.6	2.6	2.5	1.9	2.8	3.4	2.6	2.8	2.7	2.55	3.0
23	2.5	2.45	2.55	2.5	2.45	2.75	3.45	2.5	2.95	2.6	2.7	3.2
24	2.4	2.5	2.6	2.45	2.5	2.8	2.5	2.5	3.2	2.75	2.8	3.35
25	2.15	2.6	2.6	2.3	2.5	2.8	2.5	2.6	3.55	2.8	2.75	3.25
26	2.0	2.6	2.6	2.5	2.4	2.8	3.5	2.6	3.9	2.75	2.75	3.15
27	2.5	2.5	2.6	2.5	2.45	2.85	3.6	2.8	4.1	2.6	2.6	.....
28	2.4	2.6	2.2	2.5	2.5	3.0	3.6	3.25	5.75	2.6	2.65	.....
29	2.4	2.6	2.6	2.6	.....	3.3	3.55	3.3	5.35	2.55	2.7	.....
30	2.4	2.45	2.5	2.55	.....	3.8	3.7	3.25	4.85	2.6	2.6	.....
31	2.5	.....	2.6	2.5	.....	4.05	.....	3.1	.....	2.6	2.7	.....

RED CEDAR RIVER AT MENOMONIE, WIS.

Location.—About 900 feet below the power house of the Wisconsin & Minnesota Light & Power Co., about 13 miles above the confluence of Red Cedar and Chippewa rivers. Wilson Creek enters from the right into the service reservoir just above the station.

Records available.—June 16, 1907, to September 5, 1908; May 9, 1913, to September 30, 1914.

Drainage area.—1,810 square miles.

Gage.—From June 16, 1907, to September 5, 1908, the gage was attached to a highway bridge about 200 rods west of the Chicago & North Western Railway station west of Menomonie; on May 9, 1913, a Barrett & Lawrence recording gage was installed over wooden intake and well on right bank of river about 1 mile above site of old gage. Relation between datums of the two gages not determined.

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

Discharge measurements.—Made from the highway bridge to which the old gage was fastened.

Winter flow.—Formation of ice on the control is prevented by the flow of relatively warm water from the service reservoir immediately above the gage; winter records as accurate as those of summer.

Regulation.—Considerable diurnal fluctuation in stage at the gage section is caused by the operation of the power plants of the Wisconsin & Minnesota Light & Power Co. at Menomonie and Cedar Falls, and minor changes are also caused by smaller plants on the tributaries of the Red Cedar above Menomonie.

Floods.—The flow of the water is so well controlled by dams at Menomonie and Cedar Falls and by storage in the headwaters that the occurrence of floods is unlikely.

Accuracy.—Rating curve carefully developed; mean stage accurately determined from recording gage; records excellent.

Cooperation.—Recording gage installed and gage-height record furnished by the Wisconsin & Minnesota Light & Power Co.

Discharge measurements of Red Cedar River at Menomonie, Wis., 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.*
Jan. 24	Hoyt and Steller	2.24	689	Sept. 10	H. C. Beckman	2.72	1,300
Sept. 9	H. C. Beckman	2.71	1,250	10	do	2.74	1,330

[a] Gage heights refer to recording gage about 1 mile above the site of the old gage.

Daily gage height, in feet, of Red Cedar River at Menomonie, Wis., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.42	2.49	2.64	2.30	2.18	2.16	3.8	3.65	2.95	3.28	2.52	2.64
2	2.41	2.17	2.75	2.37	2.30	2.21	3.5	3.25	2.98	3.11	2.38	2.57
3	2.43	2.35	2.99	2.46	2.43	2.37	3.12	3.12	2.92	2.57	2.72	2.61
4	2.42	2.56	2.75	2.22	2.41	2.42	3.02	2.99	3.42	3.02	2.58	2.70
5	2.28	2.55	2.72	2.39	2.39	2.41	3.03	3.04	4.6	3.39	2.62	2.55
6	2.66	2.56	2.60	2.56	2.45	2.38	3.04	3.05	5.35	3.33	2.59	2.60
7	2.85	2.55	2.25	2.47	2.38	2.40	2.90	3.65	4.85	3.01	2.41	2.70
8	2.52	2.46	2.46	2.46	2.19	2.22	2.89	2.95	4.55	2.85	2.62	2.71
9	2.87	2.40	2.36	2.46	2.30	2.21	2.86	2.97	2.64	2.94	2.36	2.64
10	2.73	2.36	2.30	2.45	2.44	2.39	2.78	2.69	3.11	2.86	2.54	2.68
11	2.52	2.58	2.40	2.14	2.38	2.37	2.86	3.13	3.65	2.82	2.50	2.62
12	2.26	2.46	2.48	2.23	2.47	2.34	2.43	2.61	3.12	2.67	2.43	2.60
13	2.50	2.59	2.64	2.22	2.45	2.29	2.56	2.78	3.19	2.85	2.50	2.67
14	2.52	2.48	2.32	2.23	2.53	2.49	2.72	2.63	2.55	2.98	2.53	2.70
15	2.58	2.50	2.50	2.25	2.49	2.52	2.64	3.03	2.88	3.00	2.52	3.08
16	2.42	2.22	2.48	2.34	2.42	2.36	2.62	2.57	2.74	3.02	2.16	3.25
17	2.40	2.32	2.58	2.58	2.45	2.58	2.52	2.41	2.80	3.07	2.50	[a]3.30
18	2.34	2.24	2.39	2.39	2.45	2.38	2.62	2.62	2.74	3.13	2.37	[a]3.30
19	2.23	2.26	2.40	2.40	2.44	3.46	2.65	2.71	2.71	2.85	2.39	3.00
20	2.34	2.37	2.35	2.35	2.45	3.08	3.12	2.68	2.62	2.95	2.31	2.85
21	2.60	2.30	2.06	2.06	2.32	2.90	3.51	2.56	2.65	2.81	2.32	2.88
22	2.61	2.36	2.16	2.16	2.14	2.57	3.37	2.62	2.86	2.79	2.38	2.94
23	2.56	2.39	2.31	2.53	2.21	2.77	3.23	2.61	2.73	2.75	2.30	3.16
24	2.58	2.44	2.22	2.37	2.54	2.69	3.17	2.09	3.30	2.65	2.54	3.20
25	2.27	2.57	1.94	2.28	2.40	2.49	3.01	2.68	3.48	2.66	2.83	3.20
26	2.18	2.48	1.83	2.37	2.37	2.67	3.06	2.68	3.75	2.54	2.17	3.06
27	2.41	2.43	2.31	2.48	2.36	2.83	3.10	2.88	4.3	2.67	2.56	2.66
28	2.65	2.60	2.14	2.51	2.38	2.82	3.25	3.17	5.05	2.80	2.61	2.73
29	2.58	2.56	2.44	2.44	.....	3.27	3.30	3.20	4.5	2.70	2.60	2.74
30	2.54	2.56	2.58	2.36	.....	3.75	3.65	3.07	4.05	2.53	2.37	2.62
31	2.41	.....	2.38	2.43	.....	4.0	.....	3.09	.....	2.51	2.55	.....

[a] Gage height partly estimated.

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

Daily discharge, in second-feet, of Red Cedar River at Menomonie, Wis., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	916	1,010	1,210	770	626	602	3,070	2,790	1,660	2,160	1,050	1,210
2	903	614	1,360	854	770	662	2,520	2,110	1,700	1,900	866	1,110
3	929	830	1,720	968	929	854	1,910	1,910	1,610	1,110	1,320	1,160
4	916	1,100	1,360	674	903	916	1,760	1,720	a2,380	a1,760	1,120	1,290
5	756	1,080	1,320	878	878	903	1,780	1,790	4,750	2,330	1,180	1,080
6	1,280	1,100	1,150	1,100	955	866	1,790	1,800	6,700	2,240	1,140	1,150
7	1,500	1,080	710	981	866	890	1,580	1,800	5,340	1,740	903	1,290
8	1,050	968	968	968	638	674	1,560	1,660	4,640	1,500	1,180	1,300
9	1,540	890	842	968	770	662	1,520	1,680	1,210	1,640	842	1,210
10	1,340	842	770	955	942	878	1,400	1,280	1,900	1,520	1,070	1,260
11	1,050	1,120	894	578	866	854	1,520	1,920	2,790	1,460	1,020	1,180
12	722	968	994	686	981	818	929	1,160	1,910	1,250	929	1,150
13	1,020	1,140	1,210	674	955	758	1,100	1,400	2,020	1,500	1,020	1,250
14	1,050	994	794	686	1,060	1,010	1,320	1,190	1,080	a1,700	1,060	1,290
15	1,120	1,020	1,020	710	1,010	1,050	1,210	1,780	1,550	a1,730	1,050	1,850
16	916	1,670	994	818	916	842	1,180	1,110	1,350	1,760	602	2,110
17	890	794	1,120	1,120	955	1,120	1,050	903	1,430	1,840	1,020	2,190
18	818	698	878	878	955	866	1,180	1,180	1,350	1,920	854	2,190
19	686	722	890	890	942	2,450	1,220	1,300	1,300	1,500	878	1,730
20	818	854	830	830	955	1,850	1,910	1,260	1,180	1,660	782	1,500
21	1,150	770	486	486	794	1,580	2,540	1,100	1,220	1,440	794	1,550
22	1,160	842	602	602	578	1,110	2,300	1,180	1,520	1,420	866	1,640
23	1,100	878	782	1,060	662	1,390	2,080	1,160	1,330	1,360	770	1,970
24	1,120	942	674	854	1,070	1,280	1,980	519	2,190	1,220	1,070	2,030
25	734	1,110	354	746	890	1,010	1,740	1,260	2,490	1,230	1,480	2,030
26	626	994	420	854	854	1,250	1,820	1,260	2,980	1,070	614	1,820
27	903	929	600	994	842	1,480	1,880	1,550	4,070	1,250	1,100	1,230
28	1,220	1,150	578	1,030	866	1,460	2,110	1,980	5,860	1,430	1,160	1,330
29	1,120	1,100	942	942	.....	2,140	2,190	2,030	a4,520	1,290	1,150	1,350
30	1,070	1,100	1,120	842	.....	2,980	2,790	1,840	3,560	1,060	854	1,180
31	903	.....	866	929	.....	3,460	.....	1,860	.....	1,030	1,080	.....

a Estimated in part.

NOTE.—Daily discharge computed from a rating curve well defined between 530 and 7,730 second-feet (gage heights, 2.1 and 5.7 feet).

Monthly discharge of Red Cedar River at Menomonie, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 1,810 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,540	626	1,010	0.558	0.64	A.
November	1,670	614	977	.540	.60	A.
December	1,720	354	918	.507	.58	A.
January	1,120	486	849	.469	.54	A.
February	1,070	578	872	.482	.50	A.
March	3,460	602	1,250	.691	.80	A.
April	3,070	929	1,760	.972	1.08	A.
May	2,790	519	1,530	.845	.97	A.
June	6,700	1,080	2,590	1.43	1.60	A.
July	2,330	1,030	1,550	.856	.99	A.
August	1,480	602	994	.549	.63	A.
September	2,190	1,080	1,490	.823	.92	A.
The year	6,700	354	1,320	.729	9.85	

ZUMBRO RIVER AT ZUMBRO FALLS, MINN.

Location.—At the highway bridge at Zumbro Falls, about 8 miles below the mouth of South Branch.

Records available.—June 8, 1909, to September 30, 1914.

Drainage area.—1,120 square miles.

Gage.—Chain gage attached to bridge; read twice daily to hundredths. Limits of use: Hundredths below 5.0, half-tenths between 5.0 and 6.5, and tenths above 6.5 feet.

Channel and control.—Slightly shifting.

Discharge measurements.—Made from bridge.

Winter flow.—For a short time during and following extremely cold weather ice forms below gage and causes backwater. The river is, however, fed by springs in the vicinity of the gage and the warmer water gradually wears away the ice. Daily gage heights are recorded during the winter and from a close inspection of gage heights and temperature the necessary corrections can be made in the discharge.

Maximum flow.—The high water of June, 1908, which reached a stage of 26.7 feet above the datum of the gage, is marked by a spike in a telegraph pole near the railroad station at Zumbro Falls. The high water of April, 1888, reached a stage of approximately 29.7, as shown by a mark not so well defined as that of the 1908 flood.

Regulation.—The slight artificial regulation at the small power plants above Zumbro Falls is not observable at the gage.

Discharge measurements of Zumbro River at Zumbro Falls, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 16	4.81	[a] 161	Apr. 7	5.38	262
Feb. 20	4.84	[b] 138	Aug. 27	5.01	215

[a] Control clear; no ice.

[b] Small amount of ice at control.

Daily gage height, in feet, of Zumbro River at Zumbro Falls, Minn., for the year ending Sept. 30, 1914.

[A. H. Sugg, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.91	4.95	4.89	4.86	5.05	5.15	6.50	6.8	5.3	8.2	5.2	4.99
2	4.98	4.89	4.90	4.81	5.1	5.0	5.8	6.35	5.4	7.8	5.15	4.95
3	4.98	4.90	4.94	4.86	5.1	5.05	5.7	6.1	5.4	7.2	5.2	4.95
4	4.98	4.94	4.98	4.88	5.0	4.98	5.6	6.1	5.45	6.9	5.15	4.94
5	4.96	4.95	4.99	4.81	4.94	5.36	5.5	6.0	5.55	6.7	5.1	4.96
6	4.92	4.90	4.98	4.88	4.95	5.55	5.4	5.9	5.6	6.45	5.1	4.91
7	5.05	4.91	4.86	4.89	4.80	5.4	5.4	5.7	10.0	6.3	5.05	4.90
8	5.05	4.95	5.55	4.86	5.3	5.45	5.4	5.6	8.4	6.15	5.1	4.92
9	5.1	4.85	5.1	4.75	5.0	5.4	5.35	5.6	7.2	6.1	5.05	4.90
10	5.05	4.81	4.89	4.64	4.94	5.4	5.3	5.5	6.6	5.95	5.0	4.90
11	5.05	5.3	4.89	4.75	4.94	5.3	5.25	5.9	6.6	5.8	5.05	4.90
12	5.05	4.90	4.86	4.99	4.92	5.3	5.2	6.15	8.0	5.75	5.0	4.89
13	4.99	4.90	4.88	4.84	4.99	5.5	5.25	5.95	8.3	5.7	4.98	4.91
14	5.0	4.86	4.85	4.82	4.92	6.4	5.2	5.75	8.8	5.65	5.0	4.99
15	4.95	4.90	4.82	4.81	4.95	7.0	5.15	5.6	9.8	5.65	5.0	5.05
16	4.91	4.86	4.89	4.86	4.91	6.7	5.2	5.5	8.2	5.65	4.98	5.0
17	4.90	4.82	4.90	4.80	4.90	6.2	5.15	5.4	7.4	5.6	4.98	4.96
18	4.90	4.86	4.86	4.81	4.88	5.8	5.2	5.4	6.9	5.55	5.05	4.95
19	4.91	4.84	4.84	4.80	4.84	5.55	5.25	5.4	6.7	5.45	5.1	4.92
20	4.92	4.91	4.85	4.82	4.86	5.4	5.3	5.4	8.5	5.5	5.2	4.90
21	4.91	4.91	5.7	4.64	4.84	5.4	5.4	5.7	14.1	5.4	5.1	4.95
22	4.90	4.99	4.92	4.72	5.0	5.35	5.35	6.3	11.3	5.4	5.05	5.1
23	4.95	5.25	4.78	4.79	4.92	5.25	5.3	6.2	8.2	5.4	5.2	5.05
24	4.91	4.94	4.82	4.81	4.82	5.3	5.3	5.9	8.1	5.4	5.25	5.05
25	4.96	4.96	4.84	4.75	4.79	5.15	5.4	5.9	8.0	5.3	5.15	5.0
26	4.91	5.0	4.66	4.72	4.84	5.2	5.5	5.9	12.2	5.3	5.15	5.0
27	4.94	4.99	4.81	4.78	4.86	5.15	5.75	5.8	15.6	5.25	5.1	4.98
28	5.0	4.98	4.86	5.0	5.1	5.25	8.0	5.6	13.7	5.3	5.05	4.92
29	4.99	4.96	4.69	5.7	.....	6.3	8.6	5.55	10.0	5.2	5.05	4.92
30	4.99	4.95	4.85	5.2	.....	7.1	7.4	5.5	8.5	5.2	4.99	4.92
31	4.94	.....	4.86	5.2	.....	6.5	.....	5.4	.....	5.2	4.96	.....

NOTE.—Discharge relation probably affected by ice about Dec. 8-9, 21-22; Jan. 12-14, 28-31; and Feb. 1-28.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	174	182	170	166	.....	232	498	820	238	1,690	270	211
2	189	170	172	158	.....	193	403	620	267	1,450	255	201
3	189	172	180	166	.....	206	367	518	267	1,120	270	201
4	189	180	189	169	.....	189	332	518	282	970	255	199
5	185	182	191	158	.....	295	298	479	315	872	240	203
6	176	172	189	169	.....	360	267	441	332	756	240	191
7	206	174	166	170	.....	308	267	367	2,890	689	226	189
8	206	182	170	166	.....	325	267	332	1,810	624	240	194
9	218	164	170	150	.....	308	252	332	1,120	603	226	189
10	206	158	170	139	.....	308	238	298	825	542	213	189
11	206	160	170	150	.....	276	224	441	825	482	226	189
12	206	172	166	150	.....	276	210	538	1,570	463	213	187
13	191	172	169	150	.....	342	224	460	1,750	444	208	191
14	193	166	164	150	.....	698	210	385	2,060	426	213	211
15	182	172	159	158	.....	980	198	332	2,740	426	213	226
16	174	166	170	166	.....	834	210	298	1,690	426	208	213
17	172	159	172	156	.....	612	198	267	1,230	407	208	203
18	172	166	166	158	.....	452	210	267	970	389	226	201
19	174	162	162	156	.....	360	224	267	872	354	240	194
20	176	174	164	159	.....	308	238	267	1,870	371	270	189
21	174	174	160	139	.....	308	267	367	6,250	336	240	201
22	172	191	157	146	.....	292	252	599	3,860	336	226	240
23	182	261	154	155	.....	261	238	558	1,690	336	270	226
24	174	180	159	158	.....	276	238	441	1,630	336	286	226
25	185	185	162	150	.....	232	267	441	1,570	302	255	213
26	174	193	140	146	.....	210	298	441	4,560	302	255	213
27	180	191	158	154	.....	198	385	403	7,750	286	240	208
28	193	189	166	.....	.....	224	1,440	332	5,850	302	226	194
29	191	185	143	.....	.....	599	1,800	315	2,890	270	226	194
30	191	182	164	.....	.....	965	1,120	298	1,870	270	211	194
31	180	.....	166	.....	.....	685	.....	267	.....	270	203	.....

NOTE.—Daily discharge determined as follows: Oct. 1, 1913, to Mar. 25, 1914, from a well-defined rating curve; Mar. 26 to Sept. 30, from two rating curves based on discharge measurements made Apr. 7 and Aug. 27; Dec. 8–9, 21–22, and Jan. 12–14, estimated on account of ice. Discharge estimated, because of ice, from gage heights observer's notes, discharge measurements, and climatic records as follows: Jan. 28–31, 160 second-feet; and Feb. 1–28, 165 second-feet.

Monthly discharge of Zumbro River at Zumbro Falls, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,120 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	218	172	186	0.166	0.19	A.
November	261	158	178	.159	.18	A.
December	191	140	166	.148	.17	B.
January	.....	.....	157	.140	.16	C.
February	.....	.....	165	.147	.15	C.
March	980	189	391	.349	.40	C.
April	1,800	198	388	.346	.39	B.
May	820	267	410	.366	.42	B.
June	7,750	238	2,060	1.84	2.05	B.
July	1,690	270	544	.486	.56	B.
August	286	203	235	.210	.24	A.
September	240	187	203	.181	.20	A.
The year	7,750	.....	423	.378	5.11	

SOUTH BRANCH OF ZUMBRO RIVER NEAR ZUMBRO FALLS, MINN.

Location.—In sec. 22, T. 109 N., R. 14 W., at the Woodville Bridge, 1¼ miles above the mouth of the river and 6 miles below the mouth of the Middle Branch.

Records available.—June 16, 1911, to September 30, 1914.

Drainage area.—821 square miles.

Gage.—Chain gage attached to bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.5, half-tenths between 2.5 and 3.5, and tenths above 3.5 feet.

Channel and control.—Control is at a well-defined riffle a short distance below gage; channel practically permanent.

Discharge measurements.—At medium and higher stages, from highway bridge; at low stages, by wading a short distance above the gage.

Winter flow.—River freezes over near the station after long cold periods. The rapids below, however, remain partly open, so that the effect from backwater is slight. Discharge measurements are made to aid in estimating flow for the winter.

Regulation.—Effect of the small power plants above station is not noticeable at the gage.

Discharge measurements of South Branch of Zumbro River near Zumbro Falls, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec. ft.*		*Feet.*	*Sec. ft.*
Jan. 15	1.98	[a] 110	Apr. 6	2.19	[c] 204
Feb. 19	2.11	[b] 90	Aug. 26	2.15	158

[a] Measurement made from ice about 50 feet above gage. Control practically clear of ice. Very little if any backwater from ice.
[b] Almost complete ice cover at control.
[c] Control clear.

Daily gage height, in feet, of South Branch of Zumbro River near Zumbro Falls, Minn., for the year ending Sept. 30, 1914.

[W. M. Whipple, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.02	2.01	1.97	1.98	.....	2.40	2.55	2.85	2.15	5.5	2.26	2.12
2	2.04	2.07	2.01	.....	2.25	2.30	2.48	2.75	2.11	5.0	2.27	2.11
3	2.01	2.05	2.01	1.92	2.20	2.20	2.35	2.65	2.13	3.8	2.25	2.12
4	2.01	2.02	2.03	.....	.....	2.25	2.25	2.6	2.28	3.6	2.26	2.12
5	2.00	2.05	2.04	1.92	2.05	2.40	2.18	2.5	2.43	3.4	2.26	2.11
6	1.98	2.05	2.01	.....	.....	2.5	2.18	2.46	4.7	3.2	2.25	2.06
7	.....	2.05	2.01	1.92	2.00	2.42	2.16	2.44	4.6	2.95	2.23	2.05
8	.....	2.02	1.99	.....	.....	2.30	2.18	2.33	5.0	2.8	2.18	2.04
9	.....	2.01	1.97	1.95	2.00	2.28	2.12	2.30	3.8	2.65	2.16	2.04
10	2.10	2.00	2.05	.....	2.05	2.28	2.14	2.24	2.95	2.7	2.15	2.02
11	2.08	1.94	2.01	1.85	2.05	2.22	2.11	2.26	2.9	2.65	2.13	2.02
12	2.07	2.02	2.01	1.95	2.10	2.20	2.06	2.26	3.9	2.55	2.12	2.02
13	2.07	1.98	2.01	.....	2.15	2.25	2.10	2.23	4.3	2.55	2.13	2.04
14	2.07	1.98	1.96	1.98	2.10	2.40	2.04	2.25	5.6	2.45	2.11	2.02
15	2.05	2.05	1.94	2.00	2.18	3.3	2.04	2.18	4.9	2.5	2.11	2.05
16	2.05	2.05	1.97	.....	2.10	3.0	2.05	2.17	3.6	2.47	2.11	2.06
17	2.05	2.02	2.01	1.92	2.10	2.8	2.06	2.14	3.4	2.49	2.09	2.11
18	2.01	2.00	2.04	1.90	2.15	2.42	2.04	2.09	3.3	2.47	2.16	2.10
19	2.05	2.02	2.01	.....	2.10	2.30	2.05	2.13	3.35	2.40	2.17	2.11
20	2.05	2.05	2.06	2.30	2.12	2.28	2.16	2.11	5.0	2.39	2.17	2.09
21	2.01	2.05	2.06	.....	2.18	2.20	2.19	3.25	7.7	2.40	2.19	2.16
22	2.02	2.04	2.03	2.00	2.12	2.15	2.18	2.5	6.4	2.42	2.18	2.16
23	2.00	2.02	1.95	1.92	2.10	2.12	2.15	2.45	4.6	2.37	2.19	2.15
24	2.00	2.01	1.91	.....	2.12	2.15	2.15	2.40	4.4	2.33	2.17	2.15
25	2.05	2.05	1.83	.....	2.15	2.10	2.21	2.41	7.2	2.30	2.17	2.11
26	2.00	2.05	1.80	1.88	2.18	2.15	2.29	2.41	6.1	2.32	2.18	2.09
27	2.02	2.02	1.94	.....	2.30	2.10	2.65	2.35	10.3	2.30	2.15	2.02
28	2.05	2.05	1.89	1.95	2.8	2.10	4.7	2.20	8.8	2.30	2.15	2.04
29	2.05	2.04	1.86	4.0	.....	2.8	4.6	2.21	6.3	2.33	2.12	2.04
30	2.05	2.02	1.89	2.48	.....	3.25	3.5	2.20	4.9	2.33	2.12	2.05
31	2.00	.....	1.96	.....	.....	2.85	.....	2.15	.....	2.29	2.11	.....

NOTE.—Discharge relation probably affected by ice about Feb. 1-28, 1914.

Daily discharge, in second-feet, of South Branch of Zumbro River near Zumbro Falls, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	122	118	106	109	.....	258	317	441	166	2,040	205	155
2	128	138	118	100	.....	220	289	399	152	1,640	209	152
3	118	132	118	90	.....	183	239	358	158	900	202	155
4	118	122	125	90	.....	202	202	337	213	790	205	155
5	115	132	128	90	.....	258	176	297	270	690	205	152
6	109	132	118	90	.....	297	176	281	1,440	595	202	135
7	118	132	118	90	.....	266	169	274	1,380	484	194	132
8	128	122	112	95	.....	220	176	231	1,640	420	176	128
9	138	118	106	100	.....	213	155	220	900	358	169	128
10	148	115	132	86	.....	213	162	198	484	378	166	122
11	141	96	118	73	.....	190	152	205	462	358	158	122
12	138	122	118	100	.....	183	135	205	955	317	155	122
13	138	109	118	104	.....	202	148	194	1,190	317	158	128
14	138	109	103	109	.....	258	128	202	2,130	278	152	122
15	132	132	96	115	.....	640	128	176	1,580	297	152	132
16	132	132	106	102	.....	505	132	172	790	285	152	135
17	132	122	118	90	.....	420	135	162	690	293	145	152
18	118	115	128	84	.....	266	128	145	640	285	169	148
19	132	122	118	152	.....	220	132	158	665	258	172	152
20	132	132	135	220	.....	213	169	152	1,640	254	172	145
21	118	132	135	168	.....	183	180	618	4,090	258	180	169
22	122	128	125	115	.....	166	176	297	2,850	266	176	169
23	115	122	100	90	.....	155	166	278	1,380	247	180	166
24	115	118	87	86	.....	166	166	258	1,250	231	172	166
25	132	132	69	83	.....	148	187	262	3,590	220	172	152
26	115	132	62	80	.....	166	216	262	2,580	228	176	145
27	122	122	96	90	.....	148	358	239	6,820	220	166	122
28	132	132	82	100	.....	148	1,440	183	5,190	220	166	128
29	132	128	75	1,010	.....	420	1,380	187	2,760	231	155	128
30	132	122	82	289	.....	618	740	183	1,580	231	155	132
31	115	.....	103	220	.....	441	.....	166	.....	216	152	.....

NOTE.—Daily discharge computed from a rating curve well defined between 62 and 3,890 second-feet (gage heights, 1.8 and 7.5 feet). Above 3,890 second-feet (gage height, 7.5 feet) the rating curve is an extension and is subject to an error of about 10 per cent at a discharge of 6,490 second-feet (gage height, 10.0 feet). Discharge Feb. 1–28 estimated, because of ice, from gage heights, observer's notes, one discharge measurement, and climatic records, at 115 second-feet. Discharge interpolated for days on which gage was not read.

Monthly discharge of South Branch of Zumbro River near Zumbro Falls, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 821 square miles.]

Mont.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	148	109	127	0.155	0.18	B.
November	132	96	124	.151	.17	B.
December	135	62	108	.132	.15	B.
January	1,010	73	143	.174	.20	B.
February	.....	.....	115	.140	.15	C.
March	640	148	264	.322	.37	B.
April	1,440	128	282	.343	.38	B.
May	618	145	250	.305	.35	B.
June	6,820	152	1,650	2.01	2.24	B.
July	2,040	216	445	.542	.62	A.
August	209	145	173	.211	.24	B.
September	169	122	142	.173	.19	B.
The year	6,820	.....	318	.387	5.24	

TREMPEALEAU RIVER AT DODGE, WIS.

Location.—At highway bridge in the village of Dodge, Wis., 9 miles above mouth of river.

Records available.—December 13, 1913, to September 30, 1914.

Drainage area.—633 square miles.

Gage.—Chain gage attached to downstream side of bridge; read daily, morning and evening, to half-tenths. Limits of use: Half-tenths below and tenths above 2.0 feet.

Channel and control.—Sand; likely to shift at medium and high stages.

Discharge measurements.—Made from downstream side of bridge.

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

Regulation.—No power plants above station having sufficient storage capacity to affect the natural flow of the river.

Accuracy.—Records good except for a short period in May when there was a decided change in the discharge relation as shown by discharge measurements made during June.

Discharge measurements of Trempealeau River at Dodge, 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.*
Dec. 13	Canfield and Beckman.	1.82	[a] 274	June 11	G. H. Canfield.....	6.45	1,600
Jan. 23	Hoyt and Steller.....	2.04	[b] 190	12	.....do.....	4.96	1,060
Feb. 28	O. A. Steller.....	2.67	[b] 201	12	.....do.....	4.27	796
Apr. 3	G. H. Canfield.....	3.46	[c] 682	13	.....do.....	3.81	709
May 13	H. C. Beckman.....	2.36	442	Sept. 2	Beckman and Dillon...	2.32	397
June 9	G. H. Confield.....	8.40	3,540	2	.....do.....	2.42	418
10	.....do.....	7.88	2,740				

[a] Measurement made from bridge; some ice below bridge.
[b] Measurement made under complete ice cover.
[c] Control clear.

Daily gage height, in feet, of Trempealeau River at Dodge, Wis., for the year ending Sept. 30, 1914.

[J. Johnson, observer.]

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.1	5.7	2.6	5.8	3.2	3.3	5.2	1.7	2.0
2	.....	2.0	5.2	3.0	4.3	2.8	2.6	4.3	1.9	2.4
3	.....	2.2	4.1	3.0	3.5	2.5	2.6	3.6	1.75	2.6
4	.....	2.1	3.4	2.9	3.0	2.4	3.4	3.4	1.8	2.5
5	.....	2.2	3.1	3.0	2.6	2.3	4.2	3.0	1.6	2.5
6	.....	2.1	3.0	3.6	2.6	2.2	5.2	2.7	1.7	2.6
7	.....	2.2	3.0	4.2	2.7	2.1	6.4	2.6	1.6	2.2
8	.....	2.2	2.8	4.0	2.8	1.9	7.2	2.7	1.7	1.8
9	.....	2.2	2.6	3.7	2.8	1.9	8.3	2.4	1.55	1.8
10	.....	2.2	2.6	3.8	2.7	2.0	7.7	2.2	1.6	1.75
11	.....	2.2	2.6	3.8	2.6	2.2	6.6	2.3	1.6	1.8
12	.....	2.2	2.6	3.8	2.6	2.3	4.7	3.0	1.7	1.8
13	1.9	2.2	2.6	3.9	2.5	2.2	4.0	4.2	1.55	1.7
14	1.85	2.4	2.6	4.4	2.4	2.2	4.0	4.8	1.65	2.4
15	1.7	2.2	2.6	4.7	2.3	1.9	3.8	4.6	1.55	3.2
16	1.8	2.2	2.5	4.9	2.3	1.9	3.4	3.1	1.65	3.2
17	1.8	2.4	2.5	5.0	2.3	1.8	3.0	2.7	1.6	2.8
18	1.75	2.2	2.6	4.8	2.3	1.6	2.7	2.6	1.7	2.5
19	1.8	2.2	2.5	4.1	2.4	1.6	2.6	2.2	1.75	2.3
20	1.85	2.2	2.5	3.4	2.6	1.5	2.6	2.0	1.95	2.1
21	1.3	2.2	2.5	3.0	2.5	2.3	2.8	2.0	1.8	2.0
22	1.75	2.2	2.5	2.8	2.3	2.9	2.7	2.0	1.85	2.2
23	2.0	2.2	2.5	2.7	2.2	2.8	7.8	1.95	2.2	2.5
24	2.2	2.3	2.4	2.8	2.2	2.9	2.8	2.5	3.0	2.3
25	2.2	2.2	2.5	2.6	3.6	3.0	3.2	2.6	2.4	2.1
26	2.2	2.0	2.5	2.5	3.3	2.7	3.3	2.6	2.1	1.9
27	1.85	2.1	2.5	2.5	3.4	3.3	4.7	1.9	1.8	1.9
28	2.2	2.4	2.7	2.5	3.6	3.8	5.4	2.0	1.9	1.85
29	2.0	4.6	.....	3.4	3.9	4.5	6.1	1.8	1.8	1.8
30	2.0	5.0	.....	4.8	3.6	4.4	6.0	1.8	1.7	1.75
31	2.1	5.4	.....	5.8	.....	4.0	.....	1.7	1.9	.....

NOTE.—Discharge relation affected by ice about Dec. 13, 1913, to Mar. 15, 1914.

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

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1,420	619	582	1,100	294	340
2	.....	910	528	438	827	324	404
3	.....	691	465	438	653	302	438
4	.....	573	445	605	605	309	421
5	.....	485	426	801	514	279	421
6	.....	485	408	1,100	456	294	438
7	.....	506	391	1,570	438	279	372
8	.....	528	359	2,080	456	294	309
9	.....	528	359	3,360	404	272	309
10	.....	506	375	2,550	372	279	302
11	.....	485	408	1,670	388	279	309
12	.....	485	426	937	514	294	309
13	.....	465	408	750	801	272	294
14	.....	445	408	750	967	286	404
15	.....	426	359	701	908	272	559
16	1,090	426	359	605	536	286	559
17	1,120	426	343	514	456	279	474
18	1,060	426	314	456	438	294	421
19	850	445	314	438	372	302	388
20	667	485	300	438	340	332	356
21	573	465	426	474	340	309	340
22	528	426	550	456	340	316	372
23	506	408	528	2,660	332	372	421
24	528	408	550	474	421	514	388
25	485	716	573	559	438	404	356
26	465	643	506	582	438	356	324
27	465	667	643	937	324	309	324
28	465	716	766	1,170	340	324	316
29	667	792	970	1,440	309	309	309
30	1,060	716	853	1,400	309	294	302
31	1,420	.....	750	.....	294	324	.....

NOTE.—Daily discharge, Mar. 16 to May 29, computed from a fairly well defined rating curve; daily discharge, May 30 to Sept. 30, computed from a rating curve well defined between 340 and 3,530 second-feet (gage heights, 2.0 and 8.4 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 13–20, 270 second-feet; Dec. 21–31, 1913, 285 second-feet; Jan. 1–10, 270 second-feet; Jan. 11–20, 240 second-feet; Jan. 21–31, 350 second-feet; Feb. 1–10, 410 second-feet; Feb. 11–20, 205 second-feet; Feb. 21–28, 180 second-feet; and Mar. 1–15, 1914, 600 second-feet.

Monthly discharge of Trempealeau River at Dodge, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 633 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
December 13–31	.....	.....	279	0.441	0.31	C.
January	.....	.....	289	.457	.53	D.
February	.....	.....	271	.428	.45	D.
March	1,420	.....	676	1.07	1.23	C.
April	1,420	408	570	.900	1.00	A.
May	970	300	488	.771	.89	B.
June	3,360	438	1,030	1.63	1.82	A.
July	1,100	294	498	.787	.91	A.
August	514	272	311	.491	.57	B.
September	559	294	376	.594	.66	A.

BLACK RIVER AT NEILLSVILLE, WIS.

Location.—At lower highway bridge, city of Neillsville, Wis. O'Neill Creek enters from the left about 1 mile above the gage, and Cunningham Creek, also from the left, about 1½ miles below.

Records available.—April 7, 1905, to March 31, 1909; December 11, 1913, to September 30, 1914.

Drainage area.—774 square miles (revised since last published).

Gage.—Chain gage fastened to downstream side of highway bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.5 feet, half-tenths between 3.5 and 4.5 feet, and tenths above 4.5 feet.

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

Discharge measurements.—Made from bridge and by wading.

Floods.—On June 6, 1905, the river reached a stage of 19.8 feet; on June 5, 1914, a stage of 19.55 feet. A rating curve, developed during June, 1914, when discharge measurements were made at a stage of 12.53 feet, indicates that the discharge June 6, 1905, was approximately 29,400 second-feet[1] and on June 5, 1914, 28,700 second-feet.

Winter flow.—Discharge relation affected by ice.

Regulation.—Marked by diurnal fluctuations, especially during low stages, are caused by the operation of power plants above.

Accuracy.—Medium and high stage records excellent; low-stage records, especially during the winter, only fair, owing to diurnal fluctuations.

Discharge measurements of Black River at Neillsville, 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.*
Dec. 11	G. H. Canfield	3.42	[a] 186	June 6	G. H. Canfield	12.53	11,200
Jan. 24	H. C. Beckmann	3.30	[b] 47.8	8	do	8.60	4,430
Mar. 2	O. A. Steller	2.30	[b] 38.2	10	do	5.88	1,630
Apr. 10	M. F. Rather	4.40	620	Sept. 4	E. E. Dillon	4.28	559
May 12	H. C. Beckman	4.37	621	5	H. C. Beckman	3.87	414

[a] Ice at control section. [b] Measurement made under complete ice cover.

[1] Previously determined as 23,000 second-feet from a curve the highest measurement of which was made at a stage of only 7.7 feet.

Daily gage height, in feet, of Black River at Neillsville, Wis., for the year ending Sept. 30, 1914.

[A. Bissell, observer.]

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.95	5.9	3.9	6.9	7.6	4.25	7.0	2.75	3.11
2	.....	3.05	5.6	3.05	6.9	6.7	3.9	6.8	2.68	3.40
3	.....	2.95	5.2	2.75	6.5	6.1	3.85	5.8	2.49	4.3
4	.....	2.8	5.0	3.1	6.0	5.6	10.8	5.0	2.55	4.3
5	.....	2.65	5.0	3.2	5.5	5.2	17.5	4.4	2.41	5.5
6	.....	2.9	4.8	3.9	5.3	5.1	13.2	4.2	2.50	5.7
7	.....	2.7	4.7	3.3	5.1	4.8	11.2	3.9	2.34	4.3
8	.....	2.7	4.5	3.2	4.8	4.7	9.0	3.55	2.40	3.75
9	.....	2.7	4.35	3.1	4.6	4.5	7.3	3.36	2.38	3.40
10	.....	2.7	4.5	3.1	4.4	4.3	6.0	3.22	2.54	3.21
11	3.4	2.65	4.3	3.25	4.4	4.25	5.3	3.08	2.59	3.45
12	.....	2.65	4.2	3.65	4.4	4.4	4.6	3.8	2.54	3.75
13	.....	2.15	4.2	4.4	4.5	4.3	4.15	6.0	2.65	3.85
14	.....	2.95	4.3	5.6	4.9	4.05	3.9	5.2	2.70	4.9
15	.....	3.1	4.2	6.6	5.2	4.05	3.85	4.5	2.49	7.9
16	.....	3.05	3.55	6.3	5.3	3.75	4.45	3.9	2.52	7.5
17	.....	3.1	3.3	6.9	5.6	3.55	4.15	3.5	2.41	7.4
18	.....	3.25	4.05	6.4	5.7	3.44	3.8	3.25	3.36	6.5
19	3.0	3.1	3.15	6.1	6.5	3.30	3.65	3.04	2.99	5.7
20	2.85	3.0	3.0	5.6	6.7	3.26	3.65	2.98	4.1	4.8
21	2.75	3.0	3.8	5.3	6.4	4.8	4.3	3.12	4.2	4.3
22	2.85	2.9	4.2	5.0	6.0	9.1	4.5	2.81	3.75	4.2
23	2.6	3.2	2.8	4.7	5.7	7.7	4.2	2.86	3.7	4.6
24	2.8	3.2	2.95	4.6	5.5	6.7	4.25	2.72	3.55	4.5
25	2.6	3.0	3.0	4.6	8.7	6.0	4.3	2.68	3.9	4.3
26	2.7	3.3	2.8	4.5	8.2	5.3	4.5	2.61	3.95	4.2
27	2.7	3.3	3.0	4.6	7.7	6.7	7.2	2.62	3.55	3.95
28	2.65	3.5	3.0	4.8	8.1	5.8	8.4	2.71	3.4	3.75
29	2.6	5.9	.....	7.4	9.1	5.6	8.0	2.68	3.3	3.55
30	2.7	5.5	.....	9.1	8.7	5.4	6.9	2.68	3.12	3.44
31	2.85	5.4	.....	6.9	.....	4.8	.....	2.86	3.16	.....

NOTE.—Discharge relation affected by ice Dec. 11, 1913, to about Mar. 31, 1914.

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

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,560	3,260	565	2,660	72	129	16	1,220	340	672	400	50	3,160
2	2,560	2,360	400	2,460	64	210	17	1,430	262	515	245	43	3,060
3	2,160	1,800	380	1,570	47	590	18	1,500	224	360	164	197	2,160
4	1,720	1,430	7,960	1,010	52	590	19	2,160	178	300	116	106	1,500
5	1,360	1,150	23,000	645	43	1,360	20	2,360	167	300	105	490	880
6	1,220	1,080	12,500	540	48	1,500	21	2,070	880	590	132	540	590
7	1,080	880	8,640	400	39	590	22	1,720	5,160	700	79	340	540
8	880	820	5,000	262	42	340	23	1,500	3,360	540	86	320	760
9	760	700	2,960	197	41	210	24	1,360	2,360	565	68	262	700
10	645	590	1,720	156	51	153	25	4,560	1,720	590	64	400	590
11	645	565	1,220	123	55	228	26	3,910	1,220	700	57	422	540
12	645	645	760	360	51	340	27	3,360	2,360	2,860	58	262	422
13	700	590	515	1,720	61	380	28	3,790	1,570	4,160	67	210	340
14	945	468	400	1,150	66	945	29	5,160	1,430	3,680	64	178	262
15	1,150	468	380	700	47	3,570	30	4,560	1,290	2,560	64	132	224
							31	.....	880	.....	86	141	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 445 second-feet (gage height 4.0 feet), and well defined between 445 and 14 300 second-feet (gage heights 4.0 and 14.0 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 11-20, 96 second-feet; Dec. 21-31, 54 second-feet; Jan. 1-10, 51 second-feet; Jan. 11-20, 67 second-feet; Jan. 21-31, 232 second-feet; Feb. 1-10, 392 second-feet; Feb. 11-20, 84 second-feet; Feb. 21-28, 48 second-feet; Mar. 1-10, 80 second-feet; Mar. 11-20, 1,210 second-feet; Mar. 21-31, 1,330 second-feet.

Monthly discharge of Black River at Neillsville, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 774 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
December 11–31			74.0	0.096	0.07	D.
January			120	.155	.18	D.
February			184	.238	.25	D.
March			888	1.15	1.33	D.
April	5,160	645	1,990	2.57	2.87	A.
May	5,160	167	1,300	1.68	1.94	B.
June	23,000	300	2,850	3.68	4.11	A.
July	2,660	57	510	.659	.76	B.
August	540	39	157	.203	.23	B.
September	3,570	129	895	1.16	1.29	B.

LA CROSSE RIVER NEAR WEST SALEM, WIS.

Location.—At highway bridge 2 miles west of West Salem, Wis., and 10 miles above the mouth of the river. Dutch Creek enters from the right 6 miles above the station.

Drainage area.—412 square miles.

Records available.—December 22, 1913, to September 30, 1914.

Gage.—Chain gage fastened to concrete guardrail on the upstream side of bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.0 feet, and tenths above 2.0 feet.

Channel and control.—Heavy gravel and rock; probably permanent. The section of the bridge was originally unfavorable for making accurate discharge measurements. The channel was, however, cleaned out during the summer of 1914, making accurate discharge measurements possible.

Discharge measurements.—Made from upstream side of bridge during medium and high stages; by wading during low stages.

Regulation.—During low stages a small diurnal fluctuation at the gage is caused by operation of power plant above.

Accuracy.—Results only fair; accuracy of records impaired by artificial regulation of flow.

Discharge measurements of La Crosse River near West Salem, 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.*
Dec. 22	H. C. Beckman	1.16	[a] 186	June 29	G. H. Canfield	4.27	1,230
Jan. 22	O. A. Steller	1.45	[a] 169	29	do	3.85	1,080
22	W. G. Hoyt	1.32	[a] 174	29	do	3.70	1,020
Feb. 27	O. A. Steller	1.34	[a] 203	30	do	2.79	774
Mar. 28	H. C. Beckman	1.32	194	Aug. 31	Beckman and Dillon	1.48	235
June 23	do	2.37	626	Sept. 1	do	1.48	223
25	do	1.80	375				

[a] Measurement made under partial ice conditions.

NOTE.—See "Channel and control" in station description.

Daily gage height, in feet, of La Crosse River near West Salem, Wis., for the year ending Sept. 30, 1914.

[Henry Schucht, observer.]

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.45	1.65	1.8	1.9	1.75	1.55	2.2	1.5	1.7
2	.....	1.45	1.6	2.0	1.85	1.7	1.45	2.2	1.5	1.75
3	.....	1.45	1.5	1.65	1.75	1.6	1.5	2.1	1.5	1.6
4	.....	1.45	1.5	1.75	1.65	1.6	1.55	2.0	1.5	1.5
5	.....	1.45	1.45	2.0	1.5	1.65	1.9	1.9	1.5	1.4
6	.....	1.45	1.4	2.1	1.55	1.5	1.95	1.75	1.4	1.4
7	.....	1.4	1.4	2.0	1.6	1.55	2.0	1.7	1.4	1.4
8	.....	1.45	1.3	2.0	1.6	1.4	2.4	1.7	1.45	1.45
9	.....	1.5	1.45	1.8	1.55	1.45	3.2	1.75	1.4	1.45
10	.....	1.4	1.4	1.75	1.5	1.4	2.3	1.6	1.45	1.4
11	.....	1.4	1.5	1.8	1.5	1.5	1.9	1.6	1.5	1.5
12	.....	1.2	1.5	1.6	1.5	1.5	1.75	2.5	1.45	1.4
13	.....	1.1	1.4	1.65	1.55	1.5	1.65	2.5	1.5	1.55
14	.....	1.4	1.45	1.7	1.5	1.4	1.7	2.2	1.4	1.9
15	.....	1.6	1.4	1.7	1.5	1.5	1.8	1.7	1.35	2.0
16	.....	1.55	1.4	1.7	1.5	1.4	1.7	1.6	1.5	1.95
17	.....	1.45	1.3	1.65	1.5	1.4	1.7	1.65	1.45	1.8
18	.....	1.4	1.4	1.55	1.55	1.4	1.65	1.6	1.65	1.8
19	.....	1.4	1.4	1.5	1.5	1.35	1.6	1.55	1.7	1.7
20	.....	1.55	1.5	1.4	1.65	1.3	1.6	1.55	1.7	1.5
21	.....	1.4	1.5	1.4	1.6	1.55	2.3	1.6	1.5	1.5
22	1.15	1.35	1.3	1.[illegible]	1.6	1.7	2.5	1.55	1.5	1.65
23	1.6	1.7	1.5	1.4	1.5	1.75	2.4	1.55	1.6	1.55
24	2.3	1.5	1.4	1.4	1.9	1.75	1.95	1.55	1.6	1.55
25	1.45	1.3	1.45	1.5	1.85	1.85	1.8	1.6	1.5	1.5
26	1.6	1.35	1.45	1.5	1.9	1.95	1.75	1.5	1.5	1.5
27	1.6	1.5	1.5	1.5	1.9	1.9	3.3	1.45	1.55	1.5
28	1.35	1.65	2.1	1.45	1.9	1.75	4.7	1.5	1.5	1.5
29	1.5	1.65	.....	1.65	1.9	1.8	4.1	1.5	1.5	1.55
30	1.5	2.1	.....	2.1	1.9	1.8	2.8	1.5	1.45	1.55
31	1.45	1.75	.....	2.1	.....	1.6	.....	1.5	1.45	.....

NOTE.—Discharge relation affected by ice about Dec. 22, 1913, to Mar. 31, 1914.

Daily discharge, in second-feet, of La Crosse River near West Salem, Wis., for the year ending Sept. 30, 1914.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	416	348	260	551	239	326	16	239	204	326	281	239	438
2	394	326	222	551	239	348	17	239	204	326	304	222	371
3	348	281	239	506	239	281	18	260	204	304	281	304	371
4	304	281	260	461	239	239	19	239	192	281	260	326	326
5	239	304	416	416	239	204	20	304	180	281	260	326	239
6	260	239	438	348	204	204	21	281	260	595	281	239	239
7	281	260	461	326	204	204	22	281	326	678	260	239	304
8	281	204	638	326	222	222	23	239	348	638	260	281	260
9	260	222	889	348	204	222	24	416	348	438	260	281	260
10	239	204	595	281	222	204	25	394	394	371	281	239	239
11	239	239	416	281	239	239	26	416	438	348	239	239	239
12	239	239	348	678	222	204	27	416	416	916	222	260	239
13	260	239	304	678	239	260	28	416	348	1,390	239	239	239
14	239	204	326	551	204	416	29	416	371	1,150	239	239	260
15	239	239	371	326	192	461	30	416	371	779	239	222	260
							31	.....	281	.....	239	222	.....

NOTE.—Daily discharge computed from a rating curve well defined between 204 and 1,310 second-feet (gage heights, 1.4 and 4.5 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 22–31, 1913, 198 second-feet; Jan. 1–15, 1914, 178 second-feet; Jan. 16–31, 214 second-feet; Feb. 1–15, 200 second-feet; Feb. 16–28, 193 second-feet; Mar. 1–15, 258 second-feet; and Mar. 16–31, 262 second-feet.

Monthly discharge of La Crosse River near West Salem, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 412 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
December 22-31			198	0.481	0.18	C.
January			197	.478	.55	C.
February			197	.478	.50	C.
March			260	.631	.73	D.
April	416	239	307	.745	.83	B.
May	438	180	281	.682	.79	B.
June	1,390	222	500	1.21	1.35	B.
July	678	222	348	.845	.97	B.
August	326	192	241	.585	.67	B.
September	461	204	277	.672	.75	B.

ROOT RIVER NEAR HOUSTON, MINN.

Location.—In sec. 34, T. 104 N., R. 6 W., at highway bridge 1 mile east of Houston, 1 mile above the mouth of South Root River.

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

Drainage area.—1,560 square miles.

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

Channel and control.—No well-defined control; channel shifting, scouring out during floods and gradually filling in afterward; nearly permanent at low stages.

Discharge measurements.—Made from bridge.

Floods.—River overflows during heavy rains. Estimates of discharge for flood stages above 8.9 feet in 1911, as published in Water-Supply Paper 305, are too low, on account of an erroneous extension of the rating curve above 8.9 feet. The high-water part of the rating curve, based on discharge measurements made on June 28 and 29, 1914, at gage heights 9.80 and 6.98 feet, gives the same discharge as the rating curve used for 1911 at about gage height 8.9 feet. At gage height 10.0 feet the new curve gives a discharge about 44 per cent larger than that given by the 1911 rating curve. The discharge corresponding to gage height 10.8 feet (maximum gage height, which occurred on Aug. 14, 1911) is about 15.200 second-feet.

Winter flow.—When the flow was affected by ice in 1914, estimates were based on gage heights, climatic data, one discharge measurement and a comparison with the flow of North Branch of Root River near Lanesboro, there being a well-defined open-water relation between these stations.

Regulation.—No dam below the station; nearest dam above is at Rushford. As the flow is ample at all times for the power generated at that point, it is not held back during certain parts of the day, and the dam has no influence on the gage heights at Houston.

Accuracy.—Because of shifting channel, the results are probably only fair.

Discharge measurements of Root River near Houston, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 23	1.73	[a] 231	June 28	9.80	[c] 9,530
Apr. 9	1.71	[b] 383	June 29	6.98	3,180
June 16	4.47	1,590	Sept. 10	1.42	362

[a] Partial ice cover at control.
[b] Control clear.
[c] For about 48 per cent of the discharge in the main channel, the velocities were determined by the surface method. For the remainder of the discharge the velocities were determined either by the two-tenths and eight-tenths method or by the six-tenths method.

Daily gage height, in feet, of Root River near Houston, Minn., for the year ending Sept. 30, 1914.

[Olaf Larson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.6	1.3	1.35	2.0	2.8	4.0	2.1	2.7	1.7	5.4	1.9	1.4
2	1.5	1.3	1.3	.....	.....	.....	2.0	2.4	1.7	4.8	1.9	2.0
3	1.4	1.3	1.35	2.1	2.6	3.0	2.0	2.3	1.8	4.3	1.8	1.7
4	1.4	1.3	1.35	2.0	.....	.....	1.9	2.2	2.0	4.2	1.7	1.5
5	1.5	1.3	1.3	.....	2.3	3.0	1.8	2.4	2.4	3.8	1.7	1.45
6	1.4	1.25	1.3	2.0	.....	.....	1.8	2.2	4.9	3.4	1.7	1.45
7	1.4	1.3	1.35	.....	2.2	3.7	1.8	2.2	4.9	3.3	1.7	1.45
8	1.35	1.3	.....	2.0	2.3	3.5	1.8	2.1	5.1	3.1	1.6	1.45
9	1.45	1.3	1.3	.....	.....	.....	1.7	2.0	4.1	3.0	1.6	1.35
10	1.8	1.25	.....	1.5	2.2	3.0	1.7	1.9	3.4	2.9	1.6	1.35
11	1.8	1.2	1.35	1.3	.....	.....	1.7	1.9	4.6	2.8	1.6	1.4
12	1.5	1.25	1.4	.....	2.2	2.6	1.6	1.9	5.9	2.8	1.6	1.4
13	1.4	1.3	1.35	1.5	.....	.....	1.7	1.8	5.2	2.6	1.6	1.5
14	1.4	1.3	1.35	.....	2.3	3.1	1.6	1.8	4.8	2.5	1.5	2.3
15	1.4	1.3	1.3	2.0	2.2	3.0	1.6	1.8	5.0	2.5	1.5	2.1
16	1.35	1.3	1.3	.....	.....	2.9	1.6	1.7	4.7	2.5	1.6	2.0
17	1.35	1.3	1.35	2.0	2.2	2.8	1.6	1.7	3.8	2.4	1.5	1.8
18	1.35	1.3	1.25	2.0	.....	2.4	1.6	1.7	3.4	2.4	1.5	1.8
19	1.33	1.33	1.2	.....	2.2	2.1	1.7	1.7	3.2	2.2	1.6	1.7
20	1.4	1.35	1.35	2.0	.....	2.0	1.6	1.6	3.4	2.2	1.8	1.6
21	1.4	1.35	1.25	.....	2.2	1.9	1.6	1.8	6.2	2.1	1.8	1.6
22	1.35	1.35	1.3	1.4	2.2	1.8	1.6	2.6	4.4	2.1	1.6	1.8
23	1.4	1.3	1.4	.....	.....	1.8	1.5	2.0	3.6	2.1	1.8	1.7
24	1.3	1.3	1.45	2.0	2.2	1.8	1.8	2.1	3.3	2.0	1.7	1.7
25	1.35	1.35	1.8	1.7	.....	1.7	2.2	2.3	3.0	1.9	1.7	1.7
26	1.35	1.3	2.8	.....	2.2	1.7	1.9	2.2	5.2	2.0	1.6	1.6
27	1.35	1.3	2.6	1.8	.....	1.7	2.6	2.1	9.8	1.9	1.45	1.6
28	1.3	1.3	2.7	.....	2.8	1.7	2.9	2.1	9.8	2.6	1.5	1.5
29	1.35	1.35	2.2	6.4	.....	2.5	3.1	2.0	7.2	2.4	1.45	1.5
30	1.4	1.35	2.2	.....	.....	2.8	2.9	1.8	5.7	2.1	1.45	1.5
31	1.35	.....	2.2	3.4	.....	2.3	.....	1.8	.....	2.0	1.4	.....

NOTE.—Discharge relation affected by ice about Dec. 23, 1913, to Mar. 14, 1914.

Daily discharge, in second-feet, of Root River near Houston, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	379	303	315	.....	.....	.....	533	757	407	2,160	468	340
2	352	303	303	.....	.....	.....	500	638	407	1,800	468	500
3	327	303	315	.....	.....	.....	500	602	437	1,530	437	407
4	327	303	315	.....	.....	.....	468	567	500	1,480	407	352
5	352	303	303	.....	.....	.....	437	638	638	1,270	407	340
6	327	292	303	.....	.....	.....	437	567	1,860	1,070	407	340
7	327	303	315	.....	.....	.....	437	567	1,860	1,020	407	340
8	315	303	a 309	.....	.....	.....	437	533	1,980	933	379	340
9	340	303	303	.....	.....	.....	407	500	1,420	888	379	315
10	437	292	a 309	.....	.....	.....	407	468	1,070	843	379	315
11	437	281	315	.....	.....	.....	407	468	1,700	799	379	327
12	352	292	327	.....	.....	.....	379	468	2,490	799	379	327
13	327	303	315	.....	.....	.....	407	437	2,040	716	379	352
14	327	303	315	.....	.....	.....	379	437	1,800	676	352	602
15	327	303	303	.....	.....	888	379	437	1,920	676	352	533
16	315	303	303	.....	.....	843	379	407	1,750	676	379	500
17	315	303	315	.....	.....	799	379	407	1,270	638	352	437
18	315	303	292	.....	.....	638	379	407	1,070	638	352	437
19	315	315	281	.....	.....	533	407	407	978	567	379	407
20	327	315	315	.....	.....	500	379	379	1,070	567	437	379
21	327	315	292	.....	.....	468	379	437	2,700	533	437	379
22	315	315	303	.....	.....	437	379	716	1,580	533	379	437
23	327	303	.....	.....	.....	437	352	500	1,170	533	437	407
24	303	303	.....	.....	.....	437	437	533	1,020	500	407	407
25	315	315	.....	.....	.....	407	567	602	888	468	407	407
26	315	303	.....	.....	.....	407	468	567	2,040	500	379	379
27	315	303	.....	.....	.....	407	716	533	9,470	468	340	379
28	303	303	.....	.....	.....	407	843	533	9,470	716	352	352
29	315	315	.....	.....	.....	676	933	500	3,530	638	340	352
30	327	315	.....	.....	.....	799	843	437	2,360	533	340	352
31	315	.....	.....	.....	.....	602	.....	437	.....	500	327	.....

a Interpolated.

NOTE.—Daily discharge computed from a rating curve, well defined between 888 and 10,600 second-feet (gage heights 3.0 and 10.0 feet) and fairly well defined below 843 second-feet (gage height 2.9 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, climatic records, and the open-water relation between the flow of North Branch of Root River near Lanesboro and Root River at Houston as follows: Dec. 23–31, 330 second-feet; Jan. 1–31, 318 second-feet; Feb. 1–28, 251 second-feet; and Mar. 1–14, 689 second-feet.

Monthly discharge of Root River near Houston, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 1,560 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	437	303	333	0.213	0.25	B.
November	315	281	304	.195	.22	B.
December	.....	281	314	.201	.23	C.
January	.....	.....	318	.204	.24	C.
February	.....	.....	251	.161	.17	D.
March	.....	407	624	.400	.46	C.
April	933	352	478	.306	.34	B.
May	757	379	512	.328	.38	B.
June	9,470	407	2,030	1.30	1.45	B.
July	2,160	468	828	.531	.61	B.
August	468	327	388	.249	.29	B.
September	602	315	391	.251	.28	B.
The year	9,470	.....	564	.362	4.92	

NORTH BRANCH OF ROOT RIVER NEAR LANESBORO, MINN.

Location.—In sec. 6, T. 103 N., R. 9 W., in Fillmore County, at the first highway bridge, 1 mile above the junction of the North and South branches, 3 miles north of Lanesboro, and about 5 miles below a small creek that enters from the west.

Records available.—March 9, 1910, to September 30, 1914.

Drainage area.—647 square miles.

Gage.—Chain gage; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.5, half-tenths between 2.5 and 4.0, and tenths above 4.0 feet.

Channel and control.—Practically permanent. As there is more than 10 feet fall between the station and the mouth of the South Branch, backwater from that stream is improbable. At a stage of 6 feet the river overflows into a former channel 1,000 feet back from the right bank. At extreme flood stages the right bank is overflowed for a width of one-fourth mile.

Discharge measurements.—Made from the bridge. At extreme flood stages measurements may be made from the railroad bridge just above the junction with the South Branch, and at low stages by wading a short distance above station.

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

Regulation.—None.

Accuracy.—Conditions favorable for accurate results and estimates should be reliable.

Discharge measurements of North Branch of Root River near Lanesboro, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 23	2.00	[a] 92	June 29	4.51	1,600
Apr. 8	2.14	[b] 171	Sept. 10	1.94	100
June 16	3.51	846			

[a] Partial ice cover at control; complete ice cover at gage.
[b] Control clear.

Daily gage height, in feet, of North Branch of Root River near Lanesboro, Minn., for the year ending Sept. 30, 1914.

[Kreston E. Hoium, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.20	1.96	2.05	.....	2.20	3.0	2.40	2.6	2.22	3.65	2.35	2.18
2	2.10	1.96	2.05	2.00	2.20	3.0	2.31	2.42	2.22	3.55	2.22	2.21
3	2.00	1.94	1.95	2.00	2.10	3.0	2.25	2.48	2.29	3.5	2.19	2.21
4	2.00	1.92	1.95	.....	2.00	3.0	2.25	2.75	2.32	2.45	2.16	2.19
5	2.10	1.95	1.92	1.95	2.00	3.1	2.19	2.6	2.38	3.25	2.18	2.18
6	2.05	1.95	1.92	.....	2.00	3.2	2.11	2.44	2.8	3.15	2.19	2.11
7	2.05	1.92	1.94	2.00	1.90	3.1	2.12	2.44	4.8	3.05	2.20	2.08
8	2.00	1.95	1.95	.....	1.90	3.0	2.12	2.35	3.9	2.9	2.18	2.05
9	2.05	1.95	1.95	1.95	1.90	2.9	2.05	2.32	2.9	2.8	2.10	2.04
10	2.05	1.96	1.95	2.00	2.00	2.7	2.10	2.32	3.3	2.75	2.05	1.98
11	2.15	1.95	1.92	.....	2.30	2.5	2.10	2.28	4.6	2.6	2.05	1.98
12	2.04	1.95	1.94	2.10	2.30	2.30	2.04	2.22	4.9	2.55	2.08	1.98
13	2.05	1.92	1.94	.....	2.30	2.20	1.98	2.19	3.8	2.41	2.06	2.08
14	2.05	1.92	2.00	2.20	2.30	2.30	1.94	2.15	4.1	2.36	2.08	2.28
15	2.02	1.92	1.96	.....	2.20	2.85	1.92	2.08	4.4	2.32	2.05	2.30
16	1.96	1.94	1.92	1.90	2.20	3.0	1.91	2.02	3.5	2.36	2.05	2.25
17	1.96	1.95	1.90	1.98	2.20	2.95	1.94	2.10	3.1	2.42	2.09	2.25
18	1.95	1.98	1.85	.....	2.10	2.95	1.91	2.02	2.8	2.41	2.10	2.25
19	2.00	1.98	1.88	1.95	2.10	2.9	1.94	2.09	2.7	2.32	2.22	2.15
20	2.01	1.95	1.85	.....	2.10	2.8	1.92	2.08	3.35	2.24	2.32	2.10
21	2.04	2.00	.....	2.20	2.10	2.7	1.91	2.06	3.6	2.24	2.18	2.05
22	2.02	2.05	.....	.....	2.10	2.65	1.92	2.21	3.2	2.22	2.21	2.05
23	2.02	2.00	.....	2.00	2.10	2.6	1.92	2.22	3.05	2.22	2.28	2.06
24	2.00	2.00	1.95	2.00	2.10	2.5	2.15	2.35	2.8	2.21	2.25	2.08
25	2.01	1.99	.....	.....	2.10	2.49	2.12	2.45	2.6	2.16	2.20	2.08
26	2.01	1.98	1.88	2.10	2.20	2.41	2.18	2.38	5.7	2.16	2.14	2.05
27	1.95	1.98	1.90	2.00	2.40	2.32	2.49	2.36	9.7	2.12	2.09	2.05
28	1.91	1.98	.....	2.00	3.4	2.34	3.0	2.32	5.6	2.65	2.09	2.00
29	1.94	2.00	1.90	4.6	.....	2.65	2.9	2.28	4.4	2.6	2.09	1.98
30	1.95	2.00	.....	2.40	.....	2.6	2.9	2.26	3.75	2.45	2.06	1.98
31	1.95	.....	1.85	2.30	.....	2.25	.....	2.22	.....	2.40	2.08	.....

NOTE.—Discharge relation affected by ice about Jan. 11 to Mar. 12, 1914.

Daily discharge, in second-feet, of North Branch of Root River near Lanesboro, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	194	121	147	112	.....	.....	266	347	201	882	222	165
2	162	121	147	132	.....	.....	233	274	201	813	178	175
3	132	115	118	132	.....	.....	212	297	226	779	168	175
4	132	110	118	125	.....	.....	212	414	236	747	159	168
5	162	118	110	118	.....	.....	191	347	259	625	165	165
6	147	118	110	125	.....	.....	165	282	438	568	168	144
7	147	110	115	132	.....	.....	168	282	2,040	514	172	135
8	132	118	118	125	.....	.....	168	248	1,160	438	165	126
9	147	118	118	118	.....	.....	147	236	488	391	141	124
10	147	121	118	132	.....	.....	162	236	715	369	126	107
11	178	118	110	.....	.....	.....	162	222	1.830	305	126	107
12	144	118	115	.....	.....	.....	144	201	2,150	286	135	107
13	147	110	115	.....	.....	194	126	191	1,070	233	129	135
14	147	110	132	.....	.....	229	115	178	1,340	215	135	198
15	138	110	121	.....	.....	463	110	156	1,620	201	126	204
16	121	115	110	.....	.....	541	107	138	847	215	126	188
17	121	118	104	.....	.....	514	115	162	590	236	138	188
18	118	126	92	.....	.....	514	107	138	429	233	141	188
19	132	126	99	.....	.....	488	115	159	378	201	178	156
20	135	118	92	.....	.....	438	110	156	721	175	212	141
21	144	132	98	.....	.....	391	107	150	882	175	165	126
22	138	147	105	.....	.....	369	110	198	619	168	175	126
23	138	132	111	.....	.....	347	110	201	530	168	198	129
24	132	132	118	.....	.....	305	178	248	400	165	188	135
25	135	129	108	.....	.....	301	168	286	309	150	172	135
26	135	126	99	.....	.....	270	188	259	2,940	150	153	126
27	118	126	104	.....	.....	236	301	251	8,350	138	138	126
28	107	126	104	.....	.....	244	541	236	2,800	326	138	112
29	115	132	104	.....	.....	369	488	222	1,500	305	138	107
30	118	132	98	.....	.....	347	488	215	933	248	129	107
31	118	.....	92	.....	.....	212	.....	201	.....	229	135	.....

NOTE.—Daily discharge computed from rating curve well defined between 79 and 4,660 second-feet (gage heights, 1.8 and 7.0 feet). Discharge interpolated for days when gage was not read. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 11–25, 97 second-feet; Jan. 26–31, 290 second-feet; Feb. 1–28, 110 second-feet; and Mar. 1–12, 220 second-feet.

Monthly discharge of North Branch of Root River near Lanesboro, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 647 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	194	107	138	0.213	0.25	A.
November	147	110	122	.189	.21	A.
December	147	92	111	.172	.20	B.
January	.....	.....	143	.221	.25	C.
February	.....	.....	110	.170	.18	D.
March	541	.....	304	.470	.54	C.
April	541	107	194	.300	.33	A.
May	414	138	230	.355	.41	A.
June	8,350	201	1,210	1.87	2.09	B.
July	882	138	343	.530	.61	B.
August	222	126	156	.241	.28	B.
September	204	107	144	.223	.25	B.
The year	8,350	.....	267	.413	5.60	

UPPER IOWA RIVER NEAR DECORAH, IOWA.

Location.—At the highway bridge in the village of Freeport, which is 3 miles below Decorah and about 4 miles above the upper power plant of the Upper Iowa Power Co; nearest tributary, Trout Creek, which enters from the right about 1 mile above station.

Records available.—August 28, 1913, to September 30, 1914.

Drainage area.—551 square miles.

Gage.—Chain gage attached to bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.0, half-tenths from 3.0 to 4.5, and tenths above 4.5 feet.

Channel and control.—Sand and gravel; may shift during high water.

Discharge measurements.—Made from bridge.

Regulation.—A number of small gristmills above the station produce a slight regulation.

Data insufficient for estimating discharge.

Discharge measurements of Upper Iowa River near Decorah, Iowa, 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. 18	S. B. Soulé	2.52	87.1	May 21	J. B. Stewart	2.71	139
Dec. 4	do	2.44	88.3	Sept. 24	S. B. Soulé	2.78	175

Daily gage height, in feet, of Upper Iowa River near Decorah, Iowa, for the year ending Sept. 30, 1914.

[Chas. Savoy, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.51	2.40	2.50	2.25	.....	.....	2.76	3.4	3.2	4.2	2.65	2.81
2	2.32	2.40	2.50	.....	2.60	4.0	2.72	3.2	3.1	4.05	2.60	2.68
3	2.38	2.40	2.48	2.25	.....	.....	2.65	3.1	3.2	4.25	2.56	2.48
4	2.30	2.40	2.45	.....	3.2	3.1	2.58	3.05	3.6	3.6	2.58	2.39
5	2.38	.....	2.40	2.30	.....	.....	2.50	2.92	4.4	3.35	2.50	2.34
6	2.40	2.40	2.40	.....	.....	.....	2.50	2.85	5.7	3.25	2.54	2.28
7	2.75	2.40	2.30	2.30	3.05	2.80	2.50	2.98	5.1	3.35	2.45	2.28
8	2.40	2.40	2.20	.....	.....	.....	2.42	2.80	5.4	3.1	2.44	2.25
9	3.0	2.40	2.40	.....	2.90	2.60	2.39	2.81	4.4	3.35	2.40	2.27
10	3.15	2.40	2.45	2.30	.....	.....	2.40	2.75	3.8	3.3	2.44	2.31
11	3.75	2.40	2.45	.....	2.70	2.50	2.40	4.7	5.1	2.88	2.42	2.26
12	2.80	2.40	2.42	2.70	.....	.....	2.36	3.9	5.0	2.92	2.40	2.22
13	2.65	2.40	2.40	.....	.....	.....	2.35	3.3	5.8	2.88	2.36	2.39
14	2.50	2.38	.....	2.20	2.65	2.90	2.31	3.2	6.5	2.84	2.35	4.6
15	2.50	2.35	2.35	.....	.....	.....	2.30	3.0	6.3	2.82	2.35	3.85
16	2.50	2.35	.....	.....	2.60	3.0	2.30	2.88	5.1	2.82	2.42	3.15
17	2.50	2.35	.....	2.25	.....	.....	2.30	2.80	4.4	2.92	2.44	3.2
18	2.50	2.35	2.42	.....	2.60	3.5	2.30	2.74	4.05	2.75	2.40	2.98
19	2.50	2.40	.....	2.85	.....	.....	2.40	2.69	4.65	2.72	2.40	2.82
20	2.52	2.40	2.35	.....	.....	.....	2.38	2.66	3.75	2.66	2.68	2.74
21	2.45	2.48	.....	2.30	2.60	2.70	2.36	2.68	4.6	2.64	2.45	2.66
22	2.42	2.58	2.30	.....	.....	.....	2.30	2.90	3.8	2.60	2.39	2.90
23	2.40	2.40	.....	.....	2.60	2.40	2.30	2.85	3.75	2.60	2.54	2.83
24	2.40	2.40	.....	2.40	.....	.....	2.45	8.2	3.45	2.90	2.48	2.72
25	2.45	2.40	2.30	.....	2.60	2.58	2.65	5.6	3.3	2.75	2.40	2.66
26	2.42	2.40	.....	2.30	.....	2.51	2.59	5.1	4.1	2.72	2.31	2.61
27	2.40	2.40	.....	.....	.....	2.48	3.3	4.3	8.1	2.65	2.32	2.74
28	2.40	2.40	.....	4.8	4.0	2.46	5.4	3.95	7.3	3.9	2.36	2.59
29	2.40	2.40	2.30	8.0	.....	2.75	4.0	3.8	5.9	2.90	2.34	2.54
30	2.40	2.50	.....	3.5	.....	2.92	3.5	3.6	4.6	2.72	2.31	2.50
31	2.40	.....	.....	2.60	.....	2.72	.....	3.3	.....	2.65	2.30	.....

NOTE.—Discharge relation probably affected by ice about Jan. 5–15 and Feb. 4–28.

WISCONSIN RIVER NEAR RHINELANDER, WIS.

Location.—In sec. 27, T. 36 N., R. 8 E., at highway bridge just below Rhinelander Power Co.'s power station, 8 miles southwest of Rhinelander, Wis., and 8 miles below the mouth of Pelican River.

Records available.—December 1, 1905, to September 30, 1914.

Drainage area.—1,110 square miles.

Gage.—Standard chain gage, fastened to upstream side of bridge; read once daily, October 1, 1913, to April 15, 1914, to nearest tenth, and twice daily, morning and evening, to nearest tenth from April 16 to September 30, 1914. Limits of use: Half-tenths below 3.5 and tenths above 3.5 feet.

Discharge measurements.—Made from downstream side of bridge to which gage is attached.

Winter flow.—Little ice forms in the vicinity of the gage, owing to the relatively high temperature of the water coming from the service reservoirs.

Regulation.—Flow of river controlled by the Rhinelander Power Co.'s plant near Rhinelander and the plant at Otter Rapids; modified also by storage reservoirs in the headwaters operated by the Upper Wisconsin Valley Improvement Co.

Accuracy.—Records only fair, owing to the operation of the power plants and to the presence of grass in the stream, which may cause backwater at times.

Discharge measurements of Wisconsin River near Rhinelander, 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.*
Dec. 11	Hoyt and Gross	2.18	554	May 2	H. C. Beckman	4.26	2,680
Feb. 14	O. A. Steller	2.74	1,010	Aug. 12	M. F. Rather	3.38	1,080
Mar. 19	H. C. Beckman	2.00	554	12	do	3.45	1,180

NOTE.—Grass in channel when measurements were made.

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

[Geo. N. Kramer, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.9	3.6	3.4	2.8	2.0	2.4	3.3	3.5	2.8	4.1	3.9	4.6
2	3.9	2.9	3.2	.....	3.3	3.0	3.0	3.5	2.7	4.6	4.0	4.5
3	3.5	3.4	3.0	3.0	2.9	3.3	3.0	3.0	2.65	4.4	4.1	4.5
4	3.4	3.5	3.5	2.0	3.5	3.0	3.2	3.45	2.95	4.4	3.8	4.5
5	2.6	3.4	3.3	3.2	3.4	2.7	2.0	3.35	3.0	4.3	3.8	4.4
6	3.5	3.3	3.1	3.4	3.1	2.7	3.3	3.4	3.1	4.4	3.6	3.8
7	3.5	3.7	2.5	3.4	2.9	2.9	3.3	3.45	2.75	4.2	3.6	3.4
8	3.4	3.7	2.9	2.7	2.2	1.9	3.0	3.3	2.65	4.0	3.5	3.8
9	3.7	2.4	2.9	2.9	2.7	3.0	2.9	3.15	2.85	4.1	3.2	3.8
10	3.9	3.7	2.7	3.5	2.6	3.0	2.8	2.6	2.9	3.8	3.45	3.8
11	3.7	3.5	3.1	2.2	2.6	3.3	2.8	3.3	2.8	3.9	3.35	3.8
12	2.6	3.3	3.0	2.8	2.4	2.7	2.8	3.35	2.7	3.7	3.05	3.7
13	3.3	3.6	2.9	3.0	2.6	2.7	2.8	3.1	2.5	4.0	3.1	3.5
14	3.7	3.4	2.5	2.7	2.75	2.8	2.9	2.7	1.85	3.9	3.3	3.7
15	3.7	3.4	3.2	2.9	2.2	2.0	2.8	2.75	2.55	3.8	3.5	3.5
16	3.9	2.4	3.5	2.9	2.8	2.7	2.75	2.9	2.65	3.9	3.7	3.6
17	3.4	3.7	2.9	2.7	2.8	2.8	2.85	2.2	2.8	3.8	3.8	3.4
18	3.4	3.3	3.1	2.5	2.6	2.8	2.8	2.85	2.85	3.7	4.0	3.45
19	3.0	3.5	3.0	2.4	2.5	2.7	2.8	2.9	2.8	3.7	4.2	3.6
20	3.4	3.5	3.4	2.6	2.9	2.8	2.85	2.6	2.55	3.8	4.6	3.5
21	3.2	3.3	2.5	2.5	2.8	2.7	3.0	2.75	1.95	3.7	4.8	3.6
22	3.5	3.7	3.1	2.5	2.2	1.9	2.95	2.75	2.9	3.8	4.6	3.45
23	3.7	2.8	3.1	2.7	2.9	2.6	2.95	2.6	2.9	4.0	4.9	3.6
24	2.9	3.6	2.8	2.6	2.8	2.8	3.1	2.2	3.0	4.0	4.6	3.45
25	2.9	3.3	2.2	1.7	3.1	2.7	3.15	3.4	3.05	3.7	4.9	3.4
26	2.6	3.5	2.2	3.3	3.3	2.7	2.8	2.8	3.4	3.9	4.6	3.5
27	3.4	3.1	2.4	3.0	3.9	2.7	3.0	2.9	3.9	4.0	4.9	3.2
28	3.3	2.9	2.6	3.5	2.9	2.6	3.5	2.8	3.8	4.0	4.8	3.2
29	3.7	3.3	3.5	3.3	.....	3.0	3.7	2.8	3.8	4.0	4.4	3.35
30	3.5	2.6	3.0	2.7	.....	3.3	3.5	2.9	4.4	4.2	4.9	3.45
31	3.7	.....	3.0	2.7	.....	3.0	.....	2.25	.....	4.0	4.8	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,220	1,860	1,640	1,060	469	747	1,530	1,750	1,060	2,220	1,580	2,480
2	2,220	1,150	1,430	1,150	1,530	1,240	1,240	1,750	985	2,880	1,700	2,350
3	1,750	1,640	1,240	1,240	1,150	1,530	1,240	1,240	945	2,610	1,800	2,350
4	1,640	1,750	1,750	469	1,750	1,240	1,430	1,700	1,200	2,480	1,480	2,350
5	905	1,640	1,530	1,430	1,640	985	469	1,580	1,240	2,350	1,480	2,220
6	1,750	1,530	1,330	1,640	1,330	985	1,530	1,640	1,330	2,480	1,280	1,530
7	1,750	1,980	825	1,640	1,150	1,150	1,530	1,700	1,020	2,220	1,280	1,150
8	1,640	1,980	1,150	985	602	406	1,240	1,530	945	1,980	1,200	1,530
9	1,980	747	1,150	1,150	985	1,240	1,150	1,380	1,110	2,100	945	1,530
10	2,220	1,980	985	1,750	905	1,240	1,060	905	1,150	1,750	1,150	1,530
11	1,980	1,750	1,330	602	905	1,530	1,060	1,530	1,060	1,860	1,060	1,530
12	905	1,530	1,240	1,060	747	985	1,060	1,580	985	1,640	825	1,430
13	1,530	1,860	1,150	1,240	905	985	1,060	1,330	825	1,860	865	1,240
14	1,980	1,640	825	985	1,020	1,060	1,150	985	380	1,750	1,020	1,430
15	1,980	1,640	1,430	1,150	602	469	1,060	1,020	865	1,640	1,200	1,240
16	2,220	747	1,750	1,150	1,060	985	1,020	1,150	865	1,750	1,380	1,330
17	1,640	1,980	1,150	985	1,060	1,060	1,110	602	985	1,640	1,480	1,150
18	1,640	1,530	1,330	825	905	1,060	1,060	1,110	1,020	1,530	1,700	1,200
19	1,240	1,750	1,240	747	825	985	1,060	1,150	985	1,530	1,920	1,330
20	1,640	1,750	1,640	905	1,150	1,060	1,110	905	786	1,640	2,420	1,240
21	1,430	1,530	825	825	1,060	985	1,240	1,020	380	1,530	2,680	1,330
22	1,750	1,980	1,330	825	602	406	1,200	1,020	1,060	1,530	2,420	1,200
23	1,980	1,060	1,330	985	1,150	905	1,200	905	1,060	1,750	2,810	1,330
24	1,150	1,860	1,060	905	1,060	1,060	1,330	602	1,150	1,750	2,420	1,200
25	1,150	1,530	602	310	1,330	985	1,380	1,640	1,110	1,430	2,810	1,150
26	905	1,750	602	1,530	1,530	985	1,060	1,060	1,430	1,640	2,420	1,240
27	1,640	1,330	747	1,240	2,220	985	1,240	1,150	1,980	1,750	2,810	985
28	1,530	1,150	905	1,750	1,150	905	1,750	1,060	1,860	1,750	2,680	985
29	1,980	1,530	1,750	1,530	.....	1,240	1,980	1,060	1,860	1,750	2,160	1,110
30	1,750	905	1,240	985	.....	1,530	1,750	1,150	2,610	1,980	2,810	1,200
31	1,980	.....	1,240	985	.....	1,240	.....	638	.....	1,750	2,680	.....

NOTE.—Discharge computed from rating curve well defined between 775 and 3,070 second-feet. See "Accuracy" in station description.

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

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	2,220	905	1,680	B.
November	1,980	747	1,570	B.
December	1,750	602	1,220	B.
January	1,750	310	1,100	B.
February	2,220	469	1,100	B.
March	1,530	406	1,040	B.
April	1,980	469	1,240	B.
May	1,750	602	1,220	B.
June	2,610	380	1,140	C.
July	2,880	1,430	1,890	C.
August	2,810	825	1,820	B.
September	2,480	985	1,460	C.
The year	2,880	310	1,380	

NOTE.—See "Accuracy" in station description.

WISCONSIN RIVER AT MERRILL, WIS.

Location.—At highway bridge, east end of the city of Merrill, 1,000 feet below the power house and dam of the Merrill Electric Railway & Power Co., and half a mile below the mouth of Prairie River, coming in from the left.

Records available.—November 17, 1902, to September 30, 1914.

Drainage area.—2,630 square miles.

Gage.—Stevens recording gage installed September 11, 1914. November 17, 1902, to June 17, 1903, staff gage; June 17, 1903, to September 10, 1914, chain gage, attached to downstream side of the highway bridge; datum the same since June 17, 1903; records prior to this date doubtful. From January to July the chain gage was read twice daily; from August to December once daily, in the morning.

Channel and control.—Heavy gravel and rock; probably permanent, except for possible scour in high water.

Discharge measurements.—Made from highway bridge to which the gage is attached.

Winter flow.—Little ice forms at gage section. Ice forms on the right bank of the river below the gage, extending at times nearly to the center of the channel and causing a small amount of backwater at the gage.

Regulation.—Upstream from the gage are the following power plants, in order:

Merrill: Merrill Electric Light & Railway Co.
Tomahawk: Tomahawk Pulp & Paper Co.
Tomahawk: Tomahawk Tannery Co.
Kings: Tomahawk Power Co.
Hat Rapids: Rhinelander Power Co.
Rhinelander: Rhinelander Paper Co.
Otter Rapids: Eagle River Electric Co.

All these plants control the flow somewhat by means of service reservoirs. The plant at Otter Rapids has a pondage with an area of 5 square miles. In addition to regulation by the plants named above, 17 reservoirs, having a capacity of over 4,000,000,000 cubic feet, are operated for storage in the Wisconsin basin above Merrill by the Wisconsin Valley Improvement Co.

Floods.[1]—On July 24, 1912, at 5 a. m., the water reached a stage of approximately 17.5 feet, corresponding to a discharge of 45,000 second-feet. During the 24 hours previous 11.25 inches of rain had fallen in the vicinity of Merrill. According to C. B. Stewart, consulting engineer, Madison, the run-off of the 700 square miles between Merrill and Tomahawk was at the rate of 65 cubic feet per square mile; if the estimate is extended to the entire drainage area above Merrill, the flow was 17 second-feet per square mile; little rain, however, had fallen in the basin above Tomahawk.

Accuracy.—Accuracy of records impaired by diurnal fluctuations caused by the operation of power plants, by backwater from ice during the winter, and possibly from logs in the spring on the control.

Cooperation.—Station maintained in cooperation with the United States Weather Bureau and the Wisconsin Valley Improvement Co.

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[1] See Stewart, C. B., Investigation of flood flow on the watershed of upper Mississippi River: Western Soc. Engineers Jour., vol. 23, No. 4, April, 1913.

Discharge measurements of Wisconsin River at Merrill, 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.*
Dec. 9	Hoyt and Gross	5.19	[a] 2,150	Apr. 23	H. C. Beckman	6.35	4,330
Jan. 19	H. C. Beckman	4.76	[b] 1,800	May 4	.....do	7.51	[f] 7,100
Feb. 12	O. A. Steller	4.96	[c] 1,990	June 24	G. H. Canfield	6.04	3,850
Mar. 20	H. C. Beckman	4.70	[d] 1,590	Sept. 12	.....do	5.30	2,190
Apr. 22	.....do	7.10	[e] 6,170				

[a] Ice along right bank.
[b] About 50 per cent ice cover at gage.
[c] About 15 per cent ice cover at gage.
[d] Main channel clear of ice.
[e] Logs floating in river.
[f] Logs jammed in river parallel to thread of stream.

Daily gage height, in feet, of Wisconsin River at Merrill, Wis., for the year ending Sept. 30, 1914.

[A. F. Lueck, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.9	5.6	5.8	4.7	5.1	4.8	6.2	8.6	5.7	7.8	5.4	6.7
2	6.1	5.7	5.7	4.9	5.2	5.0	6.2	7.6	5.3	7.6	5.3	6.0
3	6.3	5.5	5.3	5.4	5.0	4.8	6.0	7.6	5.2	7.1	5.6	5.8
4	5.2	5.4	5.7	5.4	5.2	4.8	6.0	7.4	6.8	7.2	5.4	6.2
5	5.7	5.6	5.7	5.2	4.8	4.9	5.6	7.1	6.9	6.8	5.2	5.8
6	6.2	5.3	5.8	4.8	5.0	4.8	5.9	7.0	7.4	6.5	5.2	6.0
7	5.8	6.0	5.4	5.0	5.4	4.8	5.8	6.5	7.6	6.3	5.5	5.1
8	5.9	6.4	4.3	5.0	4.9	4.7	5.5	7.0	7.0	6.0	5.2	5.3
9	6.0	5.4	5.0	5.3	4.6	4.0	5.4	6.4	6.7	5.8	5.2	5.2
10	5.3	5.0	5.0	5.2	5.0	4.2	5.4	6.8	6.4	5.5	5.0	5.2
11	5.4	5.1	4.8	5.0	4.9	4.8	5.4	6.2	6.3	5.8	5.2	5.8
12	5.8	4.9	4.8	4.9	5.0	4.7	5.4	6.4	6.5	5.8	5.2	5.4
13	5.8	5.0	5.2	5.2	4.9	4.8	4.9	6.0	5.6	5.7	5.2	5.9
14	5.7	5.4	5.1	4.8	5.0	4.8	5.4	5.8	5.5	5.8	5.4	6.0
15	5.6	5.1	4.4	4.9	5.2	4.8	5.8	5.3	5.3	5.6	5.3	5.3
16	5.3	4.9	4.3	5.0	4.9	5.0	5.7	5.4	5.0	5.8	5.2	5.5
17	5.2	4.5	4.9	5.0	4.8	5.0	5.9	5.6	5.1	5.6	5.1	5.4
18	5.6	5.4	4.6	5.0	4.8	5.1	6.9	4.8	5.2	5.4	5.2	5.7
19	5.8	5.4	4.8	4.6	4.6	4.9	6.4	5.4	5.4	4.35	5.8	5.6
20	5.3	5.1	4.8	4.8	5.0	4.9	7.0	5.2	5.4	5.3	5.8	5.8
21	5.0	4.9	4.6	4.8	5.0	4.6	7.0	5.7	5.5	5.8	5.8	5.5
22	4.6	5.7	4.2	4.8	4.9	4.4	6.8	6.7	5.3	5.2	6.0	5.7
23	4.3	5.6	4.6	5.2	3.8	3.6	6.6	6.4	5.4	5.4	6.6	5.6
24	4.9	5.0	4.4	4.8	4.8	4.6	6.8	6.6	5.6	5.5	7.1	5.6
25	5.2	5.0	4.3	4.6	4.8	.....	7.4	5.9	5.8	6.0	6.7	5.4
26	4.9	5.1	4.2	4.8	4.9	5.0	7.4	5.5	6.5	5.6	6.8	5.4
27	5.7	4.9	4.0	4.8	4.8	4.8	7.3	5.8	6.6	5.4	6.8	5.3
28	5.7	5.4	5.3	4.7	4.8	4.7	8.0	5.8	7.7	5.4	6.6	5.2
29	6.0	5.4	5.2	5.2	.....	5.1	8.8	5.7	7.7	5.2	6.2	5.1
30	6.1	5.6	5.2	4.9	.....	5.6	8.8	5.7	7.8	5.7	6.5	5.1
31	5.6	.....	4.3	5.2	.....	5.8	.....	5.6	.....	5.4	6.2	.....

NOTE.—Discharge relation affected by ice about Jan. 1 to Mar. 20, 1914.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,480	2,920	3,290	.....	.....	.....	4,080	10,100	3,100	7,890	2,590	5,180
2	3,880	3,100	3,100	.....	.....	.....	4,080	7,370	2,440	7,370	2,440	3,680
3	4,290	2,750	2,440	.....	.....	.....	3,680	7,370	2,300	6,120	2,920	3,290
4	2,300	2,590	3,100	.....	.....	.....	3,680	6,680	5,410	6,360	2,590	4,080
5	3,100	2,920	3,100	.....	.....	.....	2,920	6,120	5,640	5,410	2,300	3,290
6	4,080	2,440	3,290	.....	.....	.....	3,480	5,880	6,860	4,730	2,300	3,680
7	3,290	3,680	2,590	.....	.....	.....	3,290	4,730	7,370	4,290	2,750	2,170
8	3,480	4,510	1,300	.....	.....	.....	2,750	5,880	5,880	3,680	2,300	2,440
9	3,680	2,590	2,050	.....	.....	.....	2,590	4,510	5,180	3,290	2,300	2,300
10	2,440	2,050	2,050	.....	.....	.....	2,590	5,410	4,510	2,750	2,050	2,300
11	2,590	2,170	1,820	.....	.....	.....	2,590	4,080	4,290	3,290	2,300	3,290
12	3,290	1,930	1,820	.....	.....	.....	2,590	4,510	4,730	3,290	2,300	2,590
13	3,290	2,050	2,300	.....	.....	.....	1,930	3,680	2,920	3,100	2,300	3,480
14	3,100	2,590	2,170	.....	.....	.....	2,590	3,290	2,750	3,290	2,590	3,680
15	2,920	2,170	1,400	.....	.....	.....	3,290	2,440	2,300	2,920	2,440	2,440
16	2,440	1,930	1,300	.....	.....	.....	3,100	2,590	2,050	3,290	2,300	2,750
17	2,300	1,500	1,930	.....	.....	.....	3,480	2,920	2,170	2,920	2,170	2,590
18	2,920	2,590	1,600	.....	.....	.....	5,640	1,820	2,300	2,590	2,300	3,100
19	3,290	2,590	1,820	.....	.....	.....	4,510	2,590	2,590	1,350	3,290	2,920
20	2,440	2,170	1,820	.....	.....	.....	5,880	2,300	2,590	2,440	3,290	3,290
21	2,050	1,930	1,600	.....	.....	1,600	5,880	3,100	2,750	3,290	3,290	2,750
22	1,600	3,100	1,210	.....	.....	1,400	5,410	5,180	2,440	2,300	3,680	3,100
23	1,300	2,920	1,600	.....	.....	760	4,950	4,510	2,590	2,590	4,950	2,920
24	1,930	2,050	1,400	.....	.....	1,600	5,410	4,950	2,920	2,750	6,120	2,920
25	2,300	2,050	1,300	.....	.....	[a]1,820	6,860	3,480	3,290	3,680	5,180	2,590
26	1,930	2,170	1,210	.....	.....	2,050	6,860	2,750	4,730	2,920	5,410	2,590
27	3,100	1,930	1,040	.....	.....	1,820	6,610	3,290	4,950	2,590	5,410	2,440
28	3,100	2,590	2,440	.....	.....	1,710	8,430	3,290	7,630	2,590	4,950	2,300
29	3,680	2,590	2,300	.....	.....	2,170	10,700	3,100	7,630	2,300	4,080	2,170
30	3,880	2,920	2,300	.....	.....	2,920	10,700	3,100	7,890	3,100	4,730	2,170
31	2,920	.....	1,300	.....	.....	3,290	.....	2,920	.....	2,590	4,080	.....

[a] Interpolated.

NOTE.—Daily discharge computed from a rating curve fairly well defined between 1,600 and 8,430 second-feet (gage heights, 4.6 and 8.0 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 1–10, 2,110 second-feet; Jan. 11–20, 1,890 second-feet; Jan. 21–31, 1,860 second-feet; Feb. 1–10, 2,020 second-feet; Feb. 11–20, 1,880 second-feet; Feb. 21–28, 1,710 second-feet; Mar. 1–10, 1,630 second-feet; Mar. 11–20, 1914, 1,840 second-feet.

Monthly discharge of Wisconsin River at Merrill, Wis., for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	4,290	1,300	2,910	B.
November	4,510	1,500	2,520	B.
December	3,290	1,040	2,000	B.
January	.....	.....	1,950	C.
February	.....	.....	1,850	C.
March	3,290	.....	1,710	C.
April	10,700	1,930	4,680	B.
May	10,100	1,820	4,320	B.
June	7,890	2,050	4,140	B.
July	7,890	1,350	3,580	B.
August	6,120	2,050	3,280	B.
September	5,180	2,170	2,950	B.
The year	10,700	.....	3,270	

WISCONSIN RIVER NEAR NEKOOSA, WIS.

Location.—One and one-half miles below Nekoosa, Wis. Tenmile Creek enters from the left about 2 miles below the station. Big Roche a Cri Creek enters also from the left about 28 miles below the station.

Records available.—May 21 to September 30, 1914.

Drainage area.—5,500 square miles.

Gage.—Staff gage, in two sections; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.0 feet, half-tenths from 3.0 to 4.0 feet, and tenths above 4.0 feet. Records after September 30, 1914, to be obtained from recording gage in a timber well in the river, on the right bank, about 300 feet below the site of the staff gage.

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

Discharge measurements.—Made from a car suspended from a cable having a clear span of 750 feet a short distance from staff gage.

Winter flow.—Data not yet available.

Regulation.—Flow controlled by the operation of the power plants and storage reservoirs above.

Cooperation.—The Wisconsin Valley Improvement Co. aided financially in establishing the recording gage and cable.

Data insufficient for estimates of discharge.

The following discharge measurement was made by G. H. Canfield and H. C. Beckman:

September 22, 1914: Gage height, 3.19 feet; discharge, 5,000 second-feet.

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

[Henry Manns, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	.....	.....	.....	.....	.....	3.65	8.0	2.58	3.2
2	.....	.....	.....	.....	.....	.....	.....	.....	3.85	8.0	2.55	4.2
3	.....	.....	.....	.....	.....	.....	.....	.....	3.85	8.2	2.15	3.6
4	.....	.....	.....	.....	.....	.....	.....	.....	6.55	7.8	2.05	3.65
5	.....	.....	.....	.....	.....	.....	.....	.....	10.0	6.3	2.55	3.5
6	.....	.....	.....	.....	.....	.....	.....	.....	(a)	5.7	2.42	3.6
7	.....	.....	.....	.....	.....	.....	.....	.....	(a)	4.6	1.90	3.2
8	.....	.....	.....	.....	.....	.....	.....	.....	(a)	4.1	1.80	3.25
9	.....	.....	.....	.....	.....	.....	.....	.....	(a)	3.55	1.95	2.75
10	.....	.....	.....	.....	.....	.....	.....	.....	9.2	3.45	2.25	2.45
11	.....	.....	.....	.....	.....	.....	.....	.....	7.2	3.55	2.25	2.65
12	.....	.....	.....	.....	.....	.....	.....	.....	5.0	3.85	2.12	2.65
13	.....	.....	.....	.....	.....	.....	.....	.....	4.5	3.9	2.00	2.8
14	.....	.....	.....	.....	.....	.....	.....	.....	3.9	3.85	1.85	3.75
15	.....	.....	.....	.....	.....	.....	.....	.....	3.8	3.9	1.55	3.4
16	.....	.....	.....	.....	.....	.....	.....	.....	3.9	3.95	1.28	4.4
17	.....	.....	.....	.....	.....	.....	.....	.....	2.80	3.35	1.75	4.8
18	.....	.....	.....	.....	.....	.....	.....	.....	2.48	3.35	2.15	5.2
19	.....	.....	.....	.....	.....	.....	.....	.....	2.60	3.3	2.78	4.5
20	.....	.....	.....	.....	.....	.....	.....	.....	3.25	3.25	3.9	4.4
21	.....	.....	.....	.....	.....	.....	.....	3.0	3.5	2.95	3.8	4.3
22	.....	.....	.....	.....	.....	.....	.....	3.35	3.7	2.50	3.45	3.6
23	.....	.....	.....	.....	.....	.....	.....	6.7	3.4	2.50	2.95	3.05
24	.....	.....	.....	.....	.....	.....	.....	8.4	3.15	2.52	3.4	3.4
25	.....	.....	.....	.....	.....	.....	.....	7.7	3.6	2.50	3.95	3.1
26	.....	.....	.....	.....	.....	.....	.....	6.1	3.85	2.45	4.4	2.90
27	.....	.....	.....	.....	.....	.....	.....	5.5	4.3	3.35	4.0	2.92
28	.....	.....	.....	.....	.....	.....	.....	4.9	6.0	3.1	3.75	2.75
29	.....	.....	.....	.....	.....	.....	.....	4.6	7.6	2.55	3.95	2.42
30	.....	.....	.....	.....	.....	.....	.....	4.2	8.0	2.20	3.65	2.45
31	.....	.....	.....	.....	.....	.....	.....	3.6	.....	2.32	3.5	.....

(a) Water above the gage.

WISCÓNSIN RIVER NEAR NECEDAH, WIS.

Location.—At the highway bridge known as "Pete-in Well Bridge," about 3 miles east of Necedah, Wis., on the road from Necedah to Strongs Prairie, about 5 miles above the mouth of Big Roche a Cri Creek, coming in from the left.

Records available.—December, 1902, to June 30, 1914, when station was discontinued.

Drainage area.—5,800 square miles.

Gage.—Chain gage attached to bridge.

Channel and control.—Bed of river near right bank rocky; both up and down stream the bed is for the most part sandy and, as shown by the cross section of measurements, shifts continually.

Floods.—Highest stage recorded at this station, 16.8 feet, October 10, 1911.

Winter flow.—Discharge relation greatly modified by ice that forms at the gage to a thickness of 1 to 2 feet.

Accuracy.—Owing to the shifting nature of the bed, estimates based on occasional discharge measurements would be only approximate. No estimates have therefore been prepared.

Cooperation.—Gage heights furnished by the Wisconsin Valley Improvement Co.

Discharge measurements of Wisconsin River near Necedah, 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.*
Dec. 9	Beckman and Canfield.	5.98	[a] 4,030	Apr. 9	M. F. Rather.....	6.88	6,390
Jan. 28	O. A. Steller.....	6.26	[b] 2,600				

[a] About 50 per cent ice cover; slush ice running. [b] About 90 per cent ice cover.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.6	6.6	5.8	7.4	.....	.....	7.2	11.4	7.4	.....	.....	.....
2	6.5	6.2	6.0	.....	6.1	6.2	8.0	12.2	7.2	.....	.....	.....
3	6.4	6.4	6.1	7.4	.....	.....	8.0	12.2	7.1	.....	.....	.....
4	6.2	6.2	6.2	.....	.....	.....	8.2	11.4	6.9	.....	.....	.....
5	6.1	5.8	6.4	6.6	6.4	6.6	8.2	10.0	9.1	.....	.....	.....
6	5.8	5.6	6.2	.....	.....	.....	8.0	9.5	12.0	.....	.....	.....
7	6.1	5.8	6.1	.....	6.2	6.7	7.7	9.1	14.4	.....	.....	.....
8	5.9	5.7	6.3	7.3	.....	.....	7.1	8.8	15.4	.....	.....	.....
9	6.2	6.0	6.1	.....	5.8	6.2	7.0	8.8	14.0	.....	.....	.....
10	6.6	6.7	5.8	6.5	.....	.....	6.5	8.2	13.3	.....	.....	.....
11	6.4	7.0	5.6	.....	.....	.....	6.6	8.1	11.9	.....	.....	.....
12	6.2	5.4	5.5	6.1	6.2	6.3	6.3	7.8	10.7	.....	.....	.....
13	6.8	5.4	5.8	.....	.....	.....	6.2	8.1	8.95	.....	.....	.....
14	6.7	5.6	5.7	.....	6.4	6.7	6.2	6.8	8.5	.....	.....	.....
15	6.0	5.5	5.2	6.4	.....	.....	6.4	7.2	8.0	.....	.....	.....
16	6.4	5.6	5.6	.....	6.2	6.3	6.6	7.2	7.8	.....	.....	.....
17	6.4	5.8	5.5	6.5	.....	.....	6.7	7.1	7.5	.....	.....	.....
18	6.1	6.1	5.4	.....	.....	.....	7.2	7.0	7.0	.....	.....	.....
19	6.0	5.9	5.4	6.3	6.4	6.6	7.7	6.9	6.9	.....	.....	.....
20	5.9	5.6	5.2	.....	.....	.....	8.2	6.8	7.1	.....	.....	.....
21	6.3	5.6	5.1	.....	6.5	7.2	8.5	6.6	7.4	.....	.....	.....
22	5.9	5.3	5.0	6.4	.....	.....	9.1	6.6	7.3	.....	.....	.....
23	6.0	5.4	5.2	.....	6.2	6.8	8.9	7.1	7.4	.....	.....	.....
24	5.6	6.0	5.4	6.3	.....	.....	8.5	9.8	7.7	.....	.....	.....
25	5.5	6.2	5.3	.....	.....	.....	8.5	10.7	7.2	.....	.....	.....
26	5.7	6.2	5.2	6.4	6.2	5.8	8.2	10.3	7.2	.....	.....	.....
27	5.3	6.1	5.5	.....	.....	5.8	8.7	9.2	7.6	.....	.....	.....
28	5.4	6.0	5.4	.....	6.5	5.5	9.5	8.6	8.5	.....	.....	.....
29	5.7	5.9	7.0	5.7	.....	6.2	9.9	8.2	9.1	.....	.....	.....
30	6.1	6.2	7.4	.....	.....	5.8	10.4	8.0	10.1	.....	.....	.....
31	6.4	.....	7.4	6.3	.....	6.2	.....	7.6	.....	.....	.....	.....

NOTE.—Discharge relation affected by ice about Dec. 23, 1913, to Mar. 31, 1914.

WISCONSIN RIVER AT MUSCODA, WIS.

Location.—At highway bridge 1 mile north of the village of Muscoda, Wis. Eagle or Mill Creek enters from the right about half a mile below the station. Underwood Creek enters from the left 4½ miles above the station.

Records available.—December 21, 1902, to December 31, 1903; December 4, 1913, to September 30, 1914. Gage heights for November 1, 1908, to December 31, 1912, published in United States Weather Bureau bulletin "Daily river stages," parts 9, 10, and 11.

Drainage area.—10,300 square miles.

Gage.—Chain gage fastened to plate girder on downstream side of bridge; read daily, morning and evening, to half-tenths. Limits of use: Tenths throughout entire range in stage during the year ending September 30, 1914. Elevation of zero of present gage is approximately 12.62 feet above that of gage maintained December 20, 1902, to December 31, 1903; elevation of gage during the period November, 1908, to December 3, 1913, as read and published by the United States Weather Bureau, was approximately the same as during the period December 4, 1913, to September 30, 1914. Elevation of present gage is approximately 666.2 feet above sea level.

Channel and control.—No well-defined control at this station; rock outcrops for about 100 feet under right hand end of the bridge; rest of the channel is sand and shifts during medium and high stages.

Discharge measurements.—Made from downstream side of bridge.

Floods.—Levels run to a stake which was place by William Hessler, observer, at the crest of a flood that occurred during October, 1911, gave a stage of 10.4 feet compared with present datum of gage; old residents report that the crest of a flood during 1888 marked a stage approximately 1 foot higher than that of October, 1911.

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

Regulation.—Nearest power plant above the station is at Prairie du Sac, about 40 miles distant; no diurnal fluctuation at this station caused by operation of this plant.

Accuracy.—Records for year good.

Discharge measurements of Wisconsin River at Muscoda, 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.*
Dec. 5	Canfield and Beckman.	2.28	7,320	June 12	Hoyt and Gross.....	8.37	43,300
Feb. 4	Beckman and Steller...	2.41	[a] 4,680	18	Beckman and Rather..	4.48	16,100
Apr. 3	Beckman and Rather..	2.47	8,590	Aug. 19	Hoyt and Dillon.....	1.91	6,150
May 4	H. C. Beckman.....	3.78	13,300				

[a] Complete ice cover above gage; partial ice cover below.

Daily gage height, in feet, of Wisconsin River at Muscoda, Wis., for the year ending Sept. 30, 1914.

[Wm. Hessler, observer.]

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.7	2.5	2.8	2.3	4.5	4.0	3.6	2.0	2.5
2	.....	1.6	2.6	2.7	2.4	4.8	3.7	4.3	2.1	2.6
3	.....	1.9	2.6	2.8	2.6	5.1	3.6	4.6	1.9	2.4
4	2.4	1.8	2.5	2.6	2.8	5.3	3.3	4.6	2.0	2.6
5	2.2	1.7	2.4	2.6	3.3	5.7	3.3	5.2	1.9	2.6
6	2.3	1.8	2.4	2.6	3.4	6.0	3.2	5.2	1.9	2.6
7	2.4	1.9	2.1	2.8	3.6	6 4	3.3	5.2	1.8	2.5
8	2.4	1.9	2.2	2.8	3.4	6.4	4.0	5.4	1.8	2.5
9	2.2	1.8	2.3	2.6	3.4	5.3	4.7	5.0	1.6	2 3
10	2.3	1.9	2.6	2.8	3.2	4.7	5.4	4.5	1.8	2.6
11	2.0	1.8	2.4	2.6	3.0	4.5	6.8	3.7	1.6	2.3
12	2.1	1.9	2.5	2.8	2.8	4.4	8.3	3.7	1.6	2.2
13	2.2	2.6	2.6	2.6	2.7	4.1	8.5	3.4	1.4	2.0
14	2.1	3.0	2.5	2.7	2.5	3.8	8.0	3.3	1.5	2.0
15	2.1	2.9	2.6	2.8	2.6	3.9	7.5	3.0	1.6	2.3
16	1.9	3.0	2.5	2.6	2.4	3.6	6.6	3.0	1.7	2.4
17	2.1	3.0	2.6	2.5	2.5	3.5	5.6	2.9	1.5	2.5
18	1.8	3.0	2.6	2.0	2.4	3.2	4.4	3.0	1.6	2.7
19	1.9	3.1	2.7	1.6	2.5	3.0	4.1	2.9	1.8	2.8
20	1.9	2.7	2.7	2.0	2.6	2.8	3.7	3.0	2.0	3.1
21	1.8	2.6	2.5	2.1	2.8	2.8	3.4	2.8	1.8	3.2
22	1.8	2.6	2.6	2.2	3.2	2.7	3.3	2.7	2.0	3.4
23	1.5	2.6	2.6	2.1	3.4	2.7	3.5	2.4	1.9	3.2
24	1.5	2.5	2.6	2.1	3.6	2.6	3.4	2.5	2.0	3.2
25	1.5	2.4	2.6	2.2	4.1	2.6	3.4	2.4	2.0	3.1
26	1.5	2.1	2.5	2.4	4.0	3.4	3.3	2.3	2.2	2.9
27	1.5	2.4	2.5	2.3	4.0	4.3	3.6	2.2	2.0	2.5
28	1.6	2.5	2.6	2.3	3.8	4.6	3.4	2.2	2.1	2.4
29	1.6	2.5	.....	2.3	3.9	4.9	3.4	2.0	2.1	2.2
30	1.5	2.6	.....	2.3	4.2	4.7	3.4	2.0	2.3	2.4
31	1.5	2.6	.....	2.0	.....	4.4	.....	2.0	2.4	.....

NOTE.—Discharge relation probably affected by ice about Dec. 1, 1913, to Mar. 15, 1914.

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

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	7,620	16,500	14,400	12,800	6,510	8,400
2	.....	8,010	17,700	13,200	15,700	6,870	8,790
3	.....	8,790	19,000	12,800	16,900	6,160	8,010
4	.....	9,570	19,900	11,600	16,900	6,510	8,790
5	.....	11,600	21,900	11,600	19,400	6,160	8,790
6	.....	12,000	23,600	11,200	19,400	6,160	8,790
7	.....	12,800	26,200	11,600	19,400	5,830	8,400
8	.....	12,000	26,200	14,400	20,400	5,830	8,400
9	.....	12,000	19,900	17,300	18,600	5,250	7,620
10	.....	11,200	17,300	20,400	16,500	5,830	8,790
11	.....	10,400	16,500	29,300	13,200	5,250	7,620
12	.....	9,570	16,100	42,800	13,200	5,250	7,240
13	.....	9,180	14,900	44,700	12,000	4,780	6,510
14	.....	8,400	13,600	39,900	11,600	5,000	6,510
15	.....	8,790	14,000	35,300	14,400	5,250	7,620
16	8,790	8,010	12,800	27,700	10,400	5,530	8,010
17	8,400	8,400	12,400	21,400	9,970	5,000	8,400
18	6,510	8,010	11,200	16,100	10,400	5,250	9,180
19	5,250	8,400	10,400	14,900	9,970	5,830	9,570
20	6,510	8,790	9,570	13,200	10,400	6,510	10,800
21	6,870	9,570	9,570	12,000	9,570	5,830	11,200
22	7,240	11,200	9,180	11,600	9,180	6,510	12,000
23	6,870	12,000	9,180	12,400	8,010	6,160	11,200
24	6,870	12,800	8,790	12,000	8,400	6,510	11,200
25	7,240	14,900	8,790	12,000	8,010	6,510	10,800
26	8,010	14,400	12,000	11,600	7,620	7,240	9,970
27	7,620	14,400	15,700	12,800	7,240	6,510	8,400
28	7,620	13,600	16,900	12,000	7,240	6,870	8,010
29	7,620	14,000	18,100	12,000	6,510	6,870	7,240
30	7,620	15,300	17,300	12,000	6,510	7,620	8,010
31	6,510	.....	16,100	.....	6,510	8,010	.....

NOTE.—Daily discharge computed from a rating curve well defined between 5,830 and 16,500 second-feet (gage heights, 1.8 and 4.5 feet) and fairly well defined between 16,910 and 44,690 second-feet (gage heights, 4.6 and 8.5 feet).

Discharge estimated because of ice from gage heghts, observer's notes, discharge measurements, and climatic records, as follows: Dec. 1–31, 6,680 second-feet; Jan. 1–31, 5,380 second-feet; Feb. 1–28, 5,000 second-feet; Mar. 1–15, 7,630 second-feet.

Monthly discharge of Wisconsin River at Muscoda, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 10,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
December	.....	.....	6,680	0.649	0.75	D.
January	.....	.....	5,380	.522	.60	D.
February	.....	.....	5,000	.485	.50	D.
March	.....	.....	7,420	.720	.83	C.
April	15,300	7,620	10,900	1.06	1.18	A.
May	26,200	8,790	15,500	1.50	1.73	B.
June	44,700	11,200	18,100	1.76	1.96	A.
July	20,400	6,510	12,000	1.17	1.35	A.
August	8,010	4,780	6,110	.593	.68	B.
September	12,000	6,510	8,810	.855	.95	A.

TOMAHAWK RIVER NEAR BRADLEY, WIS.

Location.—Three and one-half miles southeast of Cassian, Wis., 5 miles north of Bradley, Wis., and about 8 miles above the mouth of the river.

Records available.—September 18 to September 30, 1914.

Drainage area.—422 square miles.

Gage.—Standard chain gage fastened to cantilever arm on right bank of river; read to quarter-tenths morning and evening. Limits of use: Hundredths below 3.0 feet, half-tenths from 3.0 to 4.0 feet, and tenths above 4.0 feet.

Channel and control.—Heavy gravel; not likely to shift. Logs may collect at this point during spring.

Discharge measurements.—Made from cable about half a mile below the gage.

Winter flow.—Discharge relation affected by ice.

Regulation.—Flow is controlled by operation of storage reservoirs of the Wisconsin Valley Improvement Co., situated above the gage.

Data insufficient for estimates of discharge.

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

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 23[a]	G. H. Canfield		610
Sept. 18	H. C. Beckman	3.45	639

[a] Made from highway bridge 900 feet below the gage which was not installed until Sept. 18.

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

[Frank Sutherland, observer.]

Day.	Sept.	Day.	Sept.	Day.	Sept.
18	3.4	23	3.15	28	2.82
19	3.4	24	3.1	29	2.78
20	3.3	25	3.05	30	2.71
21	3.25	26	2.98		
22	3.2	27	2.89		

PRAIRIE RIVER NEAR MERRILL, WIS.

Location.—At highway bridge 4½ miles northeast of Merrill, Wis., and about 5½ miles above the mouth of the river. Haymeadow Creek enters from the left about 5 miles above the station.

Records available.—January 18 to September 30, 1914.

Drainage area.—164 square miles.

Gage.—Chain gage attached to downstream side of bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.0 feet, half-tenths between 2.0 and 3.0 feet, and tenths above 3.0 feet.

Channel and control.—Probably permanent, except during extreme high stages.

Discharge measurements.—At low stages made by wading; at medium and high stages from highway bridge to which gage is fastened.

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

Regulation.—None.

Accuracy.—Rating curve fairly well defined; records probably good.

Discharge measurements of Prairie River near Merrill, 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. 17	H. C. Beckman	1.81	[a] 88.5	Apr. 22	H. C. Beckman	3.76	[d] 762
Feb. 11	O. A. Steller	1.81	[b] 88.6	May 4	do	3.20	539
Mar. 20	H. C. Beckman	1.91	[c] 99	Sept. 12	G. H. Canfield	2.02	142

[a] Measurement made partly from bridge and partly from ice. Small amount of ice at control.
[b] About 50 per cent ice cover at control.
[c] Measurement made from bridge; small ice cover at control.
[d] No ice present.

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

[G. H. Bell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.85	1.84	2.6	4.3	2.15	3.5	1.79	2.15
2	.....	1.82	1.80	2.55	3.4	2.0	3.4	1.78	2.2
3	.....	1.84	1.84	2.45	3.3	2.0	3.3	1.78	2.35
4	.....	1.79	1.85	2.5	3.2	3.2	3.0	1.78	2.35
5	.....	1.80	1.85	2.4	3.1	3.5	2.85	1.75	2.3
6	.....	1.82	1.85	2.3	2.8	3.4	2.6	1.75	2.2
7	.....	1.82	1.85	2.2	2.9	3.3	2.5	1.75	2.1
8	.....	1.81	1.85	2.2	2.8	3.1	2.35	1.74	2.1
9	.....	1.80	1.79	2.0	2.7	2.8	2.2	1.72	2.05
10	.....	1.82	1.75	2.1	2.7	2.65	2.1	1.92	2.0
11	.....	1.81	1.78	2.0	2.7	2.4	1.97	1.91	2.0
12	.....	1.82	1.76	1.98	2.7	2.2	1.91	1.89	2.0
13	.....	1.82	1.85	2.05	2.5	2.0	2.4	1.84	2.1
14	.....	1.82	1.88	2.15	2.5	2.0	2.3	1.89	2.55
15	.....	1.82	1.90	2.25	2.3	2.0	2.25	1.84	2.6
16	.....	1.82	1.99	2.2	2.3	2.0	2.15	1.82	2.7
17	1.81	1.85	1.96	2.2	2.2	2.0	2.1	1.86	2.8
18	1.80	1.85	1.91	2.2	2.15	1.9	1.99	1.96	2.8
19	1.81	1.85	1.85	3.4	2.1	2.05	2.0	2.05	2.75
20	1.82	1.85	1.75	3.4	2.1	2.2	1.99	2.15	2.6
21	1.80	1.85	1.78	3.4	2.75	2.2	1.95	2.2	2.45
22	1.76	1.85	1.78	2.9	3.9	2.3	1.90	2.2	2.35
23	1.80	1.85	1.74	1.90	3.7	2.3	1.88	2.4	2.25
24	1.79	1.85	1.82	2.05	3.6	2.5	1.86	2.7	2.2
25	1.75	1.85	2.05	2.3	3.4	2.5	1.84	2.7	2.15
26	1.78	1.85	2.05	2.95	2.8	2.5	1.81	2.5	2.1
27	1.84	1.89	2.1	3.3	2.65	2.75	1.81	2.35	2.0
28	1.81	1.89	1.98	3.6	2.6	2.8	1.84	2.2	2.0
29	1.90	.....	2.1	4.5	2.45	3.3	1.89	2.1	1.99
30	1.91	.....	2.75	4.6	2.35	3.3	1.85	2.1	1.94
31	1.86	.....	2.7	.....	2.25	.....	1.81	2.0	.....

NOTE.—Discharge relation affected by ice about Jan. 17 to Mar. 31.

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

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	313	1,010	172	655	102	172	16	184	212	137	172	106	348
2	296	614	137	614	101	184	17	184	184	137	159	112	384
3	261	574	137	574	101	228	18	184	172	118	135	129	384
4	278	535	535	458	101	228	19	614	159	148	137	148	366
5	244	496	655	402	97	212	20	614	159	184	135	172	313
6	212	384	614	313	97	184	21	614	366	184	128	184	261
7	184	421	574	278	97	159	22	421	825	212	118	184	228
8	184	384	496	228	96	159	23	118	738	212	115	244	198
9	137	348	384	184	93	148	24	148	696	278	112	348	184
10	159	348	330	159	122	137	25	212	614	278	109	348	172
11	137	348	244	131	120	137	26	440	384	278	104	278	159
12	133	348	184	120	116	137	27	574	330	366	104	228	137
13	148	278	137	244	109	159	28	696	313	384	109	184	137
14	172	278	137	212	116	296	29	1,110	261	574	116	159	135
15	198	212	137	198	109	313	30	1,160	228	574	110	159	126
							31	.....	198	.....	104	137	.....

NOTE.—Daily discharge computed from a rating curve fairly-well defined between 103 and 870 second-feet (gage heights 1.8 and 4.0 feet).

Discharge estimated because of ice, from gage heights, observer's notes, discharge measurements and climatic records, as follows: Jan. 17–31, 88 second-feet; Feb. 1–10, 87 second-feet; Feb. 11–20, 86 second-feet; Feb. 21–28, 78 second-feet; Mar. 1–10, 72 second-feet; Mar. 11–20, 84 second-feet; Mar. 21–31, 165 second-feet.

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

[Drainage area, 164 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January 17–31	.....	.....	88.0	0.537	0.30	C.
February	.....	.....	84.1	.513	.53	C.
March	.....	.....	112	.683	.79	C.
April	1,160	118	344	2.10	2.34	A.
May	1,010	159	401	2.45	2.82	B.
June	655	118	298	1.82	2.03	A.
July	655	104	217	1.32	1.52	A.
August	348	93	152	.927	1.07	B.
September	384	126	213	1.30	1.45	A.

LITTLE RIB RIVER NEAR WAUSAU, WIS.

Location.—At second highway bridge above the mouth, about 3½ miles west of Wausau, Wis., and 1 mile above the junction with Big Rib River.

Records available.—January 10 to September 30, 1914.

Drainage area.—76 square miles.

Gage.—Chain gage fastened to downstream side of highway bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.0 feet, half-tenths between 2.0 and 3.0 feet, and tenths above 3.0 feet.

Channel and control.—Heavy gravel; free from vegetation. Probably permanent.

Discharge measurements.—Made from downstream side of bridge during high water; at low and medium stages by wading.

Regulation.—None.

Accuracy.—Records excellent except for periods when ice is present.

Discharge measurements of Little Rib River near Wausau, 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. 9	H. C. Beckman	1.23	[a] 7.5	May 5	H. C. Beckman	2.24	129
Feb. 9	O. A. Steller	1.42	[b] 8.2	June 5	W. G. Hoyt	6.15	764
Mar. 21	H. C. Beckman	1.48	[c] 24	Sept. 3	do	1.72	52
Apr. 21	do	2.15	[d] 107				

[a] Small amount of ice at control.
[b] Complete ice cover at control.
[c] Ice at measuring section, open at control.
[d] No ice at control.

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

[Harry Hartwig, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.62	1.29	2.6	2.75	1.42	3.4	1.22	4.2
2	.....	1.48	1.26	3.2	2.45	1.36	3.1	1.21	2.05
3	.....	1.42	1.28	2.45	2.15	1.64	2.2	1.20	1.68
4	.....	1.39	1.25	2.1	2.45	[a] 7.8	1.95	1.20	1.56
5	.....	1.42	1.24	1.88	2.25	5.4	1.82	1.19	1.50
6	.....	1.38	1.25	1.72	2.15	3.7	1.72	1.18	1.52
7	.....	1.38	1.26	1.88	1.98	5.3	1.64	1.18	1.48
8	.....	1.36	1.25	1.68	1.86	3.6	1.55	1.18	1.40
9	.....	1.42	1.22	1.84	1.76	2.6	1.49	1.18	1.35
10	1.12	1.48	1.22	1.60	1.74	2.2	1.44	1.24	1.42
11	1.21	1.48	1.22	1.58	1.72	2.0	1.41	1.31	1.69
12	1.24	1.45	1.21	1.62	1.78	1.86	1.41	1.25	1.51
13	1.28	1.42	1.25	2.1	1.64	1.78	1.72	1.21	1.56
14	1.27	1.39	1.36	1.92	1.55	1.72	1.54	1.20	2.55
15	1.22	1.4	3.4	2.1	1.48	1.80	1.41	1.19	2.7
16	1.21	1.44	4.4	2.2	1.46	1.65	1.36	1.24	2.1
17	1.24	1.32	3.4	2.15	1.42	1.55	1.32	1.32	1.84
18	1.21	1.35	2.35	2.15	1.38	1.48	1.30	1.39	1.75
19	1.21	1.34	2.0	2.8	1.36	1.86	1.31	1.65	1.65
20	1.22	1.3	1.84	2.35	1.32	1.72	1.30	1.51	1.58
21	1.21	1.31	1.52	2.1	2.1	1.65	1.26	1.36	1.54
22	1.24	1.29	1.38	1.98	4.6	1.68	1.25	1.30	1.54
23	1.24	1.29	1.48	1.88	2.75	1.55	1.26	1.34	1.54
24	1.26	1.29	1.38	1.82	2.2	1.82	1.26	1.54	1.51
25	1.26	1.24	2.75	2.9	2.1	1.78	1.26	1.34	1.54
26	1.28	1.26	3.9	2.5	1.92	1.60	1.24	1.20	1.48
27	1.26	1.25	2.05	2.15	1.92	3.50	1.26	1.25	1.42
28	1.25	1.25	1.95	4.1	1.74	3.6	1.30	1.25	1.41
29	1.24	.....	2.8	5.7	1.62	2.3	1.29	1.24	1.38
30	1.58	.....	5.9	3.6	1.54	1.95	1.24	1.22	1.35
31	1.76	.....	2.75	.....	1.46	.....	1.24	1.36	.....

[a] Gage height at 6 p. m. 9.85 feet.

NOTE.—Discharge relation affected by ice about Jan. 22 to Mar. 14.

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

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	176	200	20	304	8	432
2	.....	.....	.....	272	154	16	256	8	96
3	.....	.....	.....	154	110	41	117	7	46
4	.....	.....	.....	103	154	[a] 1,150	82	7	32
5	.....	.....	.....	72	124	635	64	7	26
6	.....	.....	.....	51	110	352	51	6	28
7	.....	.....	.....	72	86	618	41	6	24
8	.....	.....	.....	46	69	336	31	6	18
9	.....	.....	.....	67	56	176	25	6	15
10	5	.....	.....	36	53	117	21	9	20
11	8	.....	.....	34	51	89	19	13	47
12	9	.....	.....	38	58	69	19	10	27
13	11	.....	.....	103	41	58	51	8	32
14	10	.....	.....	78	31	51	30	7	168
15	8	.....	304	103	24	61	19	7	192
16	8	.....	465	117	23	42	16	9	103
17	9	.....	304	110	20	31	13	13	67
18	8	.....	138	110	17	24	12	17	54
19	8	.....	89	208	16	69	13	42	42
20	8	.....	67	138	13	51	12	27	34
21	8	.....	28	103	103	42	10	16	30
22	.....	.....	17	86	499	46	10	12	30
23	.....	.....	24	72	200	31	10	14	30
24	.....	.....	17	64	117	64	10	30	27
25	.....	.....	200	224	103	58	10	14	30
26	.....	.....	384	161	78	36	9	7	24
27	.....	.....	96	110	78	320	10	10	20
28	.....	.....	82	416	53	336	12	10	19
29	.....	.....	208	686	38	131	12	9	17
30	.....	.....	772	336	30	82	9	8	15
31	.....	.....	200	.....	23	.....	9	16	.....

[a] Discharge at 6 p. m. 1,880 second-feet (gage height 9.85 feet).

NOTE.—Daily discharge computed from a rating curve well defined between 7 and 830 second-feet (gage heights 1.2 and 6.5 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 22–31, 13 second-feet; Feb. 1–10, 11 second-feet; Feb. 11–20, 8 second-feet; Feb. 21–28, 4 second-feet; and Mar. 1–14, 6 second-feet.

Monthly discharge of Little Rib River near Wausau, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 76 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January 10–31	.....	.....	10.5	0.138	0.11	C.
February	.....	.....	7.9	.104	.12	C.
March	722	.....	111	1.46	1.68	C.
April	686	34	145	1.90	2.12	A.
May	499	13	88.1	1.16	1.34	A.
June	1,150	16	172	2.26	2.52	A.
July	304	9	72.0	.553	.64	A.
August	42	6	11.9	.157	.18	B.
September	432	15	58.2	.766	.85	B.

EAU CLAIRE RIVER AT KELLEY, WIS.

Location.—At highway bridge three-fourths of a mile below Kelley, Wis., about 1 mile above mouth of Big Sandy Creek, which enters from the right, and 4½ miles above mouth of river.

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

Drainage area.—326 square miles.

Gage.—Chain gage fastened to downstream side of highway bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.5 feet, and tenths above 2.5 feet.

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

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

Regulation.—Immediately above the gage is a dam that was formerly used to create a pond at a mill but is now used for floating logs; during a few days in the spring the manipulation of the gates in the dam causes sudden fluctuations at the gage; at other times the flow is natural.

Accuracy.—Records excellent.

Discharge measurements of Eau Claire River at Kelley, 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. 1	G. H. Canfield	0.77	[a] 77	May 6	H. C. Beckman	2.23	[d] 651
Feb. 10	O. A. Steller	.90	[b] 130	June 5	W. G. Hoyt	3.22	1,260
Mar. 21	H. C. Beckman	.91	[c] 103	Sept. 2	do	1.69	333
Apr. 21	do	2.61	[d] 855				

[a] Wading measurement, 400 feet below gage; no ice present.
[b] Measurement made under complete ice cover about 1,000 feet below gage.
[c] Wading measurement; little ice present.
[d] Measurement made from bridge.

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

[John Duginski, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.78	0.85	.....	2.1	3.1	1.8	3.2	0.51	1.3
2	.79	.84	.....	1.9	3.0	1.75	3.0	.....	1.65
3	.80	.82	.....	1.8	.....	2.4	2.7	.50	1.8
4	.82	.85	.....	1.7	2.7	4.4	.....	.50	1.85
5	.81	.85	0.90	1.5	2.45	4.0	2.2	.50	1.8
6	.82	.84	.94	1.65	2.15	3.7	1.9	.50	1.75
7	.82	.84	.92	1.6	2.05	3.4	1.6	.50	1.7
8	.85	.82	.....	1.5	1.9	3.2	1.2	.49	1.7
9	.86	.86	.95	1.3	1.7	3.1	1.1	.....	1.7
10	.85	.85	1.0	1.25	1.6	2.7	1.0	.80	1.8
11	1.4	.86	1.0	1.2	1.5	2.2	.98	.79	2.2
12	1.4	.92	.95	1.1	1.3	2.05	1.0	.65	2.5
13	.84	.91	1.0	1.2	1.15	1.85	1.2	.46	2.5
14	.82	.89	1.1	1.3	1.05	1.9	1.1	.46	2.2
15	.86	.88	.....	1.4	1.2	1.95	1.1	.45	1.9
16	.84	1.0	1.2	1.5	1.15	1.8	1.0	.60	1.95
17	.84	1.05	1.2	1.65	1.2	1.7	1.05	.72	2.15
18	.82	1.05	1.1	1.8	1.1	1.5	.96	.98	1.9
19	.84	1.0	1.1	2.1	1.05	1.4	.....	1.2	1.65
20	.85	1.05	1.0	3.0	1.0	1.3	.92	1.25	1.5
21	.85	1.05	1.0	2.7	1.3	.....	.81	1.15	1.4
22	.85	.98	1.0	2.5	3.7	1.4	.79	1.1	1.3
23	.84	1.0	1.0	2.05	3.1	1.5	.72	1.0	1.15
24	.84	.....	1.0	2.1	2.6	1.5	.69	.92	1.05
25	.82	.....	1.0	2.25	2.8	1.5	.62	.86	.75
26	.84	.....	1.1	2.7	2.25	1.5	.60	.82	.66
27	.84	.....	1.1	2.9	2.05	2.1	.66	.82	.....
28	.84	.....	1.2	.....	2.0	3.8	.71	.81	.61
29	.78	.....	.....	4.0	2.2	3.4	.64	.84	.49
30	.84	.....	1.9	.....	2.1	3.4	.55	.80	.51
31	.85	.....	2.1	.....	1.9	.....	.51	.89	.....

NOTE.—Discharge relation affected by ice about Jan. 11 to Mar. 20.

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

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	79	.....	.....	557	1,180	390	1,250	45	203
2	80	.....	.....	443	1,120	365	1,120	a 44	318
3	82	.....	.....	390	a1,020	738	925	44	390
4	86	.....	.....	340	925	2,120	a 771	44	416
5	84	.....	.....	261	769	1,820	617	44	390
6	86	.....	.....	318	587	1,600	443	44	365
7	86	.....	.....	296	528	1,390	296	44	340
8	92	.....	.....	261	443	1,250	176	43	340
9	94	.....	.....	203	340	1,180	150	a 62	340
10	92	.....	.....	190	296	925	125	82	390
11	.....	.....	.....	176	261	617	120	81	617
12	.....	.....	.....	150	203	528	125	61	800
13	.....	.....	.....	176	163	416	176	40	800
14	.....	.....	.....	203	138	443	150	40	617
15	.....	.....	.....	231	176	471	150	40	443
16	.....	.....	.....	261	163	390	125	55	471
17	.....	.....	.....	318	176	340	138	70	587
18	.....	.....	.....	390	150	261	116	120	443
19	.....	.....	.....	557	138	231	a 112	176	318
20	.....	.....	.....	1,120	125	203	107	190	261
21	.....	.....	125	925	203	a 217	84	163	231
22	.....	.....	125	800	1,600	231	81	150	203
23	.....	.....	125	528	1,180	261	70	125	163
24	.....	.....	125	557	862	261	66	107	138
25	.....	.....	125	647	990	261	57	94	74
26	.....	.....	150	925	647	261	55	86	62
27	.....	.....	150	1,060	528	557	62	86	a 59
28	.....	.....	176	a1,440	499	1,670	68	84	56
29	.....	.....	a 310	1,820	617	1,390	60	90	43
30	.....	.....	443	1,500	557	1,390	50	82	45
31	.....	.....	557	.....	443	.....	45	100	.....

a Interpolated.

NOTE.—Daily discharge computed from a rating curve well defined between 67 and 1,460 second-feet (gage heights, 0.7 and 3.5 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 11–20, 84 second-feet; Jan. 21–31, 77 second-feet; Feb. 1–10, 72 second-feet; Feb. 11–20, 73 second-feet; Feb. 21–28, 72 second-feet; Mar. 1–10, 89 second-feet; and Mar. 11–20, 135 second-feet.

Monthly discharge of Eau Claire River near Kelley, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 326 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	79.7	0.244	0.28	C.
February	.....	.....	72.4	.222	.23	D.
March	557	.....	150	.460	.53	C.
April	1,820	150	568	1.74	1.94	B.
May	1,600	125	549	1.68	1.94	A.
June	2,120	203	739	2.27	2.53	A.
July	1,250	45	255	.782	.90	A.
August	190	40	81.8	.251	.29	B.
September	800	43	331	1.02	1.14	A.

BIG EAU PLEINE RIVER NEAR STRATFORD, WIS.

Location.—Highway bridge at a place locally known as Weber Farm, about 2 miles north of Stratford, Wis. Station is about 1 mile above the Northwestern Railroad bridge. Dill Creek enters from the right about 5 miles above the station.

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

Drainage area.—223 square miles.

Gage.—Sloping gage, reading from 1.0 to 15.6, on the right bank of the river; on same section and at upper end of sloping gage is a vertical staff gage, reading from 15 to 18 feet; gage read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.0 feet, half-tenths between 2.0 and 3.0 feet, and tenths above 3.0 feet.

Channel and control.—Heavy gravel; probably permanent except during high stages.

Discharge measurements.—At low stages made by wading near gage; at medium and high stages made either from a highway bridge or the Northwestern Railroad bridge, both below the gage.

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

Regulation.—None.

Data insufficient for estimates of discharge.

Discharge measurements of Big Eau Pleine River near Stratford, Wis., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 23	H. C. Beckman	1.83	[a] 22.8
Sept. 18	M. F. Rather	3.78	598

[a] Wading measurement, 1,000 feet below gage.

Daily gage height, in feet, of Big Eau Pleine River near Stratford, Wis., for the year ending Sept. 30, 1914.

[Christian Weber, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	1.80	2.5	11	.....	1.70	2.2	21	.....	2.1	2.4
2	.....	1.80	2.25	12	.....	1.68	2.35	22	.....	1.98	2.45
3	.....	1.75	2.3	13	.....	1.68	2.2	23	.....	1.98	2.7
4	.....	1.72	2.15	14	.....	1.70	3.3	24	1.8	2.6	2.55
5	.....	1.70	2.1	15	.....	1.65	4.0	25	1.8	2.25	2.4
6	.....	1.65	2.1	16	.....	1.65	3.6	26	1.78	2.1	2.3
7	.....	1.65	2.05	17	.....	1.65	3.7	27	1.82	1.92	2.2
8	.....	1.65	1.98	18	.....	2.2	3.8	28	1.92	1.85	2.1
9	.....	1.62	1.92	19	.....	2.5	3.0	29	1.98	1.85	2.05
10	.....	1.68	1.92	20	.....	2.25	2.6	30	1.92	1.82	2.0
								31	1.88	1.90	.....

PLOVER RIVER NEAR STEVENS POINT, WIS.

Location.—At Fast Waters highway bridge, 7 miles above mouth of river.

Records available.—January 5 to September 30, 1914.

Drainage area.—136 square miles.

Gage.—Metal staff gage bolted to the left abutment, downstream side of bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.0 feet, and tenths above 2.0 feet.

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

Discharge measurements.—Made from downstream side of bridge to which gage is attached.

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

Regulation.—Two dams are used in connection with gristmills above the station, but the plants have little pondage, so that flow at the gage is nearly natural.

Accuracy.—Rating curve well defined; records probably good.

Discharge measurements of Plover River near Stevens Point, 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. 5	H. C. Beckman	1.30	[a] 124	May 6	H. C. Beckman	1.90	282
Feb. 6	O. A. Steller	1.43	[b] 113	June 6	W. G. Hoyt	4.15	1,120
Mar. 23	H. C. Beckman	1.15	[c] 111	9	H. C. Beckman	3.38	697
Apr. 30	do	2.75	502	Sept. 23	G. H. Canfield	1.75	252
30	do	2.76	519				

[a] Measurement made from bridge; little ice.
[b] Measurement made from bridge; about 90 per cent ice cover.
[c] Thin ice at edge only.

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

[C. A. Van Order, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.45	2.0	1.5	2.6	1.5	2.4	1.2	1.4
2	.....	1.3	2.0	1.4	2.4	1.4	2.4	1.3	1.3
3	.....	1.3	1.85	1.4	2.2	1.7	2.2	1.3	1.3
4	.....	1.5	1.8	1.35	1.95	4.1	2.2	1.2	1.2
5	1.3	1.5	1.8	1.3	1.65	4.6	2.0	1.25	1.3
6	.....	1.3	1.75	1.3	1.8	4.2	1.8	1.2	1.25
7	1.25	1.35	1.95	1.3	1.75	4.4	1.65	1.2	1.3
8	1.2	1.45	1.95	1.2	1.75	4.0	1.6	1.15	1.25
9	1.25	1.65	1.9	1.15	1.65	3.4	1.5	1.15	1.2
10	1.5	1.45	1.85	1.2	1.6	2.9	1.5	1.2	1.2
11	1.5	1.5	1.85	1.2	1.55	2.5	1.5	1.15	1.25
12	1.6	1.6	1.75	1.25	1.4	1.9	1.55	1.1	1.3
13	1.55	1.6	1.75	1.2	1.6	1.9	1.55	1.2	1.4
14	1.2	1.6	1.6	1.2	1.45	1.9	1.6	1.15	1.8
15	1.3	1.8	2.0	1.3	1.45	1.7	1.6	1.2	1.9
16	1.3	1.8	1.7	1.25	1.45	1.8	1.5	1.25	2.3
17	1.25	1.75	1.65	1.35	1.4	1.6	1.45	1.4	2.7
18	1.3	1.8	1.55	1.35	1.25	1.6	1.4	1.55	2.8
19	1.3	1.8	1.6	1.6	1.25	1.65	1.4	1.55	2.4
20	1.25	1.7	1.55	1.8	1.25	1.7	1.45	1.5	2.1
21	1.4	1.7	1.2	1.85	1.45	1.75	1.35	1.5	1.85
22	1.55	2.0	1.2	1.8	2.0	1.8	1.3	1.5	1.7
23	1.25	1.95	1.55	1.5	2.0	1.85	1.25	1.45	1.4
24	1.2	1.65	1.45	1.5	2.3	1.7	1.45	1.3	1.55
25	1.6	1.95	1.2	1.65	2.3	1.7	1.4	1.2	1.5
26	1.7	2.2	1.3	1.75	1.95	1.7	1.3	1.2	1.5
27	1.3	2.2	1.2	2.0	1.9	1.7	1.4	1.25	1.4
28	1.4	1.9	1.4	2.1	1.9	2.2	1.3	1.2	1.4
29	1.35	.....	1.3	2.7	1.8	2.3	1.3	1.2	1.35
30	1.5	.....	1.4	2.7	1.8	2.3	1.3	1.25	1.3
31	1.2	.....	1.45	.....	1.7	.....	1.25	1.3	.....

NOTE.—Discharge relation affected by ice about Jan. 5 to Mar. 31.

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

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	198	446	198	410	141	178	16	150	188	262	198	150	383
2	178	410	178	410	159	159	17	168	178	219	188	178	494
3	178	357	240	357	159	159	18	168	150	219	178	208	522
4	168	296	1,090	357	141	141	19	219	150	230	178	208	410
5	159	230	1,450	308	150	159	20	262	150	240	188	198	332
6	159	262	1,160	262	141	150	21	274	188	251	168	198	274
7	159	251	1,300	230	141	159	22	262	308	262	159	198	240
8	141	251	1,020	219	132	150	23	198	308	274	150	188	178
9	132	230	711	198	132	141	24	198	383	240	188	159	208
10	141	219	551	198	141	141	25	230	383	240	178	141	198
11	141	208	438	198	132	150	26	251	296	240	159	141	198
12	150	178	285	208	124	159	27	308	285	240	178	150	178
13	141	219	285	208	141	178	28	332	285	357	159	141	178
14	141	188	285	219	132	262	29	494	262	383	159	141	168
15	159	188	240	219	141	285	30	494	262	383	159	150	159
							31	.....	240	.....	150	159	.....

NOTE.—Daily discharge computed from a rating curve well defined between 198 and 1,370 second-feet (gage heights 1.5 and 4.5 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Jan. 5–15, 125 second-feet; Jan. 16–31, 123 second-feet; Feb. 1–10, 115 second-feet; Feb. 11–20, 100 second-feet; Feb. 21–28, 140 second-feet; Mar. 1–10, 165 second-feet; Mar. 11–20, 192 second-feet; and Mar. 21–31, 140 second-feet.

Monthly discharge of Plover River near Stevens Point, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 136 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January 5–31	.....	.....	124	0.912	0.92	C.
February	.....	.....	117	.860	.90	C.
March	.....	.....	165	1.21	1.40	D.
April	494	132	212	1.56	1.74	B.
May	466	150	257	1.89	2.18	B.
June	1,450	178	449	3.30	3.68	A.
July	410	150	217	1.60	1.84	B.
August	208	124	155	1.14	1.31	B.
September	522	141	223	1.64	1.83	B.

BARABOO RIVER NEAR BARABOO, WIS.

Location.—At highway bridge 4 miles downstream from Baraboo, Wis., about 3 miles below the outlet of Devils Lake coming in from the right, and 15 miles above mouth of river.

Records available.—December 18, 1913, to September 30, 1914.

Drainage area.—572 square miles.

Gage.—Chain gage, attached to upstream side of bridge; read daily, morning and evening, to hundredths. Limits of use: Hundredths below 2.0 feet, half-tenths between 2.0 and 3.0 feet, and tenths above 3.0 feet.

Channel and control.—Sandy; likely to shift during floods.

Discharge measurements.—Made from highway bridge to which gage is attached.

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

Regulation.—Daily flow may be somewhat affected by operation of power plants in Baraboo; estimates of mean monthly discharge probably represent nearly the natural flow.

Accuracy.—Records probably good.

Discharge measurements of Baraboo River near Baraboo, 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.*
Dec. 18	H. C. Beckman	2.16	[a]212	May 11	H. C. Beckman	2.41	271
Jan. 23	do	1.90	[b]185	29	G. H. Canfield	4.02	493
Feb. 25	O. A. Steller	2.24	[c]150	June 22	H. C. Beckman	5.47	777
Mar. 27	W. G. Hoyt	2.77	[a]323	Aug. 19	do	5.53	664
Apr. 1	Canfield and Rather	4.58	571				

[a] No ice; control clear. [b] Thin ice along banks at control. [c] Complete ice cover.

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

[G. C. Johnson, observer.]

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.45	6.0	2.9	4.5	6.5	2.0	4.3	1.44	1.74
2	.....	1.90	5.5	2.75	4.5	5.4	2.1	2.9	1.24	1.64
3	.....	1.84	3.8	3.2	4.3	3.6	2.1	2.7	1.08	2.9
4	.....	1.66	3.1	3.7	2.8	3.8	2.4	2.55	1.11	2.8
5	.....	1.40	2.45	3.6	3.0	4.0	2.1	1.88	1.60	2.3
6	.....	1.68	2.4	2.9	2.65	4.4	2.3	2.0	1.70	1.8
7	.....	1.88	2.0	2.85	2.9	3.7	3.5	2.05	1.61	1.93
8	.....	1.96	1.80	2.2	2.9	2.95	3.2	2.05	1.36	1.35
9	.....	1.93	1.78	2.15	2.85	3.3	3.3	1.97	1.40	1.52
10	.....	1.92	2.2	2.25	2.9	2.35	2.55	1.82	1.24	1.44
11	.....	2.1	2.35	2.25	2.75	2.45	1.98	2.3	1.24	1.74
12	.....	1.88	2.35	2.3	2.85	4.1	1.60	1.36	1.52	1.62
13	.....	1.95	2.15	2.75	2.5	4.2	1.45	1.93	1.41	1.42
14	.....	2.15	2.2	.....	2.5	3.6	1.61	3.3	1.67	1.85
15	.....	2.1	1.88	3.8	2.4	2.95	.....	5.2	1.55	4.0
16	.....	2.05	1.81	4.1	2.8	2.6	.....	5.7	1.62	5.4
17	.....	1.76	2.1	4.4	2.65	2.1	1.99	4.5	1.08	5.7
18	2.15	1.51	2.25	4.6	2.75	2.0	1.95	2.9	1.97	5.5
19	2.05	1.40	2.2	3.4	2.85	2.0	1.62	2.25	4.6	4.8
20	2.2	1.59	2.25	2.55	3.5	1.97	1.70	1.74	3.9	3.0
21	1.74	1.94	2.25	2.25	.....	2.05	3.4	1.96	3.3	2.35
22	1.76	2.35	1.97	1.93	.....	2.1	5.5	1.95	3.2	1.98
23	2.1	1.96	1.98	2.45	.....	2.55	6.7	1.83	2.6	1.53
24	1.93	1.92	2.15	2.5	.....	2.4	7.2	1.82	2.75	2.1
25	1.90	2.1	2.3	2.55	3.3	3.0	7.3	1.72	2.85	1.96
26	1.69	1.96	2.25	2.6	3.4	4.9	5.4	1.78	2.6	1.88
27	1.83	1.88	2.35	2.6	3.4	5.5	3.7	1.56	2.2	1.69
28	1.72	2.1	2.45	2.7	4.2	5.5	3.4	1.42	1.96	1.62
29	1.78	3.5	.....	2.95	4.8	3.9	4.3	1.71	1.82	1.84
30	1.78	5.4	.....	3.7	6.4	2.85	5.1	1.70	1.74	1.90
31	2.05	5.6	.....	4.0	.....	1.61	.....	1.73	1.52	.....

NOTE.—Discharge relation affected by ice about Dec. 18, 1913, to Mar. 10, 1914.

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

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	568	1,040	213	535	152	181
2	.....	568	755	226	337	134	171
3	.....	535	435	226	309	119	337
4	.....	323	463	267	288	122	323
5	.....	351	491	226	198	167	253
6	.....	302	551	253	213	177	188
7	.....	337	449	421	220	168	204
8	.....	337	344	379	220	144	144
9	.....	330	393	393	209	148	159
10	.....	337	260	288	190	134	152
11	246	316	274	210	253	134	181
12	253	330	505	167	144	159	169
13	316	281	520	152	204	149	150
14	*a* 390	281	435	168	393	174	194
15	463	267	344	*a* 183	710	162	491
16	505	323	295	*a* 197	826	169	755
17	551	302	226	212	568	119	826
18	586	316	213	206	337	209	778
19	407	330	213	169	246	502	625
20	288	421	209	177	181	396	351
21	246	*a* 416	220	407	208	350	260
22	204	*a* 411	226	778	206	325	210
23	274	*a* 405	288	1,100	192	295	160
24	281	*a* 400	267	1,250	190	316	226
25	288	393	351	1,280	179	330	208
26	295	407	646	755	186	295	198
27	295	407	778	449	163	239	176
28	309	520	778	407	150	208	169
29	344	625	477	535	178	190	193
30	449	1,010	330	688	177	181	200
31	491	.....	168	.....	180	159	.....

a Interpolated.

NOTE.—Daily discharge computed from a rating curve fairly well defined between 188 and 826 second-feet (gage heights, 1.8 and 5.7 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 18–31, 184 second-feet; Jan. 1–10, 170 second-feet; Jan. 11–20, 180 second-feet; Jan. 21–31, 380 second-feet; Feb. 1–10, 366 second-feet; Feb. 11–20, 165 second-feet; Feb. 21–28, 156 second-feet; and Mar. 1–10, 296 second-feet. Discharge Aug. 19–22 estimated by means of measurement made Aug. 19.

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

[Drainage area, 572 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
December 18–31	.....	.....	184	0.322	0.17	C.
January	.....	.....	248	.434	.50	D.
February	.....	.....	234	.409	.43	D.
March	586	.....	337	.589	.68	C.
April	1,010	267	405	.708	.79	A.
May	1,040	168	418	.731	.84	A.
June	1,280	152	413	.722	.81	A.
July	826	144	277	.484	.56	A.
August	502	119	211	.369	.43	B.
September	826	144	288	.503	.56	A.

KICKAPOO RIVER AT GAYS MILLS, WIS.

Location.—At highway bridge immediately below the Norwood Mill, in the town of Kickapoo, Wis., about 25 miles above the mouth of the river and 2 miles below the mouth of Tainter Creek, coming in from the right.

Records available.—December 25, 1913, to September 30, 1914.

Drainage area.—629 square miles.

Gage.—Chain gage fastened to downstream side of highway bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.0 feet, and tenths above 2.0 feet.

Channel and control.—May shift during high water.

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

Regulation.—Little, if any, diurnal fluctuation noted at the gage; flow probably natural.

Accuracy.—See footnotes.

Discharge measurements of Kickapoo River at Gays Mills, 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.*
Dec. 18	G. H. Canfield	0.96	[a] 224	June 23	M. F. Rather	5.47	1,310
24	H. C. Beckman	1.13	[b] 274	24	do	3.46	693
Jan. 21	W. G. Hoyt	.97	[a] 228	24	do	2.67	530
Feb. 26	O. A. Steller	1.58	[c] 213	24	do	2.52	527
Mar. 27	H. C. Beckman	1.32	[a] 336	24	do	2.07	508
Apr. 4	Beckman and Rather	1.44	[a] 363	25	do	1.87	441
June 23	M. F. Rather	5.35	1,300	Aug. 21	E. E. Dillon	1.50	326

[a] Control clear of ice.
[b] Thin ice along shore.
[c] Measurement made under complete ice cover; partial ice cover at control.

Daily gage height, in feet, of Kickapoo River at Gays Mills, Wis., for the year ending Sept. 30, 1914.

[N. T. Norwood, observer.]

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.1	3.8	2.7	2.3	1.4	1.15	2.8	0.91	2.1
2	.....	1.1	1.55	2.8	2.5	1.3	1.05	3.1	1.0	2.6
3	.....	1.1	1.3	2.4	1.7	1.35	1.1	2.0	1.0	1.5
4	.....	1.1	1.25	1.9	1.45	1.2	1.15	1.9	1.0	1.2
5	.....	1.1	1.2	1.95	1.25	1.5	1.65	1.55	.90	1.1
6	.....	1.1	1.15	2.0	1.35	1.35	2.1	1.3	1.0	1.1
7	.....	1.1	1.2	3.0	1.4	1.2	1.65	1.4	1.0	1.0
8	.....	1.1	1.4	2.2	1.4	1.2	2.0	1.5	1.0	1.0
9	.....	1.1	1.35	1.8	1.3	1.2	2.3	1.3	.97	1.0
10	.....	1.1	1.5	1.5	1.2	1.1	1.5	1.2	.93	1.0
11	.....	1.05	1.75	1.4	1.3	1.3	1.1	1.2	.90	1.0
12	.....	1.2	1.6	1.35	1.3	1.4	1.2	1.75	.90	1.0
13	.....	1.1	1.45	1.3	1.25	1.35	1.1	3.0	.93	1.0
14	.....	1.1	1.4	1.55	1.3	1.3	1.05	2.6	.89	1.95
15	.....	1.15	1.4	2.2	1.2	1.2	1.3	2.0	.88	3.6
16	.....	1.15	1.6	2.5	1.3	1.1	1.1	1.5	.....	3.3
17	.....	1.1	1.6	1.9	1.25	1.0	1.0	1.4	.96	2.7
18	.....	1.1	1.55	1.2	1.2	1.05	1.05	1.3	1.0	2.0
19	.....	1.1	1.55	1.1	1.3	1.0	1.05	1.2	1.8	1.5
20	.....	1.15	1.5	1.1	1.6	1.05	1.0	1.1	1.3	1.2
21	.....	1.1	1.5	1.1	1.45	1.05	2.3	1.1	1.4	1.2
22	.....	.....	1.4	1.1	1.25	1.1	4.6	1.1	1.1	1.3
23	.....	.....	1.5	1.1	1.2	2.1	5.3	1.05	1.5	1.5
24	.....	.....	1.5	1.1	1.15	2.4	2.9	1.05	1.9	1.4
25	1.2	.....	1.55	1.15	1.3	4.7	1.7	1.1	1.25	1.25
26	1.15	.....	1.5	1.2	1.7	4.3	4.6	1.1	1.05	1.15
27	1.1	.....	1.65	1.3	1.5	1.9	4.0	1.1	1.0	1.1
28	1.1	.....	2.6	1.3	1.45	1.6	4.8	1.2	1.0	1.05
29	1.05	.....	.....	1.45	1.75	1.5	4.6	1.05	.98	1.1
30	1.05	5.0	.....	3.2	1.95	1.3	2.3	1.05	1.0	1.1
31	1.1	4.4	.....	3.1	.....	1.15	.....	1.0	.99	.....

NOTE.—Discharge relation affected by ice about Feb. 9 to Mar. 11.

Daily discharge, in second-feet, of Kickapoo River at Gays Mills, Wis., for the year ending Sept. 30, 1914.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	265	790	.....	518	355	280	545	162	470
2	.....	265	392	.....	525	325	251	595	185	522
3	.....	265	325	.....	430	340	265	485	185	325
4	.....	265	310	.....	368	295	280	470	185	237
5	.....	265	295	.....	310	380	418	392	159	211
6	.....	265	280	.....	340	340	500	325	185	211
7	.....	265	295	.....	355	295	418	355	185	185
8	.....	265	355	.....	355	295	485	380	185	185
9	.....	265	.....	.....	325	295	518	325	177	185
10	.....	265	.....	.....	295	265	380	295	167	185
11	.....	251	.....	.....	325	325	265	295	159	185
12	.....	295	.....	340	325	355	295	440	159	185
13	.....	265	.....	325	310	340	265	575	167	185
14	.....	265	.....	392	325	325	251	527	156	440
15	.....	280	.....	510	295	295	325	485	154	670
16	.....	280	.....	525	325	265	265	380	[a]164	595
17	.....	265	.....	470	310	237	237	355	175	525
18	.....	265	.....	295	295	251	251	325	185	450
19	.....	265	.....	265	325	237	251	295	405	325
20	.....	280	.....	265	405	251	237	265	265	237
21	.....	265	.....	265	368	251	518	265	295	237
22	.....	[b]265	.....	265	310	265	1,030	265	211	265
23	.....	[b]265	.....	265	295	500	1,260	251	325	325
24	.....	[b]265	.....	265	280	522	560	251	430	295
25	295	[b]265	.....	280	325	1,060	430	265	251	251
26	280	[b]265	.....	295	430	940	1,030	265	198	224
27	265	[b]290	.....	325	380	470	850	265	185	211
28	265	[b]300	.....	325	368	405	1,100	295	185	198
29	251	[b]500	.....	368	440	380	1,030	251	180	211
30	251	1,160	.....	620	478	325	518	251	185	211
31	265	971	.....	595	.....	280	.....	237	182	.....

[a] Interpolated. [b] Estimated.

NOTE.—Daily discharge computed from a rating curve well defined between 211 and 1,340 second-feet (gage heights, 0.9 and 5.5 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Feb. 9–15, 280 second-feet; Feb. 16–28, 226 second-feet; and Mar. 1–11, 436 second-feet.

Monthly discharge of Kickapoo River at Gays Mills, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 629 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
December 25–31	295	251	267	0.424	0.11	B.
January	1,160	251	328	.521	.60	B.
February	790	.....	284	.452	.47	C.
March	620	.....	389	.618	.71	C.
April	525	280	358	.569	.63	A.
May	1,060	237	370	.588	.68	A.
June	1,260	237	492	.782	.87	A.
July	595	237	354	.563	.65	B.
August	430	154	206	.328	.38	C.
September	670	185	298	.474	.53	B.

TURKEY RIVER AT GARBER, IOWA.

Location.—At single-span highway bridge at Garber, about 800 feet above the mouth of Wayne Creek, which enters from the right.

Records available.—August 29, 1913, to September 30, 1914, when station was discontinued.

Drainage area.—1,560 square miles.

Gage.—Chain gage attached to the bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 3.0, half-tenths between 3.0 and 4.0, and tenths above 4.0 feet.

Channel and control.—Control consists of sand and mud; channel shifting.

Discharge measurements.—Made from the bridge and at low water by wading.

Regulation.—An electric-light plant and gristmill at Elkader probably produce a slight daily fluctuation.

Floods.—What is probably the highest stage within the past 20 years occurred on May 18, 1902. On that date a stage of about 23.7 feet referred to gage datum was reached as indicated by the high-water marks on the door of A. F. Grafe's residence in Garber.

Accuracy.—Gage-height record reliable.

Data insufficient for estimates of discharge.

Discharge measurements of Turkey River at Garber, Iowa, during the year ending Sept. 30, 1914.

[Made by J. B. Stewart.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 20	3.23	348
June 25	4.84	1,110

Daily gage height, in feet, of Turkey River at Garber, Iowa, for the year ending Sept. 30, 1914.

[E. J. Prolow, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.7	3.05	3.3	.....	4.5	.....	4.4	4.2	3.95	4.3	3.25	4.1
2	3.35	3.1	3.35	.....	3.6	.....	4.2	3.85	3.7	4.2	3.15	3.2
3	3.2	3.05	3.35	.....	3.7	.....	4.0	3.75	3.6	4.0	3.1	3.1
4	3.05	3.1	3.3	.....	3.4	.....	3.8	4.3	3.5	3.85	3.05	3.05
5	4.1	3.05	3.3	.....	3.6	.....	3.5	4.2	4.3	3.9	3.15	3.05
6	3.3	3.05	3.3	.....	4.6	.....	3.4	3.85	5.0	3.8	3.15	2.89
7	3.2	3.05	3.35	.....	.....	.....	3.5	3.65	5.8	3.95	3.05	2.85
8	3.25	3.05	3.05	.....	.....	.....	3.35	3.45	5.1	4.0	3.0	2.87
9	3.2	3.05	3.15	.....	.....	.....	3.25	3.45	4.6	3.6	2.91	2.81
10	3.7	3.05	3.2	.....	.....	.....	2.98	3.40	4.2	3.6	2.88	2.92
11	5.2	2.99	3.2	.....	.....	.....	3.2	3.75	4.0	3.6	3.0	3.0
12	4.2	3.05	3.2	.....	.....	4.1	3.15	3.65	3.9	3.45	2.96	2.92
13	4.0	3.05	3.25	.....	.....	4.1	3.1	3.75	3.95	3.65	2.96	3.15
14	3.7	3.05	3.25	.....	.....	4.1	3.1	3.7	10.9	3.45	2.91	5.6
15	3.5	3.05	3.25	.....	.....	3.9	3.1	3.6	12.3	3.4	2.97	5.4
16	3.4	3.05	3.2	.....	.....	3.8	3.1	3.55	8.1	3.5	3.05	4.4
17	3.4	3.0	3.2	.....	.....	3.5	3.0	3.45	6.3	3.55	2.91	4.0
18	3.3	3.0	3.2	.....	.....	3.25	3.05	3.4	5.5	3.55	3.0	3.9
19	3.2	3.15	3.2	.....	.....	3.25	3.15	3.3	5.6	3.4	3.95	3.7
20	3.2	3.2	3.15	.....	.....	3.2	3.35	3.3	5.1	3.4	3.8	3.5
21	3.2	3.2	.....	.....	.....	3.2	3.3	3.15	5.6	3.35	3.3	3.45
22	3.2	3.2	.....	.....	.....	3.15	3.15	3.25	7.2	3.3	3.0	4.0
23	3.15	3.2	.....	.....	.....	3.1	3.15	3.25	6.0	3.25	3.05	4.1
24	3.1	3.2	.....	.....	.....	3.05	3.1	5.4	5.2	4.0	2.96	3.9
25	3.1	3.15	.....	.....	.....	3.05	3.2	5.8	4.7	4.5	3.1	3.7
26	3.1	3.1	.....	.....	.....	3.2	3.3	8.2	5.2	4.1	2.98	3.55
27	3.05	3.1	.....	.....	.....	3.25	3.35	5.7	4.7	3.65	2.91	3.35
28	3.0	3.1	.....	.....	.....	3.8	3.8	5.0	4.3	3.5	2.88	3.35
29	3.15	3.15	.....	7.2	.....	4.3	4.9	4.9	4.1	3.35	2.93	3.35
30	3.15	3.25	.....	5.6	.....	4.5	4.6	4.4	4.1	3.25	2.97	3.35
31	3.1	.....	.....	4.7	.....	4.6	.....	4.0	.....	3.3	2.90	.....

NOTE.—Discharge relation probably affected by ice about Dec. 21, 1913, to Mar. 11, 1914.

MAQUOKETA RIVER ABOVE MOUTH OF NORTH FORK OF MAQUOKETA RIVER, NEAR MAQUOKETA, IOWA.

Location.—At the Goddard Bridge, about 6 miles northwest of Maquoketa; about 1,000 feet above the mouth of Pumpkin Run entering from the right, and about 7 miles above the mouth of North Fork of Maquoketa River.

Records available.—August 31, 1913, to September 30, 1914.

Drainage area.—957 square miles.

Gage.—Chain gage attached to bridge; read daily, in the morning, to half-tenths. Limits of use: Half-tenths below and tenths above 3.0 feet.

Channel and control.—No well-defined control; channel somewhat shifting.

Discharge measurements.—Made from bridge.

Regulation.—A gristmill at Canton, about 12 miles upstream, probably causes a slight fluctuation at the gage.

Data insufficient for estimating discharge for stages above 4.2 feet.

Discharge measurements of Maquoketa River above the mouth of North Fork of Maquoketa River near Maquoketa, Iowa, 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. 27	W. F. Bickel	2.54	279	June 24	J. B. Stewart	2.94	430
May 19	J. B. Stewart	2.28	238				

Daily gage height, in feet, of Maquoketa River above the mouth of North Fork of Maquoketa River near Maquoketa, Iowa, for the year ending Sept. 30, 1914.

[Frank Prindle, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.2	2.15	2.2	.....	.....	.....	2.95	2.15	2.55	2.55	2.1	2.8
2	2.1	2.15	2.15	.....	.....	.....	3.2	2.15	2.5	2.5	2.1	2.7
3	2.2	2.2	2.2	.....	.....	.....	2.9	2.15	2.2	2.45	1.95	2.75
4	2.1	2.1	2.2	2.3	.....	.....	2.8	4.0	12.0	2.4	1.95	2.7
5	2.2	2.15	2.2	2.3	.....	.....	2.75	3.2	7.1	2.3	1.95	2.7
6	2.1	2.1	2.15	2.3	.....	.....	2.65	2.85	5.6	2.3	1.9	12.1
7	2.1	2.1	2.15	2.3	.....	.....	2.6	2.85	4.2	2.5	1.9	3.6
8	2.1	2.2	2.1	2.2	.....	.....	2.6	2.5	4.0	2.1	1.9	3.0
9	2.1	2.1	2.1	2.25	.....	.....	2.55	2.5	3.8	2.1	1.85	2.9
10	2.1	2.1	2.1	2.25	.....	.....	2.45	2.5	3.6	2.5	1.8	2.9
11	2.4	2.15	2.1	.....	.....	.....	2.4	3.4	3.2	2.5	1.8	2.7
12	2.2	2.1	2.1	.....	.....	.....	2.4	3.2	3.1	2.5	1.8	2.25
13	2.2	2.15	2.1	.....	.....	.....	2.35	3.0	2.8	2.5	1.8	2.6
14	2.2	2.1	2.1	.....	.....	.....	2.35	2.95	2.9	2.0	1.8	2.6
15	2.15	2.1	2.15	.....	.....	2.5	2.3	2.8	2.85	2.0	1.8	14.1
16	2.15	2.1	2.15	.....	.....	2.5	2.25	2.8	2.8	2.0	1.9	8.4
17	2.3	2.15	2.15	.....	.....	2.35	2.25	2.8	2.8	2.35	1.9	5.9
18	2.2	2.1	2.15	.....	.....	2.3	2.25	2.4	2.8	2.15	1.9	4.7
19	2.2	2.2	2.15	.....	.....	2.2	2.2	2.2	2.8	2.1	7.8	4.2
20	2.2	2.15	2.15	.....	.....	2.2	2.2	2.25	2.55	2.1	2.3	3.8
21	2.15	2.15	2.4	.....	.....	2.2	2.2	2.2	2.55	2.5	2.3	3.6
22	2.1	2.1	.....	.....	.....	2.2	2.2	2.55	2.8	2.5	2.3	4.1
23	2.2	2.1	.....	.....	.....	2.15	2.15	2.15	2.9	2.5	2.3	3.6
24	2.1	2.1	.....	.....	.....	2.1	2.15	2.15	3.6	2.5	2.3	3.4
25	2.15	2.1	.....	.....	.....	2.2	2.15	2.2	4.1	2.5	2.3	3.2
26	2.15	2.1	.....	.....	.....	3.2	2.1	2.35	3.9	1.95	2.3	3.1
27	2.1	2.15	.....	.....	.....	2.4	2.1	2.65	3.8	1.95	2.3	3.3
28	2.15	2.15	.....	.....	.....	2.4	2.1	2.65	3.2	1.95	2.3	3.3
29	2.2	2.1	.....	.....	.....	2.6	2.15	3.3	3.1	2.15	2.3	3.3
30	2.2	2.1	.....	.....	.....	2.8	2.15	2.75	2.8	2.1	1.85	3.2
31	2.15	.....	.....	.....	.....	2.9	.....	2.6	.....	2.1	2.9	.....

NOTE.—Discharge relation affected by ice about Dec. 21, 1913, to Mar. 14, 1914.

Daily discharge, in second-feet, of Maquoketa River above the mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, for the period Sept. 1, 1913, to Sept. 30, 1914.

Day.	Sept.	Day.	Sept.	Day	Sept.
1913.		1913.		1913.	
1	187	11	193	21	223
2	193	12	193	22	223
3	181	13	207	23	223
4	187	14	200	24	215
5	193	15	193	25	207
6	193	16	207	26	215
7	207	17	193	27	207
8	181	18	215	28	207
9	193	19	207	29	193
10	187	20	207	30	207

Daily discharge, in second-feet, of Maquoketa River above the mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, for the period Sept. 1, 1913, to Sept. 30, 1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913-14.												
1	223	215	223	.....	.....	.....	430	215	296	296	207	370
2	207	215	215	.....	.....	.....	548	215	283	283	207	337
3	223	223	223	.....	.....	.....	408	215	223	272	187	354
4	207	207	223	.....	.....	.....	370	1,000	.....	261	187	337
5	223	215	223	.....	.....	.....	354	548	.....	241	187	337
6	207	207	215	.....	.....	.....	322	389	.....	241	181	.....
7	207	207	215	.....	.....	.....	308	389	.....	283	181	750
8	207	223	207	.....	.....	.....	308	283	1,000	207	181	451
9	207	207	207	.....	.....	.....	296	283	870	207	176	408
10	207	207	207	.....	.....	.....	272	283	750	283	170	408
11	261	215	207	.....	.....	.....	261	648	548	283	170	337
12	223	207	207	.....	.....	.....	261	548	498	283	170	232
13	223	215	207	.....	.....	.....	251	451	370	283	170	308
14	223	207	207	.....	.....	.....	251	430	408	193	170	308
15	215	207	215	.....	.....	283	241	370	389	193	170	.....
16	215	207	215	.....	.....	283	232	370	370	193	181	.....
17	241	215	215	.....	.....	251	232	370	370	251	181	.....
18	223	207	215	.....	.....	241	232	261	370	215	181	.....
19	223	223	215	.....	.....	223	223	223	370	207	.....	.....
20	223	215	215	.....	.....	223	223	232	296	207	241	870
21	215	215	.....	.....	.....	223	223	223	296	283	241	750
22	207	207	.....	.....	.....	223	223	296	370	283	241	1,070
23	223	207	.....	.....	.....	215	215	215	408	283	241	750
24	207	207	.....	.....	.....	207	215	215	750	283	241	648
25	215	207	.....	.....	.....	223	215	223	1,070	283	241	548
26	215	207	.....	.....	.....	548	207	251	930	187	241	498
27	207	215	.....	.....	.....	261	207	322	870	187	241	598
28	215	215	.....	.....	.....	261	207	322	548	187	241	598
29	223	207	.....	.....	.....	308	215	598	498	215	241	598
30	223	207	.....	.....	.....	370	215	354	370	207	176	548
31	215	.....	.....	.....	.....	408	.....	308	.....	207	408	.....

Monthly discharge of Maquoketa River above the mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, for the period Sept. 1, 1913, to July 31, 1914.

[Drainage area, 957 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
September	223	181	201	0.210	0.23	A.
October	261	207	218	.228	.26	A.
November	223	207	211	.220	.25	A.
December 1-20	223	207	214	.224	.17	B.
March 15-31	548	207	279	.292	.18	B.
April	548	207	272	.284	.32	A.
May	1,000	215	356	.372	.43	B.
July	296	187	242	.253	.29	B.

MAQUOKETA RIVER BELOW MOUTH OF NORTH FORK OF MAQUOKETA RIVER, NEAR MAQUOKETA, IOWA.

Location.—At the Bridgeport Bridge, about 3 miles northeast of Maquoketa, in the southwest corner of the NE. ¼ sec. 17, T. 84 N., R. 3 E., about 1,200 feet above the mouth of Mill Creek, which enters from the right, and about 2 miles below the mouth of North Fork of Maquoketa River.

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

Drainage area.—1,570 square miles.

Channel and control.—No well-defined control; channel shifting.

Discharge measurements.—Made from bridge.

Regulation.—Practically no control at this station.

Data insufficient for estimating discharge for stages above 5.8 feet.

Discharge measurements of Maquoketa River below the mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, 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. 26	W. F. Bickel	3.50	962	June 24	J. B. Stewart	3.00	689
May 19	J. B. Stewart	2.47	432				

Daily gage height, in feet, of Maquoketa River below mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, for the year ending Sept. 30, 1914.

[John Strodthoff, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.5	2.4	2.4	2.3	2.6	.....	3.2	2.4	2.6	2.8	2.05	4.6
2	2.4	2.4	2.4	2.25	2.6	.....	3.2	2.4	2.5	2.6	2.05	4.2
3	2.35	2.4	2.45	2.4	2.9	.....	3.1	2.4	2.6	2.6	2.0	3.2
4	2.4	2.4	2.4	2.4	2.6	.....	3.0	5.0	2.5	2.5	2.0	2.7
5	2.4	2.35	2.4	2.4	.....	.....	2.8	3.9	13.1	2.4	2.0	2.5
6	2.4	2.35	2.4	.....	2.6	.....	2.8	3.0	7.5	2.4	2.1	11.6
7	2.35	2.35	.....	2.3	3.8	.....	2.7	2.9	6.5	2.25	2.0	3.2
8	2.3	2.4	2.1	2.3	.....	.....	2.7	2.7	4.1	2.3	2.0	2.8
9	2.35	2.35	2.15	2.3	.....	.....	2.6	2.6	3.8	2.25	1.95	2.5
10	2.35	2.35	2.3	2.1	.....	.....	2.6	2.5	3.6	2.25	.....	2.4
11	2.8	2.2	2.4	2.0	.....	.....	2.6	3.8	3.3	.....	1.9	2.4
12	2.6	2.25	2.45	2.5	.....	3.6	2.6	4.2	3.3	2.25	1.9	2.4
13	2.6	2.4	2.45	3.2	.....	2.7	2.5	3.8	3.0	2.2	1.9	2.35
14	2.45	2.3	2.4	.....	.....	2.7	2.5	3.3	3.3	2.2	1.9	7.2
15	2.4	2.3	2.35	.....	.....	2.7	2.5	3.0	3.2	2.2	1.9	16.4
16	2.4	2.3	2.3	2.9	.....	2.7	2.5	2.8	3.0	2.1	2.0	15.1
17	2.5	2.3	2.3	.....	.....	2.6	2.45	2.6	2.9	2.6	2.1	6.3
18	2.5	2.3	2.3	.....	.....	2.5	2.4	.....	2.9	2.4	1.95	5.0
19	2.45	2.35	2.15	.....	.....	2.45	2.4	2.5	2.8	2.25	6.8	4.3
20	2.4	2.4	2.3	2.4	.....	2.4	2.4	2.4	2.7	2.15	2.9	4.0
21	2.4	2.4	2.1	2.2	.....	2.4	2.4	2.4	2.7	2.1	2.4	3.6
22	2.4	2.4	2.2	2.15	.....	.....	2.4	2.5	3.0	2.1	2.2	.....
23	2.3	2.4	2.15	2.2	.....	2.35	2.3	2.4	3.1	2.1	2.15	3.5
24	2.3	2.3	2.25	2.2	.....	2.35	2.3	2.4	3.0	2.15	2.1	3.2
25	2.35	2.3	2.3	2.2	.....	2.4	2.35	2.4	3.7	2.2	2.05	3.1
26	.....	2.3	2.4	3.8	.....	3.3	2.3	2.9	3.7	2.1	2.0	2.9
27	2.3	2.3	2.3	4.0	.....	3.0	2.35	2.9	3.4	2.0	1.95	2.8
28	2.35	2.3	2.3	2.6	.....	2.6	2.35	5.8	3.5	2.5	1.95	2.7
29	2.4	2.3	2.3	3.5	.....	2.8	2.4	3.6	3.3	2.2	1.95	2.7
30	2.5	2.3	2.2	4.0	.....	3.0	2.4	2.9	2.9	2.1	1.90	2.6
31	2.4	.....	2.25	2.9	.....	3.3	.....	2.7	.....	.....	1.95	.....

NOTE.—Discharge relation affected by ice about Jan. 12 to Mar. 11, 1914.

Daily discharge, in second-feet, of Maquoketa River below mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, for the period Sept. 1, 1913, to Sept. 30, 1914.

Day.	Sept.	Day.	Sept.	Day.	Sept.
1913.		1913.		1913.	
1	366	11	358	21	458
2	378	12	358	22	440
3	373	13	373	23	433
4	366	14	410	24	401
5	366	15	373	25	407
6	366	16	378	26	384
7	366	17	401	27	373
8	358	28	392	28	378
9	358	19	384	29	366
10	358	20	433	30	378

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913-14.												
1	440	407	407	378	.....	.....	771	407	477	561	327	1,890
2	407	407	407	366	.....	.....	771	407	440	477	327	1,500
3	392	407	424	407	.....	.....	714	407	477	477	320	771
4	407	407	407	407	.....	.....	660	2,330	440	440	320	517
5	407	392	407	407	.....	.....	561	1,250	.....	407	320	440
6	407	392	407	a 392	.....	.....	561	660	.....	407	334	.....
7	392	392	a 370	378	.....	.....	517	609	.....	366	320	771
8	378	407	334	378	.....	.....	517	517	1,410	378	320	561
9	392	392	344	378	.....	.....	477	477	1,180	366	314	440
10	392	392	378	334	.....	.....	477	440	1,030	366	a 311	407
11	561	353	407	320	.....	.....	477	1,180	831	a 366	308	407
12	477	366	424	.....	.....	1,030	477	1,500	831	366	308	407
13	477	407	424	.....	.....	517	440	1,180	660	353	308	392
14	424	378	407	.....	.....	517	440	831	831	353	308	.....
15	407	378	392	.....	.....	517	440	660	771	353	308	.....
16	407	378	378	.....	.....	517	440	561	660	334	320	.....
17	440	378	378	.....	.....	477	424	477	609	477	334	.....
18	440	378	378	.....	.....	440	407	a 458	609	407	314	2,330
19	424	392	344	.....	.....	424	407	440	561	366	.....	1,590
20	407	407	378	.....	.....	407	407	407	517	344	609	1,330
21	407	407	334	.....	.....	407	407	407	517	334	407	1,030
22	407	407	353	.....	.....	a 400	407	440	660	334	353	a 995
23	378	407	344	.....	.....	392	378	407	714	334	344	960
24	378	378	366	.....	.....	392	378	407	660	344	334	771
25	392	378	378	.....	.....	407	392	407	1,100	353	327	714
26	a 385	378	407	.....	.....	831	378	609	1,100	334	320	609
27	378	378	378	.....	.....	660	392	609	894	320	314	561
28	392	378	373	.....	.....	477	392	3,350	960	440	314	517
29	407	378	373	.....	.....	561	407	1,030	831	353	314	517
30	440	378	353	.....	.....	660	407	609	609	334	308	477
31	407	.....	366	.....	.....	831	.....	517	.....	330	314	.....

a Interpolated.

NOTE.—Daily discharge computed as follows: Between 353 and 1,100 second-feet (gage heights 2.2 and 3.7 feet), from a well-defined rating curve; below 353 second-feet from a poorly defined rating curve. Above 1,100 second-feet estimates are based on an extension of the rating curve and should be used with care.

Monthly discharge of Maquoketa River below mouth of North Fork of Maquoketa River, near Maquoketa, Iowa, for the period Sept. 1, 1913, to July 31, 1914.

[Drainage area, 1,570 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
September	458	358	384	0.245	0.27	B.
October	561	378	414	.264	.30	B.
November	407	353	389	.248	.28	B.
December	424	334	382	.243	.28	B.
January 1–11	407	320	377	.240	.10	C.
March 12–31	1,030	392	543	.346	.26	C.
April	771	378	477	.304	.34	B.
May	3,350	407	774	.493	.57	B.
July	561	320	380	.242	.28	B.

WAPSIPINICON RIVER AT STONE CITY, IOWA.

Location.—At the highway bridge at Stone City, Iowa, a short distance above the Chicago, Milwaukee & St. Paul Railway bridge, about 4 miles above the mouth of Buffalo Creek.

Records available.—August 19, 1903, to September 30, 1914, when station was discontinued.

Drainage area.—1,310 square miles.

Gage.—Chain gage, attached to bridge; read daily, in the morning, to quarter-tenths. Limits of use: Hundredths below 3.0, half-tenths from 3.0 to 4.0, and tenths above 4.0 feet. On December 4, 1906, repairs to the bridge resulted in raising the gage box. Gage heights from that date to January 23, 1910, when the change was determined, have been corrected. Corrected gage heights for 1907, 1908, and 1909 were published in Water-Supply Paper 265.

Channel and control.—Control is the remains of a loose-rock dam under the Chicago, Milwaukee & St. Paul Railway bridge; practically permanent. Construction of a dam at Anamosa caused backwater at gage during July, August, and September, 1914.

Discharge measurements.—Made from upstream side of bridge.

Floods.—The high water of July, 1892, reached a stage of 28 feet, referred to present gage. According to the observer, this stage is probably within one-half foot of the true elevation of the flood.

Winter flow.—Discharge relation affected during winter by ice 1 to 2 feet thick.

Regulation.—During 1912 there was a power development installed at Center City, about 20 miles above station, which may possibly cause some diurnal fluctuation at gage.

Accuracy.—The discharge measurement of September 28, 1914, indicates that about 0.65 foot of backwater was present at the gage. This backwater was caused by the addition of flashboards to the dam near Anamosa during the latter part of June, 1914. As sufficient data have not been collected to determine the effect of these flashboards for the various stages at Stone City, no estimates of discharge have been prepared subsequent to June 23, 1914.

Cooperation.—The gage heights are furnished by Frank Dearborn, of Stone City, Iowa.

Discharge measurements of Wapsipinicon River at Stone City, Iowa, 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. 15	W. M. Bickel	3.32	[b] 248	Sept. 28	S. B. Soulé	4.60	[c] 630
June 23	J. B. Stewart	6.60	2,160				

[a] Engineer of Bickel Engineering Co., Cedar Rapids, Iowa.
[b] Small amount of ice present.
[c] Backwater present from the dam at Anamosa.

Daily gage height, in feet, of Wapsipinicon River at Stone City, Iowa, for the year ending Sept. 30, 1914.

[Frank Dearborn, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.42	3.0	2.95							4.9	3.95	3.7
2	2.37	2.98	2.95							4.7	3.9	3.7
3	2.88	2.93	2.98							4.2	3.8	3.6
4	2.82	2.90	3.05							4.1	3.8	3.6
5	2.75	2.90	3.1							3.95	3.65	3.55
6	2.94	2.90	3.1							3.85	3.5	3.5
7	3.05	2.87	3.15							4.1	3.55	3.4
8	3.1	2.90	3.4							4.0	3.4	3.5
9	2.92	2.82	3.7							3.85	3.05	3.6
10	3.0	2.88								3.75	2.9	3.55
11	3.25	2.85	3.55							3.65	2.9	3.4
12	3.27	2.82								3.55	2.35	3.4
13	3.2	2.80	3.3							3.35	2.2	3.5
14	3.15	2.85								3.6	2.15	3.5
15	3.25	2.90								3.65	2.1	7.2
16	3.4	2.88								3.7	2.25	4.7
17	3.3	2.85								4.1	2.65	4.3
18	3.2	2.90								4.65	3.4	3.5
19	3.3	2.98								3.85	3.35	4.5
20	3.3	2.95								4.0	3.3	5.2
21	3.25	3.0								3.7	3.4	5.1
22	3.1	3.05								3.55	3.65	5.1
23	3.05	3.1							6.4	3.4	3.1	5.2
24	3.25	3.15								3.35	3.3	5.0
25	3.05	3.1							6.0	3.37	3.45	4.8
26	2.98	3.0							5.8	3.45	3.6	4.7
27	2.97	2.98							5.9	3.55	3.3	4.7
28	2.92	2.90							6.0	3.6	3.4	4.7
29	2.90	2.95							5.8	3.45	3.12	4.4
30	2.92	2.96							5.1	3.75	3.35	4.0
31	2.88									3.9	4.9	

Note.—Discharge relation affected by ice about Dec. 7–22, 1913.

Daily discharge, in second-feet, of Wapsipinicon River at Stone City, Iowa, for the period Oct. 1 to Dec. 6, 1913.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	78	220	205	16	375	185	.....
2	199	214	205	17	335	177	.....
3	185	199	214	18	295	190	.....
4	169	190	238	19	335	214	.....
5	151	190	255	20	335	205	.....
6	174	190	255	21	315	220	.....
7	238	182	.....	22	255	238	.....
8	255	190	.....	23	238	255	.....
9	196	169	.....	24	275	275	.....
10	220	185	.....	25	238	255	.....
11	315	177	.....	26	190	220	.....
12	295	169	.....	27	205	214	.....
13	295	164	.....	28	196	190	.....
14	295	177	.....	29	190	205	.....
15	355	190	.....	30	196	208	.....
				31	214	.....	.....

NOTE.—Daily discharge computed from a rating curve well defined between 58 and 2,380 second-feet (gage heights, 2.3 and 7.0 feet).

Discharge Dec. 7-13, 1913, estimated, because of ice, from gage heights, observer's notes, one discharge measurement, and climatic records, at 310 second-feet. See "Accuracy" in station description.

Monthly discharge of Wapsipinicon River at Stone City, Iowa, for the period Oct. 1 to Dec. 13, 1913.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	375	78	247	0.189	0.22	A.
November	275	164	202	.154	.17	A.
December 1-13	.....	205	272	.208	.10	C.

ROCK RIVER AT WATERTOWN, WIS.

Location.—At Milwaukee Street highway bridge, city of Watertown, Wis. Crawfish River enters from the right about 16 miles below and Oconomowoc River from the left about 9 miles above the station.

Records available.—June 18 to September 30, 1914.

Drainage area.—964 square miles.

Gage.—Standard chain gage attached to downstream side of bridge; read daily morning and afternoon, to hundredths. Limits of use: Hundredths below 3.0 feet, half-tenths between 3.0 and 4.0 feet, and tenths above 4.0 feet.

Channel and control.—Composed of heavy gravel in which there is a large growth of grass; bed of river is in itself permanent; amount of grass depends on the season.

Discharge measurements.—Made from downstream side of bridge during high water and by wading during low and medium stages.

Winter flow.—Data not available.

Regulation.—Immediately above the station is a dam with a 10-foot head, furnishing water to two gristmills, one on each side of the river. During periods of low flow the water stands below the crest of the dam, the entire flow passing through the wheels; gage record for such periods shows a diurnal fluctuation; the flow is also influenced to some extent by operations of the Rough and Ready Dam, about 1½ miles above the station.

Accuracy.—Gage-height record only fair.

Data insufficient for estimates of daily and monthly discharge.

Discharge measurements of Rock River at Watertown, 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.*
June 18	G. H. Canfield	2.15	281	July 21	W. G. Hoyt	2.30	[a] 254
29	W. G. Hoyt	3.33	1,410				

[a] Wading measurement at bridge.

NOTE.—Grass in section and at control when above measurements were made.

Daily gage height, in feet, of Rock River at Watertown, Wis., for the year ending Sept. 30, 1914.

[Herbert Euper, observer.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		3.05	2.37	2.40	16		2.36	[a] 1.66	3.8
2		2.92	[a] 1.92	2.43	17		2.36	2.41	3.65
3		2.84	2.34	2.40	18	1.99	2.32	2.20	3.55
4		2.67	2.36	2.36	19	2.10	2.16	2.33	3.45
5		2.57	2.21	2.31	20	2.10	2.31	2.40	3.2
6		2.59	2.14	[a] 1.86	21	2.19	2.28	2.44	3.05
7		2.44	2.22	2.22	22	2.98	2.32	2.62	2.88
8		2.48	2.36	2.29	23	3.55	2.26	[a] 2.36	2.78
9		2.47	[a] 1.64	1.95	24	3.6	2.33	2.50	2.69
10		2.44	2.34	2.31	25	3.55	2.10	2.42	2.64
11		2.39		2.16	26	3.45	[a] 1.64	2.40	2.60
12		2.32	2.34	2.21	27	3.5	2.35	2.32	2.54
13		2.30	2.22	[a] 1.74	28	3.4	2.30	2.23	2.54
14		2.38	2.20	2.36	29	3.3	2.30	2.20	2.48
15		2.38	1.92	3.6	30	3.2	2.10	[a] 1.80	2.42
					31		2.12	2.42	

[a] Sunday.

ROCK RIVER AT AFTON, WIS.

Location.—At highway bridge, town of Afton, Wis., about 9 miles above the Illinois State line. Bass Creek enters from the right about three-fourths mile below the station.

Records available.—February 5 to September 30, 1914.

Drainage area.—3,190 square miles.

Gage.—Chain gage fastened to downstream side of highway bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 2.0 feet, half-tenths between 2.0 and 3.0 feet, and tenths above 3.0 feet.

Channel and control.—No definite control below gage. River bed consists of gravel and clam shells and is probably permanent.

Discharge measurements.—Made from the downstream side of highway bridge during medium and high stages; at low stages by wading.

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

Regulation.—Operation of power plants at Janesville and above causes fluctuations at the gage during low stages.

Accuracy.—Rating curve well defined; records excellent except for periods of extremely low water, when the mean daily gage height may be in error owing to fluctuations in stage.

Discharge measurements of Rock River at Afton, 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. 5	Hoyt and Canfield	2.51	[a] 1,270	May 15	M. F. Rather	4.37	2,970
Mar. 3	H. C. Beckman	1.96	[b] 673	July 23	W. G. Hoyt	1.15	[d] 709
28	G. H. Canfield	3.46	[c] 2,180	Sept. 15	do	7.52	[e] 4,880
May 13	do	4.28	2,910	18	do	5.24	3,950

[a] Small amount of ice in river below bridge.
[b] Nearly complete ice cover below bridge.
[c] River clear of ice.
[d] Measurement made by wading at a section 20 feet above the gage.
[e] Apparently backwater; cause of backwater not known.

Daily gage height, in feet, of Rock River at Afton, Wis., for the year ending Sept. 30, 1914.

[Aden Clark, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.15	4.2	3.6	3.4	4.0	1.12	1.09
2	.....	2.15	4.4	3.5	3.4	4.2	.86	1.24
3	.....	2.1	4.6	3.4	3.2	4.2	1.14	1.36
4	.....	1.98	4.7	3.5	3.3	3.9	1.05	1.22
5	2.5	2.1	4.6	3.7	3.3	3.7	1.05	1.28
6	2.2	2.1	4.8	3.6	3.1	3.7	.90	1.08
7	2.4	1.78	4.8	3.7	2.75	3.7	.81	1.26
8	2.55	1.70	4.8	3.9	2.8	3.7	.86	1.29
9	2.7	1.68	4.4	3.7	2.7	3.5	.66	1.49
10	2.7	1.65	4.4	3.5	2.65	3.2	.88	1.10
11	2.7	1.61	4.3	4.1	2.5	3.0	.94	1.14
12	2.65	1.58	4.1	4.4	2.45	3.0	1.05	1.20
13	2.5	1.85	4.2	4.4	2.4	2.65	1.06	1.04
14	2.35	2.2	4.1	4.3	2.35	2.55	1.08	1.48
15	2.1	2.0	4.0	4.3	2.35	2.3	.92	6.2
16	2.35	2.25	3.9	4.2	2.1	2.35	.52	5.4
17	2.35	2.60	3.8	4.2	1.98	2.1	.85	5.3
18	2.2	3.0	3.6	4.2	1.86	1.52	.89	5.2
19	2.1	3.2	3.3	4.0	1.88	1.62	1.00	5.2
20	2.35	3.2	3.6	3.7	1.95	1.64	1.01	5.4
21	2.4	3.4	3.3	3.6	1.90	1.55	1.06	5.4
22	1.88	3.3	3.4	3.4	2.15	1.28	1.14	5.4
23	2.00	3.4	3.3	3.1	2.2	1.32	1.32	5.4
24	2.05	3.3	3.1	3.1	2.45	1.16	1.49	5.3
25	2.1	3.2	2.7	3.9	2.6	1.31	1.42	5.3
26	2.1	3.2	3.1	3.6	3.6	.84	1.31	5.2
27	2.1	3.6	3.3	3.5	4.4	1.19	1.21	4.8
28	2.1	3.4	3.4	3.3	3.9	1.14	1.14	4.7
29	.....	3.6	3.5	3.2	4.2	1.30	1.10	4.4
30	.....	4.0	3.6	3.2	4.2	1.30	1.06	3.9
31	.....	4.0	.....	3.3	.....	1.20	1.10	.....

NOTE.—Discharge relation affected by ice about Feb. 5 to Mar. 13.

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

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2,850	2,310	2,140	2,670	692	678
2	.....	3,010	2,220	2,140	2,850	579	748
3	.....	3,240	2,140	1,980	2,850	702	804
4	.....	3,340	2,220	2,060	2,580	660	739
5	.....	3,240	2,400	2,060	2,400	660	767
6	.....	3,450	2,310	1,900	2,400	595	674
7	.....	3,450	2,400	1,640	2,400	559	758
8	.....	3,450	2,580	1,670	2,400	579	771
9	.....	3,040	2,400	1,600	2,220	506	866
10	.....	3,040	2,220	1,560	1,980	587	683
11	.....	2,940	2,760	1,460	1,820	612	702
12	.....	2,760	3,040	1,430	1,820	660	730
13	.....	2,850	3,040	1,400	1,560	665	656
14	1,270	2,760	2,940	1,360	1,500	674	861
15	1,150	2,670	2,940	1,360	1,330	604	a 4,530
16	1,300	2,580	2,850	1,210	1,360	465	4,160
17	1,530	2,490	2,850	1,140	1,210	575	4,040
18	1,820	2,310	2,850	1,070	881	591	3,920
19	1,980	2,060	2,670	1,080	932	638	3,920
20	1,980	2,310	2,400	1,120	942	642	4,160
21	2,140	2,060	2,310	1,090	896	665	4,160
22	2,060	2,140	2,140	1,240	767	702	4,160
23	2,140	2,060	1,900	1,270	785	785	4,160
24	2,060	1,900	1,900	1,430	711	866	4,040
25	1,980	1,600	2,580	1,530	781	833	4,040
26	1,980	1,900	2,310	2,310	571	781	3,920
27	2,310	2,060	2,220	3,040	725	735	3,450
28	2,140	2,140	2,060	2,580	702	702	3,340
29	2,310	2,220	1,980	2,850	776	683	3,040
30	2,670	2,310	1,980	2,850	776	665	2,580
31	2,670	.....	2,060	.....	730	683	.....

a Discharge estimated from discharge measurement made on this date.

NOTE.—Daily discharge computed from a rating curve well defined between 638 and 4,290 second-feet (gage heights, 1.0 and 5.5 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Feb. 5–15, 1,100 second-feet; Feb. 16–28, 840 second-feet; and Mar. 1–13, 970 second-feet.

Monthly discharge of Rock River at Afton, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 3,190 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
February 5–28	.....	.....	959	0.301	0.27	C.
March	2,670	.....	1,550	.486	.56	C.
April	3,450	1,600	2,610	.818	.91	A.
May	3,040	1,900	2,420	.759	.88	A.
June	3,040	1,070	1,720	.539	.60	A.
July	2,850	571	1,490	.467	.54	A.
August	866	465	656	.206	.24	B.
September	4,530	656	2,400	.752	.84	B.

ROCK RIVER AT ROCKFORD, ILL.

Location.—In the southern part of T. 44 N., R. 1 E., at highway bridge at Nelson Avenue, Rockford, Winnebago County, Ill., about 2 miles below mouth of Kent Creek.

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

Drainage area.—6,520 square miles.

Gage.—Standard chain gage attached to bridge; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Probably permanent.

Discharge measurements.—Made from upstream side of bridge.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Regulation.—A dam 2 miles upstream, in the city of Rockford, controls the flow past the gage. The operation of the power plant at this dam causes fluctuation at the gage.

Accuracy.—Gage readings reliable; measurements good. Regulation of stream may affect mean daily gage height as obtained from two readings per day.

Data insufficient for making estimates of discharge.

Discharge measurements of Rock River at Rockford, Ill., 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.*
July 16	B. J. Peterson	3.06	2,660	Sept. 10	Peterson and Kessler	1.86	1,360
30	Peterson and Espinosa	2.32	1,730				

Daily gage height, in feet, of Rock River at Rockford, Ill., for the year ending Sept. 30, 1914.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1		2.38	2.92	11		2.16	2.16	21		2.35	7.88
2		2.18	2.56	12		2.11	2.20	22		2.45	7.25
3		2.34	3.53	13		2.36	1.54	23		2.48	6.88
4		2.39	3.20	14		2.16	2.36	24		2.55	5.72
5		2.61	2.53	15		2.20	5.35	25		2.57	4.84
6		2.62	2.03	16		1.70	7.85	26		2.34	4.61
7		2.65	2.36	17		2.18	8.20	27		2.18	4.35
8		2.14	2.53	18		2.10	7.98	28		2.26	4.31
9		.84	2.36	19		2.18	7.80	29		1.96	4.18
10		1.94	2.35	20		2.26	7.88	30	2.55	1.13	4.09
								31	2.51	2.42	

PECATONICA RIVER AT DILL, WIS.

Location.—At Illinois Central Railroad bridge at Dill (Ramona P. O.), Wis., 9 miles above the Illinois State line; about 1 mile below the junction of the east and west branches of Pecatonica River. Skinner Creek enters from the left about 1 mile below station.

Records available.—February 9 to September 30, 1914.

Drainage area.—959 square miles.

Gage.—Cast-iron staff gage fastened to downstream side of the left-hand abutment; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.0 feet, and tenths above 2.0 feet.

Channel and control.—Sandy; likely to shift during all periods of the year.

Discharge measurements.—At low and medium stages made from upstream side of highway bridge about 400 feet above the gage; during extremely high water considerable water overflows to the left of this highway bridge, and measurements are made from the railroad bridge to which the gage is attached.

Regulation.—Operation of power plants above the station causes little if any diurnal fluctuation noticeable at the gage.

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

Accuracy.—Records good.

Discharge measurements of Pecatonica River at Dill, 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. 9	Canfield and Hoyt	1.80	[a] 325	June 29	M. F. Rather	3.35	1,050
Mar. 5	H. C. Beckman	3.63	[a] 765	July 22	W. G. Hoyt	1.20	352
Apr. 17	W. G. Hoyt	1.65	[b] 449	Aug. 27	H. C. Beckman	.79	274
May 13	M. F. Rather	2.80	883	Sept. 17	W. G. Hoyt	8.97	2,890
14	do	1.90	546	18	do	6.06	1,630

[a] Measurement made under complete ice cover.

[b] Control clear of ice.

Daily gage height, in feet, of Pecatonica River at Dill, Wis., for the year ending Sept. 30, 1914.

[Edward Kuhl, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	5.5	2.1	1.5	1.7	1.9	1.1	3.6
2	.....	6.3	2.3	1.5	2.2	1.8	1.1	2.8
3	.....	5.8	2.1	1.5	1.6	1.7	1.1	1.4
4	.....	4.4	2.1	1.8	1.45	1.65	1.1	1.15
5	.....	3.9	1.9	2.1	1.9	1.6	1.1	1.1
6	.....	4.2	1.85	1.8	2.6	1.6	1.1	1.1
7	.....	4.6	1.85	1.55	2.4	1.75	1.1	1.15
8	.....	4.4	1.85	1.5	1.8	1.55	1.1	1.15
9	1.8	4.2	1.85	1.5	1.65	1.45	1.1	1.1
10	.....	3.9	1.85	1.45	1.6	1.4	1.1	1.15
11	.....	3.6	1.85	2.2	1.5	1.35	1.1	1.2
12	.....	3.2	1.8	2.8	1.5	1.3	1.05	1.35
13	1.85	3.2	1.7	2.7	1.5	1.4	1.05	1.3
14	1.85	4.0	1.65	2.1	1.55	1.6	1.05	2.5
15	1.85	4.4	1.6	1.7	1.8	1.5	.94	a 11.4
16	1.85	4.3	1.6	1.5	1.9	1.45	1.4	a 11.1
17	1.75	2.2	1.6	1.5	1.7	1.5	1.8	a 9.6
18	1.75	2.1	1.65	1.5	1.5	1.45	1.5	5.1
19	1.75	1.9	1.65	1.5	1.45	1.3	1.5	2.9
20	1.75	1.4	1.6	1.5	1.45	1.2	2.2	1.95
21	1.75	1.6	1.6	1.5	1.45	1.2	1.6	1.9
22	1.8	1.55	1.6	1.5	1 95	1.2	1.3	1.8
23	1.8	1.55	1.6	1.5	3.0	1.2	1.3	1.7
24	1.85	1.5	1.6	1.25	2.7	1.35	1.2	1.7
25	1.85	1.45	2.6	2.9	2.4	2.8	1.05	1.55
26	1.8	2.2	2.6	2.2	3.2	2.7	1.0	1.5
27	1.7	2.6	1.85	1.6	4.8	1.35	.95	1.5
28	1.9	2.3	1.65	2.6	4.6	1.25	.96	1.5
29	.....	2.5	1.65	4.3	3.0	1.2	1.0	1.5
30	.....	2.5	1.5	4.5	1.8	1.2	1.1	1.45
31	.....	1.9	.....	2.8	.....	1.15	1.05	.....

a Estimated; gage height for crest of flood determined by engineers of the Survey from point marked by the observer.

NOTE.—Discharge relation affected by ice about Feb. 9 to Mar. 20.

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

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		613	411	468	539	327	1,120
2		689	411	651	502	327	879
3		613	411	438	468	327	387
4		613	502	399	453	327	336
5		539	613	539	438	327	327
6		520	502	803	438	327	327
7		520	424	727	485	327	336
8		520	411	502	424	327	336
9		520	411	453	399	327	327
10		520	399	438	387	327	336
11		520	651	411	376	327	345
12		502	879	411	365	318	376
13		468	841	411	387	318	365
14		453	613	424	438	318	765
15		438	468	502	411	300	4,110
16		438	411	539	399	387	3,960
17		438	411	468	411	502	3,210
18		453	411	411	399	411	1,400
19		453	411	399	365	411	912
20		438	411	399	345	651	558
21	438	438	411	399	345	438	539
22	424	438	411	558	345	365	502
23	424	438	411	953	345	365	468
24	411	438	355	841	376	345	468
25	399	803	917	727	879	318	424
26	651	803	651	1,020	841	310	411
27	803	520	438	1,340	376	302	411
28	689	453	803	1,310	355	303	411
29	765	453	1,260	953	345	310	411
30	765	411	1,290	502	345	327	399
31	539	.....	879	.....	336	318	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 260 and 2,910 second-feet (gage height, 0.7 and 9.0 feet).

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Feb. 9–20, 320 second-feet; Feb. 21–28, 290 second-feet; Mar. 1–10, 300 second-feet; and Mar. 11–20, 680 second-feet.

Monthly discharge of Pecatonica River at Dill, Wis., for the year ending Sept. 30, 1914.

[Drainage area, 959 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
February 9–28	.....	.....	308	0.321	0.24	C.
March	.....	.....	681	.710	.82	C.
April	803	411	515	.537	.60	A.
May	1,290	355	575	.600	.69	B.
June	1,340	399	613	.639	.72	A.
July	879	336	430	.448	.52	A.
August	651	300	352	.367	.42	A.
September	4,110	327	839	.875	.98	B.

PECATONICA RIVER AT FREEPORT, ILL.

Location.—In T. 27 N., R. 8 E., at the highway bridge at Hancock Avenue, Freeport, Stephenson County, Ill., about half a mile east of the Illinois Central Railway station at Freeport and about 2 miles above the mouth of Yellow Creek.

Records available.—September 10 to September 30, 1914.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to bridge; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Soft mud; probably shifts.

Discharge measurements.—Made from upstream side of highway bridge.

Floods.—Maximum gage height since establishment of gage, 18.45 feet, occurred September 16, 1914.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Regulation.—A dam three-fourths of a mile upstream regulates the flow past the gage.

Data insufficient for making estimates of discharge.

The following discharge measurement was made by Peterson and Kessler:

September 10, 1914: Gage height, 3.94 feet; discharge, 386 second-feet.

Daily gage height, in feet, of Pecatonica River at Freeport, Ill., for the period Sept. 11–30, 1914.

[William Stout, observer.]

Day.	Sept.	Day.	Sept.	Day.	Sept.
11	4.02	18	17.18	25	5.42
12	4.06	19	16.05		
13	4.08	20	12.74	26	5.22
14	5.30			27	4.95
15	15.70	21	7.61	28	4.80
		22	6.42	29	4.78
16	18.35	23	5.80	30	4.79
17	17.84	24	5.52		

SUGAR RIVER NEAR BRODHEAD, WIS.

Location.—At highway bridge 2 miles southwest of the village of Brodhead, Wis. and about 12 miles above the Illinois State line. Jordan Creek enters from the right about 2 miles below the station, and Little Jordan Creek also from the right about 4 miles above the station.

Records available.—February 7 to September 30, 1914.

Drainage area.—529 square miles.

Gage.—Chain gage attached to downstream side of highway bridge; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.0 foot, half-tenths between 1.0 and 2.5 feet, and tenths above 2.5 feet.

Channel and control.—Bed of river sandy; may shift during high stages.

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

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

Regulation.—During extremely low water there may be some diurnal fluctuation caused by the operation of power plants above the gage, especially the plant at Brodhead.

Accuracy.—Rating curve well defined; records good.

Discharge measurements of Sugar River near Brodhead, 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. 7	Hoyt and Canfield	3.55	[a] 223	June 29	M. F. Rather	3.61	1,010
Mar. 4	H. C. Beckman	3.25	[a] 391	July 22	W. G. Hoyt	1.52	273
27	G. H. Canfield	2.04	[b] 394	Aug. 27	H. C. Beckman	1.36	[c] 207
Apr. 16	W. G. Hoyt	1.59	268	Sept. 16	W. G. Hoyt	7.66	4,010
May 13	M. F. Rather	2.65	664	16	do	7.13	3,200
14	do	2.56	598	17	do	5.73	2,120
June 28	do	3.87	1,140				

[a] Ice below gage and at section. [b] No ice at control. [c] Wading measurement, 300 feet above gage.

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

[Arthur Christianson, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.4	2.45	1.75	1.65	2.15	1.35	1.45
2	.....	3.2	2.4	1.7	1.6	1.8	1.15	1.3
3	.....	3.2	2.25	1.4	1.55	1.6	1.4	1.3
4	.....	3.2	2.05	1.75	1.6	1.5	1.3	1.2
5	.....	3.2	1.85	1.9	1.55	1.65	1.4	1.2
6	.....	2.9	1.95	2.0	1.6	1.7	1.1	1.15
7	3.3	2.8	2.0	1.7	1.55	1.65	1.3	1.3
8	2.2	2.5	1.9	1.6	1.55	3.0	1.35	1.35
9	2.25	2.5	1.8	1.5	1.5	1.85	[a] .90	1.3
10	2.05	2.2	1.8	1.35	1.45	1.5	1.35	1.3
11	1.9	2.15	1.75	1.75	1.4	1.4	1.3	1.15
12	1.9	2.15	1.65	2.0	1.3	1.3	1.3	1.25
13	2.0	2.15	1.65	2.3	1.4	1.4	1.3	[a] .80
14	2.0	2.7	1.55	2.5	1.35	1.6	1.3	1.7
15	1.95	3.2	1.55	1.95	1.5	1.55	1.3	8.1
16	2.15	3.3	1.6	1.75	1.6	1.45	[a] .92	7.4
17	2.05	2.6	1.65	1.6	1.65	1.6	1.25	5.5
18	2.05	2.1	1.65	1.6	1.5	1.4	1.4	4.0
19	2.05	1.85	1.6	1.5	1.4	1.1	1.35	3.0
20	2.1	1.8	1.6	1.75	1.5	1.25	1.3	1.9
21	2.1	1.7	1.65	1.5	1.45	1.35	1.3	1.9
22	1.8	1.6	1.55	1.5	1.6	1.2	1.5	1.4
23	2.25	1.7	1.55	1.6	1.9	1.1	[a] 1.05	1.45
24	2.15	1.7	1.5	1.6	2.1	1.0	1.4	1.4
25	2.15	1.6	1.65	1.65	1.8	1.2	1.45	1.6
26	2.0	1.75	1.8	1.9	1.85	1.15	1.5	1.7
27	2.15	2.0	2.0	1.9	2.8	1.4	1.4	[a] 1.3
28	2.3	2.15	1.9	1.8	3.8	1.25	1.4	1.55
29	.....	2.4	2.05	1.8	3.4	1.2	1.4	1.3
30	.....	2.5	2.05	1.8	2.8	1.4	[a] .45	1.55
31	.....	2.6	.....	1.7	.....	1.35	1.4	.....

[a] Sunday.

NOTE.—Discharge relation affected by ice about Feb. 7 to Mar. 20.

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

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	556	322	292	450	212	237
2	.....	538	307	278	337	166	199
3	.....	484	224	264	278	224	199
4	.....	416	322	278	250	199	176
5	.....	352	368	264	292	224	176
6	.....	384	400	278	307	156	166
7	.....	400	307	264	292	199	199
8	.....	368	278	264	766	212	212
9	.....	337	250	250	352	a 124	199
10	.....	337	212	237	250	212	199
11	.....	322	322	224	224	199	166
12	.....	292	400	199	199	199	188
13	.....	292	502	224	224	199	a 110
14	.....	264	575	212	278	199	307
15	.....	264	384	250	264	199	b 4,750
16	.....	278	322	278	237	a 127	3,600
17	.....	292	278	292	278	188	1,980
18	.....	292	278	250	224	224	1,190
19	.....	278	250	224	156	212	766
20	.....	278	322	250	188	199	368
21	307	292	250	237	212	199	368
22	278	264	250	278	176	250	224
23	307	264	278	368	156	a 148	237
24	307	250	278	433	140	224	224
25	278	292	292	337	176	237	278
26	322	337	368	352	166	250	307
27	400	400	368	688	224	224	a 190
28	450	368	337	1,100	188	224	264
29	538	416	337	928	176	224	199
30	575	416	337	688	224	a c 74	264
31	612	.....	307	.....	212	224	.....

a Sunday.
b Discharge at crest of flood (gage height, 9.0 feet) about 6,500 second-feet.
c Approximate; based on extension of rating curve.

NOTE.—Daily discharge computed from a rating curve well defined between 199 and 4,580 second-feet (gage heights, 1.3 and 8.0 feet).
Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Feb. 7–20, 215 second-feet; Feb. 21–28, 240 second-feet; Mar. 1–10, 445 second-feet; and Mar. 11–20, 435 second-feet.

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

[Drainage area, 529 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
February 7–28	.....	.....	224	0.423	0.35	C.
March	612	.....	425	.803	.93	C.
April	556	250	344	.650	.73	A.
May	575	212	323	.611	.70	A.
June	1,100	199	349	.660	.74	A.
July	766	140	255	.482	.56	B.
August	250	74	198	.374	.43	A.
September	4,750	110	598	1.13	1.26	B.

IOWA RIVER NEAR IOWA FALLS, IOWA.

Location.—About 1 mile above Iowa Falls and 2 miles below the Northwestern Railway bridge. A small creek enters from the left between the bridge and the gage.

Records available.—August 5, 1911, to September 30, 1914, when station was discontinued.

Gage.—Vertical staff fastened to a maple tree on the north or left bank of the river; read daily, morning and evening, to quarter-tenths. Limits of use: Hundredths below 1.5, half-tenths between 1.5 and 3.0, and tenths above 3.0 feet.

Channel and control.—Rock bottom; permanent.

Discharge measurements.—Made at low water by wading in the vicinity of the gage; at high stages from Illinois Central Railroad bridge one-fourth mile from depot.

Winter flow.—Discharge relation affected by ice. As no discharge measurements were made during the winter, no estimates of discharge have been prepared for periods when the discharge relation is believed to have been materially affected by ice.

Regulation.—A dam 7 miles above the gage at Alden is used occasionally, but flow at the gage is probably natural.

Accuracy.—Conditions favorable for good results. The rating curve, however, has not been developed for stages above about 2.2 feet, and estimates of discharge have therefore not been prepared for periods when the stage exceeded 2.2 feet.

Discharge measurements of Iowa River near Iowa Falls, Iowa, 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 14	J. B. Stewart	0.82	72	Sept. 25	S. B. Soulé	1.01	[a]95
June 22	do	1.52	290				

[a] Probably backwater from dam at Iowa Falls.

NOTE.—Measurements made by wading.

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

[Albert Kulas, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.72	0.70	0.78	0.85	1.18	1.36	0.90	1.22	0.98	1.10	0.74	0.59
2	.65	.80	.75	.82	1.20	1.35	.98	1.18	.90	1.06	.74	.62
3	.65	.75	.80	.85	1.12	1.55	.88	1.08	.88	1.01	.73	.60
4	.65	.82	.78	.86	1.18	1.55	.89	1.01	.80	1.00	.72	.58
5	.75	.76	.75	.95	1.15	1.5	.86	.99	1.00	.97	.70	.61
6	.80	.74	.81	1.02	1.06	1.48	.86	.99	2.25	.92	.68	.57
7	.95	.66	.85	1.00	1.08	1.5	.88	1.00	6.4	.90	.65	.57
8	.95	.69	.79	1.00	1.16	1.48	.84	.96	6.6	.90	.64	.58
9	1.12	.72	.80	1.02	1.16	1.40	.80	.92	4.8	.89	.64	.57
10	1.40	.72	.85	1.05	1.20	1.40	.82	.89	4.0	.88	.66	.76
11	.96	.90	.71	1.08	1.18	1.35	.80	.88	3.5	.84	.68	.82
12	.92	.80	.82	1.08	1.25	1.30	.78	.88	2.95	.86	.65	.80
13	.85	.82	.75	1.05	1.25	1.38	.79	.84	2.6	.80	.64	.85
14	.86	.84	.85	1.08	1.25	1.28	.78	.82	2.6	.80	.64	1.04
15	.75	.80	.80	1.08	1.28	1.22	.78	.81	2.7	.80	.62	1.25
16	.78	.80	.81	1.09	1.28	1.16	.78	.80	2.75	.84	.61	1.24
17	.79	.80	.84	1.09	1.29	1.19	.76	.78	2.8	.81	.60	1.12
18	.81	.80	.76	1.09	1.29	1.34	.75	.77	2.6	.80	.59	.98
19	.79	.82	.69	1.10	1.22	1.29	.80	.74	2.2	.80	.58	.91
20	.75	.85	.80	1.09	1.22	1.38	.80	.72	1.8	.80	.58	.89
21	.78	.86	.79	1.00	1.22	1.04	.84	.74	1.65	.76	.58	.86
22	.79	.82	.84	1.09	1.24	1.09	.82	.71	1.55	.73	.58	1.20
23	.76	.78	.86	1.10	1.28	1.05	.79	.72	1.6	.70	.60	1.22
24	.68	.66	.89	1.10	1.24	.98	.85	.78	1.55	.70	.60	1.12
25	.65	.60	.84	1.10	1.26	.80	.89	1.01	1.40	.84	.60	1.04
26	.79	.62	.80	1.11	1.29	.82	.90	1.48	1.32	.99	.59	.97
27	.74	.68	.85	1.10	1.45	.80	.99	1.6	1.24	.84	.59	.92
28	.70	.78	.85	1.25	1.49	1.12	1.14	1.6	1.19	.79	.59	.87
29	.72	.80	.90	1.25	.....	1.00	1.21	1.40	1.15	.71	.59	.82
30	.71	.85	.88	1.20	.....	1.00	1.22	1.14	1.13	.70	.59	.78
31	.70	.....	.88	1.15	.....	.98	.....	1.05	.....	.71	.59	.....

NOTE.—Discharge relation affected by ice about Dec. 24, 1913, to Mar. 23, 1914, and by backwater from dam at Iowa Falls Sept. 2-30, 1914.

Daily discharge, in second-feet, of Iowa River near Iowa Falls, Iowa, from Aug. 5, 1911, to Sept. 30, 1914.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1911.			1911.			1911.		
1	.....	4	11	44	46	21	20	32
2	.....	6	12	48	17	22	17	14
3	.....	8	13	30	44	23	14	17
4	.....	4	14	30	13	24	17	17
5	14	10	15	27	39	25	13	39
6	13	13	16	28	14	26	20	14
7	12	10	17	20	17	27	12	32
8	13	10	18	22	30	28	14	14
9	14	10	19	14	37	29	10	39
10	27	24	20	14	14	30	4	16
						31	4	.....

Daily discharge, in second-feet, of Iowa River near Iowa Falls, Iowa, from Aug. 5, 1911, to Sept. 30, 1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911-12.												
1	48	17	48	.....	.....	.....	.....	180	280	72	39	37
2	39	14	58	.....	.....	.....	.....	161	250	95	37	68
3	41	14	58	.....	.....	.....	.....	155	199	86	32	66
4	44	22	79	.....	.....	.....	.....	143	173	79	30	56
5	44	14	56	.....	.....	.....	.....	143	149	79	30	46
6	44	48	64	.....	.....	.....	584	143	143	64	30	46
7	44	22	64	.....	.....	.....	490	140	132	60	30	39
8	27	48	66	.....	.....	.....	424	140	115	66	41	44
9	56	24	60	.....	.....	.....	340	137	105	64	39	44
10	39	52	115	.....	.....	.....	280	137	90	66	41	66
11	41	58	112	.....	.....	.....	250	224	88	66	50	41
12	27	39	79	.....	.....	.....	228	536	81	90	90	27
13	52	a 35	102	.....	.....	.....	206	340	149	86	81	50
14	50	a 35	112	.....	.....	.....	446	276	180	86	86	52
15	14	34	95	.....	.....	.....	560	242	272	64	68	32
16	58	30	90	.....	.....	.....	424	206	186	56	64	60
17	64	86	112	.....	.....	.....	340	190	167	48	58	48
18	34	24	100	.....	.....	.....	276	170	143	48	58	27
19	44	44	79	.....	.....	.....	224	149	121	68	66	64
20	39	50	86	.....	.....	.....	206	143	112	118	72	52
21	27	39	92	.....	.....	.....	235	132	95	149	72	37
22	27	90	90	.....	.....	.....	340	118	90	143	72	46
23	52	22	81	.....	.....	.....	356	115	88	118	66	56
24	48	44	79	.....	.....	.....	344	100	81	100	64	46
25	27	48	95	.....	.....	.....	300	90	72	79	58	34
26	56	58	86	.....	.....	.....	238	102	68	79	50	34
27	27	58	81	.....	.....	.....	199	360	64	58	52	44
28	52	50	77	.....	.....	.....	213	584	64	52	46	52
29	27	52	79	.....	.....	.....	206	536	58	48	44	27
30	44	64	90	.....	.....	.....	206	377	58	48	41	56
31	30	.....	.....	.....	.....	.....	.....	280	.....	41	39	.....
1912-13.												
1	24	79	79	.....	.....	.....	261	173	560	68	22	13
2	52	81	79	.....	.....	.....	238	149	468	64	30	16
3	30	79	56	.....	.....	.....	235	137	381	90	12	12
4	30	95	86	.....	.....	.....	242	238	300	72	14	13
5	34	72	110	.....	.....	.....	242	320	272	64	20	13
6	34	52	115	.....	.....	.....	242	360	257	50	20	13
7	34	44	115	.....	.....	.....	261	340	203	48	28	14
8	52	90	.....	.....	.....	.....	381	320	193	48	8	30
9	39	60	.....	.....	.....	.....	536	320	173	44	14	39
10	50	64	.....	.....	.....	.....	.....	340	167	39	14	14
11	64	52	.....	.....	.....	.....	.....	280	146	44	30	22
12	52	66	.....	.....	.....	.....	.....	272	143	66	30	39
13	129	70	.....	.....	.....	.....	.....	280	121	56	48	13
14	115	72	.....	.....	.....	.....	.....	320	115	48	41	17
15	115	77	.....	.....	.....	.....	.....	513	115	48	39	48
16	100	72	.....	.....	.....	.....	.....	.....	110	48	30	17
17	88	79	.....	.....	.....	.....	536	.....	100	48	34	37
18	77	52	.....	.....	.....	.....	446	.....	90	64	39	12
19	68	41	.....	.....	.....	536	381	.....	88	44	28	48
20	70	72	.....	.....	.....	490	300	.....	86	8	30	39
21	90	70	.....	.....	.....	360	280	.....	88	30	30	17
22	129	77	.....	.....	.....	a 300	250	.....	86	34	39	52
23	115	86	.....	.....	.....	242	238	.....	68	46	58	22
24	110	58	.....	.....	.....	.....	228	.....	68	44	58	34
25	110	72	.....	.....	.....	.....	228	.....	86	46	50	41
26	100	46	.....	.....	.....	.....	210	.....	90	44	28	52
27	90	24	.....	.....	.....	.....	203	.....	88	44	44	58
28	90	52	.....	.....	.....	424	210	.....	90	41	28	68
29	86	90	.....	.....	.....	402	210	.....	81	41	14	48
30	86	64	.....	.....	.....	381	199	.....	70	86	2	52
31	79	.....	.....	.....	.....	340	.....	.....	.....	27	9	.....

a Estimated because of ice.

Daily discharge, in second-feet, of Iowa River near Iowa Falls, Iowa, from Aug. 5, 1911, to Sept. 30, 1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	52	48	64	.....	.....	.....	90	180	110	143	56	28
2	39	68	58	.....	.....	.....	110	167	90	132	56	19
3	39	58	68	.....	.....	.....	86	137	86	118	54	16
4	39	72	64	.....	.....	.....	88	118	68	115	52	13
5	58	60	58	.....	.....	.....	81	112	115	108	48	17
6	68	56	70	.....	.....	.....	81	112	.....	95	44	12
7	102	41	79	.....	.....	.....	86	115	.....	90	39	12
8	102	46	66	.....	.....	.....	77	105	.....	90	37	13
9	149	52	68	.....	.....	.....	68	95	.....	88	37	12
10	242	52	79	.....	.....	.....	72	88	.....	86	41	43
11	105	90	50	.....	.....	.....	68	86	.....	77	44	54
12	95	68	72	.....	.....	.....	64	86	.....	81	39	50
13	79	72	58	.....	.....	.....	66	77	.....	68	37	60
14	81	77	79	.....	.....	.....	64	72	.....	68	37	102
15	58	68	68	.....	.....	.....	64	70	.....	68	34	161
16	64	68	70	.....	.....	.....	64	68	.....	77	32	158
17	66	68	77	.....	.....	.....	60	64	.....	70	30	123
18	70	68	60	.....	.....	.....	58	62	.....	68	28	88
19	66	72	46	.....	.....	.....	68	56	584	68	27	72
20	58	79	68	.....	.....	.....	68	52	402	68	27	68
21	64	81	66	.....	.....	.....	77	56	340	60	27	62
22	66	72	77	.....	.....	.....	72	50	300	54	27	146
23	60	64	81	.....	.....	.....	66	52	320	48	30	152
24	44	41	.....	.....	.....	110	79	64	300	48	30	123
25	39	30	.....	.....	.....	68	88	118	242	77	30	102
26	66	34	.....	.....	.....	72	90	272	213	112	28	86
27	56	44	.....	.....	.....	68	112	320	186	77	28	75
28	48	64	.....	.....	.....	149	155	320	170	66	28	64
29	52	68	.....	.....	.....	115	176	242	158	50	28	54
30	50	79	.....	.....	.....	115	180	155	152	48	28	46
31	48	.....	.....	.....	.....	110	.....	129	.....	50	28	.....

NOTE.—Daily discharge computed from a rating curve well defined between 14 and 402 second-feet (gage heights 0.5 and 1.8 feet). Above 402 second-feet (gage height 1.8 feet) the rating curve is simply an extension. Daily discharge, Sept. 2-30, 1914, when flow was affected by backwater from the dam at Iowa Falls, computed from a rating curve based on the discharge measurement made on Sept. 25, 1914.

Monthly discharge of Iowa River near Iowa Falls, Iowa, from Aug. 5, 1911, to Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1911.				
August 5–31	48	4	19.1	B.
September	46	4	20.1	B.
1911–12.				
October	64	14	40.8	A.
November	90	14	41.2	B.
December	115	48	83.1	C.
May	584	90	218	A.
June	280	58	129	A.
July	149	41	76.6	A.
August	90	30	53.1	A.
September	68	27	46.6	A.
1912–13.				
October	129	24	75.5	A.
November	95	24	66.9	A.
June	560	68	163	A.
July	90	8	49.8	A.
August	58	2	28.7	B.
September	68	12	30.4	B.
1913–14.				
October	242	39	71.8	A.
November	90	30	62.0	A.
December	81	.....	66.6	B.
March	.....	.....	83.2	C.
April	180	58	85.9	A.
May	320	50	119	A.
July	143	48	79.6	A.
August	56	27	35.8	A.
September	161	12	67.7	B.

IOWA RIVER AT IOWA CITY, IOWA.

Location.—At highway bridge about 500 feet below Chicago, Rock Island & Pacific Railway main line bridge, and about three-fourths of a mile below Iowa State University's power plant; about three-fourths of a mile downstream from old gaging station, which was located at the county highway bridge.

Records available.—June 11, 1903, to July 21, 1906; October 30, 1913, to September 30, 1914.

Drainage area.—3,320 square miles.

Gage.—Chain gage attached to upstream side of bridge; read once daily to tenths during 1913, and twice daily, morning and evening, to tenths during 1914. Limits of use: Half-tenths below and tenths above 1.5 feet.

Discharge measurements.—Made from a boat about 1,000 feet below highway bridge.

Winter flow.—Discharge relation affected by ice but usually to a slight extent.

Regulation.—Probable slight daily fluctuations, due to dam and power house above.

Discharge measurements of Iowa River at Iowa City, Iowa, 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. 20	Hutchins and Dunlap	1.26	306	Mar. 14	Hutchins and Thul	1.23	510
27	do	1.36	328	28	Hutchins and Wink	1.55	611
Jan. 6	Lake, Cheseboro, and Dunlap.	1.24	388	Apr. 1	Hutchins and Thul	2.17	1,020
				10	Hutchins and Dunlap	1.55	651
6	Richards, Jaeger, and Bryant.	1.24	386	May 11	Hutchins and Woodward.	6.03	3,790

NOTE.—The above measurements were made by students at the University of Iowa.

Daily gage height, in feet, of Iowa River at Iowa City, Iowa, for the year ending Sept. 30, 1914.

[Byron Gibson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	0.5	1.4	0.2	0.5	.....	2.2	1.2	1.6	3.1	0.55	0.85
2	.....	.5	1.1	.2	.5	.....	2.0	1.25	1.6	2.7	.65	.5
3	.....	.7	.9	.1	.6	.....	2.5	1.35	1.45	2.4	.85	.5
4	.....	.7	.9	.1	.6	1.3	2.3	1.5	1.4	2.2	.6	.45
5	.....	.5	1.2	.3	.4	1.1	2.0	1.45	2.4	2.0	.5	.5
6	.....	.7	1.6	.3	.....	1.0	2.0	1.6	4.0	1.8	.8	6.9
7	.....	.6	1.0	.3	.....	.9	1.8	2.0	3.2	1.9	.55	2.5
8	.....	.6	.9	.5	.....	.9	1.6	2.0	2.6	1.8	.6	1.5
9	.....	.5	.9	.4	.....	1.05	1.6	1.7	4.2	1.8	.55	1.0
10	.....	.7	.7	.3	.....	1.1	1.6	1.45	4.8	1.6	.65	.85
11	.....	.7	.7	.2	.....	1.05	1.6	6.7	5.5	1.45	.5	1.1
12	.....	.7	.8	.3	.....	.95	1.45	5.2	5.3	1.4	.55	1.0
13	.....	.7	.9	.....	.....	1.0	1.3	4.4	5.6	1.45	.6	1.0
14	.....	.9	.9	.....	.....	1.0	1.3	3.8	6.2	1.45	.6	2.8
15	.....	.7	1.1	.7	.....	1.4	1.25	3.4	6.3	1.3	.45	(a)
16	.....	.7	1.0	.6	.....	1.3	1.15	2.4	6.5	1.3	.7	(b)
17	.....	.7	.9	.6	.....	1.4	1.05	2.0	7.0	1.2	.55	7.2
18	.....	.7	.9	.6	.....	1.25	1.05	1.8	7.3	1.2	.45	7.8
19	.....	.5	.9	.5	.....	1.25	1.1	1.6	7.2	1.25	.45	7.6
20	.....	.5	.8	.5	.....	1.3	.9	1.35	6.7	1.4	.65	7.8
21	.....	.6	.8	.5	.....	1.2	.8	1.35	5.0	1.3	.45	8.0
22	.....	.6	.8	.4	.....	1.05	.95	1.5	4.4	1.0	.45	7.6
23	.....	.5	.7	.3	.....	.95	.9	1.35	4.0	.9	.35	7.0
24	.....	.3	.7	.4	.....	.95	.85	1.3	3.5	1.05	.35	6.2
25	.....	.3	.8	.4	.....	.85	.95	1.25	3.7	.95	.4	6.0
26	.....	.1	.8	.4	.....	1.05	.75	1.2	3.3	.95	.45	5.1
27	.....	.5	.8	.6	.....	1.15	.8	1.2	4.4	.85	.4	4.5
28	.....	.6	.8	.5	.....	4.1	.9	1.1	5.0	.8	.45	4.0
29	.....	.6	.5	1.0	.....	2.2	.95	.95	4.7	.9	.35	3.5
30	0.6	.8	.....	.7	.....	2.0	1.15	1.15	3.8	.95	.35	3.2
31	.5	.....	.3	.7	.....	1.85	.....	1.6	.....	.9	.35	.....

(a) Observer reports stage above 10 feet.

(b) Stage dropped about 3 inches.

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1914.

Daily discharge, in second-feet, of Iowa River at Iowa City, Iowa, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	270	575	199	270	.....	998	492	668	1,590	284	372
2	.....	270	455	199	270	.....	880	512	668	1,320	312	270
3	.....	326	387	181	297	.....	1,180	554	598	1,120	372	270
4	.....	326	387	181	297	532	1,060	620	575	998	297	257
5	.....	270	492	220	244	455	880	598	1,120	880	270	270
6	.....	326	668	220	.....	420	880	668	2,220	770	356	4,540
7	.....	297	420	220	.....	387	770	880	1,660	824	284	1,180
8	.....	297	387	270	.....	387	668	880	1,250	770	297	620
9	.....	270	387	244	.....	438	668	718	2,370	770	284	420
10	.....	326	326	220	.....	455	668	598	2,820	668	312	372
11	.....	326	326	199	.....	438	668	4,360	3,370	598	270	455
12	.....	326	356	220	.....	404	598	3,130	3,210	575	284	420
13	.....	326	387	[a] 255	.....	420	532	2,520	3,450	598	297	420
14	.....	387	387	[a] 291	.....	420	532	2,080	3,940	598	297	1,380
15	.....	326	455	326	.....	575	512	1,800	4,020	532	257	[b] 8,000
16	.....	326	420	297	.....	532	474	1,120	4,200	532	326	[b] 7,500
17	.....	326	387	297	.....	575	438	880	4,620	492	284	4,790
18	.....	326	387	297	.....	512	438	770	4,880	492	257	5,310
19	.....	270	387	270	.....	512	455	668	4,790	512	257	5,130
20	.....	270	356	270	.....	532	387	554	4,360	575	312	5,310
21	.....	297	356	270	.....	492	356	554	2,970	532	257	5,490
22	.....	297	356	244	.....	438	404	620	2,520	420	257	5,130
23	.....	270	326	220	.....	404	387	554	2,220	387	232	4,620
24	.....	220	326	244	.....	404	372	532	1,870	438	232	3,940
25	.....	220	356	244	.....	372	404	512	2,010	404	244	3,770
26	.....	181	356	244	.....	438	341	492	1,730	404	257	3,050
27	.....	270	356	297	.....	474	356	492	2,520	372	244	2,600
28	.....	297	356	270	.....	2,300	387	455	2,970	356	257	2,220
29	.....	297	270	420	.....	998	404	404	2,740	387	232	1,870
30	297	356	245	326	.....	880	474	474	2,080	404	232	1,660
31	270	.....	220	326	.....	797	.....	668	.....	387	232	.....

[a] Interpolated. [b] Estimated.

NOTE.—Daily discharge computed from a rating curve fairly well defined between 420 and 4,620 second-feet (gage heights 1.0 and 7.0 feet).

Monthly discharge of Iowa River at Iowa City, Iowa, for the year ending Sept. 30, 1914.

[Drainage area, 3,320 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
November	387	181	296	0.089	0.10	C.
December	668	220	382	.115	.13	D.
January	420	181	257	.077	.09	D.
February 1–5	297	244	276	.083	.02	
March 4–31	2,300	372	571	.172	.18	B.
April	1,180	341	586	.177	.20	B.
May	4,360	404	973	.293	.34	B.
June	4,880	575	2,610	.786	.88	B.
July	1,590	356	636	.192	.22	B.
August	372	232	277	.083	.10	C.
September	8,000	257	2,720	.819	.91	C.

CEDAR RIVER NEAR AUSTIN, MINN.

Location.—In sec. 15, T. 102 N., R. 18 W., just below the dam of the Red Cedar Mill, 2 miles below Austin, Minn.

Records available.—May 29, 1909, to September 30, 1914, when station was discontinued.

Gage.—Chain gage since May 2, 1913; read to quarter-tenths three times daily when Red Cedar Mill is in operation and twice daily at other times. Limits of use: Hundredths below 3.0 half-tenths between 3.0 and 4.0, and tenths above 4.0 feet.

Channel and control.—Sand, gravel, and clay; may shift during high water.

Winter flow.—Somewhat affected by ice; discharge estimated from discharge measurements.

Regulation.—Immediately above the station is the water-power plant known as Red Cedar Mill. During the low-water season the water falls below the crest of the dam by the end of the 10 or 12 hour run, and after the turbine is closed the water is held back for several hours before it rises sufficiently to flow over the crest; consequently the stage of the river changes considerably during each 24 hours.

Accuracy.—Owing to the slightly shifting channel the growth of grass during the summer, and fluctuations in stage caused by the operation of the power house, records are only fair.

Discharge measurements of Cedar River near Austin, Minn., during the year ending Sept. 30, 1914.

[Made by S. B. Soulé.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 19	2.44	[a] 29	June 15	6.18	1,240
19	2.45	[a] 28	Sept. 9	2.75	[d] 71
Jan. 22	2.68	[b] 84	9	2.77	[d] 77
Apr. 8	2.53	[c] 67			

[a] Considerable quantity of grass in channel.
[b] No ice present.
[c] Measurement made by wading.
[d] Measurement made by wading; considerable quantity of grass in channel at control.

Daily gage height, in feet, of Cedar River near Austin, Minn., for the year ending Sept. 30, 1914.

[J. C. King and H. C. Buck, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.67	2.48	2.65	2.28	2.23	2.59	2.79	3.25	2.66	3.95	2.52	2.62
2	2.68	2.17	2.57	2.38	2.45	2.72	2.68	2.99	2.62	3.6	2.34	2.57
3	2.64	2.54	2.53	2.52	2.39	2.66	2.54	2.96	2.74	3.35	2.50	2.54
4	2.64	2.45	2.48	2.36	2.42	2.48	2.51	2.90	2.73	3.1	2.51	2.57
5	2.69	2.46	2.50	2.37	2.46	2.56	2.45	2.81	2.75	2.95	2.52	2.59
6	2.77	2.16	2.39	2.51	2.37	2.66	2.53	2.70	2.92	2.95	2.50	2.47
7	2.75	2.56	2.38	2.47	2.40	2.58	2.56	2.71	3.3	2.82	2.41	2.54
8	2.67	2.22	2.51	2.44	2.01	2.43	2.59	2.66	5.0	2.77	2.33	2.54
9	2.64	2.38	2.53	2.44	2.42	2.59	2.56	2.69	4.0	2.72	2.29	2.54
10	2.69	2.54	2.47	2.33	2.35	2.55	2.59	2.48	3.35	2.69	2.51	2.54
11	2.69	2.47	2.53	2.30	2.33	2.54	2.54	2.65	4.6	2.60	2.41	2.55
12	2.59	2.21	2.52	2.48	2.37	2.52	2.50	2.62	6.3	2.51	2.37	2.49
13	2.73	2.45	2.53	2.41	2.33	2.54	2.58	2.52	5.4	2.59	2.37	2.66
14	2.69	2.44	2.39	2.34	2.33	2.93	2.51	2.47	5.8	2.56	2.38	2.73
15	2.64	2.50	2.55	2.39	2.06	3.15	2.56	2.54	6.4	2.55	2.37	2.71
16	2.61	2.34	2.45	2.40	2.53	3.2	2.52	2.51	5.3	2.58	2.11	2.71
17	2.58	2.57	2.48	2.45	2.34	2.92	2.52	2.48	4.0	2.63	2.48	2.75
18	2.54	2.41	2.47	2.34	2.46	2.70	2.59	2.54	3.65	2.57	2.47	2.61
19	2.46	2.45	2.45	2.47	2.41	2.64	2.58	2.52	3.55	2.41	2.48	2.71
20	2.59	2.50	2.50	2.40	2.34	2.55	2.63	2.56	3.3	2.55	2.47	2.60
21	2.54	2.53	2.31	2.39	2.29	2.49	2.68	2.59	3.1	2.51	2.44	2.73
22	2.54	2.49	2.45	2.40	2.12	2.38	2.62	2.60	3.15	2.48	2.63	2.76
23	2.62	2.32	2.43	2.39	2.45	2.41	2.59	2.59	3.2	2.48	2.98	2.71
24	2.66	2.56	2.40	2.32	2.39	2.50	2.66	2.95	3.3	2.48	2.86	2.69
25	2.62	2.55	2.28	2.01	2.35	2.41	2.59	3.2	3.35	2.43	2.76	2.65
26	2.63	2.48	2.47	2.39	2.45	2.49	2.51	3.1	3.2	2.37	2.66	2.63
27	2.56	2.40	2.45	2.38	2.41	2.44	3.05	2.93	4.5	2.47	2.62	2.49
28	2.42	2.55	2.23	2.39	2.41	2.48	4.5	2.86	6.2	2.40	2.56	2.61
29	2.52	2.53	2.43	2.36	.....	2.51	5.6	2.71	5.4	2.38	2.58	2.61
30	2.32	2.39	2.44	2.48	.....	2.64	3.8	2.65	4.4	2.51	2.52	2.66
31	2.46	.....	2.47	2.42	.....	2.82	.....	2.60	.....	2.55	2.59	.....

NOTE.—Discharge relation affected by ice about Feb. 1 to Mar. 3, 1914.

Daily discharge, in second-feet, of Cedar River near Austin, Minn., for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	54	42	88	23	.....	.....	122	241	90	443	32	48
2	56	7	70	37	.....	.....	95	173	81	338	13	40
3	51	51	62	60	.....	.....	64	166	110	268	30	36
4	51	37	53	34	.....	53	58	150	108	202	31	40
5	60	38	56	36	.....	68	48	128	112	163	32	43
6	78	6	38	58	.....	90	62	100	155	163	30	25
7	74	54	37	51	.....	72	68	102	254	130	19	36
8	58	11	58	46	.....	45	74	90	800	118	12	36
9	54	26	62	46	.....	74	68	98	458	105	8	36
10	64	51	51	30	.....	66	74	53	268	98	31	36
11	64	46	62	25	.....	64	64	88	652	76	19	37
12	48	13	60	53	.....	60	56	81	1,290	58	15	28
13	74	43	62	42	.....	64	72	60	952	74	15	54
14	66	42	38	31	.....	158	58	51	1,100	68	16	68
15	58	51	66	38	.....	215	68	64	1,330	66	15	64
16	53	26	48	40	.....	228	60	58	914	53	4	64
17	48	64	53	48	.....	155	60	53	458	62	26	72
18	43	37	51	31	.....	100	74	64	353	51	25	46
19	31	43	48	51	.....	86	72	60	324	26	26	64
20	51	51	56	40	.....	66	83	68	254	48	25	45
21	43	62	26	38	.....	54	95	74	202	42	22	68
22	46	54	48	40	.....	37	81	76	215	37	50	74
23	60	28	45	38	.....	42	74	74	228	37	128	64
24	68	68	40	28	.....	56	90	163	254	37	98	60
25	60	66	23	5	.....	42	74	228	268	30	74	53
26	62	53	51	38	.....	54	58	202	228	22	54	50
27	50	40	48	37	.....	46	189	158	618	36	48	28
28	28	66	18	38	.....	53	618	140	1,260	25	38	46
29	43	62	45	34	.....	58	1,030	102	952	23	42	46
30	17	38	46	53	.....	86	398	88	586	42	32	54
31	34	.....	51	43	.....	130	.....	76	.....	48	43	.....

NOTE.—Daily discharge determined as follows: Between 6.7 and 1,370 second-feet (gage heights, 2.1 and 6.5 feet) from a well-defined rating curve; Oct. 1 to Nov. 20, 1913, and July 16 to Sept. 30, 1914, on account of backwater caused by grass in the channel, by the indirect method for shifting channels. Discharge estimated, because of ice, from gage heights, observer's notes, and climatic records, as follows: Feb. 1–28, 25 second-feet; and Mar. 1–3, 50 second-feet.

Monthly discharge of Cedar River near Austin, Minn., for the year ending Sept. 30, 1914.

[Drainage area, 425 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	78	17	53.1	0.125	0.14	C.
November	68	6	42.5	.100	.11	C.
December	88	18	50.3	.118	.14	C.
January	60	5	39.1	.092	.11	C.
February	.....	.....	25	.059	.06	D.
March	228	.....	79.7	.188	.22	C.
April	1,030	48	137	.322	.36	B.
May	241	51	107	.252	.29	B.
June	1,330	81	496	1.17	1.30	B.
July	443	22	96.4	.227	.26	C.
August	128	4	34.0	.080	.09	D.
September	74	25	48.7	.115	.13	C.
The year	1,330	.....	100	.235	3.21	

CEDAR RIVER AT CEDAR RAPIDS, IOWA.

Location.—In the central part of Cedar Rapids, below the dam, and between the electric railroad bridge and the Seventh Avenue combination railroad and foot-bridge.

Records available.—October 26, 1902, to September 30, 1914.

Drainage area.—6,320 square miles.

Gage.—Inclined staff gage, reading from 0 to 15 feet, fastened to posts driven in the right bank of the river in the rear of the Iowa Windmill & Pump Co.'s plant; read daily, in the morning, to tenths.

Channel and control.—Bed of river consists of rock and gravel; clean of vegetation and nearly permanent.

Discharge measurements.—Made from the upstream side of the First Avenue Bridge.

Winter flow.—The gage is located where the current is swift, and ice seldom forms across the river for the entire width; the discharge relation, therefore, is affected only slightly by ice.

Regulation.—A dam and power plant above the station may modify the flow to some extent during low stages of the river.

Accuracy.—Records good. Estimates, except when ice is present, based on a well-defined curve.

Cooperation.—Gage heights furnished by the United States Weather Bureau.

Discharge measurements of Cedar River at Cedar Rapids, Iowa, during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 5	Soulé and Bickel	3.05	983
May 13	J. B. Stewart	3.44	1,700

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.9	3.0	3.1	2.7	3.1	2.8	4.0	3.1	4.0	4.2	3.1	2.9
2	2.8	3.0	3.2	2.8	3.0	2.7	3.9	3.3	3.8	4.3	3.2	2.8
3	2.9	2.9	3.1	2.7	3.1	2.8	3.7	3.4	3.9	4.5	3.1	2.9
4	2.8	3.0	3.2	2.8	3.0	2.8	3.7	4.0	3.7	4.2	3.1	2.8
5	2.9	2.9	3.1	2.7	3.1	2.9	3.5	3.9	4.2	4.2	3.0	2.9
6	2.8	3.0	3.2	2.9	3.0	2.9	3.6	3.9	3.9	4.0	3.1	2.9
7	2.9	2.9	3.1	2.8	3.1	3.0	3.4	3.7	4.5	4.0	2.9	2.9
8	2.8	3.0	3.1	2.9	3.0	3.0	3.5	3.6	4.9	3.8	3.0	2.8
9	2.9	2.8	3.0	2.8	3.0	3.3	3.4	3.3	5.8	3.8	2.9	2.9
10	2.9	2.9	3.2	2.9	2.9	3.2	3.4	3.4	5.8	3.6	3.0	2.8
11	3.3	2.8	3.0	2.8	2.9	3.4	3.3	3.4	5.3	3.6	2.8	2.9
12	3.1	2.9	3.1	2.9	2.8	3.3	3.2	3.5	4.9	3.5	2.8	2.8
13	3.2	2.8	3.0	2.8	2.9	3.5	3.1	3.4	4.9	3.6	2.8	2.9
14	3.1	3.0	3.1	2.9	2.7	3.5	3.1	3.5	4.8	3.4	2.9	2.9
15	3.1	2.9	3.0	2.7	2.8	3.6	3.1	3.3	4.8	3.5	2.8	5.8
16	2.9	2.9	3.1	2.8	2.7	3.4	3.2	3.4	4.7	3.3	2.9	4.0
17	3.1	2.8	3.0	2.7	2.8	3.5	3.1	3.3	5.7	3.5	2.8	3.6
18	2.9	2.9	3.1	2.7	2.8	3.3	3.2	3.4	7.0	3.3	2.9	3.5
19	3.0	2.8	2.9	2.6	2.9	3.5	3.0	3.2	7.7	3.4	2.8	3.8
20	2.9	2.9	3.0	2.7	2.9	3.3	3.1	3.3	6.7	3.3	3.0	3.8
21	3.0	2.8	2.7	2.8	3.0	3.4	3.1	3.1	5.7	3.3	2.9	3.6
22	2.9	2.9	2.7	3.0	2.9	3.2	3.2	3.2	5.2	3.1	2.9	4.2
23	3.0	2.8	2.6	2.9	2.9	3.3	3.0	3.0	4.9	3.2	2.8	3.8
24	2.9	2.9	2.7	3.1	2.8	3.1	3.2	3.1	4.7	3.1	2.9	3.7
25	3.0	2.8	2.6	2.9	2.8	3.2	3.1	3.0	4.6	3.2	2.8	3.5
26	2.9	2.9	2.8	3.1	2.7	3.4	3.2	3.3	4.4	3.1	2.8	3.7
27	3.0	2.8	2.7	3.0	2.7	3.5	3.1	3.9	4.4	3.2	2.7	3.5
28	2.9	3.0	2.7	3.4	2.6	3.6	3.3	4.2	4.1	3.1	2.9	3.5
29	3.0	2.9	2.6	3.1	.....	3.7	3.2	4.4	4.1	3.3	2.8	3.4
30	3.0	3.1	2.8	3.1	.....	3.9	3.2	4.4	3.9	3.1	2.9	3.4
31	3.1	.....	2.7	3.0	.....	4.2	.....	4.0	.....	3.2	2.7	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1914.

Daily discharge, in second-feet, of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	810	950	1,100	580	1,100	690	3,170	1,100	3,170	3,790	1,100	810
2	690	950	1,260	690	950	580	2,870	1,440	2,590	4,110	1,260	690
3	810	810	1,100	580	1,100	690	2,320	1,630	2,870	4,760	1,100	810
4	690	950	1,260	690	950	690	2,320	3,170	2,320	3,790	1,100	690
5	810	810	1,100	580	1,100	810	1,840	2,870	3,790	3,790	950	810
6	690	950	1,260	810	950	810	2,070	2,870	2,870	3,170	1,100	810
7	810	810	1,100	690	1,100	950	1,630	2,320	4,760	3,170	810	810
8	690	950	1,100	810	950	950	1,840	2,070	6,120	2,590	950	690
9	810	690	950	690	950	1,440	1,630	1,440	9,340	2,590	810	810
10	810	810	1,260	810	810	1,260	1,630	1,630	9,340	2,070	950	690
11	1,440	690	950	690	810	1,630	1,440	1,630	7,530	2,070	690	810
12	1,100	810	1,100	810	690	1,440	1,260	1,840	6,120	1,840	690	690
13	1,260	690	950	690	810	1,840	1,100	1,630	6,120	2,070	690	810
14	1,100	950	1,100	810	580	1,840	1,100	1,840	5,770	1,630	810	810
15	1,100	810	950	580	690	2,070	1,100	1,440	5,770	1,840	690	9,340
16	810	810	1,100	690	580	1,630	1,260	1,630	5,430	1,440	810	3,170
17	1,100	690	950	580	690	1,840	1,100	1,440	8,970	1,840	690	2,070
18	810	810	1,100	580	690	1,440	1,260	1,630	13,900	1,440	810	1,840
19	950	690	810	490	810	1,840	950	1,260	16,600	1,630	690	2,590
20	810	810	950	580	810	1,440	1,100	1,440	12,700	1,440	950	2,590
21	950	690	580	690	950	1,630	1,100	1,100	8,970	1,440	810	2,070
22	810	810	580	950	810	1,260	1,260	1,260	7,170	1,100	810	3,790
23	950	690	490	810	810	1,440	950	950	6,120	1,260	690	2,590
24	810	810	580	1,100	690	1,100	1,260	1,100	5,430	1,100	810	2,320
25	950	690	490	810	690	1,260	1,100	950	5,090	1,260	690	1,840
26	810	810	690	1,100	580	1,630	1,260	1,440	4,430	1,100	690	2,320
27	950	690	580	950	580	1,840	1,100	2,870	4,430	1,260	580	1,840
28	810	950	580	1,630	490	2,070	1,440	3,790	3,480	1,100	810	1,840
29	950	810	490	1,100	.....	2,320	1,260	4,430	3,480	1,440	690	1,630
30	950	1,100	690	1,100	.....	2,870	1,260	4,430	2,870	1,100	810	1,630
31	1,100	.....	580	950	.....	3,790	.....	3,170	.....	1,260	580	.....

NOTE.—Daily discharge computed from a rating curve well defined between 600 and 36,000 second-feet. Open-channel rating curve applied throughout entire year.

Monthly discharge of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1914.

[Drainage area, 6,320 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,440	690	908	0.144	0.17	A.
November	1,100	690	816	.129	.14	B.
December	1,260	490	896	.142	.16	B.
January	1,630	490	794	.126	.15	B.
February	1,100	490	811	.128	.13	B.
March	3,790	580	1,520	.241	.28	A.
April	3,170	950	1,500	.237	.26	A.
May	4,430	950	1,990	.315	.36	A.
June	16,600	2,320	6,250	.989	1.10	A.
July	4,760	1,100	2,080	.329	.38	A.
August	1,260	580	826	.131	.15	A.
September	9,340	690	1,810	.286	.32	A.
The year	16,600	490	1,680	.266	3.60	

SKUNK RIVER AT COPPOCK, IOWA.

Location.—At highway bridge about one-eighth mile above railroad station and about one-fourth mile above junction with Crooked Creek.

Records available.—October 21, 1913, to September 30, 1914.

Drainage area.—Not measured.

Gage.—Chain gage attached to downstream side of bridge; read daily, in the morning, to half-tenths. Limits of use: Half-tenths below and tenths above 3.5 feet. During October, November, and December, 1913, the gage was read once daily to hundredths. For this period gage heights below 3 feet are recorded to hundredths.

Channel and control.—Gravel and sand; channel liable to shift.

Discharge measurements.—Made from highway bridge.

Winter flow.—On account of ice gage heights not a correct index of the flow during winter months.

Accuracy.—Conditions of flow fairly good. Current not normal to bridge at medium or high stages. Two railroad bridges about 500 feet below gage may catch drift at high stages.

Cooperation.—Station established by and maintained in cooperation with the Mississippi River Power Co. for flood-prediction purposes.

Discharge measurements of Skunk River at Coppock, Iowa, during the year ending Sept. 30, 1914.

[Made by D. V. Egbert.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 8	2.27	57
Oct. 21	2.73	142
Sept. 19	10.86	5,740

NOTE.—Measurements made by engineers of the Mississippi River Power Co

Daily gage height, in feet, of Skunk River at Coppock, Iowa, for the year ending Sept. 30, 1914.

[J. W. Ricks, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.50	2.45	.....	.....	.....	4.1	2.95	3.1	4.0	2.50	2.35
2	.....	2.50	2.50	.....	.....	.....	3.9	3.0	3.0	3.6	2.50	2.85
3	.....	2.48	2.43	.....	.....	.....	3.8	3.25	3.0	3.45	2.45	2.75
4	.....	2.47	2.53	.....	.....	.....	4.0	3.3	3.0	3.35	2.40	2.40
5	.....	2.47	2.56	.....	.....	.....	3.8	4.2	3.05	3.25	2.35	2.65
6	.....	2.45	2.63	.....	.....	.....	3.8	3.5	3.2	3.1	2.35	2.80
7	.....	2.45	2.62	.....	.....	.....	3.7	3.3	3.0	3.05	2.30	2.60
8	.....	2 44	2.60	.....	.....	.....	3.6	3.45	2.85	3.6	2.25	3.15
9	.....	2.42	2.62	.....	.....	.....	3.6	3.4	2.8	5.5	2.25	3.5
10	.....	2.42	2.65	.....	.....	.....	3.5	3.45	4.2	4.0	2.25	3.5
11	.....	2.40	2.62	.....	.....	.....	3.45	4.0	4.1	3.35	2.25	4.4
12	.....	2.40	2.60	.....	.....	.....	3.4	4.4	4.2	3.2	2.20	4.4
13	.....	2.39	2.58	.....	.....	.....	3.35	4.6	4.8	3.05	2.20	4.5
14	.....	2.37	2.59	.....	.....	.....	3.25	5.9	4.2	2.95	2.15	4.1
15	.....	2.40	2.62	.....	.....	.....	3.3	5.8	5.0	2.85	2.10	4.2
16	.....	2.33	2.63	.....	.....	.....	3.25	5.0	4.8	2.80	2.15	7.9
17	.....	2.38	2.63	.....	.....	.....	3.15	4.4	4.4	2.70	2.20	9.3
18	.....	2.42	2.64	.....	.....	.....	3.15	4.0	4.2	2.65	2.10	10.4
19	.....	2.37	2.65	.....	.....	.....	3.1	3.8	4.2	2.65	2.25	10.8
20	.....	2.40	2.65	.....	.....	.....	2.95	3.6	4.0	2.65	2.85	11.2
21	2.72	2.40	2.73	.....	.....	.....	2.9	3.6	3.8	2.60	2.50	11.3
22	2.63	2.40	2.85	.....	.....	.....	3.0	3.45	3.6	2.60	2.30	11.4
23	2.62	2.38	2.63	.....	.....	.....	3.2	3.3	5.0	2.65	2.20	10.3
24	2.62	2.38	2.60	.....	.....	.....	3.15	3.25	4.8	2.60	2.15	9.0
25	2.80	2.38	2.61	.....	.....	.....	3.1	3.2	3.8	2.55	2.10	9.0
26	2.76	2.38	2.63	.....	.....	3.1	3.05	3.2	3.7	2.50	2.10	8.4
27	2.68	2.39	2.53	.....	.....	.....	3.05	3.1	5.2	2.65	2.10	7.4
28	2.63	2.42	2.48	.....	.....	.....	3.15	3.05	5.9	3.1	2.15	6.6
29	2.63	2.41	2.46	.....	.....	.....	3.05	3.4	5.9	2.65	2.20	6.0
30	2.56	2.42	2.62	.....	.....	.....	2.95	3.25	4.9	2.50	2.35	5.6
31	2.56	.....	2.58	.....	.....	.....	.....	3.1	.....	2.45	2.30	.....

NOTE.—Discharge relation affected by ice about Jan. 1 to Mar. 31, 1914.

Daily discharge, in second-feet, of Skunk River at Coppock, Iowa, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	95	86	.....	.....	.....	560	190	226	520	95	70
2	.....	95	95	.....	.....	.....	480	202	202	370	95	168
3	.....	92	83	.....	.....	.....	440	265	202	325	86	146
4	.....	90	101	.....	.....	.....	520	280	202	295	78	78
5	.....	90	106	.....	.....	.....	440	600	214	265	70	124
6	.....	86	120	.....	.....	.....	440	340	250	226	70	157
7	.....	86	118	.....	.....	.....	405	280	202	214	62	114
8	.....	85	114	.....	.....	.....	370	325	168	370	54	238
9	.....	81	118	.....	.....	.....	370	310	157	1,300	54	340
10	.....	81	124	.....	.....	.....	340	325	600	520	54	340
11	.....	73	118	.....	.....	.....	325	520	560	295	54	690
12	.....	78	114	.....	.....	.....	310	690	600	250	47	690
13	.....	76	110	.....	.....	.....	295	785	885	214	47	735
14	.....	73	112	.....	.....	.....	265	1,560	600	190	40	560
15	.....	78	118	.....	.....	.....	280	1,490	995	168	33	600
16	.....	67	120	.....	.....	.....	265	995	885	157	40	3,040
17	.....	75	120	.....	.....	.....	238	690	690	135	47	4,300
18	.....	81	122	.....	.....	.....	238	520	600	124	33	5,400
19	.....	73	124	.....	.....	.....	226	440	600	124	54	5,800
20	.....	78	124	.....	.....	.....	190	370	520	124	168	6,220
21	139	78	142	.....	.....	.....	179	370	440	114	95	6,320
22	120	78	168	.....	.....	.....	202	325	370	114	62	6,430
23	118	75	120	.....	.....	.....	250	280	995	124	47	5,300
24	118	75	114	.....	.....	.....	238	265	885	114	40	4,020
25	157	75	116	.....	.....	.....	226	250	440	104	33	4,020
26	148	75	120	.....	.....	.....	214	250	405	95	33	3,460
27	131	76	101	.....	.....	.....	214	226	1,120	124	33	2,640
28	120	81	92	.....	.....	.....	238	214	1,560	226	40	2,040
29	120	80	88	.....	.....	.....	214	310	1,560	124	47	1,620
30	106	81	118	.....	.....	.....	190	265	940	95	70	1,360
31	106	.....	110	.....	.....	.....	.....	226	.....	86	62	.....

NOTE.—Daily discharge computed from a fairly well defined rating curve drawn by engineers of the Mississippi River Power Co.

Monthly discharge of Skunk River at Coppock, Iowa, for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October 21-31	157	106	126	B.
November	95	67	80.4	B.
December	168	83	114	C.
April	560	179	305	A.
May	1,560	190	457	B.
June	1,560	157	602	B.
July	1,300	86	242	A.
August	168	33	59.5	B.
September	6,430	70	2,230	A.

DES MOINES RIVER AT KALO, IOWA.

Location.—At highway bridge at Kalo, about 1½ miles east of Otho, a station on the Minneapolis & St. Louis Railroad; about 1½ miles above the mouth of Holiday Creek, which enters from the left.

Records available.—October 18, 1913, to September 30, 1914, when the station was discontinued.

Drainage area.—Not measured.

Gage.—Chain gage attached to downstream side of bridge; read daily, in the afternoon, to quarter-tenths. Limits of use: Hundredths below 0.0, half-tenths between 0.0 and 2.0, and tenths above 2.0 feet.

Channel and control.—No well-defined control; channel consists of gravel and is fairly permanent.

Discharge measurements.—Made from bridge during high stages, and by wading during low stages.

Point of zero flow.—The point of zero flow is estimated to be at gage height -1.0 ± 0.2 foot.

Winter flow.—Observations discontinued during winter months.

Discharge measurements of Des Moines River at Kalo, Iowa, 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. 16	S. B. Soulé	1.01	327	Sept. 26	S. B. Soulé	1.59	600
May 15	J. B. Stewart	1.02	290	26	do	1.46	482
June 21	do	6.88	5,980				

Daily gage height, in feet, of Des Moines River at Kalo, Iowa, for the year ending Sept. 30, 1914.

[S. C. Fuller, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1	.....	.....	0.9	.....	.....	.....	1.2	1.9	3.3	5.8	1.85	1.0
2	.....	.....	.1	.....	.....	.....	1.15	1.9	2.6	5.7	1.75	.95
3	.....	.....	.15	.....	.....	.....	1.1	1.9	2.5	4.9	1.6	1.0
4	.....	.....	.1	.....	.....	.....	1.05	1.75	2.0	4.9	1.7	.95
5	.....	0.75	.1	.....	.....	.....	1.1	1.75	2.6	4.9	1.55	.95
6	.....	.7	.9	.....	.....	.....	1.05	1.6	3.0	4.9	1.45	1.0
7	.....	.9	.95	.....	.....	.....	1.05	1.45	3.4	5.0	1.5	.95
8	.....	1.0	1.0	.....	.....	.....	1.0	1.3	3.7	4.8	1.4	1.0
9	.....	.8	.9	.....	.....	.....	1.0	1.25	4.3	4.7	1.4	1.0
10	.....	.8	.85	.....	.....	.....	.95	1.25	4.7	4.6	1.7	1.3
11	.....	.75	.8	.....	.....	.....	.9	1.2	5.3	4.4	1.25	1.4
12	.....	.75	.7	.....	.....	.....	.9	1.2	5.8	4.2	1.3	1.6
13	.....	.75	.75	.....	.....	.....	.9	1.15	6.0	4.0	1.15	1.65
14	.....	.8	.7	.....	.....	.....	.85	1.1	6.3	3.8	1.1	1.75
15	.....	.85	.65	.....	.....	.....	.85	1.0	6.6	3.6	1.15	1.7
16	.....	.75	.7	.....	.....	.....	.85	1.0	7.1	3.6	1.15	1.7
17	.....	.6	.8	.....	.....	.....	.9	1.0	7.0	3.4	1.55	1.85
18	0.95	.7	.8	.....	.....	.....	.95	1.0	6.8	3.0	1.35	1.9
19	.9	.75	.9	.....	.....	.....	1.0	1.05	7.0	3.0	1.15	1.7
20	.85	.7	1.0	.....	.....	.....	1.1	1.05	7.3	2.8	1.05	1.65
21	.85	.7	1.4	.....	.....	.....	1.15	1.0	7.0	2.6	1.0	1.65
22	.....	.8	1.7	.....	.....	0.7	1.15	1.0	6.6	2.6	1.0	1.65
23	.....	.7	.....	.....	.....	.7	1.2	1.05	6.2	2.4	.95	1.55
24	.....	.7	.....	.....	.....	.7	1.2	1.65	6.6	3.1	.9	1.45
25	.....	.85	.....	.....	.....	.9	1.2	2.2	6.8	2.5	.85	1.4
26	.....	.85	.....	.....	.....	.95	1.2	3.7	6.6	2.3	.85	1.4
27	.....	.9	.....	.....	.....	.9	1.6	4.4	6.4	2.2	1.0	1.55
28	.....	.9	.....	.....	.....	1.0	1.7	4.5	6.1	1.95	.95	1.85
29	.....	1.0	.....	.....	.....	1.1	1.7	4.8	6.0	2.0	1.0	1.45
30	.....	.9	.....	.....	.....	1.15	1.8	4.5	5.0	2.0	.95	1.4
31	.....	.....	.....	.....	.....	1.2	.....	4.0	.....	2.0	1.0	.....

NOTE.—Discharge relation affected by ice about Dec. 19, 1913, to Mar. 21, 1914.

Daily discharge, in second-feet, of Des Moines River at Kalo, Iowa, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	269	.....	.....	.....	380	734	1,750	4,580	706	303
2	.....	.....	110	.....	.....	.....	360	734	1,190	4,450	652	286
3	.....	.....	116	.....	.....	.....	340	734	1,120	3,460	571	303
4	.....	.....	110	.....	.....	.....	322	652	790	3,460	625	286
5	.....	226	110	.....	.....	.....	340	652	1,190	3,460	545	286
6	.....	213	269	.....	.....	.....	322	571	1,500	3,460	494	303
7	.....	269	286	.....	.....	.....	322	494	1,840	3,580	519	286
8	.....	303	303	.....	.....	.....	303	423	2,130	3,340	469	303
9	.....	239	269	.....	.....	.....	303	402	2,770	3,220	469	303
10	.....	239	254	.....	.....	.....	286	402	3,220	3,100	625	423
11	.....	226	239	.....	.....	.....	269	380	3,940	2,880	402	469
12	.....	226	213	.....	.....	.....	269	380	4,580	2,660	423	571
13	.....	226	226	.....	.....	.....	269	360	4,840	2,440	360	598
14	.....	239	213	.....	.....	.....	254	340	5,230	2,230	340	652
15	.....	254	202	.....	.....	.....	254	303	5,620	2,030	360	625
16	.....	226	213	.....	.....	.....	254	303	6,270	2,030	360	625
17	.....	190	239	.....	.....	.....	269	303	6,140	1,840	545	706
18	286	213	239	.....	.....	.....	286	303	5,880	1,500	446	734
19	269	226	.....	.....	.....	.....	303	322	6,140	1,500	360	625
20	254	213	.....	.....	.....	.....	340	322	6,530	1,340	322	598
21	254	213	.....	.....	.....	.....	360	303	6,140	1,190	303	593
22	.....	239	.....	.....	.....	213	360	303	5,620	1,190	303	598
23	.....	213	.....	.....	.....	213	380	322	5,100	1,050	286	545
24	.....	213	.....	.....	.....	213	380	598	5,620	1,580	269	494
25	.....	254	.....	.....	.....	269	380	913	5,880	1,120	254	469
26	.....	254	.....	.....	.....	286	380	2,130	5,620	979	254	469
27	.....	269	.....	.....	.....	269	571	2,880	5,360	913	303	545
28	.....	269	.....	.....	.....	303	625	2,990	4,970	762	286	706
29	.....	303	.....	.....	.....	340	625	3,340	4,840	790	303	494
30	.....	269	.....	.....	.....	360	679	2,990	3,580	790	286	469
31	.....	.....	.....	.....	.....	380	.....	2,440	.....	790	303	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 269 and 625 second-feet (gage heights, 0.9 and 1.7 feet). Above 1.7 feet the rating curve is based on one discharge measurement made at gage height 6.88 feet.

Monthly discharge of Des Moines River at Kalo, Iowa, for the year ending Sept. 30, 1914.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October				
November 5–30	303	190	239	C.
December 1–18	303	110	216	D.
January				
February				
March 22–31	380	213	285	C.
April	679	254	360	B.
May	3,340	303	914	B.
June	6,530	790	4,180	B.
July	4,580	762	2,180	C.
August	706	254	411	B.
September	734	286	489	B.

DES MOINES RIVER AT KEOSAUQUA, IOWA.

Location.—At county bridge one-fourth mile above old dam site and Government locks.

Records available.—May 30, 1903, to July 21, 1906; April 5 to December 31, 1910 (United States Engineer Corps); August 3, 1911, to September 30, 1914.

Drainage area.—14,300 square miles.

Gage.—Chain gage attached to upstream side of bridge. (Gage originally attached to downstream side of bridge changed because of repairs to bridge at unknown date.) Gage read once daily to half-tenths. Limits of use: Half-tenths below 2.0 feet and tenths above 2.0 feet.

Channel and control.—A riffle, consisting of gravel, about one-fourth mile below gage. Channel composed of sand and gravel on the left and rock on the right; shifts at flood stages.

Discharge measurements.—Made from the downstream side of the bridge.

Winter flow.—Observations discontinued during winter months.

The following discharge measurement was made by Bolster and Davis:

September 19, 1914: Gage height, 10.44 feet; discharge, 27,600 second-feet.

Daily gage height, in feet, of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1914.

[Oscar McCrary, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.45	0.4	0.6	.....	.....	.....	1.75	1.75	2.6	3.3	0.95	1.1
2	.45	.4	.6	.....	.....	.....	1.75	2.3	2.5	2.9	.95	1.05
3	.45	.4	.55	.....	.....	.....	1.55	2.1	2.4	2.8	.85	.85
4	.5	.4	.55	.....	.....	.....	1.4	1.95	2.2	2.6	.8	.6
5	.55	.35	.5	.....	.....	.....	1.25	1.9	2.0	2.6	.8	.55
6	.55	.35	.5	.....	.....	.....	1.25	1.6	1.8	2.6	.85	.9
7	.7	.35	.5	.....	.....	.....	1.2	1.55	1.7	2.6	.85	.75
8	.75	.35	.5	.....	.....	.....	1.15	1.95	1.45	2.8	.75	.75
9	.75	.35	.6	.....	.....	.....	1.15	1.6	1.45	2.3	.7	.7
10	1.05	.3	.55	.....	.....	.....	1.0	1.35	1.55	2.3	.7	1.75
11	.75	.3	.6	.....	.....	.....	1.0	1.55	1.85	2.3	.65	2.4
12	.65	.35	.6	.....	.....	.....	.95	3.0	2.0	2.1	.7	2.0
13	.65	.35	.6	.....	.....	.....	.95	4.2	2.0	2.3	.6	1.75
14	.65	.4	.65	.....	.....	.....	.95	5.0	2.4	2.2	.6	1.65
15	.75	.35	.6	.....	.....	.....	.9	3.8	2.6	2.0	.55	5.2
16	1.0	.35	.6	.....	.....	.....	.85	2.8	3.2	1.9	.55	8.4
17	1.0	.35	.55	.....	.....	.....	.8	2.0	3.7	2.0	.55	9.9
18	.85	.35	.55	.....	.....	.....	.75	1.35	3.8	1.95	.45	10.8
19	.8	.4	.6	.....	.....	.....	.75	1.3	3.8	1.7	.45	10.4
20	.8	.35	.55	.....	.....	.....	.7	1.25	3.5	1.5	.6	10.4
21	.75	.35	.5	.....	.....	.....	.65	1.15	3.6	1.45	.55	6.2
22	.7	.35	.5	.....	.....	.....	.65	1.1	3.4	1.35	.5	4.6
23	.65	.35	.45	.....	.....	.....	.65	1.05	3.4	1.35	.45	3.6
24	.6	.4	.5	.....	.....	.....	.7	.95	3.4	1.25	.45	4.8
25	.6	.35	.5	.....	.....	.....	.75	.9	3.2	1.15	.4	4.4
26	.55	.35	.55	.....	.....	.....	.75	1.3	3.4	1.15	.35	3.6
27	.6	.35	.6	.....	.....	.....	.75	1.5	3.4	1.05	.4	2.9
28	.6	.35	.55	.....	.....	.....	,95	2.4	4.2	1.05	.5	2.4
29	.55	.4	.55	.....	.....	.....	.9	2.2	4.6	.95	.4	2.0
30	.55	.45	.45	.....	.....	.....	1.0	2.3	3.7	.95	.4	1.9
31	.45	.....	.45	.....	.....	.....	.....	2.7	.....	.95	.35	.....

NOTE.—Discharge relation affected by ice about Jan. 1 to Mar. 31, 1914.

Daily discharge, in second-feet, of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1914.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	845	780	1,050	.....	.....	.....	3,080	3,080	5,060	6,900	1,570	1,820
2	845	780	1,050	.....	.....	.....	3,080	4,330	4,810	5,830	1,570	1,740
3	845	780	980	.....	.....	.....	2,670	3,860	4,570	5,570	1,420	1,420
4	910	780	980	.....	.....	.....	2,370	3,520	4,090	5,060	1,340	1,050
5	980	715	910	.....	.....	.....	2,090	3,410	3,630	5,060	1,340	980
6	980	715	910	.....	.....	.....	2,090	2,770	3,190	5,060	1,420	1,490
7	1,190	715	910	.....	.....	.....	2,000	2,670	2,980	5,060	1,420	1,260
8	1,260	715	910	.....	.....	.....	1,910	3,520	2,470	5,570	1,260	1,260
9	1,260	715	1,050	.....	.....	.....	1,910	2,770	2,470	4,330	1,190	1,190
10	1,740	650	980	.....	.....	.....	1,650	2,280	2,670	4,330	1,190	3,080
11	1,260	650	1,050	.....	.....	.....	1,650	2,670	3,300	4,330	1,120	4,570
12	1,120	715	1,050	.....	.....	.....	1,570	6,090	3,630	3,860	1,190	3,630
13	1,120	715	1,050	.....	.....	.....	1,570	9,330	3,630	4,330	1,050	3,080
14	1,120	780	1,120	.....	.....	.....	1,570	11,500	4,570	4,090	1,050	2,880
15	1,260	715	1,050	.....	.....	.....	1,490	8,250	5,060	3,630	980	12,000
16	1,650	715	1,050	.....	.....	.....	1,420	5,570	6,630	3,410	980	21,200
17	1,650	715	980	.....	.....	.....	1,340	3,630	7,980	3,630	980	25,900
18	1,420	715	980	.....	.....	.....	1,260	2,280	8,250	3,520	845	28,700
19	1,340	780	1,050	.....	.....	.....	1,260	2,180	8,250	2,980	845	27,400
20	1,340	715	980	.....	.....	.....	1,190	2,090	7,440	2,570	1,050	27,400
21	1,260	715	910	.....	.....	.....	1,120	1,910	7,710	2,470	980	14,800
22	1,190	715	910	.....	.....	.....	1,120	1,820	7,170	2,280	980	10,400
23	1,120	715	845	.....	.....	.....	1,120	1,740	7,170	2,280	845	7,710
24	1,050	780	910	.....	.....	.....	1,190	1,570	7,170	2,090	845	11,000
25	1,050	715	910	.....	.....	.....	1,260	1,490	6,630	1,910	780	9,870
26	980	715	980	.....	.....	.....	1,260	2,180	7,170	1,910	715	7,710
27	1,050	715	1,050	.....	.....	.....	1,260	2,570	7,170	1,740	780	5,830
28	1,050	715	980	.....	.....	.....	1,570	4,570	9,330	1,740	910	4,570
29	980	780	980	.....	.....	.....	1,490	4,090	10,400	1,570	780	3,630
30	980	845	845	.....	.....	.....	1,650	4,330	7,980	1,570	780	3,410
31	845	.....	845	.....	.....	.....	.....	5,310	.....	1,570	715	.....

NOTE.—Daily discharge computed from a fairly well defined rating curve. Open-water rating curve applied during December, 1913, nothing is known as to the effect of ice upon the discharge relation during that month.

Monthly discharge of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1914.

[Drainage area, 14,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	1,740	845	1,150	0.080	0.09	B.
November	845	650	732	.051	.06	B.
December	1,120	845	976	.068	.08	B.
April	3,080	1,120	1,670	.117	.13	B.
May	11,500	1,490	3,790	.265	.31	B.
June	10,400	2,470	5,750	.402	.45	A.
July	6,900	1,570	3,560	.249	.29	A.
August	1,570	715	1,060	.074	.09	B.
September	28,700	980	8,370	.585	.65	A.

DES PLAINES RIVER AT ROMEO, ILL.

Location.—In T. 36 N., R. 10 E. third principal meridian; at highway bridge about three-fourths of a mile west of Romeo, Will County, Ill.; about 3 miles above the junction of Des Plaines River and the Chicago drainage canal.

Records available.—September 7 to 30, 1914.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to downstream side of the second of four bridges from Romeo; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Four channels; rock bottom; control probably permanent.

Discharge measurements.—Made from downstream side of four bridges.

Point of zero flow.—A determination by leveling indicates that there would be no flow past the gage if the river were to fall to about 0.9 foot by the gage.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—Gage readings reliable; on account of the comparatively large width of the stream at the gage, it is not possible to make very accurate estimates of discharge.

The following discharge measurement was made by Peterson and Kessler:
September 7, 1914: Gage height, 1.62 feet; discharge, 16 second-feet.

Daily gage height, in feet, of Des Plaines River at Romeo, Ill., for the year ending Sept. 30, 1914.

[Fred Boehme, observer.]

Day.	Sept.	Day.	Sept.	Day.	Sept.
7	1.60	15	1.50	23	1.40
8	1.62	16	1.55	24	1.45
9	1.50	17	1.55	25	1.45
10	1.52	18	1.60	26	1.40
11	1.55	19	1.55	27	1.40
12	1.58	20	1.52	28	1.40
13	1.56	21	1.45	29	1.40
14	1.52	22	1.40	30	1.40
				31	

DES PLAINES RIVER AT JOLIET, ILL.

Location.—At Cass Street Bridge, Joliet, Ill.

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

Drainage area.—Not given because mean daily flow of approximately 7,500 second-feet from the Chicago Drainage canal enters the river above station.

Gage.—Standard chain gage fastened to downstream handrail of Cass Street Bridge. Read morning and evening to half-tenths.

Channel and control.—Probably permanent; channel excavated in solid rock with a concrete wall on either bank.

Discharge measurements.—Made from upstream side of bridge to which gage is attached.

Floods.—No records available.

Winter flow.—On account of the swift current and the rapidly fluctuating stage, ice probably does not form in sufficient amounts to affect the discharge relation.

Regulation.—The flow past the gage is largely regulated by the operation of the power plant of the Sanitary District of Chicago at Lockport, which utilizes the flow of the Chicago Drainage canal and, to a lesser extent, by the operation of the Economy Light & Power Co.'s plant about 1,500 feet above the gaging station.

Diversions.—Water is diverted to the Illinois & Michigan canal at dam No. 1, about 1,500 feet above the gage.

Accuracy.—On account of the rapid hourly fluctuations of the stage, the daily discharge obtained from two readings per day is liable to considerable error.

Discharge measurements of Des Plaines River at Joliet, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 5	Peterson and Kessler	5.50	8,380
7	....do	6.23	9,900

Discharge measurements of Illinois and Michigan canal[a] at Joliet, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.[b]	Discharge.
		Feet.	*Sec.-ft.*
Sept. 5	Peterson and Kessler	8.08	381
7	B. J. Peterson	7.92	323

[a] See "Diversions" in station description.
[b] Referred to same datum as chain gage on Des Plaines River. See "Gage" in station description.

Daily gage height, in feet, of Des Plaines River at Joliet, Ill., for the year ending Sept. 30, 1914.

[J. S. Stanton, observer.]

Day.	Sept.	Day.	Sept.	Day.	Sept.
5	5.50	14	4.55	23	4.95
6	3.32	15	4.85	24	4.95
7	6.18	16	4.3	25	5.1
8	6.5	17	4.85	26	4.75
9	5.5	18	5.1	27	.....
10	5.18	19	.....	28	5.3
11	4.5	20	.....	29	5.0
12	5.1	21	5.5	30	4.85
13	4.7	22	5.05	31	.....

FOX RIVER AT SOUTH ELGIN, ILL.

Location.—In sec. 35, T. 41 N., R. 8 E., at highway bridge at South Elgin, Kane County, Ill.

Records available.—July 29 to September 30, 1914.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to bridge; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Rock bed; probably permanent; growth of grass below gage may affect the discharge relation.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Ice may affect discharge relation during parts of December, January, and February.

Regulation.—A dam about 800 feet above the gage stores water for the Murray & Nickell Manufacturing Co. and a feed mill. Several power plants farther upstream regulate the flow and cause fluctuations in stage at the gage.

Accuracy.—Gage readings reliable; measurements good. Regulation of stream affects the mean daily gage height.

Data insufficient for estimating discharge.

Discharge measurements of Fox River at South Elgin, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 29	Peterson and Espinosa	2.42	630
Sept. 8	Peterson and Kessler	1.85	352

Daily gage height, in feet, of Fox River at South Elgin, Ill., for the year ending Sept. 30, 1914.

[C. H. Molitor, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	1.84	1.42	11	.....	2.06	1.65	21	.....	1.48	1.90
2	.....	2.02	1.45	12	.....	1.75	1.60	22	.....	1.41	2.01
3	.....	2.06	1.52	13	.....	1.65	1.62	23	.....	1.39	1.79
4	.....	2.10	1.54	14	.....	1.41	1.64	24	.....	1.52	1.82
5	.....	1.82	1.55	15	.....	1.41	1.64	25	.....	1.52	2.04
6	.....	1.60	1.69	16	.....	1.39	1.60	26	.....	1.48	2.05
7	.....	1.76	1.80	17	.....	1.41	1.64	27	.....	1.60	2.04
8	.....	1.82	1.72	18	.....	1.54	1.68	28	.....	1.56	2.00
9	.....	1.52	1.68	19	.....	1.42	1.65	29	2.15	1.51	2.00
10	.....	1.64	1.65	20	.....	1.36	1.74	30	2.02	1.52	1.99
								31	1.87	1.46	.....

FOX RIVER AT AURORA, ILL.

Location.—In T. 38 N., R. 8 E., at the Elgin, Joilet & Eastern Railway bridge in the southern part of Aurora, Kane County, Ill.

Records available.—July 29 to September 30, 1914.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to bridge; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Probably permanent.

Discharge measurements.—Made from footwalk on downstream side of bridge.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Regulation.—A dam 1½ miles above the section regulates the flow past the gage.

Accuracy.—Gage readings reliable; measurements good. Regulation of stream may affect mean gage height as obtained from two readings per day.

Data insufficient for making estimates of discharge.

Discharge measurements of Fox River at Aurora, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 24	B. J. Peterson	1.79	810
28	Peterson and Espinosa	1.54	557
Sept. 4	William Kessler	.89	173

Daily gage height, in feet, of Fox River at Aurora, Ill., for the year ending Sept. 30, 1914.

[Ralph Williams, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1		1.32	1.38	11		1.23	1.48	21		1.12	1.88
2		1.28	1.35	12		1.22	1.65	22		1.09	1.75
3		1.38	1.31	13		1.21	1.39	23		.95	1.81
4		1.44	1.25	14		1.24	1.46	24		1.19	1.79
5		1.23	1.41	15		1.14	1.51	25		1.05	1.82
6		1.06	1.05	16		.75	1.54	26		1.26	1.81
7		1.25	1.05	17		.85	1.45	27		1.16	1.90
8		1.16	1.15	18		.67	1.35	28		1.28	2.04
9		.95	1.52	19		.88	1.44	29	1.45	1.26	1.85
10		1.21	1.44	20		1.26	1.66	30	1.40	1.08	1.81
								31	1.33	1.32	

VERMILION RIVER NEAR STREATOR, ILL.

Location.—In sec. 1, T. 30 N., R. 3 E. third principal meridian, at highway bridge known as Bridge No. 3, about 1½ miles south of Streator, La Salle County, Ill.; about 100 feet below the Santa Fe Railroad bridge.

Records available.—July 27 to September 30, 1914.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to highway bridge; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Channel consists of gravel and rocks. Control consists of coarse gravel.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Data insufficient for estimating discharge.

Discharge measurements of Vermilion River near Streator, Ill., during the year ending Sept. 30, 1914.

[Made by B. J. Peterson.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
July 13	0.46	[a] 0.2
July 27	.50	[b] .8

[a] Measurement made by wading at downstream side of bridge; measurement not good because of low velocity and strong upstream wind.
[b] Measurement made by wading at a section about one-half mile downstream.

Daily gage height, in feet, of Vermilion River near Streator, Ill., for the year ending Sept. 30, 1914.

[George Gall and Michael Cipala, observers.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1		0.50	0.50	11		0.50	0.52	21		0.48	0.52
2		.50	.65	12		.48	.52	22		.50	.55
3		.50	.55	13		.49	.52	23		.60	.52
4		.50	.52	14		.50	.52	24		.50	.52
5		.50	.50	15		.46	1.08	25		.50	.52
6		.50	.55	16		.45	.64	26		.50	.52
7		.50	.54	17		.45	.52	27	0.50	.50	.52
8		.50	.52	18		.48	.52	28	.50	.58	.52
9		.48	.52	19		.48	.52	29	.49	.50	.52
10		.50	.52	20		.48	.52	30	.48	.50	.52
								31	.48	.50	

SPOON RIVER AT SEVILLE, ILL.

Location.—In sec. 24, T. 6 N., R. 1 E. fourth principal meridian, at the Toledo, Peoria & Western Railway bridge at Seville, Fulton County, Ill.; about a quarter of a mile east of the railway station at Seville.

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

Drainage area.—1,600 square miles.

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

Channel and control.—Control is a loose-rock dam, about 2 miles downstream from gage, used to create a reservoir for the pumping station of the Toledo, Peoria & Western Railway.

Discharge measurements.—Made from downstream side of bridge. Wading measurements made at wading section below the dam at the railroad station.

Winter flow.—Ice may affect discharge relation during parts of December, January, and February.

Diversions.—Water pumped from reservoir at the pumping station of the Toledo, Peoria & Western Railway; amount not known.

Accuracy.—Gage readings reliable.

The following discharge measurement was made by B. J. Peterson by wading: July 24, 1914: Gage height, 1.53 feet; discharge, 7 second-feet.

Daily gage height, in feet, of Spoon River at Seville, Ill., for the year ending Sept. 30, 1914.

[Joe Reynolds and Ray Hooper, observers.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July	Aug.	Sept.
1	.....	1.40	1.40	11	.....	1.38	3.18	21	.....	1.48	3.25
2	.....	1.40	1.90	12	.....	1.38	3.00	22	.....	1.40	3.05
3	.....	1.50	2.30	13	.....	1.40	2.92	23	.....	1.40	2.95
4	.....	1.45	2.40	14	.....	1.40	2.80	24	1.45	1.40	2.78
5	.....	1.45	2.85	15	.....	2.25	9.08	25	1.45	1.40	2.65
6	.....	1.45	4.40	16	.....	1.10	13.61	26	1.42	1.40	2.55
7	.....	1.40	9.82	17	.....	1.80	9.78	27	1.50	1.35	2.50
8	.....	1.40	4.80	18	.....	1.60	5.02	28	1.50	1.35	2.40
9	.....	1.40	4.08	19	.....	1.52	3.88	29	1.42	1.35	2.38
10	.....	1.40	5.30	20	.....	1.50	3.42	30	1.42	1.40	2.30
								31	1.35	1.40	.....

SANGAMON RIVER AT MONTICELLO, ILL.

Location.—In the northeastern part of T. 18 N., R. 5 E. third principal meridian, at the Illinois Central Railroad bridge about half a mile west of Monticello, Piatt County, Ill.

Records available.—February 4, 1908, to October 1, 1912; October 31 to December 31, 1912; June 23 to September 30, 1914.

Drainage area.—550 square miles.

Gage.—Standard chain gage attached to bridge; read daily, in the morning, June 23 to August 1, 1914, to hundredths; and August 3 to September 30, 1914, to half-tenths.

Channel and control.—Measuring section is at a pool; measurements prior to 1912 indicated that control was permanent; measurements of July 30, 1912, and August 4, 1914, indicate a slight change in discharge relation.

Discharge measurements.—Made from downstream side of bridge and wooden trestle approach.

Floods.—The flood of May, 1908, reached a height of 15.2 feet on the gage.

Point of zero flow.—Determined by soundings August 4, 1914, to be at gage height 1.4 feet.

Winter flow.—Ice usually affects the discharge relation during parts of December, January, and February.

Accuracy.—Gage-height record reliable.

Data insufficient for estimating discharge.

The following discharge measurement was made by Peterson and Kessler by wading at a section about 300 feet below gage:

August 4, 1914: Gage height, 1.66 feet; discharge, 3.2 second-feet.

Daily gage height, in feet, of Sangamon River at Monticello, Ill., for the year ending Sept. 30, 1914.

[Martin Doyle and David Cody, observers.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	2.22	1.5	1.8	16	.....	.....	.....	1.8
2	.....	2.20	.....	1.85	17	.....	.....	1.6	1.8
3	.....	2.15	1.5	1.8	18	.....	.....	1.6	1.75
4	.....	2.13	1.62	1.8	19	.....	.....	1.6	1.75
5	.....	.....	1.65	1.8	20	.....	1.70	1.6	.....
6	.....	2.10	1.6	.....	21	.....	1.70	2.1	1.65
7	.....	2.08	1.6	2.0	22	.....	1.70	1.8	1.6
8	.....	2.03	1.6	2.3	23	2.40	1.70	.....	1.6
9	.....	2.02	.....	2.2	24	2.39	1.70	1.8	1.6
10	.....	2.00	1.6	2.2	25	2.32	1.60	1 9	1.6
11	.....	1.90	1.6	2.1	26	2.32	.....	1.8	1.6
12	.....	.....	1.6	1.95	27	2.32	1.80	1.75	.....
13	.....	1.90	1.55	.....	28	.....	1.70	1.7	1.6
14	.....	1.90	1.6	1.8	29	2.21	1.60	1.8	1.6
15	.....	1.89	1.6	1.8	30	2.21	1.60	.....	1.6
					31	.....	1.50	1.8	.....

SANGAMON RIVER AT RIVERTON, ILL.

Location.—In the southeast corner of the SW. ¼ sec. 9, T. 16 N., R. 4 W. third principal meridian, at Wabash Railroad bridge about a quarter of a mile west of Riverton, Sangamon County, Ill., and about 2½ miles below the mouth of South Fork.

Records available.—February 13, 1908, to December 31, 1912; August 7 to September 30, 1914.

Drainage area.—2,560 square miles.

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

Channel and control.—Measuring section is at a pool and is slightly shifting; discharge measurements indicate that control is permanent.

Discharge measurements.—Made from downstream side of three-span bridge.

Floods.—The high water of 1883 reached a height of approximately 32 feet on the present gage; that of 1875 is said to have been one-half foot lower. The high water of October, 1911, reached a height of 27.1 feet.

Point of zero flow.—Determined by leveling, August 5, 1914, to be at gage height 6.6 feet.

Winter flow.—Ice may affect the discharge relation during short periods of extremely cold weather.

The following discharge measurement was made by Peterson and Kessler by wading at a section about one-fourth mile below gage:

August 5, 1914: Gage height, 7.38 feet; discharge, 27.2 second-feet.

Daily gage height, in feet, of Sangamon River at Riverton, Ill., for the year ending Sept. 30, 1914.

[J. H. Steele, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	7.6	11	7.3	8.0	21	7.4	7.5
2	.....	7.6	12	7.3	8.0	22	7.4	7.5
3	.....	8.0	13	7.2	7.8	23	7.4	7.5
4	.....	8.2	14	7.4	7.6	24	7.4	7.4
5	.....	8.2	15	7.35	7.5	25	7.35	7.4
6	.....	8.0	16	7.3	7.4	26	7.3	7.2
7	7.25	8.6	17	7.3	7.4	27	7.3	7.1
8	7.25	9.1	18	7.3	7.4	28	7.3	7.0
9	7.2	8.6	19	7.5	7.5	29	7.5	7.0
10	7.2	8.0	20	7.5	7.5	30	7.8	7.0
						31	7.6	.....

SANGAMON RIVER NEAR OAKFORD, ILL.

Location.—In sec. 6, T. 19 N., R. 7 W. third principal meridian, at highway bridge 3 miles northeast of Oakford, Menard County, Ill., 2½ miles above the Chicago, Peoria & St. Louis Railway bridge, and 1¼ miles above the mouth of Crane Creek.

Records available.—October 26, 1909, to June 30, 1911; December 10, 1911, to March 31, 1912; August 25 to September 30, 1914.

Drainage area.—5,000 square miles.

Gage.—Standard chain gage attached to bridge; read daily, in the morning, to tenths. The sea-level elevation of the zero of the gage is 468.80 feet.

Channel and control.—Probably shifting; the river for some distance above and below the station has been dredged and straightened, thus increasing the slope considerably and disturbing the regimen of the river. Conditions along the improved section are probably reverting to their former state. Measurements to date indicate little if any change in the discharge relation.

Discharge measurements.—Made from downstream side of bridge and wooden trestle approaches.

Floods.—The floods of February and March, 1907, May, 1908, and October, 1911, reached a height of about 21 feet by the present gage.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—Backwater caused by ice jams or drift lodging at the railroad bridge 2½ miles below the gaging station may at times affect the discharge relation.

The following discharge measurement was made by Peterson and Kessler:
August 6, 1914: Gage height, 1.07 feet; discharge, 154 second-feet.

Daily gage height, in feet, of Sangamon River near Oakford, Ill., for the year ending Sept. 30, 1914.

[J. M. Weaver, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	0.8	11	.....	1.8	21	.....	1.6
2	.....	1.3	12	.....	.....	22	.....	1.6
3	.....	.....	13	.....	1.7	23	.....	.....
4	.....	1.5	14	.....	1.7	24	.....	1.5
5	.....	.....	15	.....	1.7	25	0.9	.....
6	.....	1.6	16	.....	.....	26	.9	1.5
7	.....	.....	17	.....	1.7	27	.8	.....
8	.....	1.6	18	.....	.....	28	.8	1.4
9	.....	1.9	19	.....	.....	29	.8	.....
10	.....	1.9	20	.....	1.6	30	.7	1.4
						31	.7	.....

SOUTH FORK OF SANGAMON RIVER NEAR TAYLORVILLE, ILL.

Location.—In sec. 8, T. 12 N., R. 2 W., at the Wabash Railroad bridge about 3½ miles southwest of Taylorville, Christian County, Ill.; about one-fourth mile upstream from the highway bridge known as the Half Acre Bridge.

Records available.—February 11, 1908, to September 30, 1912; November 1 to December 31, 1912; August 8 to September 30, 1914.

Drainage area.—427 square miles.

Gage.—Standard chain gage attached to bridge; read daily, in the morning, to hundredths. On September 2, 1909, the gage datum was lowered 2 feet. The gage heights to August 10, 1909, refer to the old datum; those from August 11 to September 1, 1909, are of no value because of backwater from a construction dam built and used during that period. Gage heights from September 2, 1909, to December 31, 1912, refer to new datum. On August 8, 1914, the datum was changed by an unknown amount, all bench marks being destroyed during construction of a new concrete and steel-plate girder bridge. Gage heights from August 8 to September 30, 1914, refer to the datum used on August 8 in reestablishing the gage.

Channel and control.—In August, 1909, a drainage ditch was dug along the river in the vicinity of the station, which straightened the course of the stream but coincided with the original channel at the gaging section. Though the cross-section of the channel at the measuring section was not changed the discharge relation was considerably affected by the change in slope. Subsequent to 1912 a new bridge was built, and since then the discharge relation has again changed. The channel is probably permanent; section is in a pool; point of control about three-quarters of a mile downstream from gage; control section probably shifts slightly during floods.

Discharge measurements.—Made from downstream side of bridge.

Floods.—Maximum gage height since establishment of gage, 15.9 feet, occurred in September, 1911. No authentic record of floods prior to the establishment of the station is available.

Point of zero flow.—A determination by soundings August 8, 1914, indicates that there would be no flow past the gage if the river were to fall to 0.35 foot±0.1 foot by the present gage.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—Gage-height record reliable.

Data insufficient for estimating discharge.

Discharge measurements of South Fork of Sangamon River near Taylorville, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 8	Peterson and Kessler	0.55	0.66
Sept. 21	William Kessler	.64	2.75

NOTE.—Measurements made by wading about one-half mile below gage.

Daily gage height, in feet, of South Fork of Sangamon River near Taylorville, Ill., for the year ending Sept. 30, 1914.

[Louis Seelbach, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1		0.68	11	0.51	1.88	21	0.63	0.64
2		.69	12	.52	1.39	22	2.40	.64
3		1.08	13	.52	1.21	23	1.78	.63
4		1.43	14	.68	1.01	24	1.05	.61
5		1 25	15	.61	.94	25	.92	.58
6		1.24	16	.58	.89	26	.77	.56
7		2.32	17	.56	.85	27	1.00	.55
8	0.52	4.50	18	.54	.80	28	.68	.54
9	.52	3.01	19	.53	.74	29	.71	.55
10	.51	2.26	20	.85	.70	30	.72	.57
						31	.70	

KASKASKIA RIVER AT SHELBYVILLE, ILL.

Location.—Between secs. 8 and 17, T. 11 N., R. 4 E. third principal meridian, at highway bridge at the eastern edge of Shelbyville, Shelby County, Ill., a short distance above the Chicago & Eastern Illinois and Big Four Railroad bridges.

Records available.—February 25, 1908, to September 30, 1912; November 1 to December 31, 1912; August 11 to September 30, 1914.

Drainage area.—1,030 square miles.

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

Channel and control.—Measuring section at a pool; bed shifts. Discharge measurements indicates that control is permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—Maximum gage height, 25.8 feet, since establishment of gage, occurred in May, 1908. No available records of floods prior to installation of gage.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—During high water the discharge relation is likely to be affected by backwater caused by drift lodging at the two railroad bridges below the gaging station.

Discharge measurements of Kaskaskia River at Shelbyville, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 10	B. J. Peterson	4.81	0.6
Sept. 22	William Kessler	4.95	2.8

NOTE.—Measurements made by wading at a section about 300 feet above the gage.

Daily gage height, in feet, of Kaskaskia River at Shelbyville, Ill., for the year ending Sept. 30, 1914.

[Homer Pound, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	5.3	11	5.4	5.3	21	4.8	4.9
2	.....	5.3	12	5.3	5.2	22	4.8	4.9
3	.....	5.3	13	5.2	5.2	23	4.8	4.8
4	.....	5.3	14	5.1	5.2	24	4.8	4.8
5	.....	5.5	15	5.0	5.1	25	4.8	4.8
6	.....	7.9	16	4.9	5.1	26	4.8	4.8
7	.....	7.0	17	4.9	5.1	27	4.9	4.8
8	.....	5.7	18	4.9	5.0	28	5.4	4.8
9	.....	5.5	19	4.8	5.0	29	5.4	4.8
10	.....	5.4	20	4.8	5.0	30	5.4	4.8
						31	5.4	4.8

KASKASKIA RIVER AT VANDALIA, ILL.

Location.—In sec. 16, T. 6 N., R. 1 E. third principal meridian, at highway bridge at the east end of Main Street, Vandalia, Fayette County, Ill.

Records available.—February 26, 1908, to October 4, 1912; November 1 to December 31, 1912; August 11 to September 30, 1914.

Drainage area.—1,980 square miles.

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

Channel and control.—Measuring section is at a pool; bed is somewhat shifting; control probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The flood of May, 1908, reached a height of 21.2 feet on the gage; the flood of 1882 was about 22 feet, and that of 1875 about 22.8 feet. The river is leveed along the left bank for some miles above and below the station. It is said that the levees, by confining the floods, cause unnatural flood heights along the right bank, and lawsuits to recover damages have resulted. During extreme floods the levees sometimes give way and so reduce the flood height; this occurred during the floods of May, 1908, and October, 1911, when flood water for several days passed around the gaging station. Former statements that all the flood water eventually passed the gaging station are in error.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—Gage-height record is reliable.

Discharge measurements of Kaskaskia River at Vandalia, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 11	Peterson and Kessler	0.78	[a] 24.0
Sept. 23	William Kessler	1.14	[b] 55.5

[a] Measurement made by wading at a section about one-fourth mile below gage.
[b] Measurement made by wading at a section about 500 feet above gage.

Daily gage height, in feet, of Kaskaskia River at Vandalia, Ill., for the year ending Sept. 30, 1914.

[Wilson Haley, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	1.38	11	0.78	4.09	21	1.15	1.21
2	.....	1.33	12	.38	3.92	22	1.45	1.18
3	.....	1.30	13	2.32	2.32	23	1.15	1.08
4	.....	1.40	14	1.52	2.22	24	.95	1.08
5	.....	1.28	15	1.25	1.81	25	1.05	.98
6	.....	2.22	16	1.28	1.78	26	3.72	.92
7	.....	11.37	17	1.15	1.68	47	2.35	.88
8	.....	12.22	18	.95	1.58	28	1.73	.85
9	.....	5.29	19	.82	1.01	29	1.50	.80
10	.....	4.12	20	.82	1.28	30	1.23	.78
						31	1.28	.....

KASKASKIA RIVER AT CARLYLE, ILL.

Location.—In sec. 19, T. 2 N., R. 2 W. third principal meridian, at the Baltimore & Ohio Southwestern Railroad bridge about one-fourth mile east of Carlyle, Clinton County, Ill.

Records available.—March 2, 1908, to September 30, 1912; November 1 to December 31, 1912; August 8 to September 30, 1914.

Drainage area.—2,680 square miles.

Gage.—Standard chain gage attached to upstream side of bridge; read daily, in the morning, to quarter-tenths.

Channel and control.—Probably shifting. Measurements during 1912 and 1914 indicate a change in the discharge relation. Main channel is broken by three bridge piers and flood channel by four additional piers.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The flood of 1882, which is the highest known, is said to have attained a height 1½ feet above the flood of 1908, or about 32.5 feet on the present gage.

Point of zero flow.—Determination by soundings on August 13, 1914, indicates that there would be no flow past the gage if the river were to fall to 3.7 feet±0.3 foot, referred to gage datum.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Regulation.—None. See "Diversions."

Diversions.—A dam 3½ feet high, about 700 feet above the gaging section, is used to store water for the city of Carlyle. The average amount pumped is about 3,500,000 gallons every 30 days, and during June, July, and August about 4,500,000 gallons every 30 days. The outfalls of one section of the city sewerage system and some private sewers are above the section, so that the diversion is negligible.

Accuracy.—Not affected by diversion; gage readings reliable.

Data insufficient for estimates of discharge.

The stream never goes dry during low water; the hardness of the water indicates that the flow is kept up by springs.

Discharge measurements of Kaskaskia River at Carlyle, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 13	Peterson and Kessler	5.58	75
Sept. 24	William Kessler	5.71	106

NOTE.—Measurements made by wading at a section about 1,000 feet below gage.

Daily gage height, in feet, of Kaskaskia River at Carlyle, Ill., for the year ending Sept. 30, 1914.

[A. J. Marcham, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1		5.92	11		12.10	21	5.30	5.92
2		5.85	12		9.30	22	5.32	5.80
3		5.70	13	5.65	7.75	23	5.40	5.75
4		6.10	14	5.58	7.10	24	5.45	5.72
5		6.10	15	6.30	6.85	25	5.60	5.68
6		6.02	16	6.45	6.80	26	6.10	5.68
7		5.95	17	5.75	6.35	27	9.02	5.65
8		12.78	18	5.68	6.25	28	9.30	5.62
9		16.95	19	5.58	6.10	29	7.40	5.58
10		16.00	20	5.45	6.00	30	6.42	5.52
						31	6.15	

KASKASKIA RIVER AT NEW ATHENS, ILL.

Location.—In the W. ½ NE. ¼ sec. 28, T. 2 S., R. 7 W. third principal meridian, at the Illinois Central Railroad bridge, about 600 feet north of the railroad station at New Athens, St. Clair County, Ill., about 1 mile below the mouth of Silver Creek and 3 miles above the mouth of Lively Creek.

Records available.—January 23, 1907, to September 30, 1912; October 30 to December 31, 1912; June 22 to September 30, 1914. A record of river heights from January 23, 1907, to October 28, 1909, was kept by C. J. von Roth Roffy, the present observer, for the New Athens Journal. The river height was taken on Wednesday and Thursday mornings of each week, that for Thursday being published Friday with the change in 24 hours as obtained from the river height of Wednesday. This record was kept up for the information of farmers living on the west side of the river, who were cut off from reaching town when the river reached a height of 30 feet. The record is authentic. The gage heights have been reduced to the present datum, the maximum error probably not being over 0.4 foot and decreasing as the stage increases.

Drainage area.—5,220 square miles.

Gage.—Standard chain gage attached to the bridge, installed November 1, 1909; read daily, in the morning, to hundredths.

Channel and control.—Probably permanent.

Discharge measurements.—Made from downstream lower chord of bridge and from concrete trestle approach. A new concrete approach on right side was in process of construction during August and September, 1914.

Floods.—The flood of the fall of 1898 reached a height of about 34.5 feet, referred to the present gage datum.

Winter flow.—The discharge relation may be slightly affected by ice during parts of December, January, and February.

Accuracy.—Gage-height record reliable. Discharge relation is affected by backwater from Mississippi River when the stage at Chester reaches a gage height of approximately 20 feet. Published estimates of discharge for the following periods may be considerably in error, depending on how much backwater conditions differed from those during which discharge measurements were made from which the rating curve was derived, and depending on the exact stage at Chester at which backwater effect will be produced at New Athens: 1907, January 21–28; June 14–18; July 19 to August 3. 1908, May 17 to July 23. 1909, March 20; April 21 to May 1; May 11–17; June 12 to July 27. 1910, May 10–13; June 12–15. 1912, March 22 to May 11; June 19–22.

Discharge measurements of Kaskaskia River at New Athens, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 15	Peterson and Kessler	2.37	133
Sept. 26	William Kessler	2.94	228

NOTE.—Measurements made by wading at a section under the bridge to which the gage is attached.

Daily gage height, in feet, of Kaskaskia River at New Athens, Ill., for the year ending Sept. 30, 1914.

[C. J. von Roth Roffy, observer.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	2.78	2.23	4.50	16	.....	2.38	.....	7.90
2	.....	2.73	2.23	4.15	17	.....	2.38	.....	7.02
3	.....	2.68	2.21	4.20	18	.....	2.33	2.80	6.75
4	.....	2.68	2.18	4.62	19	.....	2.28	2.75	5.82
5	.....	2.63	2.18	4.62	20	.....	2.26	2.60	4.82
6	.....	2.68	2.13	6.90	21	.....	2.26	2.52	4.38
7	.....	2.68	2.11	7.20	22	4.83	2.26	2.45	4.08
8	.....	2.58	2.11	8.70	23	4.53	2.26	2.42	3.50
9	.....	2.58	2.10	9.15	24	4.28	2.23	2.75	3.20
10	.....	2.58	2.08	12.12	25	3.98	2.28	2.60	3.05
11	.....	2.56	2.96	12.98	26	3.98	2.38	6.40	2.92
12	.....	2.60	2.48	11.20	27	3.93	2.36	4.85	2.85
13	.....	2.53	2.38	8.42	28	3.63	2.32	5.85	2.80
14	.....	2.48	2.68	6.40	29	3.23	2.28	7.55	2.75
15	.....	2.38	2.40	5.80	30	2.93	2.23	6.58	2.65
					31	.....	2.23	5.25	.....

SHOAL CREEK NEAR BREESE, ILL.

Location.—In the southwest corner of the NW. ¼ sec. 24, T. 2 N., R. 4 W. third principal meridian, at the Baltimore & Ohio Southwestern Railroad bridge about 1½ miles east of Breese, Clinton County, Ill.; about 3 miles above the mouth of Beaver Creek.

Records available.—November 5, 1909, to September 30, 1912; October 30 to December 31, 1912; August 14 to September 30, 1914.

Drainage area.—760 square miles.

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

Channel and control.—Practically permanent; channel rough, as rock has been placed in bed of stream, under bridge, to prevent scour.

Discharge measurements.—Made from upstream side of bridge; during floods made also from downstream side of wooden trestle over overflow channel. There is a good wading section just above the bridge.

Floods.—The maximum gage height since establishment of gage, 19.6 feet, occurred in October, 1911. No available records of floods prior to installation of gage.

Point of zero flow.—A determination by leveling on August 13, 1914, indicates that there would be no flow past the gage if the river were to fall to about 0.4 foot ±0.1 foot by the gage.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Diversions.—The intake pipe of the Breese municipal pumping system is about one-fourth mile above the section, but the quantity of water diverted is negligible.

Accuracy.—Gage readings reliable.

Stream is said to be fed by springs and has never been known to go dry at station.

Discharge measurements of Shoal Creek near Breese, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 13	Peterson and Kessler	0.89	10.7
Sept. 24	William Kessler	.90	25.4

NOTE.—Measurements made by wading at sections immediately below the bridge; measuring sections poor because of rough bed and irregular velocity.

Daily gage height, in feet, of Shoal Creek near Breese, Ill., for the year ending Sept. 30, 1914.

[John Nordman, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	1.75	11	.....	2.35	21	0.9	1.5
2	.....	1.6	12	.....	1.3	22	.9	1.45
3	.....	1.7	13	.....	1.2	23	.9	1.0
4	.....	1.4	14	0.9	1.2	24	1.1	.95
5	.....	1.75	15	1.05	1.15	25	3.7	.9
6	.....	4.8	16	1.0	3.0	26	4.0	.9
7	.....	2.4	17	1.0	2.9	27	2.2	.9
8	.....	5.3	18	.9	2.7	28	1.5	.9
9	.....	4.4	19	.9	2.2	29	1.2	.9
10	.....	3.7	20	.9	1.8	30	1.2	.9
						31	1.4	.....

SILVER CREEK NEAR LEBANON, ILL.

Location.—In the northwest corner of sec. 5, T. 2 N., R. 7 W. third principal meridian at highway bridge at Wrights Crossing, about 2 miles west of Lebanon, St. Clair County, Ill.

Records available.—March 3, 1908, to September 30, 1912; November 3 to December 31, 1912; August 14 to September 30, 1914.

Drainage area.—335 square miles.

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

Channel and control.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge and small approach spans; and also at high stages from downstream side of three steel viaducts on road west of bridge.

Floods.—The maximum stage since establishment of gage, 15.9 feet, occurred in May, 1908. No available records of floods prior to the establishment of the station.

Point of zero flow.—A determination by leveling, August 14, 1914, indicates that there would be no flow past the gage if the river stage were to fall to 0.4 foot±0.1 foot referred to the gage datum.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—From March 3, 1908, to May 10, 1909, the gage was so situated that 2 feet was the lowest obtainable reading, and the gage reader noted that the stream was dry whenever the water surface was below 2 feet. On inquiry he stated that the stream was dry for only one week during 1908; therefore, where the gage heights have been marked "Dry" during this period the note was inserted, "Dry under gage; can not obtain gage height of water surface." The position of the gage was changed on May 10, 1909, so as to obviate this difficulty.

Discharge measurements of Silver Creek near Lebanon, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 14	Peterson and Kessler	0.55	[a] 0.02
Sept. 25	William Kessler	1.31	[b] 4.20

[a] Velocity determined by use of floats.
[b] Measurement made by wading about 1,000 feet below the gage.

Daily gage height, in feet, of Silver Creek near Lebanon, Ill., for the year ending Sept. 30, 1914.

[W. D. McKoin, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	2.30	11	.....	4.48	21	3.18	1.90
2	.....	5.35	12	.....	3.15	22	4.25	1.85
3	.....	4.98	13	.....	2.43	23	3.00	1.63
4	.....	4.20	14	0.58	2.25	24	2.30	1.40
5	.....	3.78	15	.55	4.13	25	3.55	1.32
6	.....	6.38	16	1.20	8.85	26	5.50	1.30
7	.....	7.95	17	1.18	7.28	27	6.75	1.25
8	.....	9.95	18	1.00	4.70	28	4.00	1.12
9	.....	9.75	19	.88	2.33	29	2.88	1.00
10	.....	6.73	20	.85	2.25	30	2.28	.92
						31	2.15	.....

BIG MUDDY RIVER AT PLUMFIELD, ILL.

Location.—In the west half of sec. 20, T. 7 S., R. 2 E., at highway bridge at Plumfield, Franklin County, Ill., and about 6 miles west of West Frankfort, Ill.; about 1½ miles below the mouth of Middle Fork, and about 2 miles downstream from station formerly maintained at the Chicago, Burlington & Quincy Railroad bridge.

Records available.—August 18 to September 30, 1914. June 16, 1908, to September 30, 1912, and November 1 to December 31, 1912, maintained at the Chicago, Burlington & Quincy Railroad.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to bridge; read daily, morning and afternoon, to quarter-tenths.

Channel and control.—Probably permanent; control section is about one-fourth mile below the gage.

Discharge measurements.—Made from downstream side of bridge and steel approach, and in high water also made from downstream side of two culverts under road on right side; at extreme high stages the lowland between the bridge and the culverts is covered with water.

Floods.—No record.

Point of zero flow.—A determination by leveling August 18, 1914, indicates that there would be no flow past the gage if the river were to fall to about 0.6 foot ±0.05 foot by the gage.

Winter flow.—Ice may affect the discharge relation during parts of December, January, and February.

Accuracy.—Gage-height record reliable.

Data insufficient for estimates of discharge.

Discharge measurements of Big Muddy River at Plumfield, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 19	Peterson and Kessler	0.37	0.0
Sept. 28	William Kessler	2.01	38.3

Daily gage height, in feet, of Big Muddy River at Plumfield, Ill., for the year ending Sept. 30, 1914.

[Louis Robertson, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1	.....	5.38	11	.....	10.34	21	0.54	2.08
2	.....	3.78	12	.....	8.78	22	.50	1.76
3	.....	2.78	13	.....	5.78	23	.50	1.65
4	.....	2.20	14	.....	3.60	24	.49	1.68
5	.....	1.89	15	.....	2.68	25	.58	1.48
6	.....	1.90	16	.....	2.28	26	.58	1.76
7	.....	3.20	17	.....	1.95	27	.92	2.20
8	.....	6.61	18	0.40	1.84	28	1.38	2.01
9	.....	9.18	19	.38	2.38	29	1.20	1.72
10	.....	10.25	20	.52	2.52	30	2.00	1.50
						31	6.00	.....

BEAUCOUP CREEK NEAR PINCKNEYVILLE, ILL.

Location.—In sec. 30, T. 5 S., R. 2 E. third principal meridian; at Illinois Central Railroad bridge about 1½ miles east of Pinckneyville, Perry County, Ill., about 10 miles above the mouth of Galum Creek.

Records available.—June 17, 1908, to September 30, 1912; November 30 to December 31, 1912; August 24 to September 30, 1914. The gage readings for 1908 were taken whenever the observer happened to be in the vicinity of the gage. Except for a few days fairly accurate results will probably be obtained if the missing gage heights are interpolated.

Drainage area.—227 square miles.

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

Channel and control.—Practically permanent except at low stages. The creek goes dry at times, the water then standing in pools near the gage.

Discharge measurements.—Made from downstream side of wooden trestle; low-water measurements made at wading section about 1,000 feet below gage.

Floods.—The flood of 1902 reached a height of about 27.5 feet, referred to the present gage.

Point of zero flow.—A determination by leveling, August 17, 1914, indicates that there would be no flow past the gage if the river were to fall to about 1.8 feet ±0.1 foot by the gage.

Winter flow.—Discharge relation may be affected by ice during parts of December, January, and February.

Accuracy.—Gage readings erroneous at times.

Discharge measurements of Beaucoup Creek near Pinckneyville, Ill., during the year ending Sept. 30, 1914.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 17	Peterson and Kessler	1.50	0.0
Sept. 26	William Kessler	2.71	[a]17

[a] Measurement made by wading at a section about 1,000 feet below gage.

Daily gage height, in feet, of Beaucoup Creek near Pinckneyville, Ill., for the year ending Sept. 30, 1914.

[R. C. Huggins, observer.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	1.84	1.62	4.80	16	.....	1.73	.....	5.4
2	.....	1.84	1.62	2.45	17	.....	1.73	1.60	4.7
3	.....	1.79	1.61	2.50	18	.....	1.74	1.55	3.2
4	.....	1.81	1.61	2.52	19	.....	1.73	1.58	2.5
5	.....	1.82	1.59	2.54	20	.....	1.72	1.58	.....
6	.....	1.82	1.58	10.10	21	.....	1.72	1.60	2.4
7	.....	1.80	1.56	12.20	22	.....	1.71	2.01	2.4
8	.....	1.80	1.54	16.90	23	.....	1.69	2.00	2.2
9	.....	1.80	.....	16.85	24	1.99	1.69	2.00	.....
10	.....	1.79	1.53	12.06	25	1.94	1.68	2.01	2.9
11	.....	1.78	1.51	4.1	26	1.94	1.67	3.70	2.9
12	.....	1.78	1.49	3.6	27	1.94	1.66	3.74	2.6
13	.....	1.78	1.49	.....	28	1.92	1.65	14.01	2.5
14	.....	1.74	1.49	2.7	29	1.89	1.65	19.10	2.4
15	.....	1.74	1.54	2.6	30	1.84	1.64	16.80	2.3
					31	.....	1.62	.....	.....

MISCELLANEOUS MEASUREMENTS.

Miscellaneous measurements in Hudson Bay drainage basin during the year ending Sept. 30, 1914.

[By J. B. Stewart.]

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 13	Big Fork River	Rainy River	Big Falls, Minn.	3.65	448

Miscellaneous measurements in upper Mississippi River drainage basin during the year ending Sept. 30, 1914.

[By S. B. Soulé, J. B. Stewart, and R. H. Bolster.]

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft*
Oct. 17	Lizard Creek	Des Moines River	Fort Dodge, Iowa	.....	69.6
May 20	Elk Creek	Turkey River	Elkport, Iowa	.....	17
20	Volga River	....do	....do	.....	83.7
Sept. 18	Des Moines	Mississippi River	Ottumwa, Iowa	10.60	24,400

Miscellaneous measurements in Wisconsin River drainage basin during the year ending Sept. 30, 1914.

[By W. G. Hoyt, G. H. Canfield, and O. A. Steller.]

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
May 22	Wisconsin River	Mississippi River	Highway bridge, Grand Rapids, Mich.	[a] 2.23	4,060
Jan. 7	Big Eau Pleine River	Wisconsin River	Highway bridge, 2 miles west of Dancy, Wis.	.....	9
Feb. 7	....do	....do	....do	.....	45
Aug. 20	Mill Creek	....do	Immediately below power house and dam of city of Muscoda, Wis., sec. 26, T. 9 N., R. 1 W.	.....	44

[a] U. S. Weather Bureau staff gage at Grand Rapids, Mich.

INDEX.

STREAM-GAGING STATIONS

AND

PUBLICATIONS RELATING TO WATER RESOURCES

PART V. HUDSON BAY AND UPPER MISSISSIPPI RIVER DRAINAGE BASINS

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

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

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

Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Boston, Mass., Custom House.
St. Paul, Minn., Old Capital Building.
Madison, Wis., Capital Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Austin, Tex., Old Post Office Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 505 Customhouse.
Los Angeles, Cal., Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 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	1888 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.

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

Report.	Character of data.	Year.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332[a]	do	1912.
WS 351 to 362[a]	do	1913.
WS 381 to 394	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 the papers on surface-water supply published from 1899 to 1914. The data for any particular station will in general be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1913, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, and 351, which contain records for the New England streams from 1903 to 1913. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

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 coast (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 drainage basins.		
												Pacific basins in Washington and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific basins in Oregon.
1899 *a*	35	*b* 35,36	36	36	36	*c* 36,37	37	37	*d* 37,38	38, *e* 39	38, *f* 39	38	38	38
1900 *g*	47, *h* 48	48	48, *i* 49	49	49	49, *j* 50	50	50	50	51	51	51	51	51
1901	65,75	65,75	65,75	65,75	*k* 65,66,75	66,75	*k* 65,66,75	66,75	66,75	66,75	66,75	66,75	66,75	66,75
1902	82	*b* 82,83	83	*l* 82,83	*k* 83,85	84	*k* 83,84	84	85	85	85	85	85	85
1903	97	*b* 97,98	98	97	*k* 98,99, *m* 100	99	*k* 98,99	99	100	100	100	100	100	100
1904	*n* 124, *o* 125, *p* 126	*p* 126,127	128	129	*k* 128,130	130, *q* 131	*k* 128,131	132	133	133, *r* 134	134	135	135	135
1905	*n* 165, *o* 166, *p* 167	*p* 167,168	169	170	171	172	*k* 169,173	174	175, *s* 177	176, *r* 177	177	178	178	*t* 177,178
1906	*n* 201, *o* 202, *p* 203	*p* 203,204	205	206	207	208	*k* 205,209	210	211	212, *r* 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, *r* 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, *r* 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	326	327	328	329	330	331	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.
t Rogue, Umpqua, and Siletz rivers only.

PART V.—HUDSON BAY AND UPPER MISSISSIPPI RIVER DRAINAGE BASINS.

PRINCIPAL STREAMS.

The Hudson Bay and upper Mississippi River basins include streams whose waters reach Hudson Bay and the Mississippi above its junction with the Ohio (except the Missouri). The principal streams flowing into Hudson Bay from the United States are St. Mary River, Red River, and Rainy River. The principal tributaries of the upper Mississippi are Crow Wing, Sauk, Crow, Rum, Minnesota, St. Croix, Chippewa, Zumbro, Black, Root, Wisconsin, Wapsipinicon, Rock, Iowa, Des Moines, Illinois, and Kaskaskia rivers. These streams drain wholly or in part the States of Illinois, Indiana, Iowa, Minnesota, Missouri, Montana, North Dakota, South Dakota, and Wisconsin.

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

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained September 30, 1914. Period after a date indicates discontinuance.

HUDSON BAY DRAINAGE BASIN.

St. Mary River near Babb (formerly dam site), Mont., 1902–
St. Mary River below Swiftcurrent Creek, at Babb, Mont., 1901–2; 1910–
St. Mary River near Kimball, Alberta, 1902–
Swiftcurrent Creek near Babb (formerly Wetzel), Mont., 1902–1910.
Swiftcurrent Creek at McDermott Lake, Mont., 1912–
Swiftcurrent Creek at Sherburne Lake, Mont., 1912–
Kennedy Creek near Babb (formerly Wetzel), Mont., 1903–1907.
Ottertail River at German Church, near Fergus Falls, Minn., 1913–
Ottertail River near Fergus Falls, Minn., 1904–1913.
Red River near Fergus Falls, Minn., 1909–10.
Red River at Fargo, N. Dak., 1901–
Red River at Grand Forks, N. Dak., 1901–
Red River at Pembina, N. Dak., 1901.
Red River at Emerson, Manitoba, 1900–1902.
Pelican River near Fergus Falls, Minn., 1909–1912.
Sheyenne River at Haggart, N. Dak., 1902–1907.
Wild Rice River at Twin Valley, Minn., 1909–
Devils Lake near Devils Lake, N. Dak., 1901–1912.

Red River tributaries—Continued.
- Red Lake River at Thief River Falls, Minn., 1909–
- Red Lake River at Crookston, Minn., 1901–
  - Thief River near Thief River Falls, Minn., 1909–
  - Clearwater River at Red Lake Falls, Minn., 1909–
  - South Branch of Two Rivers at Hallock, Minn., 1911–
- Pembina River at Neche, N. Dak., 1903–
  - Roseau River at Dominion City, Canada, 1912–
    - West Branch of Roseau River, near Malung, Minn., 1911–1914.
- Mouse River near Foxholm, N. Dak., 1904–1906.
- Mouse River at Minot, N. Dak., 1903–
  - Des Lacs River at Foxholm, N. Dak., 1904–1906.
- Rainy Lake at Rainier, Minn., 1910–
- Rainy River at International Falls, Minn., 1907–
  - Vermilion River below Lake Vermilion, near Tower, Minn., 1911–
  - Little Fork at Little Fork, Minn., 1909–
  - Big Fork at Big Falls, Minn., 1909–1912.
  - Big Fork at Laurel, Minn., 1909.
  - Black River near Loman, Minn., 1909.

UPPER MISSISSIPPI RIVER BASIN.

- Mississippi River above Sandy River, Minn., 1895–
- Mississippi River near Fort Ripley, Minn., 1909–10.
- Mississippi River near Sauk Rapids, Minn., 1903–1906.
- Mississippi River at Anoka, Minn., 1905–1914.
- Mississippi River at St. Paul, Minn., 1873–
  - Sandy River below Sandy Lake Reservoir, Minn., 1893–
  - Pine River below Pine River Reservoir, Minn., 1886–
  - Prairie River near Grand Rapids, Minn., 1909.
  - Crow Wing River at Nimrod, Minn., 1910–1914.
  - Crow Wing River at Motley, Minn., 1909; 1913–
  - Crow Wing River at Pillager, Minn., 1903; 1909–1913.
  - Long Prairie River near Motley, Minn., 1909–
  - Sauk River near St. Cloud, Minn., 1909–1913.
  - Elk River near Big Lake, Minn., 1911–
  - Crow River at Rockford River, Minn., 1909–
  - Crow River near Dayton, Minn., 1906.
    - North Fork of Crow River near Rockford, Minn., 1909–10.
    - South Fork of Crow River near Rockford, Minn., 1909–1912.
  - Rum River at Onamia, Minn., 1909–1912.
  - Rum River at Cambridge, Minn., 1909–1914.
  - Rum River at St. Francis, Minn., 1903.
  - Rum River near Anoka, Minn., 1905–6; 1909.
  - Minnesota River near Odessa, Minn., 1909–1913.
  - Minnesota River near Montevideo, Minn., 1909–
  - Minnesota River near Mankato, Minn., 1903–
    - Whetstone River near Big Stone, S. Dak., 1910–1912.
    - Lac qui Parle River at Lac qui Parle, Minn., 1910–
    - Chippewa River near Watson, Minn., 1909–
    - Redwood River near Redwood Falls, Minn., 1909–1914.
    - Cottonwood River near New Ulm, Minn., 1909–1913.
  - Blue Earth River at Rapidan Mills, Minn., 1909–10.
  - St. Croix River at Swiss, Wis., 1914–

Mississippi River tributaries—Continued.
St. Croix River near St. Croix Falls, Wis., 1902–1905; 1910–
Namakagon River at Trego, Wis., 1914–
Yellow River at Webster, Wis., 1914.
Kettle River near Sandstone, Minn., 1908–
Snake River at Mora, Minn., 1909–1913.
Snake River near Pine City, Minn., 1913–
Apple River near Somerset, Wis., 1901–
Cannon River at Welch, Minn., 1909–1914.
Chippewa River above East Fork, near Winter, Wis., 1911–1913.
Chippewa River below East Fork, near Winter, Wis., 1912–
Chippewa River near Bruce, Wis., 1913–
Chippewa River at Chippewa Falls, Wis., 1888–
Chippewa River near Eau Claire, Wis., 1902–1909.
West Fork of Chippewa River near Winter, Wis., 1911–1913.
Flambeau River near Butternut, Wis., 1914–
Flambeau River near Ladysmith, Wis., 1914.
Flambeau River at Ladysmith, Wis., 1903–1906.
Eau Claire River near Augusta, Wis., 1914–
Eau Claire River near Eau Claire, Wis., 1913–14.
Red Cedar River near Colfax, Wis., 1914–
Red Cedar River at Cedar Falls, Wis., 1909–
Red Cedar River at Menominee, Wis., 1907–8; 1913–
Zumbro River at Zumbro Falls, Minn., 1909–
South Branch of Zumbro River near Zumbro Falls, Minn., 1911–
Trempealeau River at Dodge, Wis., 1913–
Black River at Neillsville, Wis., 1905–1909; 1913–
Black River at Melrose, Wis., 1902–3.
La Crosse River near West Salem, Wis., 1913–
Root River near Houston, Minn., 1909–
North Branch of Root River near Lanesboro, Minn., 1910–
Upper Iowa River near Decorah, Iowa, 1913–
Wisconsin River near Rhinelander, Wis., 1905–
Wisconsin River at Merrill, Wis., 1902–
Wisconsin River near Nekoosa, Wis., 1914–
Wisconsin River near Necedah, Wis., 1902–1914.
Wisconsin River at Muscoda, Wis., 1902–3; 1913–
Tomahawk River near Bradley, Wis., 1914–
Prairie River near Merrill, Wis., 1914–
Little Rib River near Wausau, Wis., 1914–
Eau Claire River at Kelley, Wis., 1914–
Big Eau Pleine River near Stratford, Wis., 1914–
Plover River near Stevens Point, Wis., 1914–
Baraboo River near Baraboo, Wis., 1913–
Kickapoo River at Gays Mills, Wis., 1913–
Turkey River at Garber, Iowa, 1913–
Maquoketa River above mouth of North Fork, near Maquoketa, Iowa, 1913–
Maquoketa River at Manchester, Iowa, 1903.
Maquoketa River below mouth of North Fork, near Maquoketa, Iowa, 1913–14.
Wapsipinicon River at Stone City, Iowa, 1903–1914.
Rock River at Watertown, Wis., 1914.
Rock River at Afton, Wis., 1914–
Rock River above mouth of Pecatonica River, at Rockton, Ill., 1903.
Rock River below mouth of Pecatonica River, at Rockton, Ill., 1903–1909.

Mississippi River tributaries—Continued.
Kaskaskia River at Vandalia, Ill., 1908–1912; 1914–
Kaskaskia River at Carlyle, Ill., 1908–1912; 1914–
Kaskaskia River at New Athens, Ill., 1907–1912; 1914–
Shoal Creek near Breese, Ill., 1909–1912; 1914–
Silver Creek near Lebanon, Ill., 1908–1912; 1914–
Big Muddy River near Cambon, Ill., 1908–1912.
Big Muddy River at Plumfield, Ill., 1914–
Beaucoup Creek near Pinckneyville, Ill., 1908–1912; 1914–

REPORTS ON WATER RESOURCES OF THE HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS.

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 (at prices noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*21. Wells of northern Indiana, by Frank Leverett. 1899. 82 pp., 2 pls. (Continued in No. 26.)
Discusses by counties, glacial deposits and sources of well waters; many well sections.

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. A revised edition was published in 1905 as Water-Supply Paper 149 (q. v.).

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.
Contains notes on early floods in Mississippi Valley.

102. Contributions to the hydrology of eastern United States, 1903; M. L. Fuller, geologist in charge. 1904. 522 pp. 30c.
Contains brief reports on wells and springs of Minnesota and Missouri.
The reports comprise tabulated well records giving information as to location, owner, depth, yield, head, etc., supplemented by notes as to elevation above sea, material penetrated, temperature, use, and quality; many miscellaneous analyses.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.
Contains brief reports as follows: Missouri, by E. M. Shepard; Iowa, by W. H. Norton; Minnesota, by C. W. Hall; Wisconsin district, by Alfred R. Schultz; Illinois, by Frank Leverett; Indiana, 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.

117. The lignite of North Dakota and its relation to irrigation, by F. A. Wilder. 1905. 59 pp., 8 pls. 10c.
Describes the thickness, extent, variations, and fuel value of the lignite and its use for pumping water, the area, soils and lignite of the river flats, and the status of irrigation in the State.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.
Contains two reports relating to areas draining to Hudson Bay or upper Mississippi River:
Water resources of Mineral Point quadrangle, Wisconsin, by U. S. Grant. Describes springs, streams, and shallow and deep wells.
Water supplies at Waterloo, Iowa, by W. H. Norton. Summarizes results of investigations to determine availability of artesian water to replace the surface supply from Cedar River; discusses necessity of test wells, supplementary supplies, artesian head, and permanency of flow.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Given 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 and 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.

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

Contains accounts of floods in southeastern Minnesota, on Devils Creek, Iowa, and in Des Moines County, Iowa; gives estimates of flood discharge and frequency on Illinois River and on Mississippi River at St. Paul; gives also index to literature on floods on American streams.

*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.

*195. Underground waters of Missouri, their geology and utilization, by E. M. Shepard. 1907. 224 pp., 6 pls. 30c.

Describes the topography and geology of the State, the waters of the various formations, and discusses the water supplies by districts and counties, gives statistics of city water supplies, analyses of waters, and many well records.

*227. Geology and underground waters of South Dakota, by N. H. Darton. 1909. 156 pp., 15 pls. 40c.

Describes physical features, geologic formations, water horizons, and, by counties, deep wells and well prospects; gives notes on construction and management of artesian wells.

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 Mississippi, Minnesota, Chippewa, Wisconsin, Rock, Iowa, Cedar, Des Moines, Illinois, Kankakee, Fox, Sangamon, Kaskaskia, and Big Muddy 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 and course and the quality of water; includes short chapters on municipal supplies and industrial uses.

254. The underground waters of north-central Indiana, by S. R. Capps, with a chapter on the chemical character of the waters, by R. B. Dole. 1910. 279 pp., 7 pls. 40c.

Describes relief, drainage, vegetation, soils, and crops, industrial development, geologic formations; sources, movements, occurrence, and volume of ground water; methods of well construction and lifting devices; discusses, in detail for each county, surface features and drainage, geology and ground water, city, village, and rural supplies, and gives records of wells and analyses of waters. Discusses also, under chemical character, methods of analyses and expression of results, mineral constituents, effect of the constituents on waters for domestic and industrial and medicinal uses, methods of purification, chemical composition; many analyses and field assays.

256. Geology and underground waters of southern Minnesota, by C. W. Hall, O. E. Meinzer, and M. L. Fuller. 1911. 406 pp., 18 pls. 60c.

Discusses the physiography of the State, geologic formations and their water-bearing capacity, artesian conditions, the mineral quality of the underground waters, types of wells, finishing wells in sand, drilling in quartzite, fluctuation in yield and head, "blowing" and "breathing" wells; freezing of wells, drainage by wells, hydraulic rains, and scientific prospecting for water, municipal supplies; power; storage and distribution; consumption of water; prices; sanitation. Gives by counties details concerning surface features, rocks, yield, head, and quality of water, and summaries and analyses.

293. Underground water resources of Iowa, by W. H. Norton, W. S. Hendrixson. H. E. Simpson, O. E. Meinzer, and others. 1912. 994 pp., 18 pls. 70c.

Describes the relief, drainage, temperature, and precipitation of the State and the geologic formations; discusses the geologic occurrence of underground waters, artesian phenomena and and yield of artesian wells, the chemical composition of underground waters, municipal, domestic, and industrial water supplies, and mineral waters; gives details concerning topography, geology, underground waters, and city and village supplies by districts and counties.

345. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. Contains:

(*i*) Gazetteer of surface waters of Iowa, by H. J. Ryan, pp. 169–221.

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.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95. 4 parts. *Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV to XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

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, pp. xxv, 864, 113 pls. $2.35. Contains:

Preliminary report on artesian waters of a portion of the Dakotas, by N. H. Darton, pp. 603–694, pls. lxix to cvii. Gives an outline of the geologic relations; describes the water horizons and the extent of the artesian water, and gives details concerning wells and prospects by counties; discusses the origin, amount, pressure, head, and composition of the artesian waters. the use of artesian water for power, and gives details concerning artesian irrigation by counties; contains also remarks on the construction and management of artesian wells.

*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 of the United States Geological Survey, 1896–97, 5 parts in 6 vols., *Pt. IV, Hydrography, pp. x, 756, 102 pls. $1.75. Contains:

*The water resources of Indiana and Ohio, by Frank Leverett, pp. 419–560, pls. xxxiii to xxxvii. Describes the Wabash, Whitewater, Great Miami, Little Miami, Scioto, Hocking, Muskingum, and Beaver rivers, streams 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, discuss 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.

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 and Iowa, and detailed records of wells in Boone, Dupage, Henry, and La Salle counties, Ill., and Des Moines and Scott counties, Iowa. 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 well in Illinois, Indiana, Iowa, Minnesota, Missouri, North Dakota, South Dakota, and Wisconsin; and detailed records of wells in Brown, Hancock, La Salle, Pike, and Schuyler counties, Ill.; Blackhawk, Floyd, Louisa, Mahaska, Scott, and Wapello counties, Iowa; and Hennepin, Ottertail, and Pine counties, Minn. 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 hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 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

[1] Index maps showing areas in the Hudson Bay and upper Mississippi River basins 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.

185 and higher numbers sells for 50 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 at the retail rate.

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

An asterisk (*) indicates that the stock of the folio is exhausted.

117. Casselton-Fargo, North Dakota-Minnesota.

Gives a somewhat detailed account of the water supply, including descriptions and logs of principal wells and tabulated well records; contains artesian-water maps showing areas which will probably yield flowing wells.

*145. Lancaster-Mineral Point, Wisconsin-Iowa-Illinois.

Discusses the springs, shallow and deep wells, streams and water power; gives analyses of artesian water from well at Dubuque, Iowa.

168. Jamestown-Tower (Jamestown, Eckelson, and Tower quadrangles), North Dakota.[1]

Discusses shallow, deep, and artesian wells; head, pressure, power, volume, and character of the water, and gives a tabulated list of representative wells; contains an artesian-water map showing areas in which flowing wells may probably be obtained.

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 Hudson Bay and upper Mississippi River basins are the reports of the State surveys of Illinois and North Dakota, the Wisconsin Geological and Natural History Survey and the Railroad Commission of Wisconsin, the Illinois Water-Supply Commission, and the Rivers and Lakes Commission of Illinois, and the water-power report of the Tenth Census (vol. 17). The following reports deserve special mention:

Contributions to the physical geography of the United States, Part I, On the physical geography of the Mississippi Valley, with suggestions for the improvement of navigation of the Ohio and other rivers, by Charles Ellet, jr.: Smithsonian Pub. 13, Washington, 1850.

The Mississippi and Ohio rivers, by Charles H. Ellet. 1853.

Report upon the physics and hydraulics of the Mississippi River, by A. A. Humphreys and H. L. Abbott, 1876.

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.

Water resources of the East St. Louis district, by Isaiah Bowman: Illinois State Geol. Survey Bull. 5, 1907.

Chemical and biological survey of waters of Illinois, by Edward Bartow: Univ. Illinois Pub. 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.

[1] Issued in two editions. (See p. XIV.) Specify which edition is wanted.

Report and plans for the reclamation of lands subject to overflow in the Kaskaskia River Valley, Illinois; begun under the direction of the Internal Improvement Commission; completed and published under the direction of the Rivers and Lakes Commission of Illinois, by Jacob A. Harmon. 1912.

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 *vs.* 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.

Report on the water resources investigation of Minnesota by the State Drainage Commission, 1910.

Report of the commission on conservation [Montana] on bills relating to the public lands, water rights, and the protection and preservation of the forests, 1911.

Governor's message relating to conservation [in Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests.

Water resources of the Devils Lake region, North Dakota, by E. J. Babcock: North Dakota Geol. Survey, Second Bienn. Rept., 1903.

The water powers of Wisconsin, by Leonard S. Smith: Wisconsin Geol. and Nat. Hist. Survey Bull. 20. Madison, Wis., 1908.

Report of the Railroad Commission of Wisconsin to the Legislature on water powers: Madison, Wis., 1915.

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

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. 10c. (See Water-Supply Paper 22.)

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, 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, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage disposal plants by States; contains bibliography of publications relating to sewage, utilization and disposal.

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.)

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged edition published as Water-Supply Paper 95.

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

Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well.

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 topography and geology of the island, the springs, running streams and wells; discusses utilization of the surface and underground waters.

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 ground waters, meaning and importance of sanitary analyses, and principal sources of pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses 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 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 planetable, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)

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

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

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

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

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

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

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

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

Notes on the hydrology of Cuba, by M. L. Fuller.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

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

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters; permeability and storage capacity of rocks, water-bearing formations; recovery of water by springs, wells, and pumps; essential conditions of artesian flows; and general conditions affecting underground waters in eastern United States.

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 States legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water; describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

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. 10c.

Contains brief reports of general interest as follows:

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

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

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

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of 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 in irrigation problems, by O. H. Ensign.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, etc.—Continued.

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 irritated 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.

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

Scope indicated by title.

*151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Scope indicated by title.

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

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

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

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl. 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 manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream 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. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

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

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

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament, reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 125 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*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. Pierce and 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. Contains:

(*e*) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53-65. Scope indicated by title.

(*f*) The discharge of Yukon River at Eagle, Alaska, by E. A. Porter and R. W. Davenport, pp. 67-77, pls. IV-V. 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-meter 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.

375. Contributions to the hydrology of the United States, 1914. N. C. Grover, chief hydraulic engineer. Contains:

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

(e) A method for correcting river discharge for changing stage, by B. E. Jones, pp. 117–130.

(f) Conditions requiring the use of automatic gages in obtaining stream-flow records, by C. H. Pierce, pp. 131–139.

Three papers presented at the conference of engineers of the water resources branch in December, 1914.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. pp. xxxvi, 469, 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlain, pp. 125–173, 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, pp. xviii, 576, 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 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, Pls. CXI to CXLV. Discusses the economical 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, 172 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 water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigationson the flow of air and water through a rigid, porous medium, and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, 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, pp. vii, 660, 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 of 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., 137 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

BULLETINS.

*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.

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INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

INDEX OF STREAMS.