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

WATER-SUPPLY PAPER 355

SURFACE WATER SUPPLY OF THE UNITED STATES

FOR THE YEAR ENDING SEPTEMBER 30

1913

PART V. HUDSON BAY BASINS AND UPPER MISSISSIPPI RIVER

NATHAN C. GROVER, Chief Hydraulic Engineer
W. A. LAMB and W. G. HOYT, District Engineers

Prepared in cooperation with the States of Minnesota and Iowa

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

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

WATER-SUPPLY PAPER 355

SURFACE WATER SUPPLY OF THE UNITED STATES

FOR THE YEAR ENDING SEPTEMBER 30

1913

PART V. HUDSON BAY BASINS AND UPPER MISSISSIPPI RIVER

NATHAN C. GROVER, Chief Hydraulic Engineer

W. A. LAMB and W. G. HOYT, District Engineers

Prepared in cooperation with the States of Minnesota and Iowa

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

CONTENTS.

ILLUSTRATIONS.

SURFACE WATER SUPPLY OF HUDSON BAY BASINS AND UPPER MISSISSIPPI RIVER FOR THE YEAR ENDING SEPTEMBER 30, 1913.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of twelve reports presenting results of measurements of flow made on streams in the United States during 1913. Six of the reports for 1913 contain data for the year ending September 30, and the other six for the calendar year, as indicated in the table on page 6.

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, 1895–1914.

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 1914, 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, and of the second kind on page 16.

Measurements of stream flow have been made at about 3,000 points in the United States, and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. In July, 1913, 1,388 gaging stations were being maintained by the Survey and the cooperating organizations in the United States, and many miscellaneous discharge measurements were 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. 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 supply of the country.

Prior to 1901 gage heights and discharge measurements were published in water-supply papers or bulletins and estimates of monthly discharge in annual reports; since 1901 both classes of data have been published in water-supply papers, and they are now being published in 12 parts, as shown in the following table:

Papers on surface water supply of the United States, 1913.

Part.	No.	Title.	Year used.
I	351	North Atlantic coast basins	Calendar year.
II	352	South Atlantic coast and eastern Gulf of Mexico basins	Do.
III	353	Ohio River Basin	Year ending Sept. 30.
IV	354	St. Lawrence River Basin	Calendar year.
V	355	Upper Mississippi River and Hudson Bay basins	Year ending Sept. 30.
VI	356	Missouri River Basin	Calendar year.
VII	357	Lower Mississippi River Basin	Do.
VIII	358	Western Gulf of Mexico basins	Year ending Sept. 30.
IX	359	Colorado River Basin	Calendar year.
X	360	Great Basin	Year ending Sept. 30.
XI	361	Pacific coast basins in California	Do.
XII	362	North Pacific coast basins	Do.

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	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 for eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights for 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 for eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights for 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 [a]	do	1912.
WS 351 to 362 [a]	do	1913.

[a] In preparation.

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

The table on page 8 gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1913. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data 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. The year covered by the report is indicated at the head of the column in which the paper is listed.

Numbers of water-supply papers containing results of stream measurements, 1899–1913.

	1899 [a]	1900 [b]	1901	1902	1903	1904	1905	1906	1907–8	1909	1910	1911	1912	1913
North Atlantic	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125 [f] 126	[d] 165, [e] 166 [f] 167	[d] 201, [e] 202 [f] 203	241	261	281	301	321	351
South Atlantic and eastern Gulf of Mexico	[g] 35, 36	48	65, 75	[g] 82, 83	[g] 97, 98	[f] 126, 127	[f] 167, 168	[f] 203, 204	242	262	282	302	322	352
Ohio River basin	36	48, [h] 49	65, 75	83	98	128	169	205	243	263	283	303	323	353
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129	170	206	244	264	284	304	324	354
Hudson Bay and Upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, [k] 100	[j] 128, 130	171	207	245	265	285	305	325	355
Missouri River	[l] 36, 37	49, [m] 50	66, 75	84	99	130, [n] 131	172	208	246	266	286	306	326	356
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131	[j] 169, 173	[j] 205, 209	247	267	287	307	327	357
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248	268	288	308	328	358
Colorado River	[o] 37, 38	50	66, 75	85	100	133	175, [p] 177	211	249	269	289	309	329	359
Great Basin	38, [q] 39	51	66, 75	85	100	133, [r] 134	176, [r] 177	212, [r] 213	250, [r] 251	270, [r] 271	290, [r] 291	310	330	360
California	38, [s] 39	51	66, 75	85	100	134	177	213	251	271	291	311	331	361
North Pacific	38	51	66, 75	85	100	135	177, 178	214	252	272	292	312	[u] 332	[u] 362

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Hudson Bay only.
[l] Gallatin River.
[m] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[n] Platte and Kansas rivers.
[o] Green and Gunnison rivers and Grand River above junction with Gunnison.
[p] Below junction with Gila.
[q] Mohave River only.
[r] Great Basin in California, excepting Truckee and Carson drainage basins.
[s] Kings and Kern rivers only.
[t] Rogue, Umpqua, and Siletz rivers only.
[u] In three parts: *A*, Pacific basins in Washington and upper Columbia River; *B*, Snake River basin; *C*, Lower Columbia River and Pacific basins in Oregon.

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 of 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.
St. Paul, Minn., Old Capitol Building.
Madison, Wis., Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Salt Lake City, Utah, Federal Building
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., Federal Building.
Santa Fe, N. Mex., Capitol Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director of the United States Geological Survey, Washington, D. C.

DEFINITION OF TERMS.

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

"Second-foot" is an abbreviation for "cubic foot per second" and is a unit for the rate of discharge of water flowing in a stream. 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 a 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. 11).

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

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

Certain terms not in common use may be defined as follows:

"Control," "controlling section," and "point of control" are used to designate the cross section of the stream below the gage which controls or regulates the height of the water surface at the gage. The control may not be the same cross section at all stages.

"Discharge relation" equals "relation of gage height to discharge."

The "point of zero flow" is the stage or gage height at which the stream ceases to flow.

CONVENIENT EQUIVALENTS.

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

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

[1 foot per second=0.681818 mile per hour, or very nearly ⅔ mile per hour. 1 mile per hour=1.4667 feet per second, or very nearly 1½ feet per second. In computing the table the values 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	.955	1.02	1.09	1.16	1.23	1.30
2.....	1.36	1.43	1.50	1.57	1.64	1.70	1.77	1.84	1.91	1.98
3.....	2.05	2.11	2.18	2.25	2.32	2.39	2.45	2.52	2.59	2.66
4.....	2.73	2.80	2.86	2.93	3.00	3.07	3.14	3.20	3.27	3.34
5.....	3.41	3.48	3.55	3.61	3.68	3.75	3.82	3.89	3.95	4.02
6.....	4.09	4.16	4.23	4.30	4.36	4.43	4.50	4.57	4.64	4.70
7.....	4.77	4.84	4.91	4.98	5.05	5.11	5.18	5.25	5.32	5.39
8.....	5.45	5.52	5.59	5.66	5.73	5.80	5.86	5.93	6.00	6.07
9.....	6.14	6.20	6.27	6.34	6.41	6.48	6.55	6.61	6.68	6.75

Table for converting discharge in second-feet 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 values 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 values for one day by the number of days.

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	5.171	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

NOTE.—For part of a month multiply the value 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	14.514	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 values for one day by the number of days.

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

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

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1912, and ending September 30, 1913, and not, as in previous reports, the calendar year. At the 1st of January in most parts of the country a large amount of 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 current-meter gaging station the following data, so far as available, are given: Description of the station, list of discharge measurements, table of daily gage height, 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 installation of current-meter stations, the descriptions give information in regard to any condition which 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 measuring section. Statements are also made regarding the accuracy and reliability of the data.

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 a comparatively few 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 regular 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. All gage heights affected by the presence of ice in the streams or by backwater from obstructions 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 and has no relation to zero flow or the bottom of the river. In general the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

In the tables of daily gage height the use of zeros in the hundredths place indicates the limits of accuracy 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.

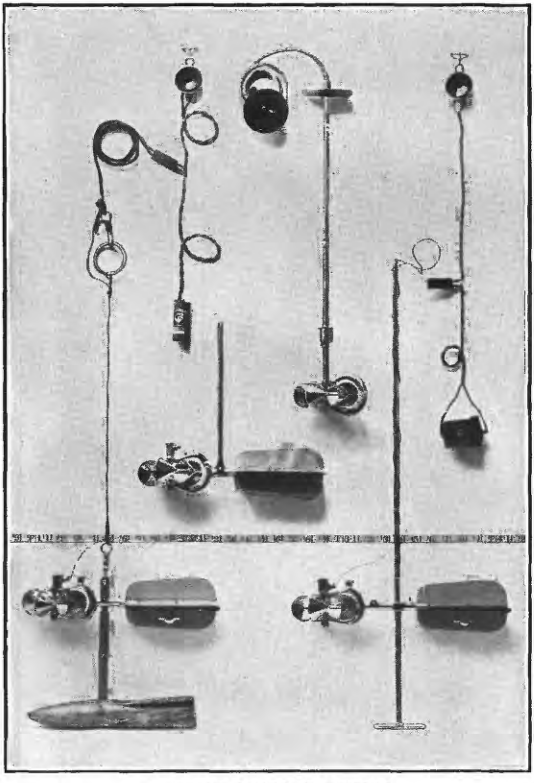
The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

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

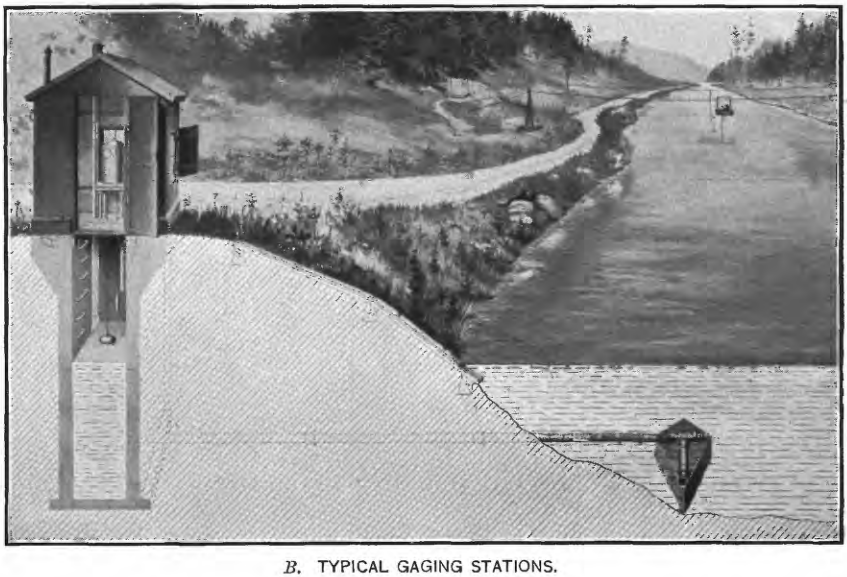
The table of daily discharge determined from the rating table gives the discharge in second-feet corresponding to the mean of the gage readings observed each day.

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 when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column at "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page —, are based.

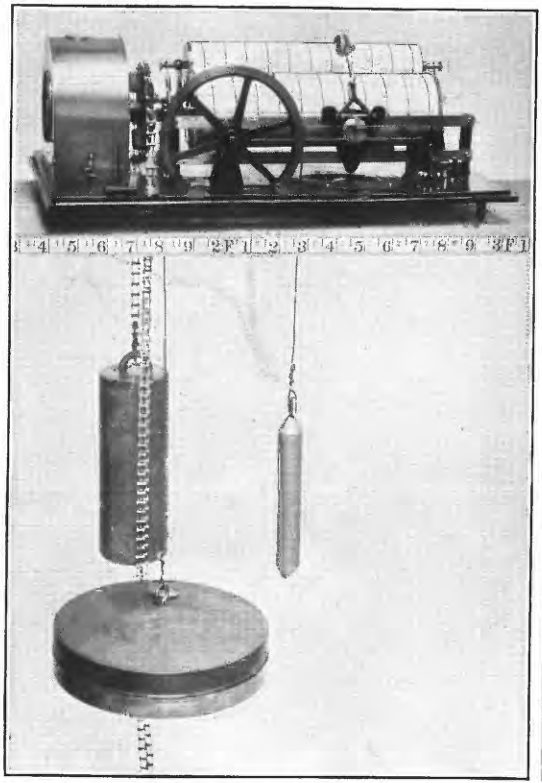
The base data presented in this report, unless otherwise stated in description of station, have been collected by the methods commonly



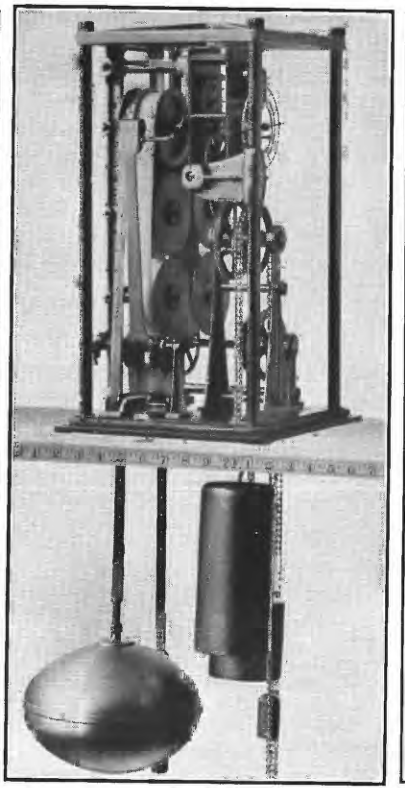
A. PRICE CURRENT METERS.



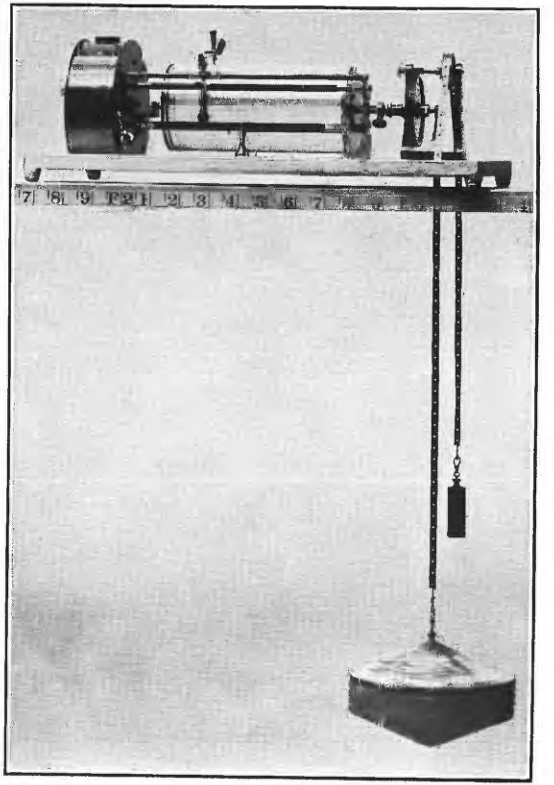
B. TYPICAL GAGING STATIONS.



A. STEVENS.



B. GURLEY.



C. FRIEZ.

AUTOMATIC GAGES.

used at current-meter gaging stations and described in standard textbooks. Plates I and II show current meters and gages used and typical gaging stations.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

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

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, 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 the computations of "second-feet per square mile" and "run-off (depth in inches)" have not been made for stations draining areas having an annual rainfall of less than 20 inches, nor for those stations draining areas of over 20 inches of rainfall for which it is believed that the computations would be uncertain and misleading because of the presence of large noncontributing districts in the measured drainage area, of omitting estimates of water diverted for irrigation or other use, or 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 exterme caution, and such values in this report 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 examining and adjusting to his own needs 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 determinations of daily discharge allow more detailed studies of the variation in flow by which the period of deficiency may be determined.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published, and the engineer who makes use of the figures presented in these papers should verify all ratings and make such adjustments for earlier years as may seem necessary.

COOPERATION.

During the year ending September 30, 1913, stream-gaging work in Montana was carried on in cooperation with the United States Reclamation Service.

In Minnesota the State cooperated under the terms of an act of the legislature of 1909 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.

Prior to March 1, 1913, George A. Ralph, chief engineer of the State drainage commission, represented the State. From March 1 to September 30 E. V. Willard was acting State drainage engineer.

Work in Iowa during the year covered by this report was carried on under a cooperative agreement with the State geological survey, George F. Kay, director.

DIVISION OF WORK.

Field data for 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, R. R. Randell, W. B.

Stevenson, and E. J. Budge. 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 B. J. Peterson and E. F. Chandler.

Field data for the Hudson Bay drainage basin in Minnesota were collected under the direction of W. G. Hoyt, district engineer, St. Paul, Minn., by E. F. Chandler, S. B. Soulé, B. J. Peterson, W. B. Stevenson, and E. J. Budge. 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 W. G. Hoyt and E. F. Chandler.

Field data for the upper Mississippi River drainage basin were collected under the direction of W. G. Hoyt, district engineer, St. Paul, Minn., by S. B. Soulé, and B. J. Peterson. 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.

The computations were made by J. G. Mathers, M. I. Walters, J. H. Morgan, E. D. Burchard, and B. J. Peterson.

The data were assembled for publication by B. J. Peterson.

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.[1]

Location.—Near dam site a quarter of a mile below the 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, 1913.

Drainage area.—177 square miles.

Gage.—Chain gage on right bank of stream. 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 farther downstream. Low-water measurements are made by wading one-fourth mile above gage.

Winter flow.—Channel freezes over at gage and considerable ice exists in the stream.

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

Accuracy.—Rating curve well defined except for winter months. Accuracy of winter records impaired by changes in datum of temporary gage and possibly by effect of ice but are probably fair.

[1] The records for this station were published in Water-Supply Papers 85 and 100 as "St. Mary River at dam site near St. Mary," and in Water-Supply Paper 130 as "St. Mary River near St. Mary."

Discharge measurements of St. Mary River near Babb, Mont., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 16	W. A. Lamb	1.16	[a] 117	June 10	R. R. Randell	5.40	2,980
Mar. 30	do	.94	[b] 86	Aug. 21	Lamb and Hoyt	2.43	604

[a] Measurement made from cable; ice along shore at gage and at measuring section.
[b] Measurement made by wading.

Daily gage height, in feet, of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1913.

[Carl Giruin, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5	1.5	1.4	0.9	0.85	0.95	0.6	1.95	5.5	4.7	2.8	2.5
2	1.4	1.55	1.3	.9	.85	.95	.6	2.05	5.8	4.5	2.8	2.5
3	1.4	1.5	1.3	.85	.85	.95	.5	2.15	5.8	4.4	2.7	2.45
4	1.3	1.5	1.35	.85	.85	.95	.5	2.0	5.9	4.2	2.7	2.5
5	1.4	1.5	1.3	.85	.9	.95	.5	2.1	5.9	4.1	2.7	2.45
6	1.4	1.5	1.3	.85	.9	1.0	.55	2.15	5.8	3.9	2.7	2.45
7	1.35	1.5	1.3	.85	.95	1.0	.6	2.15	5.6	3.9	2.8	.....
8	1.4	1.45	1.25	.85	.95	1.1	.7	2.15	5.5	3.8	2.8	2.05
9	1.4	1.5	1.3	.8	.95	1.1	.8	2.15	5.5	3.8	2.7	2.0
10	1.3	1.45	1.3	.8	.95	1.1	.9	2.0	5.4	3.7	2.6	1.95
11	1.35	1.45	1.2	.8	1.0	1.1	1.05	2.05	5.4	3.7	2.5	2.05
11	1.3	1.5	1.2	.8	1.0	1.1	1.15	2.05	5.4	3.7	2.6	1.9
13	1.35	1.5	1.2	.8	1.1	1.2	1.2	2.15	5.3	3.6	2.6	1.9
14	1.3	1.6	1.2	.85	1.1	1.2	1.25	2.2	5.2	3.4	2.5	.....
15	1.4	1.55	1.15	.85	1.1	1.2	1.45	2.3	5.1	3.4	2.6	1.8
16	1.4	1.55	1.2	.85	1.2	1.2	1.5	2.35	4.9	3.2	2.6	1.85
17	1.4	1.6	1.2	.8	1.1	1.2	1.55	2.45	4.6	3.2	2.5	1.8
18	1.4	1.55	1.2	.8	1.0	1.25	1.65	2.6	4.5	3.1	2.6	1.8
19	1.5	1.6	1.15	.8	.95	1.25	1.75	2.6	4.3	2.9	2.5	1.8
20	1.5	1.6	1.15	.85	.95	1.25	1.85	2.6	4.2	2.9	2.5	1.8
21	1.55	1.5	1.1	.85	.9	1.2	1.75	2.6	4.2	2.8	2.5	.....
22	1.5	1.5	1.1	.85	.9	1.1	1.75	2.6	4.1	2.8	2.45	1.7
23	1.6	1.5	1.1	.8	.9	1.1	1.65	2.6	4.2	2.8	2.45	1.65
24	1.55	1.5	1.1	.8	.9	1.1	1.65	2.7	4.1	2.9	2.5	1.65
25	1.6	1.45	1.1	.8	.9	1.0	1.65	2.8	4.1	2.9	2.45	1.65
26	1.55	1.5	1.05	.8	.95	.9	1.65	3.4	4.2	2.9	2.5	1.6
27	1.5	1.4	1.0	.8	.95	.8	1.75	3.9	4.3	2.9	2.45	1.5
28	1.6	1.4	1.0	.8	.95	.7	1.75	4.6	4.4	2.9	2.5	1.5
29	1.55	1.4	1.0	.85	.....	.7	1.8	5.1	4.5	2.9	2.45	1.5
30	1.6	1.35	.95	.85	.....	.65	1.9	5.4	4.5	2.9	2.45	1.5
31	1.55	.....	.95	.85	.....	.6	.....	5.5	.....	2.9	2.4	.....

NOTE.—Discharge relation probably affected by ice about Feb. 6–20, 1913.

Daily discharge, in second-feet, of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	225	225	195	79	72	88	40	385	3,080	2,280	815	645
2	195	241	166	79	72	88	40	425	3,380	2,100	815	645
3	195	225	166	72	72	88	31	468	3,380	2,010	755	618
4	180	225	180	72	72	88	31	405	3,480	1,840	755	645
5	195	225	166	72	79	88	31	445	3,480	1,760	755	618
6	195	225	166	72	.....	96	36	468	3,380	1,600	755	618
7	180	225	166	72	.....	96	40	468	3,180	1,600	815	[a] 522
8	195	210	152	72	.....	116	51	468	3,080	1,520	815	425
9	195	225	166	64	.....	116	64	468	3,080	1,520	755	405
10	166	210	166	64	.....	116	79	405	2,980	1,440	700	386
11	180	210	139	64	.....	116	106	425	2,980	1,440	645	425
12	166	225	139	64	.....	116	128	425	2,980	1,440	700	367
13	180	225	139	64	.....	139	139	468	2,880	1,360	700	367
14	166	257	139	72	.....	139	152	490	2,780	1,200	645	[a] 349
15	195	241	128	72	.....	139	210	540	2,680	1,200	700	331
16	195	241	139	72	.....	139	225	565	2,480	1,060	700	349
17	195	257	139	64	.....	139	241	618	2,190	1,060	645	331
18	195	241	139	64	.....	152	274	700	2,100	995	700	331
19	225	257	128	64	.....	152	309	700	1,920	875	645	331
20	225	257	128	72	.....	152	346	700	1,840	875	645	331
21	241	225	116	72	79	139	309	700	1,840	815	645	[a] 314
22	225	225	116	72	79	116	309	700	1,760	815	618	296
23	257	225	116	64	79	116	274	700	1,840	815	618	230
24	241	225	116	64	79	116	274	755	1,760	875	645	280
25	257	210	116	64	79	96	274	815	1,760	875	618	280
26	241	225	106	64	88	79	274	1,200	1,840	875	645	263
27	225	195	96	64	88	64	309	1,600	1,920	875	618	232
28	257	195	96	64	88	51	309	2,190	2,010	875	645	232
29	241	195	96	72	.....	51	327	2,680	2,100	875	618	232
30	257	180	88	72	.....	46	365	2,980	2,100	875	618	232
31	241	.....	88	72	.....	40	.....	3,080	.....	875	590	.....

[a] Interpolated.

NOTE.—Daily discharge Oct. 1, 1912, to Sept. 10, 1913, computed from a well-defined rating curve. Discharge Sept. 11–30, 1913, computed from a rating curve based on a discharge measurement made Dec. 19, 1913. Discharge Feb. 6–20, estimated on account of ice, 75 second-feet. Estimates for October and November differ from those published in Water-Supply Paper 325 because of revision of rating curve for stages below 2.0 feet.

Monthly discharge of St. Mary River near Babb, Mont., for the year ending Sept. 30, 1913.

[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 [a]	257	166	211	1.19	1.37	13,000	A.
November [a]	257	180	225	1.27	1.42	13,400	A.
December [a]	195	88	135	.763	.88	8,300	B.
January	79	64	68.8	.389	.45	4,230	C.
February	.....	.....	76.8	.434	.45	4,270	C.
March	152	40	106	.599	.69	6,520	C.
April	365	31	187	1.06	1.18	11,100	B.
May	3,080	385	885	5.00	5.76	54,400	A.
June	3,480	1,760	2,540	14.4	16.07	151,000	A.
July	2,280	815	1,250	7.06	8.14	76,900	A.
August	815	590	688	3.89	4.48	42,300	A.
September	645	232	389	2.20	2.46	23,100	B.
The year	3,480	31	564	3.19	43.35	409,000	

[a] Estimates differ from those published in Water-Supply Paper 325 because of revision of rating curve for stages below 2.0 feet.

ST. MARY RIVER BELOW SWIFTCURRENT CREEK AT BABB, MONT.[1]

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

Records available.—July 14, 1901, to October 18, 1902; May 13, 1910, to September 30, 1913.

Drainage area.—298 square miles.

Gage.—Chain gage installed July 19, 1911, on right bank about 100 feet farther downstream than staff gage installed on left bank May 13, 1910, and at a different datum. The original gage, which was used in 1901 and 1902, was a staff nailed to a pier of the highway bridge at Babb; it was destroyed by the flood of June 5, 1908. The gage installed May 13, 1910, was on the left bank about 75 feet below the old site and at a different datum. A temporary chain gage was also installed for low-water readings. On May 1, 1912, a gage was established on an overflow channel from Swiftcurrent Creek and gage readings obtained from May 2 to November 24. This overflow discharges into St. Mary River below the gage.

Channel and control.—Likely to change.

Discharge measurements.—In 1901 and 1902 made from highway bridge; in 1910 from a footbridge 100 feet above gage; in 1911 from a cable 50 feet above gage. Low-water measurements are made by wading. The overflow from Swiftcurrent Creek is measured from a footbridge.

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

Winter flow.—Discharge relation affected by ice.

Accuracy.—Rating curves for main stream and for Swiftcurrent Creek overflow well defined; records excellent except during winter months.

Discharge measurements of St. Mary River below Swiftcurrent Creek at Babb, Mont., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 16	W. A. Lamb	3.89	177	June 27	W. A. Lamb	7.12	2,720
Mar. 30	do	3.65	111	July 31	do	5.72	1,120
May 18	do	5.40	971	Aug. 21	do	5.27	866
June 12	R. R. Randell	7.96	4,030	Sept. 14	do	4.67	424

NOTE.—Measurements do not include flow from Swiftcurrent Creek.

Discharge measurements of Swiftcurrent Creek overflow at Babb, Mont., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 16	W. A. Lamb	4.4	[b] 2.0	June 27	W. A. Lamb	6.15	88
Mar. 30	do		(c)	July 31	do	5.18	21
May 18	do	6.3	108	Aug. 21	do	4.91	10
June 12	R. R. Randell	7.0	170	Sept. 14	do	4.6	4

[b] Estimated.

[c] No flow in the overflow channel.

[1] The records at this station for 1901 and 1902 were published in Water-Supply Paper 66 as for "St. Mary River at Main, Mont."

Daily gage height, in feet, of St. Mary River below Swiftcurrent Creek at Babb, Mont., for the year ending Sept. 30, 1913.

[Carl Giruin, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.25	4.3	4.2	3.7	3.4	3.6	3.6	4.9	8.25	7.2	5.65	5.15
2	4.2	4.3	4.2	3.65	3.4	3.55	3.6	4.9	8.35	7.15	5.65	5.1
3	4.2	4.3	4.2	3.65	3.5	3.65	3.6	4.9	8.35	7.0	5.65	5.1
4	4.2	4.3	4.15	3.65	3.6	3.65	3.6	4.95	8.15	6.8	5.65	5.15
5	4.2	4.3	4.15	3.65	3.6	3.7	3.55	4.8	8.15	6.65	5.7	5.15
6	4.15	4.25	4.15	3.65	3.7	3.7	3.5	4.85	8.15	6.7	5.65	5.0
7	4.15	4.25	4.05	3.65	3.7	3.65	3.55	4.85	7.95	6.7	5.55	5.05
8	4.2	4.2	4.05	3.65	3.9	3.75	3.6	4.8	7.95	6.65	5.6	5.0
9	4.15	4.2	4.05	3.6	3.95	3.75	3.6	4.8	7.9	6.6	5.7	5.05
10	4.1	4.2	4.05	3.6	3.9	3.75	3.7	4.65	8.05	6.55	5.8	4.75
11	4.05	4.2	4.05	3.6	3.95	3.75	3.7	4.7	8.1	6.6	5.75	4.6
12	4.05	4.25	3.95	3.6	4.0	3.75	3.8	4.8	8.0	6.5	5.75	4.65
13	4.1	4.3	3.95	3.65	4.0	3.8	3.9	4.9	7.9	6.45	5.85	4.75
14	4.05	4.35	3.95	3.65	4.1	3.85	4.0	5.1	7.85	6.3	5.6	4.8
15	4.15	4.35	3.85	3.65	4.15	3.85	4.4	5.0	7.8	6.15	5.7	4.8
16	4.2	4.35	3.85	3.65	4.25	3.85	4.55	5.1	7.55	6.0	5.6	4.7
17	4.25	4.4	3.85	3.6	4.2	3.8	4.9	5.3	7.4	5.85	5.75	4.7
18	4.3	4.35	3.85	3.6	4.1	3.9	5.4	5.5	7.4	5.9	5.5	4.7
19	4.4	4.35	3.8	3.6	4.0	3.95	5.7	5.5	7.15	5.85	5.4	4.6
20	4.35	4.35	3.8	3.6	3.85	3.95	5.6	5.5	7.1	5.8	5.35	4.6
21	4.35	4.3	3.8	3.65	3.9	4.0	5.45	5.6	7.1	5.85	5.25	4.6
22	4.4	4.3	3.8	3.5	3.8	3.95	5.3	5.7	6.95	5.85	5.3	4.6
23	4.4	4.3	3.8	3.5	3.7	3.9	5.4	5.8	6.9	5.85	5.25	4.6
24	4.4	4.3	3.8	3.45	5.7	3.9	5.25	6.3	6.95	5.9	5.25	4.5
25	4.35	4.3	3.8	3.4	3.6	3.8	5.1	6.55	6.8	5.85	5.25	4.5
26	4.3	4.25	3.75	3.35	3.65	3.75	5.05	7.1	6.9	5.95	5.3	4.4
27	4.3	4.25	3.75	3.35	3.6	3.65	5.1	7.4	7.15	5.85	5.25	4.4
28	4.4	4.25	3.75	3.35	3.6	3.7	5.1	8.0	7.5	5.9	5.35	4.4
29	4.35	4.2	3.75	3.4	.....	3.7	5.0	8.25	7.45	5.9	5.3	4.4
30	4.35	4.2	3.7	3.4	.....	3.65	4.9	8.2	7.2	5.9	5.25	4.3
31	4.35	.....	3.7	3.4	.....	3.65	.....	8.4	.....	5.65	5.1	.....

NOTE.—Discharge relation probably affected by ice about Feb. 6–24, 1913.

Daily discharge, in second-feet, of St. Mary River below Swiftcurrent Creek at Babb, Mont., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	324	347	307	122	46	95	95	657	4,200	2,790	1,120	730
2	302	347	307	108	46	82	95	657	4,340	2,720	1,120	696
3	302	347	307	108	70	108	95	657	4,340	2,530	1,120	696
4	302	347	285	108	95	108	95	689	4,060	2,280	1,120	730
5	302	347	285	108	95	122	82	595	4,060	2,100	1,160	730
6	281	324	285	108	.....	122	70	626	4,060	2,160	1,120	630
7	281	324	242	108	.....	108	82	626	3,780	2,160	1,040	663
8	302	302	242	108	.....	137	95	595	3,780	2,100	1,080	630
9	281	302	242	95	.....	137	95	595	3,710	2,040	1,160	663
10	260	302	242	95	.....	137	122	508	3,920	1,980	1,250	481
11	240	302	242	95	.....	137	122	536	3,990	2,040	1,210	400
12	240	324	203	95	.....	137	152	595	3,850	1,930	1,210	426
13	260	347	203	108	.....	152	184	657	3,710	1,880	1,300	481
14	240	371	203	108	.....	168	218	787	3,640	1,720	1,080	509
15	281	371	167	108	.....	168	382	721	3,570	1,570	1,160	509
16	302	371	167	108	.....	168	456	787	3,240	1,430	1,080	453
17	324	395	167	95	.....	152	657	925	3,050	1,300	1,210	453
18	347	371	167	95	.....	184	995	1,070	3,050	1,340	995	453
19	395	371	150	95	.....	201	1,230	1,070	2,720	1,300	914	400
20	371	371	150	95	.....	201	1,150	1,070	2,660	1,250	876	400
21	371	347	150	108	.....	218	1,030	1,150	2,660	1,300	802	400
22	395	347	150	70	.....	201	925	1,230	2,470	1,300	838	400
23	395	347	150	70	.....	184	995	1,310	2,410	1,300	802	400
24	395	347	150	58	.....	184	890	1,750	2,470	1,340	802	350
25	371	356	150	46	95	152	787	2,020	2,290	1,300	802	350
26	347	332	134	35	108	137	754	2,660	2,410	1,380	838	303
27	347	332	134	35	95	108	787	3,050	2,720	1,300	802	303
28	395	332	134	35	95	122	787	3,850	3,180	1,340	876	303
29	371	307	134	46	.....	122	721	4,200	3,120	1,340	838	303
30	371	307	118	46	.....	108	657	4,130	2,790	1,340	802	260
31	371	.....	118	46	.....	108	.....	4,410	.....	1,120	696	.....

NOTE.—Daily discharge computed as follows: Previous to Nov. 25 and after Dec. 31, 1912, from well-defined rating curves based on discharge measurements that do not include the flow in the Swiftcurrent overflow channel; Nov. 25 to Dec 31, 1912, from a well-defined rating curve based on measurements that include the flow in Swiftcurrent overflow channel. Discharge Feb. 6–24, 1913, estimated, because of ice, from gage heights and climatic records, at 150 second-feet.

Daily gage height, in feet, of Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1913.

[O. S. Main, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.9	5.0	.....	.....	.....	.....	.....	5.8	7.4	6.4	5.1	4.7
2	4.9	4.95	.....	.....	.....	.....	.....	5.8	7.3	6.2	5.1	4.7
3	4.9	4.95	.....	.....	.....	.....	.....	5.8	7.4	6.0	5.15	4.7
4	4.85	4.9	.....	.....	.....	.....	.....	5.85	7.3	5.9	5.2	4.7
5	4.85	4.85	.....	.....	.....	.....	.....	5.8	7.2	5.8	5.2	4.7
6	4.8	4.8	.....	.....	.....	.....	.....	5.8	7.2	5.65	5.2	4.7
7	4.8	4.7	.....	.....	.....	.....	.....	5.75	7.0	5.6	5.25	4.7
8	4.8	4.7	.....	.....	.....	.....	.....	5.7	7.0	5.6	5.3	4.6
9	4.8	4.65	.....	.....	.....	.....	.....	5.6	7.1	5.5	5.35	4.6
10	4.75	4.6	.....	.....	.....	.....	.....	5.6	6.9	5.55	5.4	4.6
11	4.75	4.7	.....	.....	.....	.....	.....	5.6	6.9	5.6	5.3	4.6
12	4.75	4.8	.....	.....	.....	.....	.....	5.8	7.0	5.5	5.4	4.6
13	4.75	4.9	.....	.....	.....	.....	4.8	5.9	6.9	5.45	5.1	4.6
14	4.8	5.0	.....	.....	.....	.....	5.0	6.1	6.85	5.4	5.3	4.3
15	4.9	5.1	.....	.....	.....	.....	5.4	6.2	6.5	5.35	5.3	4.4
16	5.0	5.2	.....	.....	.....	.....	5.8	6.25	6.5	5.2	5.4	4.5
17	5.1	5.25	.....	.....	.....	.....	5.9	6.3	6.4	5.2	5.45	4.6
18	5.2	5.25	.....	.....	.....	.....	6.0	6.4	6.35	5.1	5.5	4.7
19	5.3	5.25	.....	.....	.....	.....	6.2	6.5	6.3	4.9	5.4	4.7
20	5.3	5.25	.....	.....	.....	.....	6.3	6.5	6.4	4.85	5.3	4.7
21	5.3	5.25	.....	.....	.....	.....	6.3	6.5	6.45	4.8	5.2	4.7
22	5.25	5.25	.....	.....	.....	.....	6.0	6.7	6.4	4.8	5.3	4.7
23	5.25	5.1	.....	.....	.....	.....	6.0	6.9	6.2	4.75	5.4	4.8
24	5.2	5.0	.....	.....	.....	.....	5.9	7.0	6.25	4.7	5.3	4.8
25	5.2	.....	.....	.....	.....	.....	5.9	7.1	6.2	4.75	5.3	4.9
26	5.1	.....	.....	.....	.....	.....	6.0	7.2	6.05	4.8	5.4	4.9
27	5.1	.....	.....	.....	.....	.....	6.0	7.5	6.3	4.85	5.3	4.9
28	5.1	.....	.....	.....	.....	.....	5.95	7.4	6.7	5.1	5.2	4.6
29	5.1	.....	.....	.....	.....	.....	5.9	7.4	6.5	5.15	5.3	4.7
30	5.1	.....	.....	.....	.....	.....	5.85	7.4	6.5	5.3	5.2	4.7
31	5.0	.....	.....	.....	.....	.....	.....	7.3	.....	5.25	4.8	.....

Daily discharge, in second-feet, of Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	14	.....	.....	.....	.....	.....	66	214	116	18	6.0
2	10	12	.....	.....	.....	.....	.....	66	204	98	18	6.0
3	10	12	.....	.....	.....	.....	.....	66	214	82	20	6.0
4	9.2	10	.....	.....	.....	.....	.....	70	204	74	22	6.0
5	9.2	9.2	.....	.....	.....	.....	.....	66	194	66	22	6.0
6	8.0	8.0	.....	.....	.....	.....	.....	66	194	54	22	6.0
7	8.0	6.0	.....	.....	.....	.....	.....	62	174	50	25	6.0
8	8.0	6.0	.....	.....	.....	.....	.....	58	174	50	28	4.4
9	8.0	5.2	.....	.....	.....	.....	.....	50	184	42	32	4.4
10	7.0	4.4	.....	.....	.....	.....	.....	50	164	46	35	4.4
11	7.0	6.0	.....	.....	.....	.....	.....	50	164	50	28	4.4
12	7.0	8.0	.....	.....	.....	.....	.....	66	174	42	35	4.4
13	7.0	10	.....	.....	.....	.....	8.0	74	164	39	18	4.4
14	8.0	14	.....	.....	.....	.....	14	90	159	35	28	1.5
15	10	18	.....	.....	.....	.....	35	98	125	32	28	2.2
16	14	22	.....	.....	.....	.....	66	102	125	22	35	3.2
17	18	25	.....	.....	.....	.....	74	107	116	22	39	4.4
18	22	25	.....	.....	.....	.....	82	116	112	18	42	6.0
19	28	25	.....	.....	.....	.....	98	125	107	10	35	6.0
20	28	25	.....	.....	.....	.....	107	125	116	9.2	28	6.0
21	28	25	.....	.....	.....	.....	107	125	120	8.0	22	6.0
22	25	25	.....	.....	.....	.....	82	144	116	8.0	28	6.0
23	25	18	.....	.....	.....	.....	82	164	98	7.0	35	8.0
24	22	14	.....	.....	.....	.....	74	174	102	6.0	28	8.0
25	22	.....	.....	.....	.....	.....	74	184	98	7.0	28	10
26	18	.....	.....	.....	.....	.....	82	194	86	8.0	35	10
27	18	.....	.....	.....	.....	.....	82	224	107	9.2	28	10
28	18	.....	.....	.....	.....	.....	78	214	144	18	22	4.4
29	18	.....	.....	.....	.....	.....	74	214	125	20	28	6.0
30	18	.....	.....	.....	.....	.....	70	214	125	28	22	6.0
31	14	.....	.....	.....	.....	.....	.....	204	.....	25	8.0	.....

NOTE.—Daily discharge computed from a rating curve well defined above 28 second-feet (gage height 5.3 feet) and fairly well defined below that point.

Combined daily discharge, in second-feet, of St. Mary River and Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	334	361	307	122	46	95	95	723	4,410	2,910	1,140	736
2	312	359	307	108	46	82	95	723	4,540	2,820	1,140	702
3	312	359	307	108	70	108	95	723	4,550	2,610	1,140	702
4	311	357	285	108	95	108	95	759	4,260	2,350	1,140	736
5	311	356	285	108	95	122	82	661	4,250	2,170	1,180	736
6	289	332	285	108	(a)	122	70	692	4,250	2,210	1,140	636
7	289	330	242	108	(a)	108	82	688	3,950	2,210	1,060	669
8	310	308	242	108	(a)	137	95	653	3,950	2,150	1,110	634
9	289	307	242	95	(a)	137	95	645	3,890	2,080	1,190	667
10	267	306	242	95	(a)	137	122	558	4,080	2,030	1,280	485
11	247	308	242	95	(a)	137	122	586	4,150	2,090	1,240	404
12	247	332	203	95	(a)	137	152	661	4,020	1,970	1,240	430
13	267	357	203	108	(a)	152	192	731	3,870	1,920	1,320	485
14	248	385	203	108	(a)	168	232	877	3,800	1,760	1,110	510
15	291	389	167	108	(a)	168	417	819	3,700	1,600	1,190	511
16	316	393	167	108	(a)	168	522	889	3,360	1,450	1,120	456
17	342	420	167	95	(a)	152	731	1,030	3,170	1,320	1,250	457
18	369	396	167	95	(a)	184	1,080	1,190	3,160	1,360	1,040	459
19	423	396	150	95	(a)	201	1,330	1,200	2,830	1,310	949	406
20	399	396	150	95	(a)	201	1,260	1,200	2,780	1,260	904	406
21	399	372	150	108	(a)	218	1,140	1,280	2,780	1,310	824	406
22	420	372	150	70	(a)	201	1,010	1,370	2,590	1,310	866	406
23	420	365	150	70	(a)	184	1,080	1,470	2,510	1,310	837	408
24	417	361	150	58	(a)	184	964	1,920	2,570	1,350	830	358
25	393	356	150	46	95	152	861	2,200	2,390	1,310	880	360
26	365	332	134	35	108	137	836	2,850	2,500	1,390	873	313
27	365	332	134	35	95	108	869	3,270	2,830	1,310	830	313
28	413	332	134	35	95	122	865	4,060	3,320	1,360	898	307
29	389	307	134	46	.....	122	795	4,410	3,240	1,360	866	309
30	389	307	118	46	.....	108	727	4,340	2,920	1,370	824	266
31	385	.....	118	46	.....	108	.....	4,610	.....	1,140	704	.....

a Mean discharge Feb. 6–24 estimated 150 second-feet; see footnote to table of daily discharge for Swiftcurrent Creek.

Monthly discharge of St. Mary River and Swiftcurrent Creek overflow at Babb, Mont., for the year ending Sept. 30, 1913.

[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	423	247	340	1.14	1.31	20,900	A.
November	420	306	353	1.18	1.32	21,000	B.
December	307	118	196	.658	.76	12,100	B.
January	122	35	86.0	.289	.33	5,290	C.
February	.....	.....	128	.430	.45	7,110	C.
March	218	82	144	.483	.56	8,850	B.
April	1,330	70	537	1.80	2.01	32,000	B.
May	4,610	558	1,540	5.17	5.96	94,700	A.
June	4,550	2,390	3,490	11.7	13.05	208,000	A.
July	2,910	1,140	1,750	5.87	6.77	108,000	B.
August	1,320	704	1,030	3.46	3.99	63,300	B.
September	736	266	489	1.64	1.83	29,100	B.
The year	4,610	.....	842	2.83	38.34	610,000	

ST. MARY RIVER NEAR KIMBALL, ALBERTA.

Location.—In the SW. ¼ sec. 25, T. 1, R. 25 W. fourth meridian, about 1 mile above the dam and headgate of the Alberta Railway & Irrigation Co., and about 1 mile southwest of Kimball.

Records available.—January 1 to September 30, 1913. Records were obtained at Cook's ranch (St. Mary River near Cardston), about half a mile north of the boundary line and about 5 miles above this station, from September 4, 1902, to December 31, 1912. Records were also obtained by the Irrigation Branch, Department of the Interior, Canada, at a point about 3,000 feet below the present station, from 1905 to 1912. The flow at the three points is practically the same.

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

Gage.—Friez water stage register. Winter records are obtained from the staff gage at the Canadian station about 3,000 feet downstream.

Channel and control.—Shifting.

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

Diversions.—None above gage.

Winter flow.—Affected by ice.

Accuracy.—Estimates reliable.

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

Discharge measurements of St. Mary River at Kimball, Alberta, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 13	V. Meek	[a] 3.16	180	June 13	R. R. Randell	5.74	4,750
24	do	2.76	94	13	W. A. Burton	5.78	4,979
Feb. 6	G. F. Deas	2.70	100	27	F. R. Burfield	5.45	3,993
24	do	2.82	141	July 4	do	4.93	3,044
Mar. 11	do	2.95	220	21	do	3.66	1,354
Apr. 25	do	[a] 3.35	1,028	28	W. A. Lamb	3.71	1,450
May 4	F. R. Burfield	[b] 2.65	949	Aug. 7	F. R. Burfield	3.56	1,283
19	W. A. Lamb	3.45	1,590	20	W. A. Lamb	3.28	1,060
24	F. R. Burfield	3.96	2,260	28	F. R. Burfield	3.04	855
26	do	4.58	3,042	Sept. 13	W.A. Lamb	2.55	550
June 5	do	6.05	5,209	24	L. Danielson	[b] 2.35	468
9	do	5.76	5,007				

[a] Gage heights Jan. 13 to Apr. 25 refer to staff gage at the cable.
[b] Gage heights May 4 to Sept. 24 refer to the automatic gage.

Daily gage height, in feet, of St. Mary River at Kimball, Alberta, for the year ending Sept. 30, 1913.

[J. M. Dunn, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.00	2.45	2.55	2.36	2.76	6.05	5.29	3.54	2.98
2	3.00	2.65	2.55	2.37	2.74	6.09	5.24	3.53	2.98
3	3.00	2.85	2.55	2.38	2.70	6.07	5.12	3.59	2.93
4	3.00	2.85	2.65	2.38	2.68	6.06	4.94	3.60	2.94
5	3.20	2.70	2.70	2.43	2.65	6.01	4.81	3.59	2.86
6	3.40	2.70	2.75	2.53	2.62	5.99	4.71	3.57	2.86
7	3.30	2.80	2.80	2.63	2.60	5.81	4.65	3.55	2.74
8	3.35	2.90	2.95	2.64	2.62	5.83	4.58	3.64	2.70
9	3.40	2.80	2.95	2.94	2.64	5.82	4.53	3.82	2.60
10	3.43	2.82	2.95	3.06	2.57	5.86	4.47	3.96	2.56
11	3.50	2.82	2.95	3.19	2.71	5.98	4.47	3.86	2.46
12	3.55	2.85	2.87	3.19	2.89	6.07	4.45	3.78	2.38
13	3.45	2.85	2.80	3.54	3.02	5.89	4.37	3.72	2.37
14	3.60	2.90	2.80	3.04	3.09	5.79	4.24	3.69	2.34
15	3.60	3.00	2.85	2.05	3.09	5.67	4.06	3.65	2.35
16	2.90	3.00	2.90	1.65	3.18	5.55	3.91	3.53	2.40
17	1.98	3.00	2.90	3.45	3.24	5.56	3.78	3.45	2.43
18	1.90	3.00	2.86	3.50	3.37	5.55	3.70	3.40	2.47
19	2.00	3.00	2.91	3.50	3.45	5.56	3.65	3.33	2.50
20	2.06	3.00	2.81	3.55	3.33	5.56	3.62	3.24	2.53
21	2.00	2.95	2.81	2.99	3.30	5.43	3.65	3.18	2.49
22	2.30	2.95	2.79	2.98	3.42	5.02	3.68	3.11	2.51
23	2.90	2.95	2.68	2.86	3.71	4.97	3.67	3.07	2.47
24	2.76	2.82	2.62	2.84	4.00	4.90	3.65	3.03	2.36
25	3.00	2.70	2.57	2.90	4.32	4.92	3.69	3.02	2.37
26	2.30	2.70	2.57	2.90	4.66	5.12	3.89	3.04	2.26
27	2.00	2.65	2.57	2.96	5.15	5.42	3.84	3.02	2.20
28	1.95	2.63	2.42	2.93	5.17	5.65	3.75	3.02	2.20
29	2.30	.....	2.32	2.87	5.92	5.58	3.70	3.01	2.18
30	2.40	.....	2.32	2.81	6.01	5.41	3.71	3.00	2.19
31	2.45	.....	2.35	.....	6.00	.....	3.62	3.00	.....

NOTE.—Gage heights Jan. 1 to Apr. 20 read on staff gage at cable. Discharge relation was affected by ice Jan. 1 to Apr. 16.

Daily discharge, in second-feet, of St. Mary River at Kimball, Alberta, for the year ending Sept. 30, 1913.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	202	115	135	238	1,020	5,320	3,620	1,270	816
2	199	110	137	250	1,004	5,380	3,530	1,260	816
3	196	106	148	263	980	5,350	3,340	1,310	781
4	193	103	160	277	968	5,340	3,060	1,320	788
5	190	102	172	293	950	5,260	2,860	1,310	732
6	187	101	186	309	932	5,220	2,710	1,290	732
7	184	102	200	324	920	4,940	2,620	1,270	654
8	183	108	210	343	932	4,970	2,520	1,360	630
9	185	115	216	365	944	4,950	2,450	1,530	570
10	187	121	218	392	902	5,020	2,360	1,690	550
11	187	127	219	418	986	5,210	2,360	1,580	500
12	183	132	219	450	1,100	5,350	2,330	1,490	461
13	180	137	218	500	1,210	5,060	2,220	1,430	456
14	181	140	216	580	1,260	4,800	2,040	1,400	443
15	188	142	209	700	1,260	4,600	1,810	1,360	448
16	182	145	198	910	1,340	4,400	1,630	1,260	470
17	172	146	191	1,120	1,400	4,380	1,490	1,180	485
18	160	145	188	1,180	1,520	4,340	1,410	1,140	505
19	140	145	187	1,180	1,600	4,330	1,360	1,080	520
20	123	143	185	1,240	1,480	4,310	1,340	1,010	535
21	109	142	183	1,180	1,450	4,090	1,360	964	515
22	101	141	180	1,170	1,570	3,460	1,390	908	525
23	96	140	178	1,080	1,900	3,360	1,380	879	505
24	95	140	177	1,070	2,270	3,240	1,360	851	452
25	99	140	177	1,110	2,720	3,240	1,400	844	456
26	128	139	180	1,110	3,190	3,520	1,610	858	407
27	138	137	187	1,160	3,920	3,950	1,550	844	380
28	137	136	196	1,130	3,950	4,250	1,460	844	380
29	132	.....	205	1,090	5,110	4,110	1,410	837	372
30	127	.....	215	1,050	5,260	3,820	1,420	830	376
31	121	.....	226	.....	5,240	.....	1,340	830	.....

NOTE.—Discharge determined as follows: Jan. 1 to Apr. 16, estimated from current-meter measurements; Apr. 17–20, from rating curve for staff gage; Apr. 21 to June 13 and July 15 to Sept. 30, from two well-defined rating curves; June 14 to July 14, by indirect methods for shifting channel.

Monthly discharge of St. Mary River at Kimball, Alberta, for the year ending Sept. 30, 1913.

[Drainage area, 472 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	mean.	Per square mile.	
January	202	95	158	0.335	0.386
February	146	101	129	.273	.284
March	226	135	191	.405	.467
April	1,240	238	749	1.587	1.771
May	5,260	902	1,912	4.051	4.671
June	5,380	3,240	4,519	9.574	10.681
July	3,620	1,340	2,024	4.288	4.944
August	1,690	830	1,162	2.462	2.838
September	816	372	542	1.148	1.281

SWIFTCURRENT CREEK AT McDERMOTT LAKE, MONT.

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

Records available.—June 6, 1912, to September 30, 1913.

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. The control is a limestone reef at the lake outlet.

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

Winter flow.—Station not maintained during winter. Ice exists at the gage, but control section probably remains unobstructed.

Accuracy.—Rating curve for the year ending September 30, 1913, well defined below 700 second-feet. At gage height 3.0 feet the revised rating curve gives discharges about 10 per cent less than those published in Water-Supply Paper 325. Estimates for June and July, 1912, for stages above 2.5 feet should be therefore revised by persons having occasion to use them. Gage heights during low water may be affected by action of wind on the lake and therefore may not represent the mean flow for the day.

Discharge measurements of Swiftcurrent Creek at McDermott Lake, Mont., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 15	W. A. Lamb	1.39	[a] 26	July 30	W. A. Lamb	2.39	227
Apr. 1	do		[b] 8.7	Aug. 22	Lamb and Hoyt	2.13	122
June 26	do	2.93	456				

[a] Ice at gage and along shores; control not obstructed; measurement made by wading.
[b] Discharge relation affected by ice.

Daily gage height, in feet, of Swiftcurrent Creek at McDermott Lake, Mont., for the year ending Sept. 30, 1913.

[G. L. Roberts and F. M. Stevenson, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.8	1.8							3.6	3.35		2.15
2	1.8	1.8							3.65	3.25		
3	1.8	1.8							3.5	3.05	2.35	2.15
4	1.8	1.8							3.5	3.0		
5	1.8	1.8							3.55	2.95	2.35	
6	1.8	1.8							3.5			2.15
7	1.8	1.8							3.5		2.4	
8	1.8	1.8							3.6			
9	1.9								3.5		2.45	
10	1.9								3.5			
11	1.8								3.6		2.35	
12	1.8								3.5			
13	1.8								3.5		2.4	
14	1.8								3.5			
15	1.8								3.45		2.4	2.05
16	1.8							1.9	3.45			
17	1.8							2.0	3.35		2.35	
18	1.8							2.3	3.35			2.05
19	1.8							2.3	3.2		2.3	
20	1.8							2.45	3.35			1.95
21	1.8							2.4	3.25		2.2	
22	1.8							2.6	3.15			1.95
23	1.8							2.85	3.05			
24	1.8							3.1	3.0		2.2	2.0
25	1.8							3.3	2.95			
26	1.8							3.75	2.95		2.2	1.85
27								4.0	3.05			
28								4.25	3.55			
29								3.8	3.5		2.2	1.85
30								3.7	3.45			
31								3.75				

Daily discharge, in second-feet, of Swiftcurrent Creek at McDermott Lake, Mont., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	68	68							796	668	206	141
2	68	68							822	618	206	141
3	68	68							744	520	206	141
4	68	68							744	496	206	141
5	68	68							770	472	206	141
6	68	68							744		216	141
7	68	68							744		225	138
8	68	68							796		236	135
9	84								744		246	132
10	84								744		226	128
11	68								796		206	125
12	68								744		216	123
13	68								744		225	119
14	68								744		225	117
15	68								718		225	115
16	68							84	718		216	115
17	68							103	668		206	115
18	68							188	668		197	115
19	68							188	593		188	104
20	68							246	668		172	94
21	68							225	618		155	94
22	68							309	568		155	94
23	68							424	520		155	98
24	68							544	496		155	103
25	68							643	472		155	90
26	68							874	472		155	76
27	68							1,010	520		155	76
28	68							1,150	770		155	76
29	68							901	744		155	76
30	68							848	718		150	76
31	68							874			146	

NOTE.—Daily discharge computed from a rating curve well defined between 21 and 693 second-feet (gage heights 1.3 and 3.4 feet). Discharge interpolated for days on which gage was not read. Discharge July 6–31, 1913, estimated, by comparison with records of Swiftcurrent Creek at Sherburne Lake, at 270 second-feet.

Monthly discharge of Swiftcurrent Creek at McDermott Lake, Mont., for the year ending Sept. 30, 1913.

[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	84	68	69.0	2.20	2.54	4,240	B.
November 1–8	68	68	68.0	2.17	.65	1,080	B.
May 16–31	1,150	84	538	17.1	10.18	17,100	B.
June	822	472	687	21.9	24.43	40,900	B.
July	.....	.....	316	10.1	11.64	19,400	B.
August	246	146	192	6.11	7.04	11,800	B.
September	141	76	113	3.60	4.02	6,720	B.

SWIFTCURRENT CREEK AT SHERBURNE LAKE, MONT.

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

Records available.—July 1, 1912, to September 30, 1913.

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.

Diversion.—None above the 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, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 15	W. A. Lamb	2.53	[a]47	July 30	W. A. Lamb	3.98	340
June 11	R. R. Randell	6.38	1,180	Sept. 15	do	2.73	99
26	W. A. Lamb	5.06	642				

[a] Measurement made from ice.

Daily gage height, in feet, of Swiftcurrent Creek at Sherburne Lake, Mont., for the year ending Sept. 30, 1913.

[F. M. Stevenson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.44	2.39	2.30	.....	.....	.....	.....	3.2	7.1	.....	3.9	3.1
2	2.40	2.32	2.33	.....	.....	.....	.....	3.0	7.0	6.2	.....	.....
3	2.32	2.26	2.36	.....	.....	.....	.....	2.85	6.8	4.7	.....	3.1
4	2.35	2.20	2.40	.....	.....	.....	.....	2.8	6.7	.....	3.95	.....
5	2.36	2.26	2.5	.....	.....	.....	.....	2.7	6.6	4.5	.....	.....
6	2.40	2.28	2.6	.....	.....	.....	.....	2.7	6.5	.....	4.0	3.1
7	2.42	2.32	2.7	.....	.....	.....	.....	2.7	6.4	4.45	.....	.....
8	2.38	2.45	2.7	.....	.....	.....	.....	2.7	.....	.....	4.1	3.05
9	2.40	2.7	2.75	.....	.....	.....	.....	2.7	6.3	4.4	.....	.....
10	2.40	2.95	2.75	.....	.....	.....	.....	3.2	.....	.....	4.05	3.0
11	2.38	2.95	2.8	.....	.....	.....	.....	3.35	6.1	.....	.....	.....
12	2.36	2.8	.....	.....	.....	.....	.....	3.65	.....	4.5	4.0	.....
13	2.34	2.85	.....	.....	.....	.....	.....	3.85	6.0	.....	.....	2.95
14	2.26	2.8	.....	.....	.....	.....	.....	3.9	.....	4.4	4.0	.....
15	2.28	2.8	2.55	.....	.....	.....	.....	3.85	.....	.....	.....	2.9
16	2.39	2.7	.....	.....	.....	.....	.....	3.8	5.8	.....	4.0	.....
17	2.5	2.55	.....	.....	.....	.....	.....	3.6	.....	4.2	.....	2.65
18	2.85	2.44	.....	.....	.....	.....	.....	3.55	5.7	.....	3.9	.....
19	3.0	2.5	.....	.....	.....	.....	.....	3.45	.....	4.1	.....	.....
20	3.0	2.7	.....	.....	.....	.....	.....	3.35	5.7	.....	3.7	2.5
21	3.05	2.9	.....	.....	.....	.....	.....	3.45	.....	3.9	.....	.....
22	2.95	2.8	.....	.....	.....	.....	.....	3.75	.....	.....	3.35	2.55
23	3.05	2.6	.....	.....	.....	.....	.....	4.9	5.6	3.7	.....	.....
24	2.85	2.49	.....	.....	.....	.....	.....	5.4	.....	.....	3.2	.....
25	2.8	2.65	.....	.....	.....	.....	.....	6.0	5.6	.....	.....	2.6
26	2.6	2.55	.....	.....	.....	.....	.....	6.7	.....	3.6	.....	.....
27	2.55	2.41	.....	.....	.....	.....	.....	7.2	.....	.....	3.15	2.5
28	2.6	2.38	.....	.....	.....	.....	.....	7.8	6.5	3.7	.....	.....
29	2.7	2.32	.....	.....	.....	.....	.....	7.5	.....	.....	.....	2.5
30	2.6	2.28	.....	.....	.....	.....	.....	7.1	6.4	3.95	3.1	.....
31	2.55	.....	.....	.....	.....	.....	.....	7.0	.....	.....	.....	.....

Daily discharge, in second-feet, of Swiftcurrent Creek at Sherburne Lake, Mont., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	80	76	71	.....	.....	.....	.....	166	1,500	1,140	315	151
2	77	72	70	.....	.....	.....	.....	138	1,450	1,090	319	151
3	72	69	69	.....	.....	.....	.....	120	1,360	539	324	151
4	74	66	68	.....	.....	.....	.....	114	1,310	508	328	151
5	75	69	67	.....	.....	.....	.....	103	1,270	478	334	151
6	77	70	66	.....	.....	.....	.....	103	1,220	471	340	151
7	78	72	65	.....	.....	.....	.....	103	1,180	464	353	148
8	76	80	64	.....	.....	.....	.....	103	1,160	456	366	144
9	77	103	63	.....	.....	.....	.....	103	1,140	449	360	141
10	77	132	62	.....	.....	.....	.....	166	1,100	459	353	138
11	76	132	59	.....	.....	.....	.....	192	1,050	468	346	136
12	75	114	56	.....	.....	.....	.....	254	1,030	478	340	134
13	73	120	53	.....	.....	.....	.....	302	1,010	464	340	132
14	69	114	50	.....	.....	.....	.....	315	983	449	340	129
15	70	114	47	.....	.....	.....	.....	302	957	430	340	126
16	76	103	.....	.....	.....	.....	.....	290	930	412	340	112
17	84	88	.....	.....	.....	.....	.....	243	910	393	328	98
18	120	80	.....	.....	.....	.....	.....	232	891	380	315	93
19	138	84	.....	.....	.....	.....	.....	212	891	366	290	89
20	138	103	.....	.....	.....	.....	.....	192	891	340	266	84
21	144	126	.....	.....	.....	.....	.....	212	878	315	229	86
22	132	114	.....	.....	.....	.....	.....	278	866	290	192	88
23	144	93	.....	.....	.....	.....	.....	604	853	266	179	90
24	120	83	.....	.....	.....	.....	.....	779	853	258	166	91
25	114	98	.....	.....	.....	.....	.....	1,010	853	251	163	93
26	93	88	.....	.....	.....	.....	.....	1,310	975	243	161	88
27	88	78	.....	.....	.....	.....	.....	1,550	1,100	254	158	84
28	93	76	.....	.....	.....	.....	.....	1,850	1,220	266	156	84
29	103	72	.....	.....	.....	.....	.....	1,700	1,200	297	153	84
30	93	70	.....	.....	.....	.....	.....	1,500	1,180	328	151	84
31	88	.....	.....	.....	.....	.....	.....	1,450	.....	322	151	.....

NOTE.—Daily discharge computed from a rating curve well defined between 84 and 1,450 second-feet (gage heights, 2.5 and 7.0 feet).

Discharge interpolated for days on which gage was not read. Estimates for October, November, and December, 1912, differ from those published in Water-Supply Paper 325 because of revision of low-water section of the rating curve.

Monthly discharge of Swiftcurrent Creek at Sherburne Lake, Mont., for the year ending Sept. 30, 1913.

[Drainage area, 64.0 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	144	69	93.4	1.46	1.68	5,740	B.
November	132	66	92.0	1.44	1.61	5,470	B.
December 1-15	71	47	62.0	.969	.54	1,840	C.
May	1,850	103	516	8.06	9.29	31,700	B.
June	1,500	853	1,070	16.7	18.63	63,700	B.
July	1,140	243	430	6.72	7.75	26,400	B.
August	366	151	274	4.28	4.93	16,800	B.
September	151	84	116	1.81	2.02	6,900	B.

OTTERTAIL RIVER NEAR FERGUS FALLS, MINN.

Location.—At Threemile Bridge, 3½ miles northeast of Fergus Falls, between secs. 18 and 19, T. 133 N., R. 42 W., several miles above the outlet of Wall Lake and 20 miles below Ottertail Lake, through which the river flows.

Records available.—May 9, 1904, to October 22, 1913. A gaging station was maintained from May 1, 1899, to May 14, 1904, by the Engineer Corps, United States Army, at the outlet of Ottertail Lake, where the drainage area is about 12 per cent less than at the Geological Survey station, with no important tributaries intervening. The observations at Fergus Falls in connection with those at the outlet of Ottertail Lake furnish a 14-year record of flow of the river below Ottertail Lake. A concrete dam has been built about 500 feet below the gage for the purpose of diverting water into a power canal. Backwater from this dam appeared at the gage about October 4, 1913. The station was therefore discontinued on October 22, 1913, and reestablished on October 29, 1913, about 5 miles above the old site.

Drainage area.—1,310 square miles.

Gage.—Chain attached to the bridge; read once daily to half-tenths. Limits of use: Half-tenths below and tenths above 4.0 feet.

Channel and control.—Practically permanent.

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

Winter flow.—The river is frozen over from December to March and measurements are made to determine the winter flow.

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 recorded range of stage has not exceeded 2 feet. 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. Small lakes through which the river flows before reaching the gaging station tend to equalize the flow at the latter point. 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.

Discharge measurements of Ottertail River near Fergus Falls, Minn., during the period Oct. 1, 1912, to Oct. 22, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
1912.				1913.			
Dec. 17	S. B. Soulé	3.23	[a] 152	Feb. 20	S. B. Soulé	3.86	[a] 73.9
				May 27	do	2.88	247
1913.				Oct. 22	W. G. Hoyt	3.45	343
Jan. 18	do	3.47	[a] 97.5				

[a] Complete ice cover.

Daily gage height, in feet, of Ottertail River near Fergus Falls, Minn., for period Oct. 1, 1912, to Oct. 22, 1913.

[H. G. Evensen, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.7	2.7	2.8	.....	.....	.....	3.8	2.8	2.85	2.8	2.7	2.9	2.85
2	2.7	2.7	2.8	.....	.....	.....	3.75	2.8	2.85	2.8	2.7	2.9	2.9
3	2.7	2.7	2.9	3.4	.....	.....	3.6	2.8	2.9	2.8	2.7	3.1	2.9
4	2.7	2.7	.....	.....	.....	.....	3.4	2.8	2.9	3.6	2.7	3.1	3.4
5	2.7	2.65	.....	.....	.....	.....	3.3	2.8	2.9	3.8	2.7	3.05	3.4
6	2.7	2.65	.....	.....	3.4	3.7	3.2	2.8	2.9	3.6	2.7	3.0	3.4
7	2.65	2.65	.....	.....	.....	.....	3.05	2.85	2.9	3.45	2.7	3.0	3.4
8	2.65	2.7	.....	.....	.....	.....	2.95	2.85	2.9	3.3	2.7	3.4	3.4
9	2.7	2.6	.....	.....	.....	.....	2.9	2.85	2.85	3.3	2.7	3.4	3.35
10	2.6	2.7	2.85	3.4	.....	.....	2.85	2.85	2.85	3.2	2.7	3.4	3.35
11	2.7	2.7	.....	.....	.....	.....	2.7	2.85	2.85	3.2	2.65	3.35	3.35
12	2.7	2.7	.....	.....	.....	.....	2.6	2.85	2.8	3.1	2.65	3.3	3.35
13	2.7	2.7	.....	.....	.....	4.3	2.6	2.85	2.8	3.0	2.65	3.3	3.35
14	2.7	2.7	.....	.....	3.6	.....	2.6	2.9	2.8	2.95	3.0	3.3	3.4
15	2.7	2.7	.....	.....	.....	.....	2.55	2.9	2.8	2.9	3.0	3.25	3.4
16	2.65	2.7	.....	3.55	.....	.....	2.55	2.95	2.8	2.9	2.9	3.25	3.4
17	2.65	2.7	3.25	.....	.....	.....	2.6	2.95	2.8	2.85	2.9	3.2	3.4
18	2.65	2.7	.....	3.5	.....	.....	2.65	2.95	2.75	2.8	2.9	3.15	3.4
19	2.65	2.7	3.3	.....	.....	.....	2.7	2.95	2.75	2.8	3.1	3.1	.....
20	2.65	2.6	.....	.....	3.85	.....	2.7	2.9	2.75	2.8	3.1	3.0	.....
21	2.65	2.75	.....	.....	.....	4.2	2.7	2.9	2.75	2.8	3.05	3.0	.....
22	2.65	2.75	.....	.....	.....	.....	2.7	2.9	2.75	2.8	3.05	3.0	3.45
23	2.65	2.75	.....	3.6	.....	.....	2.75	2.95	2.75	2.8	3.05	3.0	.....
24	2.7	2.75	.....	.....	.....	.....	2.75	2.95	2.75	2.85	3.0	3.0	.....
25	2.7	2.75	.....	.....	.....	.....	2.75	2.95	2.8	2.85	3.0	2.95	.....
26	2.7	2.7	3.4	.....	.....	.....	2.75	2.95	2.8	2.85	3.0	2.95	.....
27	2.7	2.7	.....	.....	3.65	.....	2.75	2.9	2.8	2.85	2.95	2.9	.....
28	2.7	2.8	.....	.....	.....	4.1	2.75	2.9	2.8	2.8	2.95	2.9	.....
29	2.7	2.7	.....	.....	.....	.....	2.8	2.9	2.8	2.8	2.9	2.9	.....
30	2.6	2.8	.....	3.65	.....	3.9	2.8	2.85	2.8	2.75	2.9	2.85	.....
31	2.7	.....	.....	.....	.....	3.85	.....	2.85	.....	2.75	2.9	.....	.....

NOTE.—Discharge relation affected by ice about Nov. 30, 1912, to Apr. 11, 1913, and by backwater from the dam about Oct. 4–22, 1913. See "Gage" in station description.

Daily discharge, in second-feet, of Ottertail River near Fergus Falls, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	201	201	.....	.....	.....	.....	.....	236	255	236	201	274
2	201	201	.....	.....	.....	.....	.....	236	255	236	201	274
3	201	201	.....	.....	.....	.....	.....	236	274	236	201	357
4	201	201	.....	.....	.....	.....	.....	236	274	607	201	357
5	201	184	.....	.....	.....	.....	.....	236	274	726	201	336
6	201	184	.....	.....	.....	.....	.....	236	274	607	201	315
7	184	184	.....	.....	.....	.....	.....	255	274	526	201	315
8	184	201	.....	.....	.....	.....	.....	255	274	449	201	499
9	201	168	.....	.....	.....	.....	.....	255	255	449	201	499
10	168	201	.....	.....	.....	.....	.....	255	255	402	201	499
11	201	201	.....	.....	.....	.....	.....	255	255	402	184	474
12	201	201	.....	.....	.....	.....	168	255	236	357	184	449
13	201	201	.....	.....	.....	.....	168	255	236	315	184	449
14	201	201	.....	.....	.....	.....	168	274	236	294	315	449
15	201	201	.....	.....	.....	.....	153	274	236	274	315	426
16	184	201	.....	.....	.....	.....	153	294	236	274	274	426
17	184	201	.....	.....	.....	.....	168	294	236	255	274	402
18	184	201	.....	.....	.....	.....	184	294	218	236	274	380
19	184	201	.....	.....	.....	.....	201	294	218	236	357	357
20	184	168	.....	.....	.....	.....	201	274	218	236	357	315
21	184	218	.....	.....	.....	.....	201	274	218	236	336	315
22	184	218	.....	.....	.....	.....	201	274	218	236	336	315
23	184	218	.....	.....	.....	.....	218	294	218	236	336	315
24	201	218	.....	.....	.....	.....	218	294	218	255	315	315
25	201	218	.....	.....	.....	.....	218	294	236	255	315	294
26	201	201	.....	.....	.....	.....	218	294	236	255	315	294
27	201	201	.....	.....	.....	.....	218	274	236	255	294	274
28	201	236	.....	.....	.....	.....	218	274	236	236	294	274
29	201	201	.....	.....	.....	.....	236	274	236	236	274	274
30	168	[a] 200	.....	.....	.....	.....	236	255	236	218	274	255
31	201	.....	.....	.....	.....	.....	.....	255	.....	218	274	.....

[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, climatic records, as follows: Dec. 1–31, 164 second-feet; Jan. 1–17, 112 second-feet; Jan. 18–31, 92 second-feet; Feb. 1–19, 80 second-feet; Feb. 20–28, 70 second-feet; Mar. 1–31, 130 second-feet; and Apr. 1–11, 150 second-feet.

Discharge for the period Oct. 1–22, 1913, estimated as follows: Oct. 1, 255 second-feet; Oct. 2 and 3, 274 second-feet; and Oct. 4–22, 318 second-feet. See "Gage" in station description.

Monthly discharge of Ottertail River neat Fergus Falls, Minn., from Oct. 1, 1912, to Oct. 22, 1913.

[Drainage area, 1,310 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, 1912	201	168	193	0.147	0.17	11,900	A.
November	236	168	201	.153	.17	12,000	A.
December	.....	.....	164	.125	.14	10,100	B.
January	.....	.....	103	.079	.09	6,330	C.
February	.....	.....	76.8	.059	.06	4,270	C.
March	.....	.....	130	.099	.11	7,990	C.
April	236	.....	180	.137	.15	10,700	C.
May	294	236	266	.203	.23	16,400	B.
June	274	218	243	.185	.21	14,500	B.
July	726	218	322	.246	.28	19,800	B.
August	357	184	261	.199	.23	16,000	B.
September	499	255	359	.274	.31	21,400	B.
The year	726	.....	209	.160	2.15	151,000	
Oct. 1–22, 1913	.....	.....	311	.237	.19	13,600	B.

RED RIVER AT FARGO, N. DAK.

Location.—At 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, 1913.

Drainage area.—6,020 square miles.

Gage.—Vertical staff attached to the breakwater for the center pier of the Front Street Bridge; read from the bridge or the river banks by the aid of a field glass.

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

Discharge measurements.—Made from the Front Street Bridge and the Northern Pacific Railway bridge.

Winter flow.—Discharge relation affected by ice from about the middle of November to the first of April; observations discontinued. At the spring break-up on account of the comparatively sluggish current and the fact that the river flows northward into a colder district, a pronounced backwater effect is usually caused by ice jams and partial ice jams.

Regulation.—There is a low dam of steel sheet piling a few rods below the footbridge at Fargo Waterworks, one-half mile above the gage. This dam, a tight overflow weir without sluices, was built in August, 1910, 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. Conditions of flow at the gage are not affected by this dam.

Accuracy.—Because of the inaccessibility of the gage, the relatively poor conditions for making accurate discharge measurements, and the slightly shifting channel, records can not be rated better than fair.

Discharge measurements of Red River at Fargo, N. Dak., during the year ending Sept. 30, 1913.

Date.	Made by.	Gage height.	Discharge.	Date.	Made by.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 30	W. B. Stevenson	7.53	228	Aug. 23	W. B. Stevenson	8.88	524
June 2	do	8.31	336	Sept. 11	do	8.91	568
Aug. 9	do	7.28	172				

Daily gage height, in feet, of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1913.

[E. H. Grasse, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.0	7.7	7.1	.....	.....	.....	8.6	7.9	8.2	8.1	7.9	7.6
2	7.9	7.6	7.1	.....	.....	.....	8.8	7.9	8.2	8.5	7.8	7.4
3	7.9	7.7	7.2	.....	.....	.....	8.8	7.9	8.3	8.8	7.7	7.4
4	7.8	7.7	7.2	.....	.....	.....	8.9	8.0	8.3	9.0	7.4	7.5
5	7.7	7.8	7.1	.....	.....	.....	9.0	8.1	8.3	9.4	7.3	7.7
6	7.6	7.7	7.1	.....	.....	.....	9.1	8.1	8.2	10.8	7.2	8.0
7	7.6	7.5	7.1	.....	.....	.....	9.2	8.0	8.2	11.4	7.2	8.2
8	7.7	7.4	.....	.....	.....	.....	9.2	7.9	8.2	11.9	7.2	8.4
9	7.7	7.5	.....	.....	.....	.....	9.0	8.0	8.2	11.8	7.1	8.5
10	7.7	7.5	.....	.....	.....	.....	8.8	8.0	8.2	11.7	7.2	8.9
11	7.6	7.6	.....	.....	.....	.....	8.7	8.0	8.3	11.1	7.2	9.0
12	7.6	7.6	.....	.....	.....	.....	8.5	8.0	8.3	10.6	7.3	9.1
13	7.6	7.5	.....	.....	.....	.....	8.6	8.0	8.2	9.9	7.3	9.3
14	7.6	7.4	.....	.....	.....	.....	8.8	8.1	8.2	9.7	7.4	9.5
15	7.7	7.3	.....	.....	.....	.....	10.0	8.1	8.1	9.5	7.4	9.7
16	7.7	7.2	.....	.....	.....	.....	9.6	8.2	8.0	9.2	7.3	9.9
17	7.7	7.1	.....	.....	.....	.....	9.3	8.3	7.9	9.1	7.4	9.7
18	7.6	7.1	.....	.....	.....	.....	8.5	8.3	7.9	8.5	7.5	9.1
19	7.5	7.2	.....	.....	.....	.....	8.2	8.3	8.0	8.2	7.6	8.6
20	7.5	7.3	.....	.....	.....	.....	8.2	8.3	8.0	8.2	7.9	8.4
21	7.6	7.4	.....	.....	.....	.....	8.1	8.4	8.0	8.2	8.1	8.3
22	7.6	7.4	.....	.....	.....	.....	8.0	8.4	8.0	8.1	8.6	8.2
23	7.6	7.4	.....	.....	.....	.....	8.0	8.5	8.0	8.1	8.9	8.0
24	7.6	7.3	.....	.....	.....	.....	8.0	8.6	8.1	8.1	8.8	7.9
25	7.5	7.2	.....	.....	.....	.....	7.9	8.6	8.1	8.1	8.7	7.9
26	7.5	7.0	.....	.....	.....	.....	7.9	8.5	8.1	8.1	8.6	7.9
27	7.5	6.9	.....	.....	.....	7.3	7.9	8.5	8.1	8.0	8.4	7.9
28	7.5	7.0	.....	.....	.....	7.4	8.0	8.4	8.0	8.0	8.2	8.0
29	7.5	7.0	.....	.....	.....	7.9	8.0	8.4	8.0	8.0	8.0	8.0
30	7.6	7.1	.....	.....	.....	8.1	7.9	8.4	7.9	7.9	7.9	8.0
31	7.6	.....	.....	.....	.....	8.4	.....	8.3	.....	8.0	7.8	.....

NOTE.—Discharge relation affected by ice about Nov. 19, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	326	261	93	.....	.....	.....	455	290	358	335	290	227
2	304	240	78	.....	.....	.....	508	290	358	430	268	190
3	304	261	93	.....	.....	.....	508	290	382	508	247	190
4	282	261	78	.....	.....	.....	536	312	382	565	190	208
5	261	282	64	.....	.....	.....	565	335	382	685	173	247
6	240	261	64	.....	.....	.....	595	335	358	1,120	157	312
7	240	220	64	.....	.....	.....	625	312	358	1,300	157	358
8	261	200	.....	.....	.....	.....	625	290	358	1,460	157	406
9	261	220	.....	.....	.....	.....	565	312	358	1,430	142	430
10	261	220	.....	.....	.....	.....	508	312	358	1,400	157	536
11	240	240	.....	.....	.....	.....	481	312	382	1,210	157	565
12	240	240	.....	.....	.....	.....	430	312	382	1,060	173	595
13	240	220	.....	.....	.....	.....	455	312	358	839	173	655
14	240	200	.....	.....	.....	.....	508	335	358	777	190	715
15	261	181	.....	.....	.....	.....	870	335	335	715	190	777
16	261	162	.....	.....	.....	.....	746	358	312	625	173	839
17	261	144	.....	.....	.....	.....	655	382	290	595	190	777
18	240	144	.....	.....	.....	.....	430	382	290	430	208	595
19	220	144	.....	.....	.....	.....	358	382	312	358	227	455
20	220	162	.....	.....	.....	.....	358	382	312	358	290	406
21	240	162	.....	.....	.....	.....	335	406	312	358	335	382
22	240	162	.....	.....	.....	.....	312	406	312	335	455	358
23	240	162	.....	.....	.....	.....	312	430	312	335	536	312
24	240	144	.....	.....	.....	.....	312	455	335	335	508	290
25	220	126	.....	.....	.....	.....	290	455	335	335	481	290
26	220	94	.....	.....	.....	.....	290	430	335	335	455	290
27	220	78	.....	.....	.....	.....	290	430	335	312	406	290
28	220	93	.....	.....	.....	.....	312	406	312	312	358	312
29	220	93	.....	.....	.....	.....	312	406	312	312	312	312
30	240	93	.....	.....	.....	.....	290	406	290	290	290	312
31	240	.....	.....	.....	.....	.....	.....	382	.....	312	268	.....

NOTE.—Daily discharge computed from two fairly well defined rating curves. Discharge estimated because of ice from Nov. 19 to Dec. 7, 1912.

Monthly discharge of Red River at Fargo, N. Dak., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	326	220	248	B.
November	282	78	182	C.
December	93	64	76.3	D.
April	870	290	461	C.
May	455	290	361	C.
June	382	290	339	C.
July	1,460	290	638	B.
August	536	142	270	A.
September	839	190	421	B.

RED RIVER AT GRAND FORKS, N. DAK.

Location.—At the 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, 1913. Gage-height records have, however, been kept by the United States Engineer Corps for about 30 years at this point.

Drainage area.—25,000 square miles.

Gages.—Staff and chain, attached to Northern Pacific Railway bridge. As a rule the chain gage is read only during periods of extremely low water. The United States Engineer Corps gage is on the breakwater to which the United States Geological Survey staff gage is attached, but at a datum 5 feet higher.

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

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

Winter flow.—The river flows under smooth ice from about the middle of November to the middle of April; the flow during the winter fluctuates little, and since 1895 enough discharge measurements have been made each winter to give fairly satisfactory summaries for the winter.

When the ice breaks up in the spring, because the river has only a gentle current and because it flows north into cooler regions where the river is not yet open, the gage reading is usually excessively and disproprotionately high for a few days or weeks, so that the figures for quantity of flow must depend largely on estimation; actual measurements when the river appeared entirely open and clear of ice at this point have sometimes shown the gage reading to be 5 feet greater than would have been needed for the same discharge later in the season, after the whole length of the river was entirely open.

Regulation.—There are no dams or other obstructions below, nor rapids, the channel being fairly uniform for miles. Above there are no power plants, dams, or reservoirs affecting the flow nearer than Crookston, on Red Lake River, 25 miles above Grand Forks, along the general course of the valley; about half the water comes from Red Lake River, but the storage at the Crookston plant is so small that no fluctuations caused by it have been discovered at Grand Forks. On the other branch, the Red River proper, and its tributaries above Grand Forks, there are no reservoirs or power plants for a hundred miles above.

Discharge measurements of Red River at Grand Forks, N. Dak., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 12	Chandler and Stevenson	6.30	1,210	Apr. 17	E. J. Budge	15.86	7,310
Nov. 8	W. B. Stevenson	5.12	923	28	do	10.47	3,620
12	do	5.02	942	May 12	do	7.24	1,730
Dec. 12	do	5.00	a473	23	do	6.84	1,620
Jan. 25	E. J. Budge	4.50	a319	July 3	Chandler and Stevenson.	5.18	973
Mar. 8	W. B. Stevenson	3.90	a196				
21	E. J. Budge	4.80	a326	Sept. 8	do	4.09	568

a River frozen over.

Daily gage height, in feet, of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1913.

[H. L. Hayes, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9.0	5.7					7.9	8.8	6.4	5.2	5.0	4.9
2	8.8	5.6					10.0	8.7	6.3	5.3	5.1	4.8
3	8.6	5.2				3.0	14.5	8.0	6.4	5.1	4.8	4.6
4	8.3	5.2		4.4			18.6	8.4	6.5	5.0	4.8	4.4
5	7.8	5.2					22.4	7.7	6.6	4.9	4.7	4.3
6	7.4	5.1					25.3	8.0	6.6	4.8	4.6	4.2
7	7.0	5.0	5.2		3.2		26.4	7.6	6.8	4.7	4.4	4.1
8	6.8	5.1					26.6	7.9	6.5	4.8	4.4	4.0
9	6.7	5.2					26.4	7.8	6.4	5.1	4.4	4.0
10	6.6	5.2					25.4	7.6	6.4	6.2	4.2	4.3
11	6.4	5.2		4.3			24.0	7.4	6.2	6.8	4.1	5.3
12	6.3	5.0	5.0				22.6	7.3	6.2	7.1	4.0	6.0
13	6.0	5.0					20.4	7.2	6.1	7.0	4.0	6.6
14	5.9	4.9	4.8				18.2	7.2	6.0	6.8	4.0	6.5
15	5.8	4.8			3.0		16.8	7.2	5.8	6.5	4.0	6.4
16	5.6	4.5					16.2	7.2	5.6	6.2	4.0	6.3
17	5.5	4.6					15.9	7.0	5.4	6.0	4.0	6.6
18	5.6	4.0		4.1			15.5	7.2	5.3	5.8	4.0	6.9
19	5.5	4.4					14.9	7.0	5.4	5.6	4.3	7.0
20	5.5	4.6			3.1		14.0	7.1	5.4	5.4	4.4	6.8
21	5.4	4.5	4.7				13.1	7.1	5.4	5.3	4.4	6.5
22	5.3	5.2				3.5	12.6	7.0	5.3	5.2	4.3	6.1
23	5.4	4.8					12.0	6.8	5.4	4.9	4.3	5.7
24	5.6	5.0					11.4	6.6	5.3	4.6	4.6	5.4
25	5.7	4.5		3.9			10.0	6.8	5.4	4.6	5.0	5.2
26	5.7	4.5					9.8	6.6	5.2	4.6	5.4	5.0
27	5.7	5.0					10.2	6.7	5.1	4.6	5.6	4.8
28	5.7	4.7	4.6				10.6	6.7	5.0	4.4	5.6	4.6
29	5.7	4.8				5.4	9.8	6.4	5.0	4.4	5.6	4.4
30	5.7	4.4		3.5		5.1	9.6	6.6	5.0	4.5	5.5	4.3
31	5.6					5.8		6.3		4.8	5.2	

NOTE.—Discharge relation affected by ice about Nov. 19, 1912, to Apr. 12, 1913.

Daily discharge, in second-feet, of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,520	1,150						2,590	1,420	962	890	855
2	2,410	1,110						2,530	1,380	998	926	820
3	2,310	962						2,150	1,420	926	820	752
4	2,150	962						2,370	1,460	890	820	686
5	1,900	962						2,000	1,500	855	786	654
6	1,700	926						2,150	1,500	820	752	622
7	1,520	890						1,950	1,590	786	686	591
8	1,430	926						2,100	1,460	820	686	560
9	1,390	962						2,050	1,420	926	686	560
10	1,340	962						1,950	1,420	1,340	622	654
11	1,260	962						1,850	1,340	1,590	591	998
12	1,210	890						1,810	1,340	1,720	560	1,260
13	1,090	890					11,200	1,760	1,300	1,670	560	1,500
14	1,050	855					9,250	1,760	1,260	1,590	560	1,460
15	1,010	820					8,080	1,760	1,180	1,460	560	1,420
16	940	719					7,610	1,760	1,110	1,340	560	1,380
17	905	752					7,370	1,670	1,030	1,260	560	1,500
18	940	560					7,070	1,760	998	1,180	560	1,630
19	905						6,630	1,670	1,030	1,110	654	1,670
20	905						5,980	1,720	1,030	1,030	686	1,590
21	885						5,350	1,720	1,030	998	686	1,460
22	864						5,010	1,670	998	962	654	1,300
23	912						4,600	1,590	1,030	855	654	1,150
24	998						4,200	1,500	998	752	752	1,030
25	1,050						3,300	1,590	1,030	752	890	962
26	1,070						3,180	1,500	962	752	1,030	890
27	1,080						3,430	1,540	926	752	1,110	820
28	1,100						3,680	1,540	890	686	1,110	752
29	1,110						3,180	1,420	890	686	1,110	686
30	1,130						3,050	1,500	890	719	1,070	654
31	1,110							1,380		820	962	

NOTE.—Discharge determined from two curves, the first applicable from Oct. 1–20, 1912, and well defined above 1,000 second-feet and fairly well defined between 600 and 1,000 second-feet; the second applicable from Nov. 1 to 18, 1912, and Apr. 13 to Sept. 30, 1913, and well defined above 800 second-feet. Shifting-channel method used from Oct. 21 to 31, 1912. Mean discharge for periods affected by ice estimated from discharge measurements, observer's notes, and weather reports, as follows: Nov. 19–30, 650 second-feet; Dec. 1–31, 1912, 422 second-feet; Jan. 1–31, 1913, 318 second-feet; Feb. 1–28, 233 second-feet; Mar. 1–31, 282 second-feet; and Apr. 1–12, 9,140 second-feet. Discharge Nov. 1–18, 1912, differs from that published in Water Supply Paper 325 on account of a revision of the rating curve.

Monthly discharge of Red River at Grand Forks, N. Dak., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	2,520	864	1,300	B.
November	1,150		802	B.
December			422	C.
January			318	C.
February			233	C.
March			282	C.
April			7,060	C.
May	2,590	1,380	1,820	A.
June	1,590	890	1,190	A.
July	1,720	686	1,030	A.
August	1,110	560	760	B.
September	1,670	560	1,030	A.
The year			1,350	

WILD RICE RIVER AT TWIN VALLEY, MINN.

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

Records available.—June 30, 1909, to September 30, 1913.

Drainage area.—805 square miles.

Gage.—Vertical staff; read 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. The 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 station.

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.—There is a dam across the river at Heiberg, but the highest point affected by the backwater is more than a mile below Twin Valley. Discharge at the station is affected by the storage created by the dams at the lower end of Lower Rice Lake and at the outlet of Twin Lakes.

Discharge measurements of Wild Rice River at Twin Valley, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 24	W. B. Stevenson	[a] 5.23	16.3	Sept. 6	W. B. Stevenson	[b] 5.11	56.6
Feb. 9	E. J. Budge	[a] 5.80	10.4	7	do	[b] 5.48	101
Apr. 12	do	6.30	332				

[a] Complete ice cover.
[b] Measurement made by wading at a section 200 feet below gage. Discharge relation affected by back water from a log jam 100 feet below gage.

Daily gage height, in feet, of Wild Rice River at Twin Valley, Minn., for the year ending Sept. 30, 1913.

[Axel Johnson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.4	5.3	.....	.....	.....	.....	8.8	5.3	6.6	5.0	6.5	4.50
2	5.3	5.25	.....	.....	.....	.....	9.5	5.2	6.45	4.90	6.5	4.80
3	5.25	5.25	.....	.....	.....	5.6	9.4	5.2	6.6	4.90	6.4	4.90
4	5.15	5.2	.....	.....	5.45	.....	9.0	5.2	6.6	4.90	6.3	5.05
5	5.1	5.2	.....	.....	.....	.....	8.1	5.35	6.8	4.82	6.15	5.25
6	5.1	5.2	.....	5.45	.....	.....	7.6	5.3	6.7	4.80	6.0	5.1
7	5.1	5.2	.....	.....	.....	.....	7.3	5.3	6.6	4.80	6.0	5.4
8	5.0	5.2	.....	.....	.....	.....	6.8	5.15	6.6	4.80	5.9	5.0
9	4.90	5.2	5.0	.....	.....	.....	6.6	5.1	6.5	4.80	5.8	5.3
10	4.90	5.0	.....	.....	5.65	7.0	6.5	5.2	6.5	4.80	5.8	5.5
11	4.90	4.90	.....	.....	.....	.....	6.4	5.2	6.45	4.80	5.8	5.4
12	4.90	4.85	.....	.....	.....	.....	6.35	5.15	6.5	4.72	5.7	5.45
13	4.90	4.80	.....	.....	.....	.....	6.2	5.1	6.1	4.80	5.6	5.4
14	4.90	4.70	.....	5.65	.....	.....	6.2	5.1	5.75	4.88	5.6	5.2
15	4.80	4.70	.....	.....	.....	.....	5.95	5.1	6.1	4.92	5.6	5.1
16	4.80	4.70	5.1	.....	.....	.....	5.8	5.3	6.15	4.90	5.4	5.1
17	5.0	4.80	.....	.....	5.55	5.95	5.7	5.4	6.2	4.90	5.8	5.2
18	6.05	4.80	.....	.....	.....	4.60	5.8	5.25	6.25	4.90	5.4	5.2
19	5.9	4.70	.....	.....	.....	.....	5.5	5.1	6.25	4.78	5.4	5.1
20	5.9	4.60	.....	5.75	.....	.....	5.5	5.1	6.3	4.68	5.4	5.0
21	5.9	4.70	.....	.....	.....	.....	5.5	5.15	6.3	4.70	5.3	4.90
22	5.9	4.70	.....	.....	.....	.....	5.4	5.1	6.05	4.70	5.2	4.80
23	5.9	4.60	5.2	.....	.....	.....	5.9	5.1	6.0	4.70	5.1	4.80
24	5.9	4.65	5.2	.....	5.55	5.65	6.1	5.1	6.05	4.70	5.0	4.80
25	5.8	4.70	.....	.....	.....	.....	5.85	5.05	5.9	4.85	4.90	4.80
26	5.7	4.90	.....	.....	.....	.....	5.65	4.92	5.9	5.7	4.80	4.90
27	5.6	4.90	.....	5.35	.....	.....	5.5	5.45	5.85	6.3	4.90	4.90
28	5.6	5.1	.....	.....	.....	.....	5.45	5.7	5.5	6.6	4.95	4.90
29	5.55	5.15	.....	.....	.....	.....	5.3	5.7	5.25	6.4	4.80	4.90
30	5.5	4.70	5.2	.....	.....	.....	5.4	5.6	5.1	6.4	4.70	4.90
31	5.4	.....	.....	.....	.....	8.0	.....	6.15	.....	6.4	4.50	.....

NOTE.—Discharge relation affected by ice about Nov. 17, 1912, to Mar. 30, 1913, and by backwater from logs about July 28 to Sept. 30.

Daily discharge, in second-feet, of Wild Rice River at Twin Valley, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	168	148	.....	.....	.....	.....	1,250	123	405	75	233	12
2	148	138	.....	.....	.....	.....	1,560	106	365	61	233	30
3	138	138	.....	.....	.....	.....	1,520	106	405	61	218	37
4	120	129	.....	.....	.....	.....	1,340	106	405	61	203	50
5	110	129	.....	.....	.....	.....	955	132	464	51	182	70
6	110	129	.....	.....	.....	.....	756	123	434	48	161	54
7	110	129	.....	.....	.....	.....	639	123	405	48	161	86
8	92	129	.....	.....	.....	.....	464	98	405	48	148	45
9	75	129	.....	.....	.....	.....	405	90	378	48	135	75
10	75	92	.....	.....	.....	.....	378	106	378	48	135	98
11	75	75	.....	.....	.....	.....	352	106	365	48	135	86
12	75	67	.....	.....	.....	.....	340	98	378	38	122	92
13	75	59	.....	.....	.....	.....	303	90	280	48	110	86
14	75	44	.....	.....	.....	.....	303	90	205	58	110	64
15	59	44	.....	.....	.....	.....	247	90	280	64	110	54
16	59	44	.....	.....	.....	.....	215	123	292	61	86	54
17	92	.....	.....	.....	.....	.....	195	140	303	61	135	64
18	307	.....	.....	.....	.....	.....	215	114	315	61	86	64
19	272	.....	.....	.....	.....	.....	158	90	315	46	86	54
20	272	.....	.....	.....	.....	.....	158	90	327	34	86	45
21	272	.....	.....	.....	.....	.....	158	98	327	36	75	37
22	272	.....	.....	.....	.....	.....	140	90	269	36	64	30
23	272	.....	.....	.....	.....	.....	236	90	258	36	54	30
24	272	.....	.....	.....	.....	.....	280	90	269	36	45	30
25	250	.....	.....	.....	.....	.....	226	82	236	54	37	30
26	228	.....	.....	.....	.....	.....	186	64	236	195	30	37
27	208	.....	.....	.....	.....	.....	158	149	226	203	37	37
28	208	.....	.....	.....	.....	.....	149	195	158	248	41	37
29	198	.....	.....	.....	.....	.....	123	195	114	218	30	37
30	188	.....	.....	.....	.....	.....	140	176	90	218	23	37
31	168	.....	.....	.....	.....	.....	.....	292	.....	218	12	.....

NOTE.—Daily discharge Oct. 1 to Nov. 16, 1912, and Apr. 1 to July 26, 1913, computed from two fairly well defined rating curves. About July 28, 1913, log driving was attempted and on account of the low stage logs lodged along the shores of the channel causing backwater at the gage. The logs remained in the channel throughout the remainder of the year. Daily discharge July 27 to Sept. 30, 1913, computed from a fairly well defined rating curve based on five discharge measurements made during 1913 and 1914. Discharge estimated, because of ice, from gage heights, observer's notes, two discharge measurements, and climatic records, as follows: Nov. 17–30, 30 second-feet; Dec. 1–31, 19 second-feet; Jan. 1–15, 15 second-feet; Jan. 16–31, 10 second-feet; Feb. 1–15, 8 second-feet; Feb. 16–28, 10 second-feet; Mar. 1–15, 26 second-feet; and Mar. 16–31, 54 second-feet. A study of the rainfall records and a comparison of the flow of Wild Rice River at Twin Valley with the flow of Clearwater River at Red Lake Falls, indicate that the discharge relation was probably affected by backwater during June, 1913. Estimates of flow for this month should therefore be used with caution.

Monthly discharge of Wild Rice River at Twin Valley, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	307	59	163	B.
November	148	.....	68.1	C.
December	.....	.....	19	D.
January	.....	.....	12	D.
February	.....	.....	9	D.
March	.....	.....	40	D.
April	1,560	123	452	B.
May	292	64	118	B.
June	464	90	310	D.
July	248	34	82.8	B.
August	233	12	107	B.
September	98	12	52.1	B.
The year	1,560	.....	119	

NOTE.—See footnote to table of daily discharge.

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, 1913.

Drainage area.—3,430 square miles.

Gage.—Vertical and 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. On September 5, 1913, the gage was checked with level and the inclined section (4.6–14.0 feet) found to be in error by amounts varying from 0.01 to 0.15 foot. As nothing is known as to the probable time when these errors entered into the gage readings, the daily gage heights and the gage heights of discharge measurements prior to September 5, 1913, are published as observed. On September 5, 1913, the inclined section was rebuilt. All gage heights subsequent to this date refer to the original gage datum.

Channel and control.—Channel practically permanent. The control is changed temporarily by log jams that form below.

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

Winter flow.—The river is frozen over from the latter part of November to the first of April, and measurements are made through the ice to determine the winter 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.—Logs floated down the river may jam below the station and cause backwater. Conditions at this station are not satisfactory and similar conditions exist at all points on the upper river. Therefore, the records can not be considered better than fair.

Discharge measurements of Red Lake River at Thief River Falls, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 14	W. B. Stevenson	4.01	231	Aug. 14	E. F. Chandler	3.87	204
Dec. 22	do	3.43	[a] 25	15	do	3.88	223
Feb. 11	E. J. Budge	5.55	[b] 183	22	do	3.95	215
Apr. 9	do	7.72	[c] 1,960	Sept. 5	W. B. Stevenson	[d] 4.05	210
29	W. B. Stevenson	4.68	468				

[a] Partial ice cover.
[b] Complete ice cover.
[c] No ice passing; considerable ice above dam.
[d] New inclined gage.

Daily gage height, in feet, of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1913.

[C. P. Quist, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.55	4.45	3.65	.....	.....	.....	5.3	4.7	4.2	3.7	3.75	3.75
2	4.6	4.05	4.4	.....	.....	.....	6.8	4.7	4.4	3.65	3.80	3.90
3	4.35	3.75	4.4	.....	.....	.....	7.8	4.8	4.3	3.95	3.45	3.80
4	4.4	4.5	4.25	4.6	4.1	4.2	8.7	4.6	4.3	3.70	3.75	3.55
5	4.35	4.55	4.3	.....	.....	.....	9.7	4.75	4.35	3.92	3.90	3.68
6	4.15	4.35	4.2	.....	.....	.....	10.8	4.75	4.4	3.45	3.85	3.85
7	4.45	4.2	4.25	4.8	4.5	4.4	9.4	4.65	4.15	4.15	3.85	3.50
8	4.4	4.35	3.55	.....	.....	.....	9.0	4.7	3.90	4.15	3.88	3.85
9	4.4	4.4	4.5	.....	.....	.....	7.8	4.75	4.3	4.05	3.75	3.80
10	4.35	3.95	4.48	4.6	.....	.....	7.0	4.7	4.25	3.95	3.25	3.95
11	4.35	4.5	4.55	.....	4.45	4.4	7.3	4.6	4.3	3.98	3.90	4.05
12	4.3	4.45	4.5	.....	.....	.....	7.1	4.75	4.35	4.0	3.92	3.90
13	4.0	4.45	4.5	.....	.....	.....	7.1	4.7	4.35	3.70	3.75	3.88
14	4.35	4.45	4.25	4.1	.....	4.2	7.2	4.7	4.3	3.90	3.90	3.50
15	4.25	4.4	.....	.....	4.5	.....	7.5	4.75	4.05	4.05	3.55	3.90
16	4.15	4.2	.....	.....	.....	.....	7.2	4.7	4.25	4.15	3.75	3.85
17	4.2	3.5	.....	.....	.....	.....	6.7	4.7	4.3	4.1	3.55	3.82
18	4.2	4.3	4.3	4.15	.....	4.7	6.4	4.55	4.25	4.1	3.98	3.82
19	4.15	4.4	.....	.....	4.5	.....	6.0	4.55	4.1	4.1	3.90	4.0
20	3.8	4.3	.....	.....	.....	.....	5.6	4.5	4.1	3.65	3.40	4.05
21	4.3	4.4	4.4	4.25	.....	.....	5.4	4.4	4.1	4.15	3.75	3.45
22	4.3	4.4	3.45	.....	4.4	4.1	5.2	4.4	3.85	3.95	3.60	4.0
23	4.2	4.4	.....	.....	.....	.....	5.1	4.5	4.25	4.0	3.70	4.0
24	4.2	3.2	4.3	4.1	.....	.....	5.0	4.5	4.25	4.0	3.45	3.85
25	4.2	4.15	.....	.....	4.5	4.1	4.7	4.15	4.2	4.1	4.1	3.75
26	4.4	4.3	.....	.....	.....	.....	4.9	4.4	4.15	4.05	3.95	3.98
27	4.0	4.3	4.3	.....	.....	.....	4.3	4.3	4.2	3.60	3.92	3.85
28	4.3	4.1	.....	4.15	4.5	4.0	4.4	4.4	4.15	4.15	3.95	3.65
29	4.3	4.25	.....	.....	.....	.....	4.8	4.3	3.85	4.1	3.85	3.85
30	4.45	4.25	.....	.....	.....	.....	4.7	4.3	4.0	3.98	3.85	3.92
31	4.4	.....	4.3	3.7	.....	.....	.....	4.4	.....	3.95	3.45	.....

NOTE.—Discharge relation probably affected by ice about Nov. 21, 1912, to Apr. 7, 1913.

Daily discharge, in second-feet, of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	310	372	.....	.....	.....	.....	.....	456	293	153	166	166
2	325	248	.....	.....	.....	.....	.....	456	356	140	179	206
3	340	166	.....	.....	.....	.....	.....	491	324	220	90	179
4	356	389	.....	.....	.....	.....	.....	422	324	153	166	114
5	340	406	.....	.....	.....	.....	.....	474	340	212	206	115
6	278	340	.....	.....	.....	.....	.....	474	356	90	192	156
7	372	293	.....	.....	.....	.....	.....	439	278	278	192	78
8	356	340	.....	.....	.....	.....	3,550	456	206	278	201	156
9	356	356	.....	.....	.....	.....	2,340	474	324	248	166	143
10	340	220	.....	.....	.....	.....	1,660	456	308	220	51	183
11	340	389	.....	.....	.....	.....	1,900	422	324	228	206	212
12	324	372	.....	.....	.....	.....	1,740	474	340	234	212	169
13	234	372	.....	.....	.....	.....	1,740	456	340	153	166	164
14	340	372	.....	.....	.....	.....	1,820	456	324	206	206	78
15	308	356	.....	.....	.....	.....	2,070	474	248	248	114	169
16	278	293	.....	.....	.....	.....	1,820	456	308	278	166	156
17	293	102	.....	.....	.....	.....	1,440	456	324	263	114	148
18	293	324	.....	.....	.....	.....	1,250	406	308	263	228	148
19	278	356	.....	.....	.....	.....	1,020	406	263	263	206	197
20	179	324	.....	.....	.....	.....	815	389	263	140	79	212
21	324	.....	.....	.....	.....	.....	727	356	263	278	166	70
22	324	.....	.....	.....	.....	.....	644	356	192	220	127	197
23	293	.....	.....	.....	.....	.....	604	389	308	234	153	197
24	293	.....	.....	.....	.....	.....	565	389	308	234	90	156
25	293	.....	.....	.....	.....	.....	456	278	293	263	263	131
26	356	.....	.....	.....	.....	.....	527	356	278	248	220	191
27	234	.....	.....	.....	.....	.....	324	324	293	127	212	156
28	324	.....	.....	.....	.....	.....	356	356	278	278	220	108
29	324	.....	.....	.....	.....	.....	491	324	192	263	192	156
30	372	.....	.....	.....	.....	.....	456	324	234	228	192	175
31	356	.....	.....	.....	.....	.....	.....	356	.....	220	90	.....

NOTE.—Daily discharge computed from two fairly well defined rating curves. Rating curve used subsequent to Sept. 4, 1913, is referred to the new gage installed Sept. 5, 1913. See "Gage" in station description. Discharge estimated, because of ice, from gage heights, observer's notes, two discharge measurements, and climatic records, as follows: Nov. 21–30, 200 second-feet; Dec. 1, 1912, to Jan. 15, 1913, 125 second-feet; Jan. 16–31, 50 second-feet; Feb. 1–15, 70 second-feet; Feb. 16–28, 100 second-feet; Mar. 1–15, 80 second-feet; Mar. 16–31, 77 second-feet; and Apr. 1–7, 1,830 second-feet. See "Accuracy" in station description.

Monthly discharge of Red Lake River at Thief River Falls, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	372	179	314	B.
November	406	.....	280	C.
December	.....	.....	125	
January	.....	.....	86	D.
February	.....	.....	84	D.
March	.....	.....	78	D.
April	.....	.....	1,370	C.
May	491	278	413	B.
June	356	192	293	B.
July	278	90	221	B.
August	263	51	169	B.
September	212	70	156	B.
The year	.....	.....	298	

RED LAKE RIVER AT CROOKSTON, MINN.

Location.—At new Sampson's Addition highway bridge in Crookston, 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, 1913.

Drainage area.—5,320 square miles.

Gage.—Automatic gage installed in September, 1911, replacing the chain gage which was attached to the new Sampson's Addition bridge July 1, 1909. The 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.

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

Discharge measurements.—Made from new bridge.

Winter flow.—During the winter of 1912 and 1913 the flow in the river was so smal that there was a greater effect on the discharge, expressed in per cent, due to the retardation of the velocity by ice, than would ordinarily occur. Estimates of discharge during the winter period are therefore not as accurate as might ordinarily be expected.

Accuracy.—The operation of the power plant causes fluctuations in the water surface at the station, but the use of the automatic gage should give good results.

Discharge measurements of Red Lake River at Crookston, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 1	W. B. Stevenson	6.18	1,650	May 3	Ole Christianson	5.02	1,020
Dec. 23	do	4.57	*a* 438	5	do	6.16	1,830
Jan. 18	E. J. Budge	3.20	*a* 80	5	do	6.36	1,910
18	do	3.43	*a* 93	20	do	4.49	735
Feb. 8	do	4.26	*a* 249	Aug. 12	E. F. Chandler	3.35	267
Apr. 12	Budge & Christianson	9.50	*b* 4,600	Sept. 6	W. B. Stevenson	3.23	183
14	do	9.00	4,070				

a Measurement made under complete ice cover. *b* No ice running.

Daily gage height, in feet, of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1913.

[J. H. Wallace, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.
1	6.2	3.8	.....	3.83	.....	3.57	6.65	5.35	3.92	3.29	3.50	3.06
2	6.0	3.75	3.45	3.83	.....	3.78	8.65	4.40	4.38	3.43	3.39	3.22
3	5.6	3.6	3.45	4.10	.....	3.85	11.3	5.35	4.03	3.43	3.35	3.10
4	.....	3.65	3.20	.....	3.72	3.74	13.6	4.07	.....	3.56	3.08	3.22
5	4.8	3.6	3.8	.....	3.66	3.58	14.3	5.4	3.87	3.22	3.16	3.38
6	4.5	3.7	.....	.....	3.44	3.13	15.5	4.22	3.74	3.41	.....	3.25
7	4.9	3.65	.....	.....	.....	3.09	14.8	5.0	3.84	3.32	.....	3.40
8	4.6	3.7	3.25	.....	.....	3.19	12.4	4.79	3.71	3.17	.....	3.42
9	4.6	3.7	3.45	.....	.....	3.32	11.8	4.69	4.01	3.23	.....	3.34
10	4.4	3.6	3.6	.....	.....	3.62	10.4	4.73	3.65	3.16	.....	3.32
11	4.3	3.7	3.15	.....	.....	3.76	10.8	4.59	3.65	3.29	.....	3.64
12	4.4	3.7	3.45	.....	.....	3.69	9.5	4.73	3.66	3.24	.....	3.61
13	3.9	3.7	3.8	.....	.....	3.59	9.1	4.59	3.58	3.32	3.81	3.55
14	4.3	.....	3.0	.....	.....	3.73	8.7	4.63	3.52	3.19	3.42	3.75
15	4.1	3.85	3.45	.....	.....	3.84	9.1	4.61	3.43	3.26	3.30	3.72
16	4.3	3.8	3.25	.....	.....	4.18	9.5	4.36	3.71	3.54	3.34	3.62
17	4.0	3.6	3.25	.....	.....	3.39	9.0	4.56	.....	3.52	3.60	3.60
18	4.6	3.7	3.55	.....	.....	3.62	8.4	4.54	3.63	3.79	3.52	3.63
19	4.0	.....	3.35	.....	.....	3.58	9.0	4.67	3.66	3.86	3.26	3.42
20	3.65	.....	3.1	.....	.....	3.56	7.2	4.54	3.75	3.74	3.16	3.56
21	3.75	3.75	3.4	.....	3.39	3.53	7.2	4.37	3.87	3.56	.....	3.62
22	3.8	3.5	3.4	.....	3.24	3.66	6.6	3.94	3.62	3.42	.....	3.32
23	3.6	3.35	3.7	.....	4.02	3.95	6.2	4.02	3.35	3.35	3.62	3.32
24	3.7	.....	3.55	.....	3.38	3.62	5.9	3.79	3.20	3.44	3.13	3.40
25	3.85	2.85	3.6	.....	3.72	3.75	5.7	3.99	3.26	3.52	3.14	3.50
26	3.7	3.25	4.0	3.62	3.61	3.60	.....	3.81	3.42	3.23	3.07	3.26
27	3.6	2.87	3.7	3.44	3.40	3.62	5.85	3.93	3.76	3.42	3.14	3.26
28	3.65	2.86	3.65	3.68	3.40	3.52	5.85	4.15	3.45	3.46	3.46	3.05
29	3.65	3.45	3.8	3.63	.....	3.84	5.4	3.79	3.39	3.41	3.15	3.06
30	3.7	3.6	3.85	3.65	.....	4.24	4.45	3.94	3.24	3.36	3.22	3.22
31	3.8	.....	3.65	.....	.....	4.35	.....	4.11	.....	4.04	3.16	.....

NOTE.—Discharge relation affected by ice about Nov. 16, 1912, to Apr. 7, 1913.

Daily discharge, in second-feet, of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,720	466	.....	.....	.....	.....	.....	1,230	464	229	299	161
2	1,590	448	.....	.....	.....	.....	.....	690	680	275	262	206
3	1,350	395	.....	.....	.....	.....	.....	1,230	513	275	248	171
4	a1,100	412	.....	.....	.....	.....	.....	531	a478	321	166	206
5	910	395	.....	.....	.....	.....	.....	1,260	442	206	188	258
6	760	430	.....	.....	.....	.....	.....	602	389	268	.....	216
7	965	412	.....	.....	.....	.....	.....	1,020	430	239	.....	265
8	810	430	.....	.....	.....	.....	6,920	900	377	191	.....	272
9	810	430	.....	.....	.....	.....	6,410	844	504	210	.....	245
10	715	395	.....	.....	.....	.....	5,240	866	354	188	.....	239
11	670	430	.....	.....	.....	.....	5,570	790	354	229	.....	350
12	715	430	.....	.....	.....	.....	4,480	866	358	213	.....	339
13	502	430	.....	.....	.....	.....	4,140	790	328	239	417	317
14	670	a450	.....	.....	.....	.....	3,810	812	306	197	272	393
15	580	484	.....	.....	.....	.....	4,140	800	275	219	232	381
16	670	.....	.....	.....	.....	.....	4,480	670	377	313	245	343
17	540	.....	.....	.....	.....	.....	4,060	773	a362	306	335	335
18	810	.....	.....	.....	.....	.....	3,600	762	346	409	306	346
19	540	.....	.....	.....	.....	.....	4,060	834	358	438	219	272
20	412	.....	.....	.....	.....	.....	2,560	762	393	389	188	321
21	448	.....	.....	.....	.....	.....	2,560	675	442	321	a240	343
22	466	.....	.....	.....	.....	.....	2,100	473	343	272	a292	239
23	395	.....	.....	.....	.....	.....	1,800	508	248	248	343	239
24	430	.....	.....	.....	.....	.....	1,590	409	200	279	180	265
25	484	.....	.....	.....	.....	.....	1,460	495	219	306	183	299
26	430	.....	.....	.....	.....	.....	a1,510	417	272	210	163	219
27	395	.....	.....	.....	.....	.....	1,560	468	397	272	183	219
28	412	.....	.....	.....	.....	.....	1,560	568	282	285	285	158
29	412	.....	.....	.....	.....	.....	1,260	409	262	268	186	161
30	430	.....	.....	.....	.....	.....	715	473	213	252	206	206
31	466	.....	.....	.....	.....	.....	.....	550	.....	517	188	.....

a Discharge estimated.

NOTE.—Daily discharge Oct. 1 to Nov. 15, 1912, computed from a fairly well defined rating curve. Discharge Apr. 8 to Sept. 30, 1913, computed from a rating curve well defined between 155 and 6,580 second-feet (gage heights 3.0 and 12.0 feet), and fairly well defined beyond those points.

Discharge estimated, because of ice, from gage heights, observer's notes, four discharge measurements, and climatic records, as follows: Nov. 16–30, 295 second-feet; Dec. 1–31, 165 second-feet; Jan. 1–15, 145 second-feet; Jan. 16–31, 130 second-feet; Feb. 1–15, 130 second-feet; Feb. 16–28, 120 second-feet; Mar. 1–15, 115 second-feet; Mar. 16–31, 120 second-feet; and Apr. 1–7, 3,560 second-feet. Discharge Aug. 6–12, 1913, estimated 300 second-feet.

Monthly discharge of Red Lake River at Crookston, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	1,720	395	697	B.
November	484	.....	362	C.
December	.....	.....	165	C.
January	.....	.....	137	D.
February	.....	.....	125	D.
March	.....	.....	118	D.
April	.....	.....	3,350	C.
May	1,260	409	725	A.
June	680	200	366	B.
July	517	188	277	B.
August	.....	.....	256	B.
September	393	158	266	C.
The year	.....	.....	568	

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. The nearest tributary is the outlet of Mud Lake, which enters Thief River in the northeastern part of T. 156 N., R. 42 W.

Records available.—July 1, 1909, to September 30, 1913.

Drainage area.—1,010 square miles.

Gage.—Inclined staff; 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. On September 4, 1913, the old inclined staff gage which was in error was replaced by a new gage set at the correct datum. See Water-Supply Paper 325 for the history of the old gage. All gage heights in the following tables subsequent to December 31, 1912, refer to the original gage datum.

Channel and control.—Practically permanent.

Discharge measurements.—Made by means of a boat and cable a short distance below gage.

Winter flow.—Determined by measurements. River frozen over from middle of November to first of April.

Regulation.—The dam at Thief River Falls, at the mouth of Thief River, backs up the water in Thief River for several miles, but the station is protected by the rapids below from the influence of the 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," and footnote to daily-discharge table.

Discharge measurements of Thief River near Thief River Falls, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 21	W. B. Stevenson	5.00	[a] 16.7	Aug. 14	E. F. Chandler	4.10	[c] 12.0
Apr. 10	E. J. Budge	7.96	[b] 895	Sept. 4	W. B. Stevenson	4.00	[c] 7.3

[a] Measurement made under partial ice cover.
[b] Ice not entirely out; some ice running.
[c] Measurement made by wading at a section 100 feet above gage.

Daily gage height, in feet, of Thief River near Thief River Falls, Minn., for the year ending Sept. 30, 1913.

[H. J. Maland, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.84	5.10	.....	.....	.....	.....	6.45	5.30	4.75	3.75	3.95	4.00
2	4.72	4.80	.....	.....	.....	.....	6.65	5.20	4.85	3.75	4.25	4.00
3	4.76	4.77	.....	.....	.....	.....	8.0	5.20	4.75	3.90	4.18	4.05
4	4.74	4.70	.....	.....	.....	.....	9.7	5.20	4.70	4.05	4.05	4.00
5	4.65	4.65	4.30	.....	.....	.....	11.0	5.15	4.60	4.15	3.98	.....
6	4.70	4.60	.....	.....	.....	.....	13.0	5.10	4.55	4.22	3.98	.....
7	4.77	4.07	.....	.....	.....	.....	14.0	[a]4.60	4.65	4.28	3.98	.....
8	4.76	4.75	.....	.....	.....	.....	11.0	5.45	4.60	4.52	3.98	.....
9	4.70	4.67	.....	.....	.....	.....	9.0	5.25	4.60	4.10	3.98	.....
10	4.80	4.70	.....	.....	.....	.....	8.7	5.20	4.55	3.80	3.98	4.15
11	4.75	4.70	.....	.....	.....	.....	8.0	5.15	4.65	3.95	3.98	4.10
12	4.70	4.67	.....	.....	.....	.....	8.0	5.15	4.65	4.30	3.98	4.10
13	4.70	4.65	.....	.....	.....	.....	8.0	5.10	4.60	4.35	4.12	4.05
14	4.65	4.65	.....	.....	.....	.....	8.0	5.15	4.60	4.42	4.10	4.02
15	4.63	4.77	.....	.....	.....	.....	8.7	5.15	4.10	4.48	4.10	4.12
16	4.60	4.90	.....	.....	.....	.....	8.4	5.10	3.75	4.58	4.10	4.18
17	4.59	4.77	.....	.....	.....	.....	8.0	5.10	4.35	4.58	4.10	4.16
18	4.32	4.75	.....	.....	.....	.....	7.8	5.00	4.40	4.50	4.05	4.15
19	4.65	5.0	.....	.....	.....	.....	7.6	5.00	4.40	4.45	4.08	4.10
20	4.65	4.65	.....	.....	.....	.....	6.9	5.00	4.40	4.38	4.10	4.10
21	4.73	4.73	5.00	.....	.....	.....	6.3	5.00	4.40	4.40	4.08	4.10
22	4.57	4.87	.....	.....	.....	.....	6.05	5.00	4.35	4.35	4.10	4.10
23	4.13	4.77	.....	.....	.....	.....	5.95	4.95	4.35	4.28	4.10	4.10
24	4.38	4.65	.....	.....	.....	.....	5.65	4.95	4.25	3.80	4.05	4.14
25	5.15	4.58	.....	.....	.....	.....	5.35	5.00	4.60	3.75	4.05	4.15
26	4.80	4.62	.....	.....	.....	.....	5.35	5.00	4.60	3.65	4.00	4.10
27	4.55	4.60	.....	.....	.....	.....	5.30	5.00	4.10	3.75	4.00	4.10
28	4.69	.....	.....	.....	.....	.....	5.30	5.00	4.88	4.18	4.00	4.11
29	4.72	.....	.....	.....	.....	.....	5.40	4.90	4.25	4.18	4.00	4.12
30	4.57	.....	.....	.....	.....	.....	5.30	4.90	3.80	4.08	4.05	4.12
31	4.70	.....	.....	.....	.....	.....	.....	4.85	.....	3.98	4.00	.....

[a] Gage height probably 1 foot too low.

NOTE.—Discharge relation affected by ice about Nov. 16, 1912, to Apr. 10, 1913. See "Gage" in station description.

Daily discharge, in second-feet, of Thief River near Thief River Falls, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	55	84	.....	.....	.....	.....	.....	159	46	2.6	6.2	7.3
2	45	51	.....	.....	.....	.....	.....	134	61	2.6	14	7.3
3	48	49	.....	.....	.....	.....	.....	134	46	5.2	12	8.5
4	46	43	.....	.....	.....	.....	.....	134	40	8.5	8.5	7.3
5	39	39	.....	.....	.....	.....	.....	122	30	11	6.9	.....
6	43	35	.....	.....	.....	.....	.....	110	26	13	6.9	.....
7	40	6.9	.....	.....	.....	.....	.....	a 239	35	15	6.9	.....
8	48	47	.....	.....	.....	.....	.....	198	30	24	6.9	.....
9	43	41	.....	.....	.....	.....	.....	146	30	9.7	6.9	.....
10	51	43	.....	.....	.....	.....	.....	134	26	3.4	6.9	11
11	47	43	.....	.....	.....	.....	1,000	122	35	6.2	6.9	9.7
12	43	41	.....	.....	.....	.....	1,000	122	35	16	6.9	9.7
13	43	39	.....	.....	.....	.....	1,000	110	30	17	10	8.5
14	39	39	.....	.....	.....	.....	1,000	122	30	20	9.7	7.8
15	37	49	.....	.....	.....	.....	1,250	122	9.7	22	9.7	10
16	35	.....	.....	.....	.....	.....	1,140	110	2.6	29	9.7	12
17	34	.....	.....	.....	.....	.....	1,000	110	17	29	9.7	11
18	18	.....	.....	.....	.....	.....	935	88	19	23	8.5	11
19	39	.....	.....	.....	.....	.....	865	88	19	21	9.2	9.7
20	39	.....	.....	.....	.....	.....	622	88	19	18	9.7	9.7
21	45	.....	.....	.....	.....	.....	437	88	19	19	9.2	9.7
22	33	.....	.....	.....	.....	.....	364	88	17	17	9.7	9.7
23	8.8	.....	.....	.....	.....	.....	336	78	17	15	9.7	9.7
24	21	.....	.....	.....	.....	.....	252	78	14	3.4	8.5	11
25	90	.....	.....	.....	.....	.....	172	88	30	2.6	8.5	11
26	51	.....	.....	.....	.....	.....	172	88	30	1.3	7.3	9.7
27	32	.....	.....	.....	.....	.....	159	88	9.7	2.6	7.3	9.7
28	42	.....	.....	.....	.....	.....	159	88	66	12	7.3	10
29	45	.....	.....	.....	.....	.....	185	69	14	12	7.3	10
30	33	.....	.....	.....	.....	.....	159	69	3.4	9.2	8.5	10
31	43	.....	.....	.....	.....	.....	.....	61	.....	6.9	7.3	.....

a Estimated.

NOTE.—Daily discharge computed from two fairly well defined rating curves. Daily gage height and the rating curve used prior to 1913 refer to the old gage, which was slightly in error. The rating curve used beginning Apr. 11, 1913, refers to the new gage. Discharge estimated, because of ice, from observer's notes, one discharge measurement, and climatic records as follows: Nov. 16–30, 22 second-feet; Dec. 1–31, 1912, 14 second-feet; Jan. 1–15, 1913, 13 second-feet; Jan. 16–31, 8 second-feet; Feb. 1–15, 6 second-feet; Feb. 16–28, 12 second-feet; Mar. 1–15, 6 second-feet; Mar. 16–31, 8-second-feet; and Apr. 1–10, 750 second-feet.

Monthly discharge of Thief River near Thief River Falls, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	90	8.8	41.4	B.
November	84	.....	32.7	C.
December	.....	.....	14	
January	.....	.....	10	
February	.....	.....	9	
March	.....	.....	7	
April	.....	.....	657	C.
May	239	61	112	B.
June	66	2.6	26.9	B.
July	29	1.3	12.8	C.
August	14	6.2	8.47	C.
September	.....	.....	9.53	C.
The year	.....	.....	77.9	

NOTE.—See "Accuracy" in station description.

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, 1913.

Drainage area.—1,310 square miles.

Gage.—Vertical staff, installed September 12, 1911, about half a mile farther downstream than the original gage, as the building of a dam will cause several feet of backwater at the original section. Gage read morning and evening to tenths. Limits of use: Half-tenths below and tenths above 4.5 feet. The new gage was set to read 2.23 feet when the original gage read 5.83 feet. Owing to the fact that the new gage is at a different section, measurements referred to the old gage can not be used in rating the new section.

Channel and control.—Practically permanent.

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

Winter flow.—Determined by measurements made through the ice; river usually frozen over from middle of November to first of April.

Accuracy.—Discharge measurement made September 13, 1911, indicates that the estimates for September and October, 1911, as published in Water-Supply Paper 305, are too large; following tables probably more accurate. Backwater from the Healy dam on Red Lake River may slightly affect the discharge relation at this new site if flashboards are put in place at the Healy dam.

Discharge measurements of Clearwater River at Red Lake Falls, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	E. J. Budge	2.79	215	Apr. 21	Ole Christianson	4.27	871
Dec. 20	W. B. Stevenson	3.01	*a* 45	29	E. F. Chandler	3.52	544
Feb. 11	E. J. Budge	4.40	*a* 27.3	29	.....do	3.51	557
Apr. 11	.....do	5.30	1,930	Aug. 13	.....do	2.28	87

a River frozen over.

Daily gage height, in feet, of Clearwater River at Red Lake Falls, Minn., for the year ending Sept. 30, 1913.

[Leo Steinert, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.4	2.3	2.6	.....	.....	.....	6.8	3.4	2.65	2.4	2.25	2.0
2	4.6	2.25	2.6	.....	.....	.....	8.2	3.35	2.7	2.4	2.25	2.3
3	4.0	2.2	2.7	.....	.....	.....	10.2	3.2	2.65	2.5	2.25	2.35
4	3.7	2.25	2.55	3.1	.....	.....	10.2	3.2	2.6	2.5	2.25	2.25
5	3.4	2.3	2.7	.....	.....	.....	14.4	3.3	2.6	2.5	2.25	2.35
6	3.4	2.3	2.45	.....	.....	.....	15.0	3.3	2.6	2.5	2.3	1.95
7	3.4	2.3	2.55	.....	.....	.....	6.8	3.3	2.6	2.4	2.25	1.95
8	3.2	2.3	2.8	.....	.....	.....	6.4	3.3	2.6	2.4	2.25	2.25
9	3.1	2.25	2.35	.....	.....	.....	5.6	3.3	2.6	2.35	2.25	2.05
10	3.0	2.2	3.5	.....	.....	.....	5.4	3.3	2.6	2.35	2.25	2.25
11	3.1	2.3	3.15	.....	.....	.....	5.2	3.15	2.6	2.35	2.25	2.3
12	3.2	2.3	3.15	.....	.....	.....	5.0	3.05	2.55	2.35	2.3	2.4
13	3.2	2.3	3.15	.....	.....	.....	5.0	3.0	2.45	2.35	2.35	2.5
14	3.2	2.3	3.1	.....	.....	.....	5.0	3.05	2.4	2.35	2.25	2.45
15	3.05	2.3	3.0	.....	.....	.....	5.2	3.05	2.4	2.35	2.25	2.4
16	2.9	2.3	3.15	.....	.....	.....	5.2	3.05	2.4	2.4	2.25	2.4
17	2.9	2.0	3.3	.....	.....	.....	5.1	3.05	2.4	2.55	2.25	2.25
18	3.0	2.0	3.25	.....	.....	.....	4.8	2.95	2.4	2.45	2.25	2.4
19	3.0	2.0	3.35	.....	.....	.....	4.6	2.95	2.4	2.4	2.25	2.4
20	3.1	2.0	3.05	.....	.....	.....	4.35	2.95	2.4	2.35	2.25	2.4
21	3.1	1.9	3.1	.....	.....	.....	4.25	2.85	2.35	2.35	2.35	2.15
22	3.2	1.9	.....	.....	.....	.....	4.05	2.85	2.35	2.35	2.35	2.4
23	3.2	1.8	.....	.....	.....	.....	3.85	2.85	2.35	2.35	2.35	2.4
24	2.95	2.3	.....	.....	.....	.....	3.8	2.85	2.3	2.35	2.35	2.35
25	2.25	2.4	.....	.....	.....	.....	3.7	2.75	2.35	2.25	2.0	2.3
26	2.2	2.3	.....	.....	.....	.....	3.65	2.75	2.25	2.25	2.25	2.25
27	2.2	2.5	.....	.....	.....	.....	3.65	2.75	2.25	2.25	2.25	2.25
28	2.2	2.8	3.05	.....	.....	.....	3.55	2.7	2.35	2.25	2.30	2.25
29	2.15	2.6	.....	.....	.....	.....	3.5	2.65	2.25	2.25	2.35	2.25
30	2.4	2.15	.....	.....	.....	.....	3.45	2.6	2.35	2.25	2.35	2.25
31	2.35	.....	.....	.....	.....	.....	.....	2.5	.....	2.25	2.35	.....

NOTE.—Discharge relation affected by ice about Nov. 16, 1912, to Apr. 7, 1913.

Daily discharge, in second-feet, of Clearwater River at Red Lake Falls, Minn., for the period Sept. 12, 1911, to Sept. 30, 1913.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911-12.													
1	.....	63	58	.....	.....	.....	.....	.....	196	126	63	115	54
2	.....	74	88	.....	.....	.....	.....	.....	180	126	63	115	58
3	.....	81	166	.....	.....	.....	.....	.....	180	151	63	96	126
4	.....	81	74	.....	.....	.....	.....	.....	196	151	63	68	115
5	.....	81	68	.....	.....	.....	.....	.....	213	138	63	68	81
6	.....	81	77	.....	.....	.....	.....	.....	249	115	54	68	54
7	.....	88	77	.....	.....	.....	.....	.....	268	126	54	63	50
8	.....	74	81	.....	.....	.....	.....	.....	309	151	54	63	46
9	.....	81	88	.....	.....	.....	.....	.....	309	115	54	a 63	46
10	.....	81	88	.....	.....	.....	.....	.....	309	96	68	63	46
11	.....	74	.....	.....	.....	.....	.....	.....	309	88	88	63	54
12	63	74	.....	.....	.....	.....	.....	.....	330	96	74	63	68
13	72	74	.....	.....	.....	.....	.....	693	375	96	104	63	180
14	68	77	.....	.....	.....	.....	.....	693	352	81	213	63	352
15	58	88	.....	.....	.....	.....	.....	352	352	104	213	a 63	352
16	68	88	.....	.....	.....	.....	.....	268	309	115	213	63	375
17	74	88	.....	.....	.....	.....	.....	249	268	115	213	63	352
18	58	101	.....	.....	.....	.....	.....	213	268	115	213	63	330
19	74	58	.....	.....	.....	.....	.....	196	268	138	213	63	309
20	74	74	.....	.....	.....	.....	.....	180	231	126	180	63	268
21	68	74	.....	.....	.....	.....	.....	180	213	126	151	68	288
22	74	104	.....	.....	.....	.....	.....	151	231	a 104	166	96	126
23	74	58	.....	.....	.....	.....	.....	151	213	81	213	63	231
24	74	74	.....	.....	.....	.....	.....	151	180	81	.....	63	604
25	74	81	.....	.....	.....	.....	.....	126	180	81	.....	63	663
26	74	74	.....	.....	.....	.....	.....	151	196	81	.....	63	663
27	74	88	.....	.....	.....	.....	.....	126	196	96	.....	63	963
28	74	88	.....	.....	.....	.....	.....	213	166	88	.....	63	1,110
29	74	81	.....	.....	.....	.....	.....	196	151	81	.....	81	1,110
30	74	88	.....	.....	.....	.....	.....	180	126	68	.....	63	1,040
31	.....	88	.....	.....	.....	.....	.....	.....	138	.....	.....	54	.....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912-13.												
1	1,110	88	.....	.....	.....	.....	.....	471	166	104	81	54
2	1,270	81	.....	.....	.....	.....	.....	446	180	104	81	88
3	822	74	.....	.....	.....	.....	.....	375	166	126	81	96
4	633	81	.....	.....	.....	.....	.....	375	151	126	81	81
5	471	88	.....	.....	.....	.....	.....	422	151	126	81	96
6	471	88	.....	.....	.....	.....	.....	422	151	126	88	50
7	471	88	.....	.....	.....	.....	.....	422	151	104	81	50
8	375	88	.....	.....	.....	.....	2,870	422	151	104	81	81
9	330	81	.....	.....	.....	.....	2,150	422	151	96	81	58
10	288	74	.....	.....	.....	.....	1,970	422	151	96	81	81
11	330	88	.....	.....	.....	.....	1,790	352	151	96	81	88
12	375	88	.....	.....	.....	.....	1,610	309	138	96	88	104
13	375	88	.....	.....	.....	.....	1,610	288	115	96	96	126
14	375	88	.....	.....	.....	.....	1,610	309	104	96	81	115
15	309	88	.....	.....	.....	.....	1,790	309	104	96	81	104
16	249	.....	.....	.....	.....	.....	1,790	309	104	104	81	104
17	249	.....	.....	.....	.....	.....	1,700	309	104	138	81	81
18	288	.....	.....	.....	.....	.....	1,440	268	104	115	81	104
19	288	.....	.....	.....	.....	.....	1,270	268	104	104	81	104
20	330	.....	.....	.....	.....	.....	1,080	268	104	96	81	104
21	330	.....	.....	.....	.....	.....	1,000	231	96	96	96	68
22	375	.....	.....	.....	.....	.....	856	231	96	96	96	104
23	375	.....	.....	.....	.....	.....	724	231	96	96	96	104
24	268	.....	.....	.....	.....	.....	693	231	88	96	96	96
25	81	.....	.....	.....	.....	.....	633	196	96	81	54	88
26	74	.....	.....	.....	.....	.....	604	196	81	81	81	81
27	74	.....	.....	.....	.....	.....	604	196	81	81	81	81
28	74	.....	.....	.....	.....	.....	549	180	96	81	88	81
29	68	.....	.....	.....	.....	.....	522	166	81	81	96	81
30	104	.....	.....	.....	.....	.....	496	151	96	81	96	81
31	96	.....	.....	.....	.....	.....	.....	126	.....	81	96	.....

a Discharge estimated on account of backwater from Healy's dam.

NOTE.—Daily discharge computed from a rating curve well defined between 63 and 522 second-feet (gage heights, 2.1 and 3.5 feet) and fairly well defined between 576 and 2,510 second-feet (gage heights, 3.6 and 6.0 feet). Discharge estimated, because of ice, from observer's notes, discharge measurements, and climatic records, as follows: Nov. 11-30, 1911, 70 second-feet; Dec. 1-31, 1911, 65 second-feet; Jan. 1-31, 1912, 30 second-feet; Feb. 1-29, 35 second-feet; Mar. 1-31, 38 second-feet; Apr. 1-12, 420 second-feet; Nov. 16-30, 75 second-feet; Dec. 1-31, 1912, 60 second-feet; Jan. 1-15, 1913, 38 second-feet; Jan. 16-31, 32 second-feet; Feb. 1-15, 28 second-feet; Feb. 16-28, 30 second-feet; Mar. 1-15, 30 second-feet; Mar. 16-31, 35 second-feet; and Apr. 1-7, 1913, 1,340 second-feet. Discharge, July 24-31, 1912, estimated on account of backwater from Healy's dam at 170 second-feet.

Monthly discharge of Clearwater River at Red Lake Falls, Minn., from Sept. 12, 1911, to Sept. 30, 1913.

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

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1911.				
September 12-30	74	58	70.7	B.
1912.				
October	104	58	80.0	B.
November			75.5	C.
December			65	D.
January			30	D.
February			35	D.
March			38	C.
April		126	317	C.
May	375	126	241	A.
June	151	68	109	A.
July		54	136	B.
August	115	54	69.4	B.
September	1,110	46	337	B.
The year			127	
1913.				
October	1,270	68	365	A.
November			79.9	C.
December			60	C.
January			34.9	C.
February			28.9	C.
March			32.6	C.
April			1,290	B.
May	471	126	301	A.
June	180	81	120	A.
July	138	81	100	A.
August	96	54	84.7	A.
September	126	50	87.8	B.
The year			215	

[a] Estimates of "run-off in second-feet per square mile" and "run-off (depth in inches on drainage area)" omitted because of the large amount of swamp land (some of which is being drained artificially) in the area above this station.

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 John Ross, half a mile north of Hallock; a mile below the nearest tributary, a small creek that enters from the west.

Records available.—April 29, 1911, to September 30, 1913.

Drainage area.—776 square miles.

Gage.—Vertical staff; read daily, 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.—Probably permanent. The control is an abandoned loose-rock dam 4 feet high, a mile or more below the station. The dam was formerly used to raise the water level for a railroad water tank.

Discharge measurements.—Made from the bridge.

Winter flow.—River frozen over from November to April; gage readings discontinued.

Discharge measurements of South Branch of Two Rivers at Hallock, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 14	E. J. Budge	13.51	[a] 1,090	Aug. 23	E. F. Chandler	1.96	[b] 23.5
30	do	4.53	190	Sept. 3	W. B. Stevenson	1.51	[b] 3.1

[a] Some ice running.
[b] Measurement made by wading at a section above the gage.

Daily gage height, in feet, of South Branch of Two Rivers at Hallock, Minn., for the year ending Sept. 30, 1913.

[W. P. Willardson, observer.]

Day.	Oct.	Nov.	Dec	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.3	2.9	.....	.....	.....	.....	4.4	4.2	2.1	1.45	1.3	1.6
2	4.3	2.9	.....	.....	.....	.....	9.7	4.0	2.1	1.45	1.25	1.55
3	4.5	2.9	.....	.....	.....	.....	11.3	3.8	2.1	1.45	1.25	1.55
4	4.6	3.0	.....	.....	.....	.....	11.3	3.8	2.05	1.45	1.25	1.55
5	4.6	3.0	.....	.....	.....	.....	11.0	3.8	2.05	1.45	1.25	1.5
6	4.6	2.9	.....	.....	.....	.....	11.9	3.8	2.0	1.45	1.25	1.5
7	4.7	2.9	.....	.....	.....	.....	13.2	3.8	1.95	1.45	1.2	1.5
8	4.4	3.0	.....	.....	.....	.....	15.0	3.7	1.9	1.42	1.2	1.45
9	4.2	3.0	.....	.....	.....	.....	15.2	3.6	1.9	1.4	1.2	1.4
10	4.0	3.0	.....	.....	.....	.....	15.6	3.4	1.9	1.4	1.15	1.7
11	3.9	3.0	.....	.....	.....	.....	15.8	3.3	1.85	1.6	1.4	1.7
12	3.8	2.9	.....	.....	.....	.....	15.3	3.2	1.8	1.6	1.45	1.7
13	3.6	2.8	.....	.....	.....	.....	14.6	3.05	1.75	1.65	1.55	1.65
14	3.4	2.8	.....	.....	.....	.....	13.6	2.95	1.75	1.65	1.52	1.62
15	3.4	2.8	.....	.....	.....	.....	12.6	2.9	1.7	1.65	1.72	1.6
16	3.1	2.8	.....	.....	.....	.....	11.5	2.85	1.65	1.6	1.65	1.6
17	3.0	2.8	.....	.....	.....	.....	10.0	2.8	1.6	1.58	1.7	1.75
18	2.9	2.8	.....	.....	.....	.....	8.4	2.75	1.6	1.6	1.68	1.95
19	2.8	2.8	.....	.....	.....	.....	7.5	2.7	1.6	1.6	1.6	2.15
20	2.8	2.8	.....	.....	.....	.....	6.8	2.6	1.6	1.55	1.9	2.2
21	2.8	2.6	.....	.....	.....	.....	6.4	2.55	1.6	1.5	2.7	2.2
22	2.65	2.5	.....	.....	.....	.....	5.9	2.5	1.6	1.45	2.15	2.1
23	2.6	2.45	.....	.....	.....	.....	5.7	2.45	1.65	1.45	1.95	2.1
24	2.6	2.2	.....	.....	.....	.....	5.9	2.4	1.6	1.45	1.85	2.0
25	2.4	2.2	.....	.....	.....	.....	6.0	2.35	1.55	1.4	1.85	1.92
26	2.4	2.1	.....	.....	.....	.....	5.6	2.3	[a] 1.5	1.4	1.8	1.88
27	2.4	2.1	.....	.....	.....	.....	5.4	2.25	1.5	1.35	1.8	1.8
28	2.4	2.2	.....	.....	.....	.....	5.1	2.2	1.5	1.35	1.78	1.78
29	2.6	2.2	.....	.....	.....	.....	4.8	2.2	1.5	1.35	1.72	1.75
30	2.6	2.3	.....	.....	.....	.....	4.6	2.2	1.5	1.35	1.68	1.82
31	2.8	.....	.....	.....	.....	.....	.....	2.15	.....	1.3	1.62	.....

NOTE.—Discharge relation affected by ice about Nov. 16, 1912, to Apr. 12, 1913.

Daily discharge, in second-feet, of South Branch of Two Rivers at Hallock, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	179	69	.....	.....	.....	.....	.....	170	31	6.5	3.0	6.2
2	179	69	.....	.....	.....	.....	.....	154	31	6.5	2.0	4.4
3	197	69	.....	.....	.....	.....	.....	138	31	6.5	2.0	4.5
4	206	76	.....	.....	.....	.....	.....	138	28	6.5	2.0	4.5
5	206	76	.....	.....	.....	.....	.....	138	28	6.5	2.0	3.0
6	206	69	.....	.....	.....	.....	.....	138	26	6.5	2.0	3.0
7	215	69	.....	.....	.....	.....	.....	138	24	6.5	1.0	3.0
8	188	76	.....	.....	.....	.....	.....	130	22	5.6	1.0	2.0
9	170	76	.....	.....	.....	.....	.....	122	22	5.0	1.0	1.0
10	152	76	.....	.....	.....	.....	.....	108	22	5.0	.7	9.0
11	144	76	.....	.....	.....	.....	.....	101	20	11	5.0	9.0
12	136	69	.....	.....	.....	.....	.....	94	18	11	6.5	9.0
13	120	63	.....	.....	.....	.....	1,200	84	16	12	9.5	7.5
14	104	63	.....	.....	.....	.....	1,100	77	16	12	8.6	6.6
15	104	63	.....	.....	.....	.....	1,000	74	14	12	15	6.0
16	83	.....	.....	.....	.....	.....	890	71	12	11	12	6.0
17	76	.....	.....	.....	.....	.....	740	68	11	10	14	10
18	69	.....	.....	.....	.....	.....	580	65	11	11	13	17
19	63	.....	.....	.....	.....	.....	490	62	11	11	11	25
20	63	.....	.....	.....	.....	.....	420	56	11	9.5	.22	27
21	63	.....	.....	.....	.....	.....	380	54	11	8.0	62	27
22	54	.....	.....	.....	.....	.....	330	51	11	6.5	34	23
23	51	.....	.....	.....	.....	.....	310	48	12	6.5	24	23
24	51	.....	.....	.....	.....	.....	330	46	11	6.5	19	19
25	39	.....	.....	.....	.....	.....	340	44	9.5	5.0	18	16
26	39	.....	.....	.....	.....	.....	300	41	8.0	5.0	16	14
27	39	.....	.....	.....	.....	.....	280	38	8.0	4.0	15	12
28	39	.....	.....	.....	.....	.....	250	36	8.0	4.0	14	11
29	51	.....	.....	.....	.....	.....	222	36	8.0	4.0	11	10
30	51	.....	.....	.....	.....	.....	204	36	8.0	4.0	9.5	13
31	63	.....	.....	.....	.....	.....	.....	34	.....	3.0	7.1	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 15, 1912, and Apr. 13 to Sept. 30, 1913, from two fairly well defined rating curves, new rating curve beginning Sept. 3, 1913; Aug. 24 to Sept. 2, 1913, by the indirect method for shifting channels.

Discharge estimated, because of ice, by Prof. E. F. Chandler, from climatic records, discharge of adjacent drainage areas, and observer's reports on marked variation in discharge, as follows: Jan. 1–15, 4 second-feet; Jan. 16–31, 2 second-feet; Feb. 1–28, 2 second-feet; Mar. 1–15, 2 second-feet; Mar. 16–31, 5 second-feet. Data on which these estimates are based are less complete than similar estimates at most stations in this report, but they represent the best available information. Discharge estimated, because of ice, from daily gage height, climatic records, and discharge of adjacent areas, as follows: Nov. 16–30, 30 second-feet, varying from about 57 to 10 second-feet; Dec. 1–31, 1912, 15 second-feet; and Apr. 1–12, 1913, 820 second-feet.

Monthly discharge of South Branch of Two Rivers at Hallock, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	215	39	110	B.
November	76	.....	50.3	C.
December	.....	.....	15	
January	.....	.....	3	
February	.....	.....	2	
March	.....	.....	4	
April	.....	.....	640	C.
May	170	34	83.5	B.
June	31	8.0	16.6	B.
July	12	3.0	7.36	B.
August	62	.7	11.7	B.
September	27	1.0	11.1	D.
The year	.....	.....	79.0	

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, 1913.

Drainage area.—2,940 square miles.

Gage.—Vertical staff in two sections for medium and low stage, attached to the abutment and a piling at north end of bridge. This gage was installed July 31, 1911. The original gage, which can be read at medium and high stage, is a vertical staff attached to the abutment of the railway bridge. The zeros of the two gages are at the same elevation; at low stage the slope of the water surface between the bridges is inappreciable; at highest stage the readings at the railway bridge would probably be from 0.03 to 0.06 foot greater than at the highway bridge.

Channel and control.—A loose-rock dam about one-third mile below the gage forms the control for this station. The channel consists of clay and silt and is slightly shifting.

Discharge measurements.—Made from the highway bridge. At very low stage made by wading at a section below the Great Northern dam.

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

Regulation.—The water is raised at low stage 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. Considerable water leaks through the dam, but the effect of this dam can not be precisely determined because it is liable to be changed by ice run or spring flood in any year. There are no reservoirs or power plants that affect the flow.

Accuracy.—On account of the varying effect of the dam at low stage, records not considered better than fair.

Discharge measurements of Pembina River at Neche, N. Dak., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 7	E. J. Budge	21.50	3,870
22	E. F. Chandler	10.05	1,320
Sept. 4	.....do	2.83	67

Daily gage height, in feet, of Pembina River at Neche, N. Dak., for the year ending Sept. 30, 1913.

[P. J. Horgan and Mrs. M. Camden, observers.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.0	4.6	.....	.....	.....	.....	.....	7.9	5.0	3.7	2.8	2.8
2	4.0	4.9	.....	.....	.....	.....	.....	7.7	4.9	3.7	2.8	2.8
3	4.1	4.6	.....	.....	.....	.....	8.5	7.4	4.9	3.6	2.8	2.8
4	4.0	4.5	.....	.....	.....	.....	12.2	7.5	4.8	3.6	2.8	2.8
5	4.0	4.4	.....	.....	.....	.....	16.0	7.4	4.8	3.5	2.8	2.8
6	4.1	4.3	.....	.....	.....	.....	19.5	7.3	4.7	3.5	2.8	2.8
7	4.0	4.2	.....	.....	.....	.....	21.2	7.2	4.7	3.5	2.8	2.8
8	4.0	4.0	.....	.....	.....	.....	21.4	7.1	4.6	3.4	2.8	2.8
9	4.1	4.0	.....	.....	.....	.....	20.0	6.9	4.5	3.4	2.8	2.8
10	4.1	4.0	.....	.....	.....	.....	18.2	6.8	4.4	3.3	2.8	2.8
11	4.2	4.2	.....	.....	.....	.....	14.5	6.6	4.2	3.3	2.8	2.8
12	4.2	4.7	.....	.....	.....	.....	13.0	6.5	4.1	3.2	2.8	2.8
13	4.1	4.7	.....	.....	.....	.....	13.2	6.4	4.0	3.2	2.8	2.8
14	4.0	4.7	.....	.....	.....	.....	13.4	6.3	3.9	3.2	2.8	2.7
15	4.0	4.7	.....	.....	.....	.....	13.4	6.2	3.8	3.2	2.8	2.7
16	4.0	4.7	.....	.....	.....	.....	12.9	6.1	3.7	3.3	2.8	2.7
17	4.0	4.7	.....	.....	.....	.....	12.9	6.0	3.5	3.3	2.9	2.7
18	4.0	4.7	.....	.....	.....	.....	12.5	5.9	3.2	3.3	2.9	2.7
19	4.0	4.5	.....	.....	.....	.....	12.0	5.8	3.0	3.3	3.0	2.7
20	4.0	4.5	.....	.....	.....	.....	11.6	5.7	2.8	3.3	3.0	2.7
21	4.0	4.5	.....	.....	.....	.....	11.0	5.5	2.6	3.2	3.0	2.7
22	4.0	4.5	.....	.....	.....	.....	10.2	5.4	2.8	3.1	2.9	2.7
23	4.0	4.5	.....	.....	.....	.....	9.8	5.3	3.0	3.0	2.9	2.7
24	4.0	.....	.....	.....	.....	.....	9.2	5.2	3.2	2.9	2.9	2.7
25	3.8	.....	.....	.....	.....	.....	9.0	5.2	3.5	2.8	2.9	2.7
26	3.8	.....	.....	.....	.....	.....	9.0	5.2	3.7	2.8	2.8	2.7
27	3.8	.....	.....	.....	.....	.....	8.8	5.2	3.8	2.8	2.8	2.7
28	3.7	.....	.....	.....	.....	.....	8.6	5.1	3.8	2.8	2.8	2.8
29	3.6	.....	.....	.....	.....	.....	8.2	5.0	3.8	2.8	2.8	2.8
30	3.6	.....	.....	.....	.....	.....	8.0	5.0	3.8	2.8	2.8	2.8
31	3.6	.....	.....	.....	.....	.....	.....	5.0	.....	2.8	2.8	.....

NOTE.—Discharge relation affected by ice about Nov. 1–6, and Nov. 12, 1912, to Apr. 6, 1913.

Daily discharge, in second-feet, of Pembina River at Neche, N. Dak., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	195	250	.....	.....	.....	.....	.....	850	330	159	66	66
2	195	300	.....	.....	.....	.....	.....	810	316	159	66	66
3	208	250	.....	.....	.....	.....	.....	750	316	147	66	66
4	195	240	.....	.....	.....	.....	.....	770	302	147	66	66
5	195	230	.....	.....	.....	.....	.....	750	302	136	66	66
6	208	230	.....	.....	.....	.....	.....	730	288	136	66	66
7	195	221	.....	.....	.....	.....	3,810	710	288	136	66	66
8	195	195	.....	.....	.....	.....	3,850	690	274	125	66	66
9	208	195	.....	.....	.....	.....	3,530	651	260	125	66	66
10	208	195	.....	.....	.....	.....	3,120	632	247	114	66	66
11	221	221	.....	.....	.....	.....	2,290	594	221	114	66	66
12	221	200	.....	.....	.....	.....	1,960	575	208	104	66	66
13	208	200	.....	.....	.....	.....	2,000	556	195	104	66	66
14	195	200	.....	.....	.....	.....	2,050	538	183	104	66	57
15	195	200	.....	.....	.....	.....	2,050	520	171	104	66	57
16	195	180	.....	.....	.....	.....	1,940	502	159	114	66	57
17	195	180	.....	.....	.....	.....	1,940	485	136	114	75	57
18	195	180	.....	.....	.....	.....	1,850	468	104	114	75	57
19	195	160	.....	.....	.....	.....	1,740	452	84	114	84	57
20	195	160	.....	.....	.....	.....	1,650	436	66	114	84	57
21	195	150	.....	.....	.....	.....	1,520	405	49	104	84	57
22	195	150	.....	.....	.....	.....	1,340	390	66	91	75	57
23	195	150	.....	.....	.....	.....	1,260	375	84	84	75	57
24	195	.....	.....	.....	.....	.....	1,120	360	104	75	75	57
25	172	.....	.....	.....	.....	.....	1,080	360	136	66	75	57
26	172	.....	.....	.....	.....	.....	1,080	360	159	66	66	57
27	172	.....	.....	.....	.....	.....	1,040	360	171	66	66	57
28	161	.....	.....	.....	.....	.....	996	345	171	66	66	66
29	150	.....	.....	.....	.....	.....	912	330	171	66	66	66
30	150	.....	.....	.....	.....	.....	870	330	171	66	66	66
31	150	.....	.....	.....	.....	.....	.....	330	.....	66	66	.....

NOTE.—Daily discharge computed from two fairly well defined rating curves. The rating curves differ slightly below gage height 3.8 feet. It is probable that the rating curve used subsequent to Nov. 23, 1912, is applicable also during the month of October, 1912. Discharge estimated, because of ice, as follows: Nov. 1–6 and 12–23, 1912, daily estimates; Apr. 1–6, 1913, 870 second-feet.

Monthly discharge of Pembina River at Neche, N. Dak., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	221	150	191	11,700	C.
November 1–23	300	150	202	9,220	D.
April	3,850	.....	1,670	99,400	B.
May	850	330	529	32,600	B.
June	330	49	191	11,400	B.
July	159	66	106	6,520	B.
August	84	66	69.5	4,270	B.
September	66	57	61.8	3,680	B.

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, 6¼ miles south of Roseau, 1 mile west of Malung post office, and half a mile above the mouth of the East Branch.

Records available.—May 6, 1911, to September 30, 1913.

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 due to the 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 was not changed and has remained practically stationary subsequent to the above settlement. All gage heights subsequent to April 1, 1913, as 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 subtracted from 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 portion of the flow at Roseau that comes from the East Branch, and to estimate 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.—River frozen over November to April; 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, Rs. 43 and 44. 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, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 9	W. B. Stevenson	7.22	387
Apr. 28	.....do	3.91	81
Aug. 15	E. F. Chandler	2.36	*a* 2.5

a Measurement made by wading at a section about 600 feet below gage; velocity determined by means of floats.

Discharge measurements of East Branch of Roseau River near Malung, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 9	W. B. Stevenson	6.43	344
Apr. 28	do	3.38	131
Aug. 15	E. F. Chandler	1.21	a12.5

a Measurement made by wading.

Discharge measurements of Roseau River at Roseau, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 10	W. B. Stevenson	8.43	755
Apr. 29	do	4.91	197
Aug. 16	E. F. Chandler	2.19	a14.5

a Measurement made by wading at a section above the Great Northern Railway bridge.

Daily gage height, in feet, of West Branch of Roseau River near Malung, Minn., for the year ending Sept. 30, 1913.

[August Hedin, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	11.5	4.5						3.5	2.8	2.3	2.4	2.3
2	11.4	4.4						3.4	2.8	2.3	2.4	2.3
3	10.8	4.3						3.4		2.3	2.3	2.25
4	10.1	4.0						3.5		2.3	2.3	2.25
5	9.2	4.0						3.7		2.4	2.3	2.2
6	8.2	3.9					12.8	3.8	2.8	2.4	2.2	2.2
7	7.5	3.9					12.8	3.8	2.8	2.4	2.2	2.2
8	7.3	3.9					12.6	3.75	2.95	2.5	2.2	2.2
9	7.2	4.0					11.8	3.75	2.9	2.45	2.2	2.2
10	7.0	4.2					10.9	3.85	2.85	2.4	2.2	2.4
11	6.7	4.2					10.6	3.65	2.75	2.5	2.2	2.4
12	6.6	4.1					9.6	3.6	2.7	2.5	2.2	2.35
13	6.5	4.0					8.5	3.4	2.6	3.4	2.2	2.3
14	6.4	3.9					7.7	3.35	2.6	3.9	2.2	2.3
15	6.1	3.8					7.0	3.3	2.5	3.9	2.3	2.3
16	5.8	3.6					6.2	3.3	2.5	3.9	2.4	2.3
17	5.5	3.6					5.6	3.3	2.5	3.9	2.45	2.3
18	5.2	3.6					5.0	3.3	2.45	3.8	2.5	2.25
19	5.0	3.6					4.6	3.25	2.45	3.6	2.45	2.25
20	4.8	3.4					4.3	3.2	2.4	3.4	2.45	2.25
21	4.6	3.2					4.2	3.1	2.4	3.2	2.45	2.25
22	4.4	3.3					4.15	3.1	2.4	3.0	2.45	2.25
23	4.2	3.5					4.3	3.05	2.4	2.9	2.45	2.2
24	4.0	3.2					4.3	3.0	2.4	2.8	2.45	2.2
25	3.9	3.0					4.4	3.1	2.3	2.7	2.4	2.2
26	3.8	3.0					4.3	3.1	2.3	2.6	2.4	2.2
27	3.7	2.9					4.1	3.0	2.4	2.7	2.4	2.2
28	3.6	2.9					3.9	3.0	2.4	2.6	2.4	2.2
29	3.7	2.8					3.8	2.95	2.35	2.5	2.4	2.2
30	4.0	2.7					3.65	2.9	2.3	2.5	2.35	2.2
31	4.5							2.85		2.5	2.35	

NOTE.—Discharge relation affected by ice about Nov. 18, 1912, to Apr. 7, 1913.

Daily discharge, in second-feet, of West Branch of Roseau River near Malung, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,040	115						49	12	2.8	4.0	2.8
2	1,030	108						43	12	2.8	4.0	2.8
3	926	101						43	12	2.8	2.8	2.3
4	807	80						49	12	2.8	2.8	2.3
5	660	80						63	12	4.0	2.8	1.8
6	514	73						70	12	4.0	1.8	1.8
7	421	73						70	12	4.0	1.8	1.8
8	396	73					854	66	18	5.4	1.8	1.8
9	384	80					782	66	16	4.7	1.8	1.8
10	360	94					701	74	14	4.0	1.8	4.0
11	325	94					674	60	10	5.4	1.8	4.0
12	314	87					584	56	9.0	5.4	1.8	3.4
13	303	80					485	43	7.0	43	1.8	2.8
14	292	73					413	40	7.0	78	1.8	2.8
15	260	67					350	37	5.4	78	2.8	2.8
16	230	55					278	37	5.4	78	4.0	2.8
17	200	55					224	37	5.4	78	4.7	2.8
18	173						170	37	4.7	70	5.4	2.3
19	155						134	34	4.7	56	4.7	2.3
20	138						110	31	4.0	43	4.7	2.3
21	122						102	26	4.0	31	4.7	2.3
22	108						98	26	4.0	21	4.7	2.3
23	94						110	24	4.0	16	4.7	1.8
24	80						110	21	4.0	12	4.7	1.8
25	73						118	26	2.8	9.0	4.0	1.8
26	67						110	26	2.8	7.0	4.0	1.8
27	61						94	21	4.0	9.0	4.0	1.8
28	55						78	21	4.0	7.0	4.0	1.8
29	61						70	18	3.4	5.4	4.0	1.8
30	80						60	16	2.8	5.4	3.4	1.8
31	115							14		5.4	3.4	

NOTE.—Daily discharge computed from a rating curve fairly well defined between 49 and 440 second-feet (gage heights, 3.5 and 8.0 feet) and poorly defined beyond these stages. Discharge estimated, because of ice, from gage heights, observer's notes, climatic records, and discharge of adjacent drainage areas, as follows: Nov. 18–30, 27 second-feet, and Dec. 1–31, 1912, 10 second-feet. Discharge estimated, because of ice by Prof. E. F. Chandler, from climatic records, discharge of adjacent drainage areas, and observer's notes concerning any marked variation in discharge, as follows: Jan. 1–31, 3 second-feet; Feb. 1–28, 1 second-foot; Mar. 1–31, 2 second-feet; and Apr. 1–7, 340 second-feet. It should be noted that these estimates are based on less data than estimates at most stations in this report and that they simply represent the best values available for publication.

Monthly discharge of West Branch of Roseau River near Malung, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	1,040	55	318	C.
November	115		58.0	C.
December			10	
January			3	
February			1	
March			2	
April			303	C.
May	74	14	40.1	B.
June	18	2.8	7.68	C.
July	78	2.8	22.6	C.
August	5.4	1.8	3.37	D.
September	4.0	1.8	2.35	D.
The year			64.4	

NOTE.—See footnote to table of daily discharge.

MOUSE RIVER AT MINOT, N. DAK.

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

Records available.—May 5, 1903, to September 30, 1913.

Drainage area.—8,400 square miles.

Gage.—Vertical staff attached to pier of the Anne Street Bridge. The original gage, superseded in 1910 by this gage, was at a bridge about 40 rods farther upstream. At low stage, because the water is ponded by a dam below, there is no appreciable slope in the water surface and the gage zeros at the old and present sites have the same elevation; at high stage there is a slight slope in the water surface; hence, at highest stage the present gage would read slightly less than the original gage would have done, but the difference is probably less than 0.1 foot, even at extreme high water.

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

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

Winter flow.—Discharge relation somewhat affected by ice from about the middle of November to the middle of April. In most winters the discharge is very small, as has been found by occasional discharge measurements. Thus, from a few gage readings each winter approximate estimates of flow may be made.

Regulation.—A dam 4 feet high at the Minneapolis, St. Paul & Sault Ste. Marie Railway water tank, 1 mile below the gage (along the channel), raises the water at the gage about 3 feet at ordinary low stage. The dam has no sluices, being designed merely to give enough depth of water for the intake-pipe suction; but it is not absolutely tight. When the discharge is less than about 6 second-feet the water level falls below the crest of the dam. The crest of the dam is nearly level and can be considered as a broad-crested weir until (at gage reading about 6 feet) corrections for submergence of the weir by the filling of the channel below the weir need be applied. During the flood in April, 1913, a section of the crest of the dam was washed out. A short time later the dam was repaired and the crest was raised slightly.

Accuracy.—The percentage errors of the results for the low-water period may be largely due to small errors made by the gage observer and the undetermined leakage through the dam, although the error is but a few second-feet. At medium stages the results are good.

Discharge measurements of Mouse River at Minot, N. Dak., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 14	W. B. Stevenson	8.67	943
15	do	8.59	928
Sept. 12	E. F. Chandler	4.68	9.4

Daily gage height, in feet, of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1913.

[Ephraim Cox, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.55	4.8	.....	.....	.....	.....	10.8	5.9	5.2	4.9	5.35	5.15
2	4.5	4.8	.....	.....	.....	.....	11.2	5.85	5.15	4.85	5.3	5.1
3	4.5	4.75	.....	.....	.....	.....	11.0	5.8	5.15	4.85	5.3	5.1
4	4.5	4.75	.....	.....	.....	.....	10.5	5.7	5.1	4.8	5.3	5.0
5	4.5	4.7	.....	.....	.....	.....	9.0	5.65	5.1	4.85	5.25	5.0
6	4.5	4.7	.....	.....	.....	.....	8.8	5.6	5.0	4.85	5.25	5.0
7	4.5	4.7	.....	.....	.....	.....	8.9	5.55	5.0	4.85	5.25	5.0
8	4.5	4.7	.....	.....	.....	.....	9.4	5.5	4.95	4.85	5.2	4.95
9	4.55	4.7	.....	.....	.....	4.6	9.5	5.45	4.95	4.8	5.2	4.9
10	4.6	4.7	.....	.....	.....	4.75	9.3	5.45	4.95	4.8	5.2	4.8
11	4.65	4.7	.....	.....	.....	5.1	9.0	5.4	4.95	4.85	5.25	4.7
12	4.7	4.7	.....	.....	.....	5.6	8.8	5.4	5.0	4.85	5.25	4.65
13	4.75	4.65	.....	.....	.....	5.9	8.6	5.35	5.0	4.9	5.25	4.6
14	4.75	4.65	.....	.....	.....	5.95	8.6	5.35	5.0	4.95	5.25	4.55
15	4.8	4.65	.....	3.7	2.0	5.85	8.6	5.35	5.05	5.0	5.2	4.55
16	4.8	4.65	.....	.....	.....	5.8	8.6	5.3	5.05	5.0	5.15	4.5
17	4.75	4.65	.....	.....	.....	5.75	8.6	5.3	5.1	5.05	5.1	4.5
18	4.75	4.65	.....	.....	.....	5.7	8.4	5.35	5.1	5.1	5.1	4.45
19	4.75	4.65	.....	.....	.....	5.4	8.0	5.4	5.1	5.2	5.15	4.45
20	4.75	4.65	.....	.....	.....	5.25	7.8	5.4	5.05	5.3	5.15	4.4
21	4.75	4.6	.....	.....	.....	5.1	7.5	5.35	5.0	5.45	5.15	4.4
22	4.75	4.6	.....	.....	.....	4.95	7.2	5.35	5.0	5.55	5.1	4.4
23	4.7	4.6	.....	.....	.....	4.90	7.0	5.35	5.0	5.55	5.1	4.4
24	4.7	4.6	.....	.....	.....	4.85	7.0	5.3	4.95	5.5	5.1	4.45
25	4.7	4.6	.....	.....	.....	4.80	6.8	5.3	4.95	5.45	5.1	4.5
26	4.7	4.6	.....	.....	.....	4.75	6.6	5.3	4.95	5.4	5.1	4.5
27	4.7	4.6	.....	.....	.....	4.7	6.2	5.3	4.9	5.3	5.1	4.45
28	4.75	4.6	.....	.....	1.8	4.7	6.0	5.25	4.9	5.3	5.1	4.45
29	4.75	4.6	.....	.....	.....	4.7	5.95	5.25	4.9	5.35	5.15	4.4
30	4.75	4.6	.....	.....	.....	6.9	5.9	5.2	4.85	5.4	5.15	4.4
31	4.8	.....	.....	3.0	.....	8.9	.....	5.2	.....	5.4	5.15	.....

NOTE.—Discharge relation affected by ice about Nov. 14, 1912, to Apr. 5, 1913.

Daily discharge, in second-feet, of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	69	.....	.....	.....	.....	966	266	90	29	125	79
2	24	69	.....	.....	.....	.....	1,030	252	79	23	113	68
3	24	60	.....	.....	.....	.....	1,070	239	79	23	113	68
4	24	60	.....	.....	.....	.....	1,080	213	68	17	113	47
5	24	52	.....	.....	.....	.....	910	200	68	23	101	47
6	24	52	.....	.....	.....	.....	966	187	47	23	101	47
7	24	52	.....	.....	.....	.....	984	174	47	23	101	47
8	24	52	.....	.....	.....	.....	1,060	162	38	23	90	38
9	30	52	.....	.....	.....	.....	1,080	149	38	17	90	29
10	36	52	.....	.....	.....	.....	1,050	149	38	17	90	17
11	44	52	.....	.....	.....	.....	1,000	137	38	23	101	10
12	52	52	.....	.....	.....	.....	966	137	47	23	101	8.3
13	60	44	.....	.....	.....	.....	929	125	47	29	101	7.5
14	60	36	.....	.....	.....	.....	929	125	47	38	101	7.0
15	69	36	.....	.....	.....	.....	929	125	57	47	90	7.0
16	69	36	.....	.....	.....	.....	929	113	57	47	79	6.5
17	60	36	.....	.....	.....	.....	929	113	68	57	68	6.5
18	60	36	.....	.....	.....	.....	890	125	68	68	68	6.1
19	60	36	.....	.....	.....	.....	806	137	68	90	79	6.1
20	60	36	.....	.....	.....	.....	761	137	57	113	79	5.6
21	60	30	.....	.....	.....	.....	690	125	47	149	79	5.6
22	60	30	.....	.....	.....	.....	614	125	47	174	68	5.6
23	52	30	.....	.....	.....	.....	562	125	47	174	68	5.6
24	52	30	.....	.....	.....	.....	562	113	38	162	68	6.1
25	52	30	.....	.....	.....	.....	509	113	38	149	68	6.5
26	52	30	.....	.....	.....	.....	455	113	38	137	68	6.5
27	52	30	.....	.....	.....	.....	347	113	29	113	68	6.1
28	60	30	.....	.....	.....	.....	293	101	29	113	68	6.1
29	60	30	.....	.....	.....	.....	279	101	29	125	79	5.6
30	60	30	.....	.....	.....	.....	266	90	23	137	79	5.6
31	69	.....	.....	.....	.....	.....	.....	90	.....	137	79	.....

NOTE.—Daily discharge computed from two rating curves fairly well defined for medium and high stages. Discharge estimated, because of ice, from observer's notes and climatic records, as follows: Nov. 14–30, 1912, and Apr. 1–5, 1913, daily values; Mar. 1–31, 1913, 59 second-feet.

Monthly discharge of Mouse River at Minot, N. Dak., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
October	69	24	48.0	2,950	C.
November	69	30	42.3	2,520	C.
March	.....	.....	59	3,620	
April	1,080	266	795	47,300	B.
May	266	90	144	8,880	B.
June	90	23	30.4	1,800	B.
July	174	17	74.9	4,610	B.
August	125	68	87.3	5,370	B.
September	79	5.6	20.6	1,220	B.

EVAPORATION AT UNIVERSITY, N. DAK.[1]

The evaporation gage at University, N. Dak., was established April 17, 1905, 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, 1913, daily observations being made during the entire open season, except the first 10 days. The gage was protected from disturbance, and the records of observations are reliable.

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 precisely 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 equaivalent 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 a metal tank, 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, 1913, the gross evaporation, the total rainfall, and the mean temperatures for the 10 observations of the water and of the air.

[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.

Evaporation, rainfall, and temperature at University, N. Dak., for the year ending Sept. 30, 1913.

[T. T. Quirke and J. B. Johnson, observers.]

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	0.57	0.26	47	3,250	May 11–20	1.36	0.27	52	48
11–20	.61	.00	42	48	21–31	1.72	.75	61	61
21–31	.48	.03	37	40	June 1–10	2.45	.16	65	58
Nov. 1–9	.15	.05	32	33	11–20	2.30	.63	69	69
10–30					21–30	2.34	.42		73
Dec. 1–31					July 1–10	2.06	.79	72	65
Jan. 1–31					11–20	1.47	1.30	71	66
Feb. 1–28					21–31	2.21	.77	71	66
Mar. 1–31					Aug. 1–10	1.75	.27	71	68
Apr. 1–4					11–20	1.55	1.35	73	74
5–10	.46	.30	37	38	21–31	1.99	.07	66	67
11–20	1.65	.00	53	52	Sept. 1–10	1.23	2.55	69	68
21–30	1.76	.23	54	51	11–20	1.68	.00	61	58
May 1–10	1.15	.50	48	43	21–30	.78	.10	47	48

RAINY LAKE AT RANIER, MINN.

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

Records available.—January 1, 1910, to September 30, 1913.

Gage.—Vertical staff. Prior to August 19, 1911, the gage heights were taken 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 feet between the two points, and to make the records at the two points comparable the readings on the Minnesota and Ontario gage were reduced by 488.50 feet. Recent studies by A. F. Meyer, an 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 feet instead of 488.50 feet. Gage heights from 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 Ranier 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 available maps are too small to show this accurately. Beginning August 19, 1911, the gage heights refer to the gage established by the Canadian Department of Public Works. The gage heights have been referred to the original datum of the gage, the elevation of which is 489.00 feet above that of the Minnesota & Ontario Power Co.'s gage. The gage was maintained at the following elevations during year ending September 30, 1913: October 1, 1912, to October 9, 1912, 488.77 feet; October 15, 1912, to September 30, 1913, 489.25 feet. The records at this station, by indicating the change of water level, show the gain or loss in storage due to the control at International Falls dam, and when used in connection with the records of flow of the Rainy River at International Falls, are of value in determining the natural run-off.

Cooperation.—Gages 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, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.28	7.03	6.45	5.81	4.98	4.00	2.93	3.15	5.45	8.04	8.35	8.38
2	7.26	7.02	6.45	5.78	4.95	3.97	2.89	3.19	5.57	8.19	8.35	8.34
3	7.26	7.01	6.45	5.75	4.91	3.95	2.87	3.23	5.73	8.13	8.39	8.34
4	7.27	7.00	6.41	5.72	4.88	3.92	2.84	3.26	5.83	8.18	8.37	8.34
5	7.27	6.98	6.37	5.70	4.84	3.87	2.80	3.31	5.99	8.21	8.39	8.29
6	7.25	6.98	6.35	5.69	4.80	3.81	2.77	3.37	6.13	8.32	8.40	8.32
7	7.25	6.96	6.33	5.67	4.77	3.75	2.75	3.39	6.25	8.35	8.35	8.34
8	7.26	6.86	6.31	5.65	4.73	3.70	2.71	3.43	6.40	8.35	8.35	8.33
9	7.27	6.92	6.28	5.63	4.69	3.67	2.68	3.47	6.52	8.37	8.43	8.32
10	.....	6.90	6.25	5.61	4.66	3.65	2.65	3.51	6.65	8.37	8.45	8.29
11	.....	6.90	6.22	5.59	4.62	3.63	2.65	3.56	6.77	8.35	8.35	8.32
12	.....	6.89	6.19	5.59	4.59	3.59	2.64	3.62	6.89	8.45	8.30	8.32
13	.....	6.87	6.16	5.57	4.56	3.56	2.65	3.66	7.03	8.45	8.30	8.27
14	.....	6.84	6.12	5.53	4.52	3.53	2.68	3.70	7.11	8.47	8.30	8.24
15	7.25	6.81	6.10	5.46	4.49	3.49	2.69	3.76	7.20	8.43	8.42	8.21
16	7.23	6.77	6.09	5.43	4.45	3.45	2.71	3.83	7.29	8.45	8.35	8.21
17	7.25	6.75	6.07	5.41	4.42	3.41	2.75	3.91	7.37	8.43	8.40	8.19
18	7.19	6.73	6.05	5.39	4.37	3.38	2.79	3.99	7.47	8.41	8.37	8.15
19	7.20	6.73	6.03	5.38	4.33	3.35	2.81	4.05	7.56	8.40	8.34	8.14
20	7.23	6.71	6.01	5.36	4.27	3.32	2.83	4.11	7.63	8.39	8.33	8.15
21	7.17	6.65	5.99	5.31	4.23	3.29	2.85	4.21	7.69	8.37	8.27	8.12
22	7.16	6.65	5.98	5.27	4.19	3.27	2.87	4.33	7.73	8.40	8.29	8.11
23	7.15	6.65	5.97	5.23	4.18	3.25	2.89	4.42	7.78	.....	8.26	8.09
24	7.11	6.61	5.95	5.19	4.15	3.21	2.94	4.52	7.85	8.37	8.33	8.09
25	7.10	6.59	5.93	5.17	4.13	3.17	2.97	4.61	7.91	8.35	8.28	8.05
26	7.09	6.55	5.91	5.15	4.09	3.14	3.00	4.69	7.96	8.35	8.26	8.04
27	7.08	6.53	5.89	5.13	4.07	3.10	3.05	4.77	8.04	.....	8.29	7.99
28	7.07	6.49	5.87	5.09	4.04	3.06	3.10	4.87	8.06	8.31	8.23	8.00
29	7.05	6.41	5.85	5.07	.....	3.03	3.11	4.97	8.05	8.29	8.28	8.00
30	7.05	6.44	5.85	5.05	.....	2.99	3.13	5.11	8.07	8.26	8.31	7.98
31	7.05	.....	5.83	5.02	.....	2.95	.....	5.22	.....	8.29	8.45	.....

NOTE.—Gage heights here published refer to datum 489.00. Gage readings Oct. 1–9, 1912, have been corrected by subtracting 0.23 foot, and Oct. 15, 1912, to Sept. 30, 1913, by adding 0.25 foot.

RAINY RIVER AT INTERNATIONAL FALLS, MINN.

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

Records available.—March 1, 1907, to September 30, 1913.

Drainage area.—14,600 square miles.

Gage.—Vertical staff installed by the United States Geological Survey 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 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 by the Canadian Department of Public Works near the staff gage and at the same datum.

Channel and control.—Practically permanent.

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 is regular.

Winter flow.—Ice rarely forms in the long stretch of water below the dam. It does form, however, at the rapids below the open stretch causing serious backwater at the gage amounting at times to more than 2 feet. Estimates of winter flow are based directly on the records of flow through the turbines of the power company, as 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 Rainy 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 the previous records at 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. The estimated error for December, 1908, as given in that 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, 1913, the discharge relation was affected by backwater from log booms below the gage.

Cooperation.—Estimates of flow through the power house and results of discharge measurements furnished by Canadian Department of Public Works. Discharge measurements were 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, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	A. Pierce [a]	2.23	[b] 5,160	Apr. 2	Brown & Jamison [a]	3.21	[b] 6,020
Nov. 6	R. H. Nelson [a]	2.88	[b] 6,420	May 22	D. W. Jamison [a]	4.55	[b] 7,080
Jan. 12	A. Pierce [a]	3.43	[b] 4,850	June 13	(a)	4.14	[b] 8,180
Feb. 20	G. M. Brown [a]	4.77	[b] 6,940	July 23	D. W. Jamison [a]	7.33	[b] 12,800
Mar. 8	do	4.87	[b] 6,670	Aug. 28	(a)	3.02	7,850
20	do	4.59	[b] 6,730	Sept. 23	(a)	2.78	7,300

[a] Canadian engineers. [b] Discharge relation affected by backwater.

Daily gage height, in feet, of Rainy River at International Falls, Minn., for the year ending Sept. 30, 1913.

[Robert Caple, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.4	2.8	2.8	3.9	4.8	4.8	3.5	4.5	3.8	6.1	5.2	1.7
2	3.3	2.8	3.6	3.9	3.8	4.1	3.2	4.3	3.8	6.2	5.2	2.7
3	3.2	2.2	4.0	4.0	3.7	4.0	3.0	4.2	4.3	6.4	4.9	2.8
4	3.1	2.1	4.0	4.2	4.6	4.9	3.2	3.9	4.2	6.0	4.7	2.9
5	3.2	2.9	4.0	3.2	4.8	4.9	3.1	4.4	4.0	5.6	4.4	2.9
6	2.7	2.9	4.0	3.2	4.8	5.0	2.4	4.7	4.2	6.2	4.4	2.9
7	2.8	2.9	3.8	4.1	4.8	5.0	2.1	4.8	4.4	6.3	4.7	2.8
8	2.9	2.9	3.4	4.2	4.7	4.9	2.8	4.7	4.6	6.2	4.9	3.0
9	3.0	2.8	3.4	4.2	4.2	4.6	3.1	4.5	4.9	6.3	4.9	3.0
10	3.0	2.2	4.3	4.3	4.1	3.9	3.0	4.2	4.9	6.8	4.2	3.0
11	3.0	2.2	4.4	4.5	4.8	4.4	3.1	3.6	4.6	7.0	4.3	3.0
12	3.1	2.6	4.5	3.7	4.8	4.3	3.2	3.6	4.3	7.2	4.6	3.1
13	2.5	2.8	4.5	3.6	4.9	4.2	2.7	3.7	4.1	7.3	4.6	3.1
14	2.8	2.8	4.4	4.3	4.9	4.1	2.8	3.6	4.0	7.6	4.5	2.6
15	2.9	2.8	3.6	4.4	4.9	4.6	4.1	3.6	3.7	7.8	4.5	2.6
16	2.9	2.7	3.4	4.4	4.2	3.5	4.8	3.7	3.9	7.7	4.5	3.0
17	2.8	2.2	4.2	4.4	3.9	3.6	4.9	4.1	3.9	8.2	4.2	3.0
18	2.8	2.4	4.3	4.5	4.7	4.2	5.0	4.4	3.9	8.4	4.3	2.9
19	2.9	2.8	4.4	3.6	4.8	4.5	5.0	4.6	3.8	8.4	4.5	2.9
20	2.5	2.8	4.4	3.6	4.8	4.7	4.4	4.7	4.0	7.9	4.6	2.9
21	2.2	3.0	4.2	4.4	4.8	4.6	4.3	4.5	4.3	7.6	4.6	2.7
22	2.7	2.9	3.3	4.6	4.8	4.6	4.4	4.4	4.4	7.5	4.6	2.7
23	2.8	2.8	3.2	4.6	4.4	3.8	4.3	4.5	4.4	7.3	4.6	2.7
24	2.8	2.3	3.4	4.7	4.1	3.6	4.3	4.6	4.5	7.3	4.1	2.6
25	2.8	2.3	3.0	4.6	4.8	4.3	4.5	4.2	4.6	7.2	3.6	2.6
26	2.8	2.7	2.8	4.0	5.0	4.4	4.9	4.0	4.6	7.0	3.2	2.6
27	2.1	2.8	3.5	3.6	5.0	4.4	4.7	4.1	4.6	6.7	3.0	2.5
28	2.1	2.8	3.2	4.5	4.9	4.3	4.9	3.9	4.9	6.7	3.0	2.4
29	2.7	2.8	3.2	4.7	.....	4.2	5.0	3.7	5.7	6.8	2.9	2.5
30	2.8	2.7	3.1	4.6	.....	3.2	4.8	3.7	6.0	6.2	2.8	2.5
31	2.8	.....	3.8	4.8	.....	2.9	.....	4.1	.....	5.7	1.7	.....

NOTE.—Discharge relation affected by backwater from about Dec. 1 to the latter part of August. See "Accuracy" in station description.

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7,279	7.087	5,801	6,805	6,841	6,850	5,856	6,826	5,535	11,023	9,490	5,251
2	7,202	7,122	6,433	6,795	5,647	5,602	6,246	6,831	6,216	11,058	8,828	6,328
3	7,039	6,184	6,725	6,827	6,385	5,675	5,870	6,814	6,980	11,004	9,223	6,935
4	7,089	6,095	7,001	6,978	6,864	6,749	6,187	5,978	6,752	11,606	9,048	7,019
5	7,078	7,199	6,968	5,980	6,887	6,751	6,634	6,331	6,868	11,438	9,134	6,703
6	6,199	7,146	6,655	5,216	6,895	6,900	5,406	6,827	6,904	11,503	9,139	6,897
7	6,543	7,100	6,149	6,858	6,853	6,905	5,438	6,827	6,820	10,343	9,576	5,885
8	7,060	7,073	5,828	6,796	6,900	6,919	6,621	6,814	6,273	10,106	10,414	7,262
9	7,060	6,791	5,860	6,892	5,738	5,840	6,801	6,881	6,343	9,663	10,022	6,821
10	7,039	6,175	6,913	6,920	5,849	5,725	6,865	6,820	6,795	10,817	9,513	7,006
11	7,045	5,998	6,973	6,921	6,879	6,750	6,792	5,938	6,870	13,475	8,658	7,014
12	7,100	6,568	6,972	5,778	6,884	6,780	6,783	6,172	6,911	13,510	9,108	6,964
13	[a]6,880	6,923	6,962	6,124	6,878	6,716	5,883	6,761	6,902	12,836	9,076	7,010
14	6,664	7,020	6,675	6,911	6,872	6,798	5,419	6,788	7,052	13,539	9,207	6,223
15	7,083	6,955	5,412	6,932	6,853	6,739	6,715	6,730	6,729	14,483	9,264	6,455
16	7,044	7,041	5,532	6,941	5,618	5,464	6,837	6,765	6,398	14,332	8,968	6,960
17	7,047	5,261	7,267	6,909	5,477	5,653	6,801	6,820	7,508	14,570	8,758	7,094
18	6,852	6,511	6,987	6,947	6,865	6,730	6,716	5,994	7,410	14,243	8,651	7,000
19	6,987	6,999	6,850	6,015	6,877	6,747	6,751	6,163	7,336	15,290	9,050	6,985
20	6,594	7,015	6,989	5,073	6,853	6,682	5,324	6,772	7,473	14,706	8,943	6,975
21	5,824	7,089	6,762	6,956	6,894	6,752	6,254	6,796	7,468	12,187	8,936	6,535
22	7,076	7,033	5,900	6,945	6,844	6,715	6,368	6,777	6,689	13,221	9,118	6,909
23	7,111	7,050	4,650	6,909	5,631	5,598	6,706	6,760	7,324	13,254	8,888	7,060
24	7,070	6,174	6,581	6,937	6,054	4,921	6,758	6,785	7,814	13,331	6,232	7,046
25	7,056	5,978	5,011	6,955	6,864	6,840	6,726	6,162	7,840	13,260	7,229	7,215
26	7,078	7,002	4,591	5,896	6,847	6,813	6,746	6,088	7,856	13,262	7,022	6,994
27	6,135	7,054	5,995	6,273	6,830	6,811	5,873	6,749	8,798	12,802	6,965	6,915
28	5,927	7,047	6,549	6,856	6,830	6,775	6,180	6,550	8,832	12,844	7,005	6,021
29	6,968	6,687	5,762	6,928	.....	6,800	6,696	6,889	9,673	13,292	6,767	6,600
30	7,076	6,422	5,137	6,977	.....	5,946	6,913	6,896	9,863	13,727	6,765	7,030
31	7,112	.....	6,751	6,981	.....	5,990	.....	6,906	.....	9,794	5,660	.....

[a] Interpolated by engineers of United States Geological Survey.

NOTE. Daily discharge record 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, 1913.

[Drainage area, 14,600 square miles.[a]]

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
October	7,280	5,820	6,880
November	7,200	5,260	6,730
December	7,270	4,590	6,280
January	6,980	5,070	6,620
February	6,900	5,480	6,560
March	6,920	4,920	6,420
April	6,910	5,320	6,370
May	6,910	5,940	6,620
June	9,860	5,540	7,270
July	15,300	9,660	12,600
August	10,400	5,660	8,540
September	7,260	5,250	6,770
The year	15,300	4,590	7,320

[a] "Discharge in second-feet per square mile" and "Run-off (depth in inches)" are not published for this drainage area, because such values are believed not to represent the natural flow at this station. See "Regulation" in station description.

NOTE.—Discharge computed to 3 significant figures by engineers of the United States Geological Survey from the daily discharge record furnished by S. B. Johnson, hydraulic engineer, Department of Public Works, Canada.

VERMILION RIVER BELOW LAKE VERMILION, NEAR TOWER, MINN.

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

Records available.—May 17, 1911, to September 30, 1913.

Drainage area.—507 square miles.

Gage.—Vertical staff. From October to April, read once daily to half-tenths; from May to September, read morning and evening to half-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.—There are steep rapids just below the gage. As the bed of the stream is composed of solid rock and large bowlders, the control is permanent.

Discharge measurements.—Made from cable just below the gage.

Winter flow.—Owing to the heavy fall at the gage section, amounting to 20 feet in 200 yards, there is little or no backwater from ice during the winter months.

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. There are no gates in the dam, but on July 19, 1912, it was repaired. For a period after this date the flow was lower than normal as there was less leakage. The lake has a slightly larger storage at the present time so that the flow during the winter period of 1912–13 was somewhat larger than it would have been had not the dam been repaired.

Accuracy.—Conditions are favorable for fairly accurate 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, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 16	S. B. Soulé	0.58	105
July 2	do	2.63	908
2	do	2.62	912

Daily gage height, in feet, of Vermilion River below Lake Vermilion, near Tower, Minn., for the year ending Sept. 30, 1913.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.6	0.5	0.5	0.5	0.5	0.5	0.52	.....	3.3	2.8	1.85	0.33
2	.6	.5	.5	.5	.5	.5	.52	.....	3.3	2.7	1.95	.33
3	.6	.5	.5	.5	.5	.5	.52	.....	3.4	2.6	1.85	.33
4	.6	.5	.5	.5	.5	.5	.52	.....	3.4	2.6	1.9	.33
5	.6	.5	.5	.5	.5	.5	.52	1.2	3.4	2.5	1.8	.33
6	.6	.5	.5	.5	.5	.5	.52	1.3	3.5	2.5	1.65	.33
7	.6	.5	.5	.5	.5	.5	.52	1.3	3.5	2.35	1.25	.33
8	.6	.5	.5	.5	.5	.5	.52	1.4	3.5	2.4	1.2	.33
9	.6	.5	.5	.5	.5	.5	.52	1.4	3.5	2.35	1.1	.33
10	.6	.5	.5	.5	.5	.5	.52	1.4	3.5	2.3	.85	.33
11	.6	.5	.5	.5	.5	.5	.52	1.4	3.5	2.4	.65	.33
12	.6	.5	.5	.5	.5	.5	.52	1.4	3.4	2.35	.6	.33
13	.6	.5	.5	.5	.5	.5	.55	1.4	3.4	2.2	.55	.33
14	.6	.5	.5	.5	.5	.5	.55	1.4	3.4	2.25	.53	.33
15	.6	.5	.5	.5	.5	.5	.55	1.5	3.4	2.2	.5	.33
16	.6	.5	.5	.5	.5	.5	.....	1.6	3.4	2.25	.5	.33
17	.6	.5	.5	.5	.5	.5	.....	1.7	3.3	2.2	.5	.33
18	.6	.5	.5	.5	.5	.5	.....	1.8	3.2	2.3	.5	.33
19	.6	.5	.5	.5	.5	.5	.....	1.8	3.2	2.25	.5	.28
20	.55	.5	.5	.5	.5	.5	.....	2.0	3.2	2.2	.45	.28
21	.55	.5	.5	.5	.5	.5	.....	2.0	3.1	2.1	.45	.28
22	.55	.5	.5	.5	.5	.5	.....	2.5	3.0	2.2	.4	.25
23	.55	.5	.5	.5	.5	.5	.....	3.0	3.0	2.05	.4	.23
24	.55	.5	.5	.5	.5	.5	.....	3.1	3.0	2.2	.4	.23
25	.55	.5	.5	.5	.5	.5	.....	3.2	2.9	2.15	.35	.23
26	.55	.5	.5	.5	.5	.5	.....	3.2	2.9	2.15	.35	.23
27	.55	.5	.5	.5	.5	.5	.....	3.2	2.8	2.0	.35	.23
28	.55	.5	.5	.5	.5	.5	.....	3.2	2.8	2.1	.35	.23
29	.55	.5	.5	.5	.....	.5	.....	3.3	2.8	1.95	.35	.23
30	.55	.5	.5	.5	.....	.5	.....	3.3	2.7	1.8	.35	.23
31	.55	.....	.5	.5	.....	.5	.....	3.3	.....	1.9	.35	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1913.

Daily discharge, in second-feet, of Vermilion River below Lake Vermilion, near Tower, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	114	98	98	98	98	98	101	212	1,290	990	466	74
2	114	98	98	98	98	98	101	218	1,290	930	515	74
3	114	98	98	98	98	98	101	222	1,360	870	466	74
4	114	98	98	98	98	98	101	226	1,360	870	490	74
5	114	98	98	98	98	98	101	231	1,360	810	442	74
6	114	98	98	98	98	98	101	257	1,420	810	378	74
7	114	98	98	98	98	98	101	257	1,420	728	244	74
8	114	98	98	98	98	98	101	287	1,420	755	231	74
9	114	98	98	98	98	98	101	287	1,420	728	208	74
10	114	98	98	98	98	98	101	287	1,420	700	158	74
11	114	98	98	98	98	98	101	287	1,420	755	122	74
12	114	98	98	98	98	98	101	287	1,360	728	114	74
13	114	98	98	98	98	98	106	287	1,360	645	106	74
14	114	98	98	98	98	98	106	287	1,360	672	103	74
15	114	98	98	98	98	98	106	321	1,360	645	98	74
16	114	98	98	98	98	98	112	358	1,360	672	98	74
17	114	98	98	98	98	98	119	398	1,290	645	98	74
18	114	98	98	98	98	98	125	442	1,230	700	98	74
19	114	98	98	98	98	98	132	442	1,230	672	98	68
20	106	98	98	98	98	98	138	540	1,230	645	90	68
21	106	98	98	98	98	98	145	540	1,170	590	90	68
22	106	98	98	98	98	98	152	810	1,110	645	83	64
23	106	98	98	98	98	98	158	1,110	1,110	565	83	62
24	106	98	98	98	98	98	165	1,170	1,110	645	83	62
25	106	98	98	98	98	98	172	1,230	1,050	618	76	62
26	106	98	98	98	98	98	179	1,230	1,050	618	76	62
27	106	98	98	98	98	98	186	1,230	990	540	76	62
28	106	98	98	98	98	98	193	1,230	990	590	76	62
29	106	98	98	98	.....	98	200	1,290	990	515	76	62
30	106	98	98	98	.....	98	205	1,290	930	442	76	62
31	106	.....	98	98	.....	98	.....	1,290	.....	490	76	.....

NOTE.—Daily discharge computed from a well-defined rating curve; Apr. 16 to May 4, estimated. Estimates for October, November, and December differ from those published in Water-Supply Paper 325 because of a slight revision of rating curve below gage height 0.6 foot, and estimates of daily discharge below this stage as published in that report should be revised by persons using them. At gage height 0.42 foot (the minimum stage which occurred in 1912) the revised rating curve gives a discharge about 4½ per cent less than that published in Water-Supply Paper 325.

Monthly discharge of Vermilion River below Lake Vermilion, near Tower, Minn., for the year ending Sept. 30, 1913.

[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	114	106	111	0.219	0.25	B.
November	98	98	98	.193	.22	B.
December	98	98	98	.193	.22	B.
January	98	98	98	.193	.22	B.
February	98	98	98	.193	.20	B.
March	98	98	98	.193	.22	B.
April	[a] 205	101	130	.256	.29	C.
May	1,290	[a] 212	598	1.18	1.36	B.
June	1,420	930	1,250	2.47	2.76	A.
July	990	442	685	1.35	1.56	A.
August	515	76	177	.349	.40	A.
September	74	62	69.9	.138	.15	B.
The year	1,420	62	293	.578	7.85	

[a] Estimated.

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 in Little Fork, 1½ miles above mouth of Beaver Brook.

Records available.—June 23, 1909, to September 30, 1913.

Drainage area.—1,720 square miles.

Gage.—Vertical staff; read 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.—Practically permanent.

Discharge measurements.—Made from bridge.

Winter flow.—Determined by measurements made through the ice; river frozen over at station during winter.

Regulation.—River used throughout spring and summer for log driving. No logging dams on river; flow is natural.

Accuracy.—Conditions at station are favorable and records of flow should be reliable except for temporary backwater from log jams at railroad bridge below gage.

Discharge measurements of Little Fork River at Little Fork, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 19	S. B. Soulé	5.82	[a] 113	May 1	S. B. Soulé	13.32	[b] 3,560
Jan. 15	do	5.58	[a] 78.6	July 30	B. J. Peterson	6.88	598
Feb. 18	do	5.50	53.3				

[a] Complete ice cover.

[b] Logs running during measurement, but not lodged anywhere.

Daily gage height, in feet, of Little Fork River at Little Fork, Minn., for the year ending Sept. 30, 1913.

[Herman I. Mous, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.0	6.0	.....	.....	.....	.....	.....	13.3	13.2	8.8	6.5	5.8
2	7.9	6.0	.....	5.9	.....	.....	.....	12.4	13.3	8.6	6.1	5.8
3	7.6	6.0	.....	.....	.....	.....	6.6	12.3	12.9	8.4	5.75	5.9
4	7.4	6.0	.....	.....	.....	.....	.....	12.7	12.4	8.1	5.6	6.0
5	7.2	6.0	6.0	.....	.....	.....	.....	13.2	11.8	8.8	5.7	6.0
6	7.1	6.0	.....	.....	5.5	5.7	.....	13.2	12.4	9.2	5.7	6.1
7	7.1	6.0	.....	.....	.....	.....	.....	13.0	14.2	9.4	5.75	6.2
8	6.8	6.0	.....	.....	.....	.....	.....	12.2	15.6	9.2	5.8	6.3
9	6.6	6.0	.....	6.0	.....	.....	.....	12.0	15.5	8.6	5.85	6.3
10	6.8	6.0	.....	.....	.....	.....	8.7	11.4	14.3	7.9	5.8	6.6
11	6.8	6.0	.....	.....	.....	.....	8.9	10.6	13.2	7.6	5.9	6.8
12	6.7	5.95	5.75	.....	.....	.....	8.8	10.4	12.8	8.0	5.9	7.2
13	6.8	5.95	.....	.....	5.5	5.9	12.6	10.2	11.8	9.4	5.9	7.0
14	6.6	5.9	.....	.....	.....	.....	16.4	10.0	11.0	9.5	5.9	6.9
15	6.7	5.9	.....	5.6	.....	.....	17.2	10.2	9.8	9.4	5.9	6.8
16	6.7	5.9	.....	5.6	.....	.....	18.2	10.6	9.4	9.4	5.85	6.9
17	6.6	6.2	.....	.....	.....	.....	16.6	13.4	9.7	9.6	5.85	6.8
18	6.5	6.4	.....	.....	5.5	.....	15.8	16.4	9.4	9.9	5.75	6.8
19	6.4	6.4	5.7	.....	.....	.....	15.4	16.1	9.4	10.0	5.7	6.6
20	6.4	6.4	.....	.....	5.5	6.1	15.0	15.7	9.0	9.6	5.65	6.5
21	6.2	6.3	.....	.....	.....	.....	14.0	13.6	9.0	9.4	5.8	6.4
22	6.3	6.2	.....	.....	.....	.....	13.7	13.8	8.9	9.3	6.2	6.4
23	6.3	6.1	.....	5.6	.....	.....	13.9	14.5	8.6	9.2	6.0	6.4
24	6.2	6.1	.....	.....	.....	.....	14.0	14.4	8.2	9.0	5.95	6.3
25	6.1	6.2	.....	.....	.....	.....	14.3	13.7	7.8	8.7	5.9	6.3
26	6.1	6.3	5.9	.....	.....	.....	15.6	12.5	7.8	8.2	5.95	6.3
27	5.95	6.3	.....	.....	5.7	6.2	16.4	11.5	7.6	7.6	5.9	6.3
28	5.8	6.3	.....	.....	.....	.....	16.1	10.8	8.1	7.2	5.9	6.3
29	6.1	6.3	.....	.....	.....	.....	15.2	11.1	8.4	7.0	5.9	6.3
30	6.1	6.2	.....	.....	.....	.....	14.2	11.8	8.6	6.8	5.9	6.3
31	6.0	.....	.....	5.5	.....	.....	.....	12.7	.....	6.7	5.8	.....

NOTE.—Discharge relation probably affected by ice about Nov. 17, 1912, to Apr. 16, 1913..

Daily discharge, in second-feet, of Little Fork River at Little Fork, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,030	341	.....	.....	.....	.....	.....	3,540	3,490	1,360	482	289
2	989	341	.....	.....	.....	.....	.....	3,060	3,540	1,280	368	289
3	870	341	.....	.....	.....	.....	.....	3,010	3,320	1,190	276	315
4	793	341	.....	.....	.....	.....	.....	3,220	3,060	1,070	240	341
5	719	341	.....	.....	.....	.....	.....	3,490	2,760	1,360	264	341
6	683	341	.....	.....	.....	.....	.....	3,490	3,060	1,540	264	368
7	683	341	.....	.....	.....	.....	.....	3,380	4,040	1,630	276	395
8	578	341	.....	.....	.....	.....	.....	2,960	4,810	1,540	289	423
9	513	341	.....	.....	.....	.....	.....	2,860	4,760	1,280	302	423
10	578	341	.....	.....	.....	.....	.....	2,560	4,100	989	289	513
11	578	341	.....	.....	.....	.....	.....	2,180	3,490	870	315	578
12	545	328	.....	.....	.....	.....	.....	2,080	3,270	1,030	315	719
13	578	328	.....	.....	.....	.....	.....	2,000	2,760	1,640	315	647
14	513	315	.....	.....	.....	.....	.....	1,900	2,360	1,680	315	612
15	545	315	.....	.....	.....	.....	.....	2,000	1,820	1,640	315	578
16	545	315	.....	.....	.....	.....	.....	2,180	1,640	1,640	302	612
17	513	.....	.....	.....	.....	.....	5,360	3,600	1,770	1,720	302	578
18	482	.....	.....	.....	.....	.....	4,920	5,250	1,640	1,860	276	578
19	452	.....	.....	.....	.....	.....	4,700	5,080	1,640	1,900	264	513
20	452	.....	.....	.....	.....	.....	4,480	4,860	1,460	1,720	252	482
21	395	.....	.....	.....	.....	.....	3,930	3,710	1,460	1,640	289	452
22	423	.....	.....	.....	.....	.....	3,760	3,820	1,410	1,590	395	452
23	423	.....	.....	.....	.....	.....	3,880	4,200	1,280	1,540	341	452
24	395	.....	.....	.....	.....	.....	3,930	4,150	1,110	1,460	328	423
25	368	.....	.....	.....	.....	.....	4,100	3,760	949	1,320	315	423
26	368	.....	.....	.....	.....	.....	4,810	3,110	949	1,110	328	423
27	328	.....	.....	.....	.....	.....	5,250	2,610	870	870	315	423
28	289	.....	.....	.....	.....	.....	5,080	2,260	1,070	719	315	423
29	368	.....	.....	.....	.....	.....	4,590	2,410	1,190	647	315	423
30	368	.....	.....	.....	.....	.....	4,040	2,760	1,280	578	315	423
31	341	.....	.....	.....	.....	.....	.....	3,220	.....	545	289	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated, because of ice, from gage heights, observer's notes, 3 discharge measurements, and climatic records, as follows: Nov. 17–30, 300 second-feet; Dec. 1–18, 180 second-feet; Dec. 19–31, 105 second-feet; Jan. 1–14, 90 second-feet; Jan. 15–31, 75 second-feet; Feb. 1–17, 60 second-feet; Feb. 18–28, 55 second-feet; Mar. 1–31, 85 second-feet; Apr. 1–9, 100 second-feet; and Apr. 10–16, 1,500 second-feet.

Monthly discharge of Little Fork River at Little Fork, Minn., for the year ending Sept. 30, 1913.

[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	1,030	341	539	0.313	0.36	B.
November	.....	.....	318	.185	.21	C.
December	.....	.....	150	.087	.10	C.
January	.....	.....	82	.048	.06	C.
February	.....	.....	58	.034	.04	C.
March	.....	.....	85	.049	.06	D.
April	.....	.....	2,470	1.44	1.61	C.
May	5,250	1,900	3,180	1.85	2.13	B.
June	4,810	870	2,350	1.37	1.53	B.
July	1,900	545	1,320	.767	.88	A.
August	482	240	309	.180	.21	A.
September	719	289	464	.270	.30	A.
The year	.....	.....	946	.550	7.49	

UPPER MISSISSIPPI RIVER DRAINAGE BASIN.

MISSISSIPPI RIVER ABOVE SANDY RIVER, NEAR LIBBY, MINN.

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

Records available.—September 1, 1895, to September 30, 1913.

Drainage area.—4,510 square miles.

Gage.—Vertical staff.

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

Regulation.—Flow 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 for the purpose of determining the flow of the 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, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,440	1,460	918	563	534	636	654	2,040	2,270	2,470	1,840	1,570
2	2,340	1,420	885	563	527	633	676	2,040	2,260	2,350	1,820	1,630
3	2,240	1,380	853	563	520	630	696	2,040	2,260	2,230	1,790	1,700
4	2,140	1,340	820	563	513	628	716	2,040	2,260	2,110	1,760	1,760
5	2,040	1,300	787	563	506	625	738	2,040	2,260	1,990	1,740	1,820
6	1,940	1,260	755	563	499	622	758	2,040	2,260	1,870	1,710	1,880
7	1,930	1,220	722	563	495	620	778	2,040	2,250	1,750	1,680	1,890
8	1,930	1,180	690	562	493	617	798	2,040	2,250	1,630	1,660	1,900
9	1,930	1,150	657	560	508	614	834	2,020	2,250	1,820	1,690	1,910
10	1,930	1,110	624	557	523	611	869	2,000	2,250	2,000	1,720	1,920
11	1,920	1,070	592	555	538	608	905	1,980	2,270	2,180	1,750	1,930
12	1,920	1,030	559	552	553	600	940	1,970	2,290	2,360	1,780	1,940
13	1,920	990	523	550	578	593	976	1,950	2,320	2,540	1,810	1,900
14	1,920	988	522	547	588	586	1,010	1,930	2,340	2,720	1,840	1,860
15	1,920	986	521	545	598	579	1,050	1,920	2,360	2,910	1,870	1,820
16	1,910	983	521	542	585	572	1,080	1,900	2,380	3,090	1,900	1,780
17	1,850	981	520	545	571	564	1,120	2,010	2,400	3,270	1,890	1,740
18	1,780	979	519	549	558	557	1,160	2,120	2,430	3,450	1,870	1,700
19	1,720	976	518	552	544	550	1,250	2,220	2,450	3,300	1,850	1,660
20	1,650	974	517	556	531	543	1,340	2,330	2,470	3,130	1,830	1,620
21	1,590	972	516	559	518	551	1,430	2,440	2,500	2,960	1,810	1,580
22	1,520	970	520	563	503	559	1,520	2,540	2,510	2,790	1,790	1,540
23	1,520	967	525	567	525	567	1,610	2,650	2,520	2,620	1,770	1,520
24	1,520	965	530	570	548	575	1,700	2,600	2,530	2,430	1,760	1,490
25	1,510	963	534	574	560	583	1,800	2,550	2,540	2,260	1,720	1,470
26	1,510	960	538	569	583	591	1,850	2,500	2,550	2,200	1,680	1,450
27	1,510	958	543	563	606	600	1,900	2,460	2,560	2,130	1,650	1,420
28	1,500	955	548	558	638	608	1,940	2,410	2,570	2,070	1,620	1,400
29	1,500	953	552	552	.....	617	1,990	2,370	2,580	2,000	1,580	1,370
30	1,500	950	557	546	.....	626	2,040	2,320	2,590	1,940	1,540	1,350
31	1,500	.....	563	541	.....	634	.....	2,270	.....	1,870	1,510	.....

Monthly discharge of Mississippi River above Sandy River near Libby, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Run-off (total in millions of cubic feet).
	Maximum.	Minimum.	Mean.	
October	2,440	1,500	1,810	4,850
November	1,460	950	1,080	2,800
December	918	516	611	1,640
January	574	541	557	1,490
February	638	493	544	1,320
March	636	543	597	1,600
April	2,040	654	1,200	3,110
May	2,650	1,900	2,190	5,860
June	2,590	2,250	2,390	6,190
July	3,450	1,630	2,400	6,430
August	1,900	1,510	1,750	4,690
September	1,940	1,350	1,680	4,350
The year	3,450	493	1,410	44,300

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

MISSISSIPPI RIVER AT ANOKA, MINN.

Location.—At highway bridge connecting Anoka with Champlain, a short distance above mouth of Rum River.

Records available.—November 3, 1896, to September 10, 1897 (United States Engineer Corps records); May 8, 1905, to December 31, 1913, when station was discontinued.

Drainage area.—17,100 square miles.

Gage.—Chain gage; read morning and evening to half-tenths. Limits of use: Half-tenths below and tenths above −0.7 foot. Staff gage prior to 1909; datum of chain gage same as that used by United States Engineer Corps in 1896 and 1897.

Channel and control.—Practically permanent; control temporarily changed for a few days at a time by log jams.

Discharge measurements.—Made from bridge.

Winter flow.—Affected by ice; regular observations discontinued. Monthly discharge during winter based on records of flow kept by United States Engineer Corps at Lock and Dam No. 2 below Minneapolis, allowance being made for increase in flow between the different points.

Regulation.—Nearest dam located at Minneapolis but, because of the fall between the two points, does not influence Anoka station. The first dam above Anoka is at St. Cloud. The flow of the river is controlled by Government dams on the upper river at Lake Winnibigoshish, Leech Lake, Pokegama Falls, Sandy Lake, Pine River, and Gull Lake, for the purpose of increasing the low-water, open-season flow in the interest of navigation. River is used extensively for log driving, but there is very little backwater from log jams below the station, except for a few days at a time. Beginning December 21 the discharge relation was affected by new dam at Coon Creek Rapids.

Accuracy.—Records reliable. No measurements made during 1907 and 1908, but those made subsequently indicate no great change in rating curve as developed in 1897, 1905, and 1906; therefore it can be applied to all gage heights since establishment of station.

Discharge measurements of Mississippi River at Anoka, Minn., during the period Oct. 1, 1912, to Dec. 31, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 9	Hoyt and Soulé	0.81	[a] 6,380
Oct. 23	S. B. Soulé	.89	6,430

[a] Logs running; control apparently clear.

Daily gage height, in feet, of Mississippi River at Anoka, Minn., during the period Oct. 1, 1912, to Dec. 31, 1913.

[B. J. Witte, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.1	−0.2						1.0	1.2	0.3	1.0	0.3	0.4	0.8	0.6
2	.1	— .2						.8	1.2	.4	.9	.4	.4	.7	.6
3	.2	— .2						.9	1.0	.4	.8	.4	.2	.7	.6
4	.2	— .2					0.0	1.1	.8	1.2	.4	.4	.3	.8	.7
5	.2	— .2					.3	.8	1.0	1.0	.6	.3	.1	.7	.6
6	.2	— .3					.3	.8	.8	.8	.4	.4	.4	.7	.6
7	.2	— .3					.0	.7	.6	1.2	.6	.3	.4	.7	.2
8	.1	— .2					.1	.6	.4	1.5	.4	.5	.6	.8	.2
9	.1	— .3					.3	.7	.2	1.6	.6	.4	.4	.7	.1
10	.2	— .4					.2	.6	.3	1.4	.5	.7	.6	.7	.0
11	.2	— .4					.2	.6	.3	1.4	.5	.9	.8	.6	.1
12	.3	— .3					.3	.6	.2	1.4	.5	1.0	1.2	.5	.0
13	.2	— .4					.3	.6	.2	1.4	.5	.8	1.2	.2	—.1
14	.1	— .5					.3	.6	.2	1.6	.3	.9	1.5	.2	.0
15	.1	— .4					.3	.6	.1	1.7	.4	.9	1.4	.2	.1
16	.0	— .4					.2	.8	.2	2.1	.3	1.0	1.5	.2	.1
17	.1	— .4					.3	.8	.2	2.0	.5	.8	1.6	.1	.2
18	.1	— .5					.3	1.2	.3	2.0	.5	.9	1.4	.0	.2
19	.1	— .4					.1	1.2	.4	2.1	.6	.7	1.4	.2	.1
20	.2	— .4					— .1	1.5	.4	2.0	.5	.7	1.1	.3	.1
21	.2	— .4					.4	1.8	.4	1.9	.6	.6	1.2	.4	2.6
22	.3	— .4					.4	1.9	.4	1.9	.6	.6	1.0	.4	2.8
23	.2	— .4					.2	2.0	.3	1.8	.7	.5	.9	.3	2.4
24	.3	— .5					.5	2.0	.4	1.7	.7	.7	.9	.2	2.5
25	.1	— .6					.6	2.0	.4	1.5	.9	.5	.8	.5	2.4
26	.0	— .8					.7	2.1	.4	1.5	.8	.6	.7	.6	2.2
27	— .1	— .7					.7	1.8	.4	1.4	.8	.5	.6	.6	2.2
28	— .2	— .8					.8	1.8	.4	1.4	.6	.6	.7	.7	2.1
29	— .2	— .8					.9	1.6	.4	1.4	.6	.2	.8	.7	2.1
30	— .3	— .6					1.0	1.5	.4	1.3	.6	.4	.6	.8	2.2
31	— .2							1.4		1.2	.5		.7		2.0

NOTE.—Discharge relation probably affected by ice about Dec. 1, 1912, to Mar. 31, 1913, and Dec. 21–31, 1913.

Daily discharge, in second-feet, of Mississippi River at Anoka, Minn., for the period Oct. 1, 1912, to Dec. 21, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,290	3,690	.....	.....	.....	.....	4,080	6,780	7,520	4,740	6,780	4,740
2	4,290	3,690	.....	.....	.....	.....	4,080	6,110	7,520	4,980	6,440	4,980
3	4,510	3,690	.....	.....	.....	.....	4,080	6,440	6,780	4,980	6,110	4,980
4	4,510	3,690	.....	.....	.....	.....	4,080	7,140	6,110	7,520	4,980	4,980
5	4,510	3,690	.....	.....	.....	.....	4,740	6,110	6,780	6,780	5,510	4,740
6	4,510	3,510	.....	.....	.....	.....	4,740	6,110	6,110	6,110	4,980	4,980
7	4,510	3,510	.....	.....	.....	.....	4,080	5,800	5,510	7,520	5,510	4,740
8	4,290	3,690	.....	.....	.....	.....	4,290	5,510	4,980	8,700	4,980	5,240
9	4,290	3,510	.....	.....	.....	.....	4,740	5,800	4,510	9,100	5,510	4,980
10	4,510	3,340	.....	.....	.....	.....	4,510	5,510	4,740	8,300	5,240	5,800
11	4,510	3,340	.....	.....	.....	.....	4,510	5,510	4,740	8,300	5,240	6,440
12	4,740	3,510	.....	.....	.....	.....	4,740	5,510	4,510	8,300	5,240	6,780
13	4,510	3,340	.....	.....	.....	.....	4,740	5,510	4,510	8,300	5,240	6,110
14	4,290	3,180	.....	.....	.....	.....	4,740	5,510	4,510	9,100	4,740	6,440
15	4,290	3,340	.....	.....	.....	.....	4,740	5,510	4,290	9,500	4,980	6,440
16	4,080	3,340	.....	.....	.....	.....	4,510	6,110	4,510	11,200	4,740	6,780
17	4,290	3,340	.....	.....	.....	.....	4,740	6,110	4,510	10,700	5,240	6,110
18	4,290	3,180	.....	.....	.....	.....	4,740	7,520	4,740	10,700	5,240	6,440
19	4,290	3,340	.....	.....	.....	.....	4,290	7,520	4,980	11,200	5,510	5,800
20	4,510	3,340	.....	.....	.....	.....	3,880	8,700	4,980	10,700	5,240	5,800
21	4,510	3,340	.....	.....	.....	.....	4,980	9,910	4,980	10,300	5,510	5,510
22	4,740	3,340	.....	.....	.....	.....	4,980	10,300	4,980	10,300	5,510	5,510
23	4,510	3,340	.....	.....	.....	.....	4,510	10,700	4,740	9,910	5,800	5,240
24	4,740	3,180	.....	.....	.....	.....	5,240	10,700	4,980	9,500	5,800	5,800
25	4,290	3,030	.....	.....	.....	.....	5,510	10,700	4,980	8,700	6,440	5,240
26	4,080	2,760	.....	.....	.....	.....	5,800	11,200	4,980	8,700	6,110	5,510
27	3,880	2,890	.....	.....	.....	.....	5,800	9,910	4,980	8,300	6,110	5,240
28	3,690	2,760	.....	.....	.....	.....	6,110	9,910	4,980	8,300	5,510	5,510
29	3,690	2,760	.....	.....	.....	.....	6,440	9,100	4,980	8,300	5,510	4,510
30	3,510	3,030	.....	.....	.....	.....	6,780	8,700	4,980	7,910	5,510	4,980
31	3,690	.....	.....	.....	.....	.....	.....	8,300	.....	7,520	5,240	.....

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	4,980	6,110	5,510	16	8,700	4,510	4,290
2	4,980	5,800	5,510	17	9,100	4,290	4,510
3	4,510	5,800	5,510	18	8,300	4,080	4,510
4	4,740	6,110	5,800	19	8,300	4,510	4,290
5	4,290	5,800	5,510	20	7,140	4,740	4,290
6	4,980	5,800	5,510	21	7,520	4,980	.....
7	4,980	5,800	4,510	22	6,780	4,980	.....
8	5,510	6,110	4,510	23	6,440	4,740	.....
9	4,980	5,800	4,290	24	6,440	4,510	.....
10	5,510	5,800	4,080	25	6,110	5,240	.....
11	6,110	5,510	4,290	26	5,800	5,510	.....
12	7,520	5,240	4,080	27	5,510	5,510	.....
13	7,520	4,510	3,880	28	5,800	5,800	.....
14	8,700	4,510	4,080	29	6,110	5,800	.....
15	8,300	4,510	4,290	30	5,510	6,110	.....
				31	5,800	.....	.....

NOTE.—Daily discharge computed from a rating curve well defined between 3,180 and 29,700 second-feet (gage heights —0.5 and 6.0 feet). Discharge estimated, because of ice, from the flow of the Mississippi at Dam No. 2 as determined by the United States Engineer Corps, minus the flow of Rum River at Cambridge, and the estimated inflow from the remaining drainage area between Anoka and Dam No. 2, as follows: Dec. 1–31, 1912, 2,640 second-feet; Jan. 1–31, 1913, 2,260 second-feet; Feb. 1–28, 1,910 second-feet; Mar. 1–31, 2,400 second-feet; and Dec. 21–31, 1913, 4,290 second-feet.

Monthly discharge of Mississippi River at Anoka, Minn., from Oct. 1, 1912, to Dec. 31, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1912-13.				
October	4,740	3,510	4,300	B.
November	3,690	2,760	3,320	C.
December	.....	.....	2,640	D.
January	.....	.....	2,260	
February	.....	.....	1,910	
March	.....	.....	2,400	
April	6,780	3,880	4,840	C.
May	11,200	5,510	7,560	A.
June	7,520	4,290	5,210	B.
July	11,200	4,740	8,530	A.
August	6,780	4,740	5,500	A.
September	6,780	4,510	5,540	B.
The year	11,200	.....	4,520	
1913.				
October	9,100	4,290	6,350	A.
November	6,110	4,080	5,280	B.
December	.....	.....	4,530	C.

MISSISSIPPI RIVER AT ST. PAUL, MINN.

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

Records available.—March 1, 1892, to September 30, 1913. Gage heights by United States Singal Service (later United States Weather Bureau) 1873 to 1913; many discharge measurements by United States Engineer Corps prior to 1900; measurements by United States Geological Survey 1909 to 1913.

Drainage area.—35,700 square miles.

Gage.—Chain gage, read once daily to tenths, installed May 9, 1913, on Chicago & Great Western Railroad bridge, about 800 feet below vertical staff gage near foot of Wabasha Street used until that date. 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 present chain gage. At the lower end of the wharf is the United States Engineer Corps gage, the datum of which is 0.5 foot higher than that of the Weather Bureau gage, to which all data herein are referred.

Channel and control.—No well-defined control; channel shifts somewhat from year to year.

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

Winter flow.—River frozen from December to March.

Regulation.—Flow is regulated to a certain extent by Government reservoirs on headwaters at Lake Winnibigoshish, Leech Lake, Pokegama Falls, Sandy Lake, Pine River, and Gull Lake, but effect of these reservoirs is very gradual at St. Paul. Possibly the shutting of the wheel gates of the nearest dam at Minneapolis may cause some daily fluctuations of stage at St. Paul during extreme low water.

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

Accuracy.—As the Weather Bureau gage is read once a day, the recorded mean gage height for the day may be somewhat in error, although occasional additional readings have shown this error was not very serious, largely because of the natural storage of the river channel between the Minneapolis dam and St. Paul. Previous 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 was not then in complete operation, and as this system has had marked influence on the regimen of the river 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 estimated furnished by United States Engineer Corps.

Discharge measurements of Mississippi River at St. Paul, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 28	Hoyt and Soulé	0.38	3,830	June 24	Soulé and Peterson	1.94	6,160
May 14	do	3.16	8,570	Sept. 12	Hoyt and Soulé	3.01	8,230

Daily gage height, in feet, of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.4	0.8	−0.3	0.0	−0.2	0.3	1.9	4.1	5.0	2.3	3.2	1.7
2	1.4	.8	.2	− .1	.2	.4	2.2	4.0	4.8	2.6	3.0	1.5
3	1.4	.9	.0	.8	.4	.3	2.4	4.2	4.5	2.7	2.8	1.6
4	1.3	.9	.0	1.1	.4	.6	2.3	4.1	4.2	3.1	2.7	2.0
5	1.4	.7	.2	.2	.4	.8	2.2	4.1	4.0	3.6	2.5	1.9
6	1.4	.6	.0	.3	.5	−.2	2.4	3.9	4.7	3.5	2.4	1.8
7	1.3	.7	−1.0	.5	.4	.6	2.9	3.9	3.6	3.5	2.4	1.7
8	1.3	.6	− .5	.5	.4	.3	2.5	3.7	3.2	3.5	2.3	1.6
9	1.3	.5	1.1	.3	.4	.7	1.9	3.7	2.8	3.8	2.0	1.6
10	1.3	.5	.5	.4	.5	.8	2.3	3.7	2.8	3.7	2.0	1.7
11	1.2	.5	.8	.3	.4	.7	2.4	3.6	2.7	3.7	1.9	2.6
12	1.4	.5	.8	.2	.4	.6	2.6	3.5	2.4	3.8	1.8	2.8
13	1.4	.4	1.1	.3	.5	.4	2.6	3.3	2.2	3.7	1.9	2.9
14	1.4	.4	1.0	.2	.3	.8	2.9	3.0	2.1	3.7	1.8	2.9
15	1.3	.4	1.0	.4	.4	.7	3.1	3.3	2.0	3.7	1.8	2.6
16	1.3	.5	1.5	.5	.5	1.0	3.6	3.5	1.7	3.7	1.8	2.5
17	1.3	.6	.2	.5	.6	1.5	3.7	3.6	1.6	4.2	1.6	2.5
18	1.2	.5	.0	.3	.4	1.1	4.0	3.5	1.7	4.7	1.4	2.5
19	1.1	.5	− .2	.4	.3	1.2	3.9	4.0	1.8	4.8	1.8	2.5
20	1.2	.4	− .2	.6	.2	.9	4.1	4.5	2.0	4.8	1.9	2.8
21	1.2	.4	.1	.5	.4	.5	3.5	4.8	2.1	4.8	2.0	2.8
22	1.2	.4	.7	.5	.0	.5	4.0	5.1	2.0	4.5	2.1	2.5
23	1.0	.5	.9	.4	.3	.4	3.9	5.4	1.7	4.5	2.0	2.4
24	1.0	.5	.7	.3	.0	.5	3.8	5.7	1.7	4.4	2.0	2.2
25	1.1	.4	.5	.4	.2	.7	3.6	5.9	1.9	4.1	2.5	2.2
26	1.2	.3	.4	.4	.5	.8	3.6	6.0	2.2	3.9	2.6	2.2
27	1.1	.0	.4	.3	.1	.6	3.8	6.1	2.3	3.9	2.7	2.1
28	1.1	− .2	.1	.3	.0	.5	3.7	6.1	2.3	3.6	2.8	2.0
29	1.2	− .2	− .1	.6	.....	.4	4.1	5.9	2.2	3.5	2.5	2.0
30	1.0	− .3	.2	.5	.....	.5	4.2	5.6	2.3	3.5	2.2	1.9
31	.9	.....	.1	.0	.....	1.4	.....	5.3	.....	3.4	2.0	.....

NOTE.—Discharge relation probably affected by ice about Dec. 1, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5,170	4,290	.....	.....	.....	.....	6,090	10,600	12,800	6,820	8,630	5,730
2	5,170	4,290	.....	.....	.....	.....	6,630	10,400	12,200	7,400	8,210	5,390
3	5,170	4,420	.....	.....	.....	.....	7,010	10,800	11,500	7,600	7,800	5,560
4	5,000	4,420	.....	.....	.....	.....	6,820	10,600	10,800	8,420	7,600	6,270
5	5,170	4,160	.....	.....	.....	.....	6,630	10,600	10,400	9,480	7,200	6,090
6	5,170	4,040	.....	.....	.....	.....	7,010	10,100	9,700	9,260	7,010	5,910
7	5,000	4,160	.....	.....	.....	.....	8,000	10,100	9,480	9,260	7,010	5,730
8	5,000	4,040	.....	.....	.....	.....	7,200	9,700	8,630	9,260	6,820	5,560
9	5,000	3,920	.....	.....	.....	.....	6,090	9,700	7,800	9,920	6,270	5,560
10	5,000	3,920	.....	.....	.....	.....	6,820	9,700	7,800	9,700	6,270	5,730
11	4,840	3,920	.....	.....	.....	.....	7,010	9,480	7,600	9,700	6,090	7,400
12	5,170	3,920	.....	.....	.....	.....	7,400	9,260	7,010	9,920	5,910	7,800
13	5,170	3,800	.....	.....	.....	.....	7,400	8,840	6,630	9,700	6,090	8,000
14	5,170	3,800	.....	.....	.....	.....	8,000	8,210	6,450	9,700	5,910	8,000
15	5,000	3,800	.....	.....	.....	.....	8,420	8,840	6,270	9,700	5,910	7,400
16	5,000	3,920	.....	.....	.....	.....	9,480	9,260	5,730	9,700	5,910	7,200
17	5,000	4,040	.....	.....	.....	.....	9,700	9,480	5,560	10,800	5,560	7,200
18	4,840	3,920	.....	.....	.....	.....	10,400	9,260	5,730	12,000	5,220	7,200
19	4,690	3,920	.....	.....	.....	.....	10,100	10,400	5,910	12,200	5,910	7,200
20	4,840	3,800	.....	.....	.....	.....	10,600	11,500	6,270	12,200	6,090	7,800
21	4,840	3,800	.....	.....	.....	.....	9,260	12,200	6,450	12,200	6,270	7,800
22	4,840	3,800	.....	.....	.....	.....	10,400	13,000	6,270	11,500	6,450	7,200
23	4,550	3,920	.....	.....	.....	.....	10,100	13,800	5,730	11,500	6,270	7,010
24	4,550	3,920	.....	.....	.....	.....	9,920	14,600	5,730	11,300	6,270	6,630
25	4,690	3,800	.....	.....	.....	.....	9,480	15,200	6,090	10,600	7,200	6,630
26	4,840	3,680	.....	.....	.....	.....	9,480	15,500	6,630	10,100	7,400	6,630
27	4,690	3,330	.....	.....	.....	.....	9,920	15,800	6,820	10,100	7,600	6,450
28	4,690	3,120	.....	.....	.....	.....	9,700	15,800	6,820	9,480	7,800	6,270
29	4,840	3,120	.....	.....	.....	.....	10,600	15,200	6,630	9,260	7,200	6,270
30	4,550	3,030	.....	.....	.....	.....	10,800	14,400	6,820	9,260	6,630	6,090
31	4,420	.....	.....	.....	.....	.....	.....	13,600	.....	9,050	6,270	.....

NOTE.—Daily discharge computed from two well-defined rating curves. New rating curve used beginning Apr. 1, 1913. Discharge estimated because of ice, from discharge at lock and dam No. 2, from records of United States Engineer Corps, and flow at Mankato, as follows: Dec. 1–31, 3,170 second-feet; Jan. 1–31, 2,770 second-feet; Feb. 1–28, 2,350 second-feet; and Mar. 1–31, 3,770 second-feet.

Monthly discharge of Mississippi River at St. Paul, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	5,170	4,420	4,910	C.
November	4,420	3,030	3,870	C.
December	.....	.....	3,170	D.
January	.....	.....	2,770	
February	.....	.....	2,350	
March	.....	.....	3,770	
April	10,800	6,090	8,550	C.
May	15,800	8,210	11,500	B.
June	12,800	5,560	7,610	B.
July	12,200	6,820	9,910	B.
August	8,630	5,220	6,670	B.
September	8,000	5,390	6,660	B.
The year	15,800	.....	6,000	

NOTE.—Means for December to March, inclusive, based on records of United States Engineer Corps at lock and dam No. 2 below Minneapolis, allowance being made for flow of Minnesota River.

SANDY RIVER BELOW SANDY LAKE RESERVOIR, MINN.

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

Records available.—July 7, 1893, to September 30, 1913.

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 measurements.—The discharge over the dam is computed from the 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 of this flow has not been computed.

Cooperation.—Station maintained by the 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, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0	5	5	5	5	5	5	5	10	200	140	499
2	0	5	5	5	5	5	5	5	10	200	78	501
3	5	5	5	5	5	5	5	5	10	201	502	499
4	5	5	5	5	5	5	5	5	10	202	501	502
5	5	5	5	5	5	5	5	5	10	202	500	499
6	5	5	5	5	5	5	5	5	10	100	499	500
7	5	5	5	5	5	5	5	5	10	99	502	501
8	5	5	5	5	5	5	5	5	10	102	500	500
9	5	5	5	5	5	5	5	5	10	101	501	501
10	5	5	5	5	5	5	5	5	10	103	501	499
11	5	5	5	5	5	5	5	5	200	100	500	500
12	5	5	5	5	5	5	5	5	350	102	500	500
13	5	5	5	5	5	5	5	5	202	100	500	500
14	5	5	5	5	5	5	5	5	200	76	502	501
15	5	5	5	5	5	5	5	5	202	52	502	499
16	5	5	5	5	5	5	5	5	198	53	501	500
17	5	5	5	5	5	5	5	5	201	52	499	501
18	5	5	5	5	5	5	5	5	202	52	502	499
19	5	5	5	5	5	5	5	5	199	171	502	499
20	5	5	5	5	5	5	5	5	201	386	499	502
21	5	5	5	5	5	5	5	5	201	460	500	500
22	5	5	5	5	5	5	5	5	202	476	502	500
23	5	5	5	5	5	5	5	5	200	428	501	500
24	5	5	5	5	5	5	5	5	199	291	500	500
25	5	5	5	5	5	5	5	5	201	223	500	500
26	5	5	5	5	5	5	5	10	201	278	500	499
27	5	5	5	5	5	5	5	10	198	270	499	500
28	5	5	5	5	5	5	5	10	202	223	500	500
29	5	5	5	5	.....	5	5	10	200	222	501	499
30	5	5	5	5	.....	5	5	10	200	200	500	502
31	5	.....	5	5	.....	5	.....	10	.....	175	501	.....

Monthly discharge of Sandy River below Sandy Lake reservoir, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Run-off (total in millions of cubic feet).
	Maximum.	Minimum.	Mean.	
October	5	0	4.7	12.6
November	5	5	5	13.0
December	5	5	5	13.4
January	5	5	5	13.4
February	5	5	5	12.1
March	5	5	5	13.4
April	5	5	5	13.0
May	10	5	6.0	16.1
June	350	10	142	368
July	476	52	190	509
August	503	78	475	1,270
September	502	499	500	1,300
The year	503	0	113	3,550

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

PINE RIVER BELOW PINE RIVER RESERVOIR, MINN.

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

Records available.—March, 1886, to September 30, 1913.

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.

Cooperation.—Station maintained by United States Engineer Corps.

Pine River reservoir is the lowest in the present system of Government reservoirs on the headwaters of the Mississippi. Although the discharge at 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 of the river is increased from 452 to 691 square miles by Little Pine River and one or two other minor tributaries.

Daily discharge, in second-feet, of Pine River below Pine River Reservoir, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	145	80	59	57	a 63	a 68	73	57	50	216	63	66
2	144	a 77	59	58	63	68	73	57	50	216	a 64	66
3	144	75	58	59	63	68	73	a 58	50	216	64	66
4	143	71	58	a 59	64	69	74	58	50	216	64	66
5	a 143	68	58	59	64	69	a 74	58	50	a 216	64	66
6	142	65	57	59	64	69	75	59	49	215	64	a 67
7	141	60	a 57	60	65	70	75	59	a 49	214	64	66
8	141	55	57	60	a 65	a 70	56	59	49	212	64	65
9	140	a 51	57	60	65	71	56	60	50	109	a 64	54
10	140	51	57	61	65	71	55	a 60	52	108	64	55
11	139	51	57	a 61	65	72	55	60	310	107	64	56
12	a 138	51	57	61	65	72	a 55	61	310	a 106	64	57
13	135	51	58	61	65	73	56	62	308	104	64	a 58
14	130	52	a 58	61	65	74	57	62	a 193	100	65	58
15	57	52	58	62	a 65	a 75	58	63	195	65	65	58
16	58	a 52	59	62	65	74	59	63	200	64	a 65	59
17	59	53	59	63	65	74	354	a 64	204	63	65	110
18	60	53	59	a 63	65	73	356	64	206	62	65	115
19	a 59	54	60	63	66	73	a 358	65	210	a 61	65	120
20	59	55	60	64	66	72	346	65	215	61	65	a 124
21	30	55	a 61	64	66	71	53	66	a 219	61	66	124
22	21	56	61	64	a 66	a 69	54	67	219	61	66	124
23	12	a 57	60	65	66	69	54	67	218	62	a 66	124
24	15	57	59	65	66	70	55	a 68	218	62	66	124
25	16	57	58	a 65	66	70	56	65	217	62	66	125
26	17	58	57	65	66	71	a 56	60	217	a 62	66	125
27	78	58	56	66	66	71	56	58	216	62	66	a 125
28	80	58	a 55	66	66	72	57	56	a 215	62	66	125
29	a 81	59	56	65	.....	a 72	57	54	215	62	66	125
30	81	a 59	56	65	.....	72	58	52	216	63	a 66	125
31	82	.....	57	66	.....	73	.....	a 50	.....	63	66	.....

a Discharge measurement.

NOTE.—Daily discharge for November differs from that published in the report of the water-resources investigation of Minnesota, 1911–12, p. 122, which is erroneous, having been estimated from record of gate openings, whereas the figures here given are based on discharge measurements.

Monthly discharge of Pine River below Pine River Reservoir, Minn., for the year ending Sept. 30, 1913.

[Drainage area, 452a square miles.]

Month.	Discharge in second-feet.			Run-off (total in millions of cubic-feet).
	Maximum.	Minimum.	Mean.	
October	145	12	91.3	245
November	80	51	b 58.4	151
December	61	55	58.0	155
January	66	57	62.2	167
February	66	63	65.0	157
March	75	68	71.1	190
April	358	53	99.8	259
May	68	50	60.5	162
June	310	49	167	433
July	216	61	110	295
August	66	63	64.9	174
September	125	54	89.9	233
The year	358	12	83.1	2,620

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

b See footnote to table of daily discharge.

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 steel highway bridge at Nimrod post office, 1 mile above mouth of Cat River, 1 mile below mouth of Willow Creek and about 12 miles east of Sebeka, the nearest railroad point.

Records available.—April 15, 1910, to September 30, 1913.

Drainage area.—1,010 square miles.

Gage.—Chain gage attached to the bridge; read morning and evening to quarter-tenths. Limits of use: Hundreds below 5.0, half-tenths from 5.0 to 6.0, and tenths above 6.0 feet.

Channel and control.—No well-defined control; channel practically permanent during period covered by records.

Discharge measurements.—Made from bridge.

Winter flow.—Affected by ice; observations discontinued when river is frozen.

Regulation.—Dam at outlet of Lower Crow Wing Lake controls water from that part of drainage area. River used for logging but since establishment of station flow has not been affected by log jams. River has considerable fall near station, and 1 mile above makes a descent of 12 feet, known as Western Rapids.

Accuracy.—See footnote to daily discharge table.

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

May 27, 1913: Gage height, 4.86 feet; discharge, 378 second-feet.

Daily gage height, in feet, of Crow Wing River at Nimrod, Minn., for the year ending Sept. 30, 1913.

[W. H. Wintermute, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.0	4.80	.....	.....	.....	.....	.....	4.68	4.80	4.92	5.2	5.2
2	5.0	4.80	.....	.....	.....	.....	.....	4.68	4.80	4.92	5.2	5.2
3	5.0	4.80	.....	.....	.....	.....	.....	4.70	4.78	4.92	5.2	5.2
4	5.0	4.80	.....	.....	.....	.....	.....	4.69	4.75	4.96	5.2	5.4
5	5.0	4.80	.....	.....	.....	.....	.....	4.68	4.78	5.15	5.2	5.5
6	5.0	4.80	.....	.....	.....	.....	.....	4.68	4.78	5.15	5.2	5.5
7	5.0	4.80	.....	.....	.....	.....	.....	4.68	4.78	5.2	5.2	5.5
8	5.0	4.80	.....	.....	.....	.....	6.2	4.68	4.75	5.2	5.15	5.45
9	5.0	4.80	.....	.....	.....	.....	6.2	4.68	4.75	5.25	5.15	5.45
10	4.98	4.80	.....	.....	.....	.....	6.0	4.65	4.72	5.2	5.1	5.5
11	4.95	4.80	.....	.....	.....	.....	6.0	4.65	4.72	5.4	5.1	5.5
12	4.98	4.80	.....	.....	.....	.....	5.3	4.65	4.70	5.45	5.1	5.5
13	4.98	4.82	.....	.....	.....	.....	4.89	4.65	4.70	5.4	5.1	5.5
14	4.95	4.85	.....	.....	.....	.....	4.80	4.65	4.70	5.45	5.1	5.45
15	4.95	4.89	.....	.....	.....	.....	4.76	4.69	4.70	5.55	5.1	5.45
16	4.92	4.86	.....	.....	.....	.....	4.75	4.85	4.70	5.65	5.1	5.4
17	4.90	4.82	.....	.....	.....	.....	4.72	4.85	4.70	5.65	5.15	5.4
18	4.88	4.80	.....	.....	.....	.....	4.70	4.85	4.70	5.6	5.25	5.4
19	4.88	4.80	.....	.....	.....	.....	4.70	4.86	4.78	5.55	5.3	5.4
20	4.88	4.78	.....	.....	.....	.....	4.70	4.94	4.78	5.55	5.3	5.35
21	4.88	4.78	.....	.....	.....	.....	4.68	4.95	4.75	5.5	5.3	5.3
22	4.88	4.75	.....	.....	.....	.....	4.68	4.92	4.70	5.55	5.3	5.3
23	4.85	4.75	.....	.....	.....	.....	4.68	4.92	4.70	5.5	5.25	5.3
24	4.85	4.90	.....	.....	.....	.....	4.70	4.90	4.70	5.5	5.25	5.3
25	4.85	5.4	.....	.....	.....	.....	4.70	4.90	4.70	5.5	5.2	5.25
26	4.85	5.05	.....	.....	.....	.....	4.69	4.90	4.88	5.45	5.2	5.25
27	4.82	5.1	.....	.....	.....	.....	4.68	4.88	4.90	5.3	5.2	5.2
28	4.82	5.1	.....	.....	.....	.....	4.68	4.82	4.88	5.2	5.2	5.2
29	4.80	5.1	.....	.....	.....	.....	4.68	4.80	4.85	5.2	5.2	5.2
30	4.80	5.2	.....	.....	.....	.....	4.68	4.80	4.92	5.2	5.2	5.2
31	4.80	5.4	.....	.....	.....	.....	.....	4.80	.....	5.2	5.2	.....

NOTE.—Discharge relation affected by ice about Nov. 24, 1912, to Apr. 11, 1913.

Daily discharge, in second-feet, of Crow Wing River at Nimrod, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	457	324						253	324	402	604	604
2	457	324						258	324	402	604	604
3	457	324						264	312	402	604	604
4	457	324						258	294	429	604	758
5	457	324						253	312	567	604	838
6	457	324						253	312	567	604	838
7	457	324						253	312	604	604	838
8	457	324						253	294	604	567	798
9	457	324						253	294	641	567	798
10	443	324						236	276	604	530	838
11	422	324						236	276	758	530	838
12	443	324					678	236	264	798	530	838
13	443	337					382	236	264	758	530	838
14	422	356					324	236	264	798	530	798
15	422	382					300	258	264	880	530	798
16	402	362					294	356	264	966	530	758
17	388	337					276	356	264	966	567	758
18	375	324					264	356	264	923	641	758
19	375	324					264	362	312	880	678	758
20	375	312					264	416	312	880	678	718
21	375	312					253	422	294	838	678	678
22	375	294					253	402	264	880	678	678
23	356	294					253	402	264	838	641	678
24	356						264	388	264	838	641	678
25	356						264	388	264	838	604	641
26	356						258	388	375	798	604	641
27	337						253	375	388	678	604	604
28	337						253	337	375	604	604	604
29	324						253	324	356	604	604	604
30	324						253	324	402	604	604	604
31	324							324		604	604	

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). Estimates above 678 second-feet based on an extension of the discharge rating curve and should therefore be used with caution. Discharge Nov. 24–30, 1912, estimated, because of ice, from climatic records and discharge of adjacent drainage areas, at 294 second-feet.

Monthly discharge of Crow Wing River at Nimrod, Minn., for the year ending Sept. 30, 1913.

[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	457	324	401	0.397	0.46	A.
November	382		319	.316	.35	C.
April 12–30	678	253	295	.292	.21	C.
May	422	236	311	.308	.36	A.
June	402	264	302	.299	.33	A.
July	966	402	708	.701	.81	A.
August	678	530	597	.591	.68	A.
September	838	604	726	.719	.80	A.

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 mouth of Prairie River, the nearest tributary.

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

Drainage area.—2,140 square miles.

Gage.—Vertical staff gage; read morning and evening to hundredths. Limits of use: Hundredths below 6.0, half-tenths from 6.0 to 7.5, and tenths above 7.5 feet.

Channel and control.—Fairly permanent.

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

Winter flow.—River frozen over during the winter months; observations discontinued.

Regulation.—Nearest dam above station is over 60 miles upstream and has very slight effect on flow at station.

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

Discharge measurements of Crow Wing River at Motley, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 15	S. B. Soulé	6.35	723
May 26	do	6.77	1,120

Daily gage height, in feet, of Crow Wing River at Motley, Minn., for the year ending Sept. 30, 1913.

[S. W. Jacobs, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	6.25	6.45	6.3	6.45	6.3	16	.....	6.8	6.05	7.2	6.3	6.75
2	.....	6.25	6.4	6.25	6.35	6.25	17	6.25	6.9	6.0	7.25	6.3	6.7
3	.....	6.3	6.35	6.2	6.35	6.2	18	6.25	6.9	6.0	7.3	6.3	6.65
4	.....	6.35	6.3	6.25	6.3	6.5	19	6.2	6.85	6.05	7.2	6.45	6.65
5	.....	6.4	6.3	6.7	6.3	6.8	20	6.2	6.8	6.1	7.1	6.6	6.6
6	.....	6.35	6.3	6.9	6.25	6.85	21	6.2	6.85	6.15	7.0	6.65	6.6
7	.....	6.3	6.25	6.95	6.2	6.85	22	6.25	6.9	6.1	7.0	6.65	6.6
8	.....	6.3	6.25	7.0	6.2	6.85	23	6.25	6.9	6.05	7.0	6.65	6.5
9	.....	6.3	6.2	7.05	6.2	6.75	24	6.35	6.9	6.05	6.85	6.65	6.55
10	.....	6.25	6.2	6.95	6.2	6.75	25	6.4	6.85	6.1	6.8	6.45	6.55
11	.....	6.25	6.15	6.95	6.2	6.85	26	6.4	6.75	6.2	6.75	6.5	6.5
12	.....	6.3	6.1	7.05	6.2	6.9	27	6.4	6.7	6.2	6.75	6.45	6.5
13	.....	6.3	6.1	7.15	6.3	6.9	28	6.35	6.6	6.2	6.65	6.4	6.45
14	.....	6.3	6.05	7.15	6.2	6.85	29	6.3	6.55	6.15	6.55	6.35	6.45
15	.....	6.5	6.05	7.15	6.2	6.8	30	6.25	6.45	6.3	6.5	6.3	6.45
							31	.....	6.45	.....	6.5	6.3	.....

Daily discharge, in second-feet, of Crow Wing River, at Motley, Minn., for the year ending Sept. 30, 1913.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	650	784	680	784	680	16	.....	1,110	550	1,660	680	1,060
2	.....	650	747	650	714	650	17	650	1,240	528	1,730	680	1,000
3	.....	680	714	621	714	621	18	650	1,240	528	1,810	680	955
4	.....	714	680	650	680	822	19	621	1,170	550	1,660	784	955
5	.....	747	680	1,000	680	1,110	20	621	1,110	571	1,510	907	907
6	.....	714	680	1,240	650	1,170	21	621	1,170	596	1,360	955	907
7	.....	680	650	1,300	621	1,170	22	650	1,240	571	1,360	955	907
8	.....	680	650	1,360	621	1,170	23	650	1,240	550	1,360	955	822
9	.....	680	621	1,440	621	1,060	24	714	1,240	550	1,170	955	864
10	.....	650	621	1,300	621	1,060	25	747	1,170	571	1,110	784	864
11	.....	650	596	1,300	621	1,170	26	747	1,060	621	1,060	822	822
12	.....	680	571	1,440	621	1,240	27	747	1,000	621	1,060	784	822
13	.....	680	571	1,580	680	1,240	28	714	907	621	955	747	784
14	.....	680	550	1,580	621	1,170	29	680	864	596	864	714	784
15	.....	822	550	1,580	621	1,110	30	650	784	680	822	680	784
							31	.....	784	.....	822	680	.....

NOTE.—Daily discharge computed from a rating curve well-defined above 621 second-feet (gage-height 6.3 feet.

Monthly discharge of Crow Wing River at Motley, Minn., for the year ending Sept. 30, 1913.

[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.		
April 17–30	747	621	676	0.316	0.16	B.
May	1,240	650	893	.417	.48	A.
June	784	528	612	.286	.32	B.
July	1,810	621	1,230	.575	.66	B.
August	955	621	730	.341	.39	A.
September	1,240	621	956	.447	.50	A.

CROW WING RIVER AT PILLAGER, MINN.

Location.—In sec. 20, T. 133 N., R. 30 W., at highway bridge half a mile south of Pillager, a short distance above mouth of Pillager Creek.

Records available.—May 25 to September 1, 1903; June 11, 1909, to June 30, 1913, when station was discontinued.

Drainage area.—3,230 square miles.

Gage.—Vertical staff; read morning and evening to quarter-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.—Probably permanent except during high water.

Discharge measurements.—Made from bridge.

Winter flow.—Determined by measurements made through the ice.

Regulation.—The influence of a logging dam at the outlet of Lower Crow Wing Lake is observable at times at the gaging station.

Accuracy.—Conditions at this station were favorable for good results, but the construction of a power dam 10 miles below caused backwater at the gage and the station had to be abandoned.

Discharge measurements of Crow Wing River at Pillager, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 18	S. B. Soulé	6.14	[a] 4.40	Feb. 19	S. B. Soulé	6.47	[a] 344
Jan. 17	do	6.22	[a] 358	Apr. 15	do	6.12	970

[a] Complete ice cover.

Daily gage height, in feet, of Crow Wing River at Pillager, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.1	5.7	.....	.....	.....	.....	7.0	6.1	6.3	.....	.....	.....
2	6.1	5.6	.....	.....	.....	.....	7.0	6.25	6.25	.....	.....	.....
3	6.1	5.6	.....	6.3	.....	.....	7.3	6.25	6.2	.....	.....	.....
4	6.0	5.65	.....	.....	.....	.....	7.3	6.35	6.2	.....	.....	.....
5	5.95	5.7	5.8	.....	.....	.....	7.5	6.3	6.0	.....	.....	.....
6	5.95	5.7	.....	.....	6.35	6.6	.....	6.4	6.0	.....	.....	.....
7	5.9	5.7	.....	.....	.....	.....	.....	6.45	5.95	.....	.....	.....
8	5.9	5.7	.....	.....	.....	.....	.....	6.4	5.85	.....	.....	.....
9	5.9	5.7	.....	6.2	.....	.....	.....	6.4	5.75	.....	.....	.....
10	5.9	5.7	.....	.....	.....	.....	.....	6.3	5.65	.....	.....	.....
11	5.9	5.7	.....	.....	.....	.....	.....	6.3	5.6	.....	.....	.....
12	5.9	5.7	5.9	.....	.....	.....	6.8	6.35	5.7	.....	.....	.....
13	5.9	5.7	.....	.....	6.4	6.6	7.0	6.4	5.65	.....	.....	.....
14	5.85	5.65	.....	.....	.....	.....	6.3	6.45	5.85	.....	.....	.....
15	5.8	5.6	.....	.....	.....	.....	6.25	6.6	5.8	.....	.....	.....
16	5.8	5.75	.....	6.2	.....	.....	6.25	7.1	5.75	.....	.....	.....
17	5.8	5.7	.....	6.2	.....	.....	6.45	7.5	5.8	.....	.....	.....
18	5.8	5.65	6.15	.....	.....	.....	6.4	7.4	5.7	.....	.....	.....
19	5.8	5.6	6.15	.....	6.5	.....	6.45	7.4	5.85	.....	.....	.....
20	5.75	5.6	.....	.....	6.5	6.6	6.35	7.4	5.8	.....	.....	.....
21	5.75	5.65	.....	.....	.....	.....	6.35	7.4	5.85	.....	.....	.....
22	5.75	5.65	.....	.....	.....	.....	6.35	7.5	5.85	.....	.....	.....
23	5.75	5.6	.....	6.2	.....	.....	6.25	7.4	5.85	.....	.....	.....
24	5.75	5.5	.....	.....	.....	.....	6.35	7.4	5.95	.....	.....	.....
25	5.75	5.55	.....	.....	.....	.....	6.5	7.3	5.9	.....	.....	.....
26	5.75	6.25	6.2	.....	.....	.....	6.6	7.2	6.0	.....	.....	.....
27	5.7	.....	.....	.....	6.5	6.6	6.6	7.2	6.2	.....	.....	.....
28	5.75	.....	.....	.....	.....	.....	6.5	7.0	6.2	.....	.....	.....
29	5.75	.....	.....	.....	.....	.....	6.35	6.8	6.25	.....	.....	.....
30	5.75	.....	.....	6.3	.....	.....	6.2	6.6	6.2	.....	.....	.....
31	5.75	.....	.....	.....	.....	.....	.....	6.45	.....	.....	.....	.....

NOTE.—Discharge relation affected by ice about Nov. 26, 1912, to Apr. 14, 1913.

Daily discharge, in second-feet, of Crow Wing River at Pillager, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	865	601	.....	.....	.....	.....	.....	965	1,120	.....	.....	.....
2	865	544	.....	.....	.....	.....	.....	1,080	1,080	.....	.....	.....
3	865	544	.....	.....	.....	.....	.....	1,080	1,040	.....	.....	.....
4	793	572	.....	.....	.....	.....	.....	1,160	1,040	.....	.....	.....
5	759	601	.....	.....	.....	.....	.....	1,120	890	.....	.....	.....
6	759	601	.....	.....	.....	.....	.....	1,200	890	.....	.....	.....
7	725	601	.....	.....	.....	.....	.....	1,240	855	.....	.....	.....
8	725	601	.....	.....	.....	.....	.....	1,200	785	.....	.....	.....
9	725	601	.....	.....	.....	.....	.....	1,200	718	.....	.....	.....
10	725	601	.....	.....	.....	.....	.....	1,120	655	.....	.....	.....
11	725	601	.....	.....	.....	.....	.....	1,120	625	.....	.....	.....
12	725	601	.....	.....	.....	.....	.....	1,160	685	.....	.....	.....
13	725	601	.....	.....	.....	.....	.....	1,200	655	.....	.....	.....
14	693	572	.....	.....	.....	.....	.....	1,240	785	.....	.....	.....
15	661	544	.....	.....	.....	.....	1,080	1,370	750	.....	.....	.....
16	661	631	.....	.....	.....	.....	1,080	1,840	718	.....	.....	.....
17	661	601	.....	.....	.....	.....	1,240	2,260	750	.....	.....	.....
18	661	572	.....	.....	.....	.....	1,200	2,150	685	.....	.....	.....
19	661	544	.....	.....	.....	.....	1,240	2,150	785	.....	.....	.....
20	631	544	.....	.....	.....	.....	1,160	2,150	750	.....	.....	.....
21	631	572	.....	.....	.....	.....	1,160	2,150	785	.....	.....	.....
22	631	572	.....	.....	.....	.....	1,160	2,260	785	.....	.....	.....
23	631	544	.....	.....	.....	.....	1,080	2,150	785	.....	.....	.....
24	631	490	.....	.....	.....	.....	1,160	2,150	855	.....	.....	.....
25	631	517	.....	.....	.....	.....	1,280	2,040	820	.....	.....	.....
26	631	.....	.....	.....	.....	.....	1,370	1,940	890	.....	.....	.....
27	601	.....	.....	.....	.....	.....	1,370	1,940	1,040	.....	.....	.....
28	631	.....	.....	.....	.....	.....	1,280	1,740	1,040	.....	.....	.....
29	631	.....	.....	.....	.....	.....	1,160	1,550	1,080	.....	.....	.....
30	631	.....	.....	.....	.....	.....	1,040	1,370	1,040	.....	.....	.....
31	631	.....	.....	.....	.....	.....	.....	1,240	.....	.....	.....	.....

NOTE.—Daily discharge computed from two rating curves fairly well defined between 600 and 5,500 second-feet. Shift occurred during flood in April, 1913. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Nov. 26–30, 465 second-feet; Dec. 1–18, 470 second-feet; Dec. 19–31, 1912, 420 second-feet; Jan. 1–31, 1913, 375 second-feet; Feb. 1–28, 345 second-feet; Mar. 1–31, 410 second-feet; and Apr. 1–14, 600 second-feet.

Monthly discharge of Crow Wing River at Pillager, Minn., for the year ending Sept. 30, 1913.

[Drainage area, 3,230 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	865	601	694	0.215	0.25	B.
November	631	.....	557	.172	.19	C.
December	.....	.....	450	.139	.16	C.
January	.....	.....	375	.116	.13	C.
February	.....	.....	345	.107	.11	C.
March	.....	.....	410	.127	.15	C.
April	.....	.....	915	.283	.32	C.
May	2,260	965	1,570	.486	.56	B.
June	1,120	625	846	.262	.29	B.

LONG PRAIRIE RIVER NEAR MOTLEY, MINN.

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

Records available.—June 10, 1909, to September 30, 1913.

Drainage area.—973 square miles.

Gage.—Vertical staff; read morning and evening, generally to nearest tenth; occasional readings to half-tenths. Limits of use: Hundredths below 5.5, half tenths from 5.5 to 6.5, and tenths above 6.5 feet.

Channel and control.—Light gravel; practically permanent.

Discharge measurements.—Made from bridge at all except low stages; low-water measurements made by wading a short distance upstream.

Winter flow.—River frozen over at gage; observations discontinued. There seems to be a close comparison between the open-water discharge at this station and the flow of the Crow Wing at Pillager, and therefore the winter flow has been based on the flow at Pillager, which is determined by current-meter measurements.

Accuracy.—Conditions at this station are 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.

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

April 14, 1913: Gage height, 5.56 feet; discharge, 271 second-feet.

Daily gage height, in feet, of Long Prairie River near Motley, Minn., for the year ending Sept. 30, 1913.

[Clem Thompson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.32	5.19	.....	.....	.....	.....	.....	5.3	5.5	5.05	5.3	5.2
2	5.32	5.12	.....	.....	.....	.....	.....	5.5	5.4	5.15	5.2	5.2
3	5.31	5.15	.....	.....	.....	.....	.....	5.5	5.5	5.12	5.25	5.3
4	5.30	5.15	.....	.....	.....	.....	.....	5.5	5.45	5.3	5.15	5.5
5	5.26	5.12	.....	.....	.....	.....	.....	5.45	5.3	5.25	5.25	5.2
6	5.29	5.18	.....	.....	.....	.....	.....	5.5	5.35	5.35	5.15	5.3
7	5.25	5.18	.....	.....	.....	.....	.....	5.5	5.3	5.4	5.2	5.2
8	5.25	5.16	.....	.....	.....	.....	.....	5.5	5.3	5.4	5.1	5.3
9	5.24	5.16	.....	.....	.....	.....	.....	5.5	5.2	5.3	5.2	5.2
10	5.25	5.16	.....	.....	.....	.....	.....	5.5	5.3	5.3	5.1	5.35
11	5.26	5.15	.....	.....	.....	.....	.....	5.3	5.3	5.3	5.2	5.3
12	5.29	5.16	.....	.....	.....	.....	.....	5.4	5.2	5.5	5.1	5.3
13	5.29	5.11	.....	.....	.....	.....	.....	5.4	5.3	5.5	5.2	5.4
14	5.29	5.08	.....	.....	.....	.....	5.5	5.4	5.3	5.6	5.2	5.3
15	5.28	5.11	.....	.....	.....	.....	5.4	5.5	5.1	5.6	5.34	5.4
16	5.25	5.14	.....	.....	.....	.....	5.4	5.8	5.2	5.62	5.3	5.2
17	5.25	5.20	.....	.....	.....	.....	5.4	5.9	5.2	5.5	5.4	5.3
18	5.26	5.14	.....	.....	.....	.....	5.35	5.9	5.2	5.6	5.3	5.1
19	5.22	5.14	.....	.....	.....	.....	5.4	5.9	5.1	5.4	5.4	5.2
20	5.22	5.12	.....	.....	.....	.....	5.35	5.9	5.2	5.5	5.5	5.1
21	5.22	5.12	.....	.....	.....	.....	5.35	5.8	5.1	5.4	5.7	5.1
22	5.21	5.15	.....	.....	.....	.....	5.35	5.95	5.0	5.5	5.5	5.2
23	5.20	5.11	.....	.....	.....	.....	5.35	6.0	5.1	5.4	5.5	5.1
24	5.20	.....	.....	.....	.....	.....	5.5	6.0	5.1	5.4	5.4	5.3
25	5.20	.....	.....	.....	.....	.....	5.6	5.9	5.1	5.4	5.5	5.2
26	5.19	.....	.....	.....	.....	.....	5.6	5.9	5.3	5.5	5.38	5.2
27	5.19	.....	.....	.....	.....	.....	5.6	5.85	5.3	5.4	5.48	5.1
28	5.21	.....	.....	.....	.....	.....	5.6	5.7	5.25	5.4	5.35	5.2
29	5.22	.....	.....	.....	.....	.....	5.5	5.7	5.1	5.3	5.38	5.1
30	5.20	.....	.....	.....	.....	.....	5.4	5.6	5.25	5.35	5.25	5.2
31	5.20	.....	.....	.....	.....	.....	.....	5.45	.....	5.3	5.35	.....

NOTE.—Discharge relation affected by ice about Nov. 24, 1912, to Apr. 13, 1913.

Daily discharge, in second-feet, of Long Prairie River near Motley, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	185	145	.....	.....	.....	.....	.....	178	250	110	178	148
2	185	127	.....	.....	.....	.....	.....	250	212	135	148	148
3	181	135	.....	.....	.....	.....	.....	250	250	127	163	178
4	178	135	.....	.....	.....	.....	.....	250	231	178	135	250
5	166	127	.....	.....	.....	.....	.....	231	178	163	163	148
6	175	143	.....	.....	.....	.....	.....	250	195	195	135	178
7	163	143	.....	.....	.....	.....	.....	250	178	212	148	148
8	163	138	.....	.....	.....	.....	.....	250	178	212	122	178
9	160	138	.....	.....	.....	.....	.....	250	148	178	148	148
10	163	138	.....	.....	.....	.....	.....	250	178	178	122	195
11	166	135	.....	.....	.....	.....	.....	178	178	178	148	178
12	175	138	.....	.....	.....	.....	.....	212	148	250	122	178
13	175	125	.....	.....	.....	.....	.....	212	178	250	148	212
14	175	117	.....	.....	.....	.....	250	212	178	290	148	178
15	172	125	.....	.....	.....	.....	212	250	122	290	192	212
16	163	132	.....	.....	.....	.....	212	380	148	299	178	148
17	163	148	.....	.....	.....	.....	212	430	148	250	212	178
18	166	132	.....	.....	.....	.....	195	430	148	290	178	122
19	154	132	.....	.....	.....	.....	212	430	122	212	212	148
20	154	127	.....	.....	.....	.....	195	430	148	250	250	122
21	154	127	.....	.....	.....	.....	195	380	122	212	333	122
22	151	135	.....	.....	.....	.....	195	455	99	250	250	148
23	148	125	.....	.....	.....	.....	195	480	122	212	250	122
24	148	.....	.....	.....	.....	.....	250	480	122	212	212	178
25	148	.....	.....	.....	.....	.....	290	430	122	212	250	148
26	145	.....	.....	.....	.....	.....	290	430	178	250	205	148
27	145	.....	.....	.....	.....	.....	290	405	178	212	242	122
28	151	.....	.....	.....	.....	.....	290	333	163	212	195	148
29	154	.....	.....	.....	.....	.....	250	333	122	178	205	122
30	148	.....	.....	.....	.....	.....	212	290	163	195	163	148
31	148	.....	.....	.....	.....	.....	.....	231	.....	178	195	.....

NOTE.—Daily discharge computed from a rating curve well defined between 430 and 1,650 second-feet (gage heights, 4.9 and 8.0 feet).

Discharge estimated, because of ice, from climatic records, and open-water relation between flow of Crow Wing River at Pillager and Long Prairie River near Motley as follows: Nov. 24–30, 120 second-feet; Dec. 1–31, 1912, 100 second-feet; Jan. 1–31, 1913, 95 second-feet; Feb. 1–28, 90 second-feet, Mar. 1–31, 110 second-feet; and Apr. 1–13, 160 second-feet.

Monthly discharge of Long Prairie River near Motley, Minn., for the years ending Sept. 30, 1912–13.

[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.		
1911–12.						
October	361	125	184	0.189	0.22	A.
November 1–11	301	99	173	.178	.07	B.
December						
January			105	.108	.12	
February			100	.103	.11	
March			120	.123	.14	
April	805	172	299	.307	.34	B.
May	2,960	216	848	.872	1.01	A.
June	640	148	340	.349	.39	A.
July	250	135	171	.176	.20	A.
August	405	185	265	.272	.31	A.
September	270	185	211	.217	.24	A.
1912–13.						
October	185	145	162	.166	.19	A.
November	148		130	.134	.15	B.
December			100	.103	.12	
January			95	.098	.11	D.
February			90	.092	.10	D.
March			110	.113	.13	D.
April	290		201	.207	.23	C.
May	480	178	317	.326	.38	A.
June	250	99	164	.169	.19	A.
July	299	110	212	.218	.25	A.
August	333	122	185	.190	.22	A.
September	250	122	160	.164	.18	A.
The year	480		161	.165	2.25	

NOTE.—Estimates of "Discharge in second-feet per square mile" and "Run-off (depth in inches)" for 1912, supersede those published in Water-Supply Paper 325, which were computed from an erroneous value of the drainage area. Estimates for October, November, and December, 1911, are republished to complete the data for the climatic year.

SAUK RIVER NEAR ST. CLOUD, MINN.

Location.—In sec. 9, T. 124 N., R. 28 W., at highway bridge 3 miles west of St. Cloud 10 miles below the nearest tributary, which enters at Rockville.

Records available.—July 8, 1909, to December 31, 1913.

Drainage area.—816 square miles.

Gage.—Chain gage attached to bridge; read twice daily to quarter-tenths. Limits of use: Hundredths below 6.5, half-tenths from 6.5 to 8.0, and tenths above 8.0 feet.

Channel and control.—No well-defined control; channel shifts somewhat during high water.

Discharge measurements.—Made from bridge; at low stages by wading just a few feet above the bridge section.

Winter flow.—Affected by ice; observations discontinued.

Regulation.—Farmers Milling Co. have an 8-foot masonry dam at Cold Spring, about 15 miles above gaging station. During the fall the plants operate continuously; at other times about 10 hours a day. Fluctuations of stage is caused by operation of dam.

Accuracy.—On account of growth of vegetation and shifting channel, records only fair.

Discharge measurements of Sauk River near St. Cloud, Minn., from Oct. 1, 1912, to Dec. 31, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1912.		*Feet.*	*Sec.-ft.*	1913.		*Feet.*	*Sec.-ft.*
Oct. 15	W. G. Hoyt	6.16	165	Apr. 9	S. B. Soulé	6.90	[a]58.4
15	do	6.13	156	May 19	S. B. Soulé	5.99	148
Nov. 20	do	5.97	116	Sept. 5	W. G. Hoyt	6.38	[b]194
				Oct. 22	do	6.05	154

[a] Complete ice cover.

[b] Weeds and grass in channel.

Daily gage height, in feet, of Sauk River near St. Cloud, Minn., Oct. 1, 1912, to Dec. 31, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.35	.....	.....	.....	.....	.....	.....	6.42	6.36	5.60	6.9	6.7	6.10	6.16	5.92
2	6.30	.....	.....	.....	.....	.....	.....	6.31	6.25	5.94	6.8	6.8	6.11	5.91	6.42
3	6.35	.....	.....	.....	.....	.....	.....	6.44	6.41	6.12	6.7	6.9	6.14	5.91	6.41
4	6.30	.....	.....	.....	.....	.....	.....	6.24	6.41	6.26	6.6	6.75	6.21	6.36	6.38
5	6.30	.....	.....	.....	.....	.....	.....	6.19	6.41	6.01	6.7	6.6	6.15	6.35	6.10
6	6.40	.....	.....	.....	.....	.....	.....	6.19	6.24	6.11	6.6	6.6	5.84	6.34	6.05
7	6.35	6.09	.....	.....	.....	.....	.....	6.46	5.99	5.62	6.55	6.39	6.12	6.36	6.28
8	6.25	6.05	.....	.....	.....	.....	.....	6.44	5.80	6.14	6.65	6.38	6.12	6.35	6.55
9	6.20	5.95	.....	.....	.....	.....	6.9	6.40	5.60	6.34	6.6	6.42	6.16	6.32	6.45
10	6.05	5.85	.....	.....	.....	.....	7.4	.....	5.35	6.40	6.6	6.48	6.24	6.10	6.75
11	6.10	5.40	.....	.....	.....	.....	7.25	.....	5.55	6.9	6.28	6.7	6.28	6.55	6.6
12	6.15	6.10	.....	.....	.....	.....	7.0	.....	5.72	7.05	6.48	6.55	6.29	6.35	6.65
13	5.30	5.85	.....	.....	.....	.....	6.8	.....	5.90	7.05	6.38	6.41	5.99	6.26	6.7
14	5.35	5.70	.....	.....	.....	.....	5.96	.....	5.90	6.7	6.35	6.36	6.28	6.24	6.32
15	.....	5.75	.....	.....	.....	.....	6.20	.....	5.98	7.2	6.28	5.98	6.30	6.25	5.95
16	.....	5.90	.....	.....	.....	.....	6.05	.....	5.36	8.3	6.24	6.30	6.32	6.10	6.5
17	.....	5.65	.....	.....	.....	.....	6.06	.....	5.82	7.7	6.35	6.32	6.32	6.06	6.65
18	.....	5.50	.....	.....	.....	.....	6.08	.....	5.89	7.6	6.12	6.25	6.30	6.00	6.65
19	.....	5.75	.....	.....	.....	.....	6.05	.....	5.91	7.5	6.45	6.21	6.19	6.18	6.7
20	.....	5.90	.....	.....	.....	.....	5.99	6.5	5.96	7.45	6.55	6.20	6.02	6.21	6.55
21	.....	6.05	.....	.....	.....	.....	5.88	6.65	5.91	7.4	6.55	6.05	6.00	6.21	6.65
22	.....	6.00	.....	.....	.....	.....	6.08	6.75	5.76	7.45	6.8	5.90	6.18	6.29	6.31
23	.....	6.15	.....	.....	.....	.....	6.19	6.8	5.52	7.5	6.9	.....	6.21	5.89	6.5
24	.....	6.56	.....	.....	.....	.....	6.30	6.8	5.60	7.4	7.3	.....	6.21	5.74	6.9
25	.....	5.50	.....	.....	.....	.....	6.35	7.0	5.52	7.2	7.3	6.05	6.20	5.81	6.5
26	.....	6.15	.....	.....	.....	.....	6.35	7.0	5.79	7.15	7.1	6.20	6.14	5.86	6.28
27	.....	6.6	.....	.....	.....	.....	6.31	6.7	5.96	7.15	7.05	6.20	5.92	6.04	6.19
28	.....	.....	.....	.....	.....	.....	6.40	6.65	5.91	6.9	7.0	6.19	6.18	5.90	6.16
29	.....	.....	.....	.....	.....	.....	6.55	6.5	5.89	7.0	6.95	6.00	6.19	6.40	5.95
30	.....	.....	.....	.....	.....	.....	6.55	6.55	5.74	7.0	6.9	6.10	6.08	6.28	6.06
31	.....	.....	.....	.....	.....	.....	.....	6.44	.....	6.8	6.9	.....	6.18	.....	6.08

NOTE.—Discharge relation affected by ice about Nov. 21, 1912, to Apr. 13, 1913, but probably not materially affected during November and December, 1913.

Daily discharge, in second-feet, of Sauk River near St. Cloud, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	231	.....	.....	.....	.....	.....	.....	256	238	34	404	316
2	215	.....	.....	.....	.....	.....	.....	223	206	90	358	358
3	231	.....	.....	.....	.....	.....	.....	263	253	129	316	404
4	215	.....	.....	.....	.....	.....	.....	208	253	166	277	337
5	215	.....	.....	.....	.....	.....	.....	189	253	104	316	277
6	248	.....	.....	.....	.....	.....	.....	189	203	126	277	277
7	231	120	.....	.....	.....	.....	.....	269	140	37	259	205
8	199	132	.....	.....	.....	.....	.....	263	99	134	296	202
9	183	109	.....	.....	.....	.....	.....	250	68	189	277	215
10	142	88	.....	.....	.....	.....	.....	.....	42	208	277	234
11	155	20	.....	.....	.....	.....	.....	.....	62	404	171	316
12	169	144	.....	.....	.....	.....	.....	.....	85	482	284	259
13	14	88	.....	.....	.....	.....	.....	.....	120	482	202	211
14	19	61	.....	.....	.....	.....	.....	133	120	316	192	196
15	.....	69	.....	.....	.....	.....	.....	192	133	565	171	98
16	.....	98	.....	.....	.....	.....	.....	154	.....	38	1,320	160	177
17	.....	53	.....	.....	.....	.....	.....	156	.....	94	885	192	183
18	.....	32	.....	.....	.....	.....	.....	161	.....	107	815	129	163
19	.....	69	.....	.....	.....	.....	.....	154	.....	112	750	224	152
20	.....	98	.....	.....	.....	.....	.....	140	282	122	718	259	149
21	.....	.....	.....	.....	.....	.....	.....	116	336	101	685	259	113
22	.....	.....	.....	.....	.....	.....	.....	161	378	76	718	358	82
23	.....	.....	.....	.....	.....	.....	.....	189	400	48	750	404	a 92
24	.....	.....	.....	.....	.....	.....	.....	220	400	56	685	625	a 103
25	.....	.....	.....	.....	.....	.....	.....	235	500	48	565	625	113
26	.....	.....	.....	.....	.....	.....	.....	235	500	74	538	510	149
27	.....	.....	.....	.....	.....	.....	.....	228	356	101	538	482	149
28	.....	.....	.....	.....	.....	.....	.....	250	336	92	404	455	146
29	.....	.....	.....	.....	.....	.....	.....	300	282	89	455	430	102
30	.....	.....	.....	.....	.....	.....	.....	300	300	67	455	404	124
31	.....	.....	.....	.....	.....	.....	.....	.....	263	.....	358	404	.....

a Discharge interpolated.

Daily discharge, in second-feet, of Sauk River near St. Cloud, Minn., for the period Oct. 1 to Dec. 31, 1913.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day	Oct.	Nov.	Dec.
1	131	182	124	11	200	300	317	21	142	195	336
2	133	122	256	12	208	295	336	22	187	217	223
3	140	122	253	13	129	209	356	23	195	118	282
4	156	238	244	14	209	203	226	24	195	89	450
5	142	235	166	15	206	206	131	25	192	101	282
6	89	232	154	16	226	166	282	26	176	111	214
7	147	238	214	17	226	156	336	27	124	152	189
8	147	235	300	18	220	142	336	28	187	120	182
9	156	226	266	19	189	187	356	29	189	260	131
10	176	166	378	20	147	195	300	30	161	214	156
								31	187		161

NOTE.—Daily discharge computed from two fairly well defined rating curves. Backwater from growth of grass in channel has been assumed to have occurred during last part of June.

For days on which gage was not read discharge was estimated as follows: Oct. 15–31, 1912, 150 second-feet, and Nov. 1–6, 125 second-feet, from the discharge measurements made Oct. 15 and Nov. 20, 1912, and a study of the records of flow at Rockford and Watson, Minn.; May 10–19, 1913, 300 second-feet, from a study of the records of Long Prairie River near Motley and Elk River near Big Lake. Discharge estimated, on account of ice, as follows: Nov. 21–30, 1912, 75 second-feet; Dec. 1–31, 1912, 80 second-feet (by comparison with the flow of Elk River near Big Lake).

Monthly discharge of Sauk River near St. Cloud, Minn., Oct. 1, 1912, to Dec. 31, 1913.

[Drainage area, 816 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1912-13.						
October	248	14	162	0.199	0.23	C.
November			89.4	.110	.12	C.
December			80	.098	.11	D.
April 14-30	300	116	195	.239	.15	B.
May			304	.373	.43	B.
June	253	38	117	.143	.16	C.
July	1,320	34	455	.558	.64	C.
August	625	129	321	.393	.45	C.
September	404	82	197	.241	.27	C.
1913.						
October	226	89	171	.210	.24	B.
November	300	89	185	.227	.25	B.
December	450	124	256	.314	.36	B.

ELK RIVER NEAR BIG LAKE, MINN.

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

Records available.—April 15, 1911, to September 30, 1913.

Drainage area.—615 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 2.0, and tenths above 2.0 feet.

Channel and control.—Channel apt to shift during extremely high water; during low water practically permanent except at extremely low stages when possible backwater may result from growth of vegetation.

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

Winter flow.—Determined by measurements made through the ice.

Regulation.—Flow above station not regulated; only dam on river is 8 miles below, near mouth.

Discharge measurements of Elk River near Big Lake, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 21	S. B. Soulé	0.84	[a] 95	Feb. 25	S. B. Soulé	1.32	[a] 69
21	do	.84	[a] 94	Mar. 18	do	1.85	[b] 198
Jan. 28	do	1.24	[a] 55	Apr. 19	do	.85	182
28	do	1.24	[a] 57				

[a] Complete ice cover.
[b] About 40 per cent ice cover at control. Measurement made about 1,000 feet above gage.

Daily gage height, in feet, of Elk River near Big Lake, Minn., for the year ending Sept. 30, 1913.

[Michael Tracy, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.85	0.72	0.70	.....	.....	.....	1.4	0.96	1.1	0.45	1.4	1.0
2	.82	.72	.79	0.95	.....	.....	1.3	.95	1.0	.42	1.4	1.05
3	.82	.72	.79	.....	.....	.....	1.3	1.05	.95	.80	1.35	1.05
4	.81	.72	.79	.....	.....	.....	1.1	.99	.89	.88	1.3	1.2
5	.80	.71	.70	.....	.....	.....	1.1	.94	.82	.98	1.25	1.1
6	.79	.70	.50	.....	1.5	1.2	1.15	.89	.76	.96	1.2	1.1
7	.78	.70	.....	.....	.....	.....	1.15	.94	.71	.91	1.2	1.05
8	.79	.70	.....	.....	.....	.....	1.25	.99	.68	.89	1.15	1.05
9	.80	.70	.....	.92	.....	.....	1.2	.92	.66	.88	1.15	1.0
10	.79	.70	.....	.....	.....	.....	1.2	.86	.64	.85	1.15	1.0
11	.78	.70	.....	.....	.....	.....	1.2	.81	.61	1.05	1.1	1.2
12	.85	.70	.74	.....	.....	.....	1.15	.76	.59	1.15	1.1	1.2
13	.90	.70	.....	.....	1.65	1.65	.98	.74	.56	1.1	1.1	1.2
14	.86	.70	.....	.....	.....	.....	.86	.75	.54	1.0	1.1	1.15
15	.85	.71	.....	.....	.....	.....	.86	.89	.52	1.05	1.05	1.1
16	.81	.70	.....	1.1	.....	1.65	.88	.94	.50	1.3	1.05	1.1
17	.80	.70	.....	.....	.....	.....	.88	.96	.50	1.4	1.0	1.1
18	.80	.70	.....	.....	.....	1.85	.88	1.0	.50	1.4	1.05	1.05
19	.80	.70	1.00	.....	.....	.....	.85	1.05	.51	1.35	1.15	1.15
20	.78	.70	.....	.....	1.3	[a] .85	.81	1.3	.51	1.4	1.2	1.15
21	.78	.70	.84	.....	.....	.....	.82	1.55	.50	1.5	1.3	1.1
22	.78	.70	.....	.....	.....	.....	.81	1.6	.48	1.5	1.35	1.05
23	.76	.70	.....	1.2	.....	.....	.80	1.6	.45	1.45	1.35	1.05
24	.75	.59	.....	.....	.....	.....	.91	1.65	.48	1.4	1.35	1.1
25	.75	.50	.....	.....	1.3	.....	1.05	1.7	.54	1.4	1.3	1.05
26	.75	.61	.90	.....	.....	.....	1.05	1.65	.59	1.35	1.3	1.0
27	.75	.90	.....	.....	1.35	1.2	1.1	1.6	.56	1.3	1.25	1.0
28	.74	1.10	.....	1.25	.....	.....	1.2	1.5	.52	1.25	1.2	.96
29	.72	.92	.....	.....	.....	.....	1.15	1.4	.50	1.2	1.15	.95
30	.72	.98	.....	1.3	.....	.....	1.1	1.25	.48	1.2	1.1	.94
31	.72	.....	.....	.....	.....	1.35	.....	1.15	.....	1.3	1.05	.....

[a] Gage height probably 1.0 foot too low.

NOTE.—Discharge relation affected by ice about Nov. 27, 1912 to Mar. 31, 1913. On Nov. 27, the observer reported river partly frozen over; backwater at gage.

Daily discharge, in second-feet, of Elk River near Big Lake, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	161	129					336	211	250	62	310	190
2	153	129					307	208	222	57	310	204
3	153	129					307	236	208	139	294	204
4	151	129					250	219	191	159	278	247
5	148	126					250	205	173	185	262	218
6	146	124					264	191	158	180	247	218
7	143	124					264	205	146	167	247	204
8	146	124					292	219	139	162	232	204
9	148	124					278	200	135	159	232	190
10	146	124					278	184	130	152	232	190
11	143	124					278	171	123	204	218	247
12	161	124					264	158	119	232	218	247
13	174	124					216	154	113	218	218	247
14	164	124					184	156	108	190	218	232
15	161	124					184	191	104	204	204	218
16	151	124					189	205	100	278	204	218
17	148	124					189	211	100	310	190	218
18	148	124					189	222	100	310	204	204
19	148	124					181	236	102	294	232	232
20	143	124					171	307	102	310	247	232
21	143	124					173	380	100	343	278	218
22	143	124					171	395	96	343	294	204
23	138	124					168	395	90	326	294	204
24	136	98					197	410	96	310	294	218
25	136	78					236	426	108	310	278	204
26	136	102					236	410	119	294	278	190
27	136	100					250	395	113	278	262	190
28	134	98					278	365	104	262	247	180
29	129	96					264	336	100	247	232	177
30	129	94					250	292	96	247	218	174
31	129							264		278	204	

NOTE.—Daily discharge computed from two fairly well defined rating curves. New rating curve used July 1 to Sept. 30.

Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 1–20, 97 second-feet; Dec. 21–31, 90 second-feet; Jan. 1–31, 70 second-feet; Feb. 1–28, 65 second-feet; and Mar. 1–31, 160 second-feet.

Monthly discharge of Elk River near Big Lake, Minn., for the year ending Sept. 30, 1913.

[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	174	129	146	0.237	0.27	A.
November	129	78	118	.192	.21	B.
December			95	.154	.18	C.
January			70	.114	.13	C.
February			65	.106	.11	C.
March			160	.260	.30	C.
April	336	168	236	.384	.43	B.
May	426	154	263	.428	.49	C.
June	250	90	128	.208	.23	C.
July	343	57	233	.379	.44	B.
August	310	190	248	.403	.46	B.
September	247	174	211	.343	.38	B.
The year			165	.268	3.63	

NOTE.—See footnotes to tables of daily gage height and daily discharge.

CROW RIVER AT ROCKFORD, MINN.

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

Records available.—June 4, 1909, to September 30, 1913.

Drainage area.—2,520 square miles.

Gage.—Vertical staff; read morning and evening to hundredths. Limits of use: Hundredths below 5.5, half-tenths from 5.5 to 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 winter of 1911–12 very little ice formed and open-water rating curve applied throughout the year. During winters of 1911–12 and 1912–13 ice destroyed discharge relation making it necessary to base estimates on discharge measurements. Before the dam was destroyed the temperature of the larger body of water back of the dam was considerably above freezing and the water did not freeze quickly when released, but since the destruction of the dam natural conditions exist and ice forms.

Regulation.—On the north, middle, and south forks of Crow River are seven power plants with small storage and the flow at the various points is so slight that 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.—Records should be reliable except for periods when discharge relation may be affected by growth of grass in channel below gage.

Discharge measurements of Crow River at Rockford, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 4	S. B. Soulé	4.96	[a] 34
Apr. 7	W. G. Hoyt	5.84	[b] 546

[a] Complete ice cover at measuring section about 400 feet below gage. Nearly complete ice cover at control.
[b] Control clear.

Daily gage height, in feet, of Crow River at Rockford, Minn., for the year ending Sept. 30, 1913.

[G. W. Florida, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.6	5.18	5.25	4.97	4.80	.....	5.65	5.8	5.6	5.29	6.8	6.7
2	5.55	5.16	5.20	4.96	.....	.....	5.7	5.9	5.48	5.26	6.7	6.8
3	5.5	5.14	5.12	4.95	.....	.....	5.8	5.8	5.40	5.32	6.7	7.1
4	5.49	5.11	5.04	4.96	4.96	.....	5.8	5.65	5.39	5.39	6.7	7.2
5	5.45	5.10	5.00	5.06	.....	.....	5.75	5.6	5.36	5.65	6.6	7.2
6	5.41	5.08	5.00	5.04	5.02	5.1	5.8	5.55	5.31	5.95	6.6	7.4
7	5.36	5.08	5.08	5.03	.....	.....	5.8	5.5	5.26	6.15	6.45	7.2
8	5.32	5.08	5.15	4.95	.....	.....	5.8	5.5	5.20	6.1	6.4	7.1
9	5.32	5.08	5.30	4.80	.....	.....	5.7	5.5	5.16	6.1	6.35	7.1
10	5.30	5.08	5.04	4.82	.....	5.15	5.7	5.5	5.10	6.05	6.3	7.0
11	5.45	5.12	5.04	4.80	.....	5.5	5.7	5.48	5.08	6.3	6.3	7.1
12	5.5	5.12	5.04	4.82	.....	6.1	5.75	5.46	5.07	6.45	6.25	7.1
13	5.49	5.12	5.04	4.82	5.00	6.45	5.8	5.43	5.04	6.6	6.2	7.1
14	5.45	5.08	4.99	4.80	.....	6.0	5.85	5.40	5.04	6.7	6.2	7.1
15	5.41	5.04	4.98	4.82	.....	5.5	5.85	5.55	5.04	6.8	6.15	7.2
16	5.40	5.02	5.00	4.84	.....	5.46	5.8	5.65	5.02	7.1	6.15	7.1
17	5.36	5.02	5.01	4.85	.....	5.42	5.7	5.65	5.02	7.5	6.15	7.0
18	5.34	5.02	4.99	4.84	.....	5.40	5.65	5.65	5.00	7.7	6.1	6.9
19	5.32	5.04	4.98	4.84	.....	5.38	5.6	5.65	4.98	7.8	6.1	6.8
20	5.30	5.06	4.97	4.85	4.85	5.36	5.6	5.8	5.11	7.7	6.2	6.6
21	5.30	5.08	4.98	4.86	.....	5.32	5.55	6.0	5.12	7.6	6.6	6.5
22	5.28	5.08	4.98	4.85	.....	5.24	5.55	6.1	5.04	7.5	7.0	6.5
23	5.26	5.09	4.98	4.84	.....	5.18	5.65	6.3	5.00	7.4	7.2	6.4
24	5.24	5.06	4.96	4.84	.....	5.13	5.7	6.3	4.99	7.2	7.4	6.35
25	5.23	5.04	4.95	4.84	.....	5.14	5.85	6.25	5.42	7.1	7.4	6.35
26	5.22	5.02	4.94	4.83	.....	5.16	6.0	6.2	5.16	7.1	7.3	6.3
27	5.22	5.02	4.95	4.84	4.85	5.26	6.1	6.05	5.27	7.0	7.2	6.25
28	5.22	5.00	4.96	4.84	.....	5.33	6.0	5.9	5.38	6.9	7.0	6.2
29	5.23	4.98	4.97	4.85	.....	5.42	5.9	5.75	5.37	6.8	6.9	6.2
30	5.22	4.99	4.98	4.84	.....	5.46	5.8	5.7	5.32	6.8	6.8	6.15
31	5.20	.....	4.98	4.82	.....	5.55	.....	5.6	.....	6.8	6.7	.....

NOTE.—Discharge relation probably affected by ice about Dec. 7–13 and Dec. 29, 1912, to Mar. 14, 1913, and by backwater from grass about Aug. 1 to Sept. 30, 1913.

Daily discharge, in second-feet, of Crow River at Rockford, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	395	209	237	.....	.....	.....	420	560	395	253	998	935
2	370	202	217	.....	.....	.....	445	555	336	241	935	998
3	345	194	187	.....	.....	.....	500	500	300	266	935	1,190
4	340	183	158	.....	.....	.....	500	420	296	296	935	1,260
5	322	179	144	.....	.....	.....	472	395	283	420	875	1,260
6	304	172	144	.....	.....	.....	500	370	261	582	875	1,400
7	283	172	144	.....	.....	.....	500	345	241	695	785	1,260
8	266	172	144	.....	.....	.....	500	345	217	665	755	1,190
9	266	172	144	.....	.....	.....	445	345	202	665	725	1,190
10	257	172	143	.....	.....	.....	445	345	179	638	695	1,130
11	322	187	143	.....	.....	.....	445	336	172	785	695	1,190
12	345	187	142	.....	.....	.....	472	327	168	875	665	1,190
13	340	187	142	.....	.....	.....	500	314	158	965	638	1,190
14	322	172	141	.....	.....	.....	528	300	158	1,030	638	1,190
15	304	158	138	.....	.....	345	528	370	158	1,100	610	1,260
16	300	151	144	.....	.....	327	500	420	151	1,290	610	1,190
17	283	151	148	.....	.....	309	445	420	151	1,570	610	1,130
18	274	151	141	.....	.....	300	420	420	144	1,710	582	1,060
19	266	158	138	.....	.....	291	395	420	138	1,790	582	998
20	257	165	134	.....	.....	283	395	500	183	1,710	638	875
21	257	172	138	.....	.....	266	370	610	187	1,640	875	815
22	249	172	138	.....	.....	233	370	665	158	1,570	1,130	815
23	241	176	138	.....	.....	209	420	785	144	1,500	1,260	755
24	233	165	131	.....	.....	190	445	785	141	1,360	1,400	725
25	229	158	128	.....	.....	194	528	755	309	1,290	1,400	725
26	225	151	125	.....	.....	203	610	725	202	1,290	1,320	695
27	225	151	128	.....	.....	241	665	638	245	1,220	1,260	665
28	225	144	131	.....	.....	270	610	555	291	1,160	1,130	638
29	229	138	131	.....	.....	309	555	472	287	1,100	1,060	638
30	225	141	131	.....	.....	327	500	445	266	1,100	998	610
31	217	.....	130	.....	.....	370	.....	395	.....	1,100	935	.....

NOTE.—Daily discharge determined as follows: Oct. 1, 1912, to July 31, 1913, from a well-defined rating curve; Aug. 1 to Sept. 30, 1913, estimated on account of backwater due to grass, on basis of discharge measurement made Oct. 21, 1913.

Discharge estimated, because of ice, from gage heights, observer's notes, one discharge measurement, and climatic records, as follows: Dec. 7–13, and 29–31, 1912; Jan. 1–31, 1913, 72 second-feet; Feb. 1–28, 45 second-feet; and Mar. 1–14, 150 second-feet.

Monthly discharge of Crow River at Rockford, Minn., for the year ending Sept. 30, 1913.

[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	395	217	281	0.112	0.13	A.
November	209	138	169	.067	.07	A.
December	.....	.....	146	.058	.07	B.
January	.....	.....	72	.029	.03	D.
February	.....	.....	45	.018	.02	C.
March	.....	.....	218	.087	.10	C.
April	665	370	481	.191	.21	B.
May	785	300	477	.189	.22	B.
June	395	138	217	.086	.10	C.
July	1,790	241	1,030	.409	.47	C.
August	1,400	582	889	.353	.41	B.
September	1,400	610	1,010	.401	.45	B.
The year	1,790	.....	422	.167	2.28	

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 September 30, 1913.

Drainage area.—1,160 square miles.

Gage.—Vertical staff; read twice 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.—Determined by measurements made through the ice.

Regulation.—Flow except during low water controlled by storage in and evaporation from the lakes in the drainage area above Onamia. There is a 10-foot dam and power plant at St. Francis, 20 miles below Cambridge by river; difference in elevation between crest of dam and water surface at gaging station about 6 feet. The fact that morning and evening gage heights during low-water are for the most part identical indicates that the St. Francis dam affects this station very little though the flow may fall below the crest at times during the day. The only dam at Cambridge is at Milaca and is used to form a pool from which water is pumped.

Accuracy.—Records poor. During the summer months grass grows in channel causing backwater in varying amount at gage.

Discharge measurements of Rum River at Cambridge, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	W. G. Hoyt	3.12	121	Apr. 9	W. G. Hoyt	4.18	379
Nov. 23	.....do	2.99	116	May 23	.....do	7.02	1,220
Dec. 30	S. B. Soulé	3.34	[a] 84	July 8	Hoyt and Peterson	5.23	406
Jan. 30	.....do	3.50	[a] 55.1	Sept. 4	S. B. Soulé	4.48	264
Feb. 27	.....do	3.60	[a] 61.9				

[a] Complete ice cover at control; about 90 per cent ice cover at measuring section.

Daily gage height, in feet, of Rum River at Cambridge, Minn., for the year ending Sept. 30, 1913.

[Joseph Lofstrom, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.40	3.00	3.00	.....	.....	.....	4.35	4.85	5.1	3.78	6.1	4.8
2	3.40	3.00	3.10	.....	.....	.....	4.8	4.6	4.85	3.66	6.0	4.65
3	3.35	3.00	3.10	3.40	.....	.....	5.6	4.5	4.6	3.74	5.8	4.55
4	3.30	3.00	.....	.....	.....	.....	5.6	4.4	4.4	3.88	5.6	4.45
5	3.25	3.00	3.10	.....	.....	.....	5.2	4.3	4.3	4.3	5.4	4.4
6	3.20	3.00	.....	.....	3.50	3.58	4.8	4.2	4.2	4.5	5.1	4.4
7	3.15	2.99	.....	.....	.....	.....	4.35	4.1	4.1	4.7	5.1	4.3
8	3.15	3.00	.....	.....	.....	.....	4.3	4.0	4.0	5.2	5.0	4.2
9	3.15	3.00	.....	3.35	.....	3.68	4.2	3.96	3.89	5.6	4.95	4.1
10	3.10	3.00	.....	.....	.....	.....	4.05	3.96	3.80	5.7	4.95	4.05
11	3.15	2.99	.....	.....	.....	3.80	3.95	3.99	3.74	5.7	5.1	4.05
12	3.20	2.96	3.10	.....	.....	.....	3.99	3.95	3.65	5.7	5.2	4.05
13	3.30	2.98	.....	.....	3.52	4.0	4.0	3.84	3.58	5.5	5.2	4.05
14	3.25	2.98	.....	.....	.....	.....	4.1	3.71	3.52	5.3	5.1	4.35
15	3.25	2.96	.....	.....	.....	.....	4.2	3.86	3.49	5.5	5.0	4.5
16	3.25	2.98	.....	3.40	.....	.....	4.2	4.1	3.44	6.1	4.9	4.4
17	3.20	2.95	.....	.....	.....	.....	4.1	4.55	3.42	6.4	4.85	4.25
18	3.20	2.95	.....	.....	.....	4.65	3.98	5.7	3.44	6.5	4.8	4.1
19	3.15	2.96	3.25	.....	.....	4.65	3.86	6.4	3.45	6.4	4.95	3.98
20	3.15	2.98	.....	.....	3.60	4.55	3.79	6.9	3.48	6.3	5.2	3.90
21	3.10	2.98	.....	.....	.....	4.3	3.79	7.1	3.45	6.1	5.7	3.79
22	3.10	2.98	.....	.....	.....	4.1	3.82	7.0	3.41	5.9	5.5	3.78
23	3.10	2.98	.....	3.42	.....	3.98	3.80	7.0	3.38	5.6	7.2	3.76
24	3.10	2.68	.....	.....	.....	.....	4.0	7.3	3.34	5.4	7.6	3.85
25	3.05	2.92	.....	.....	.....	.....	4.45	7.5	3.32	5.2	7.8	3.96
26	3.05	3.05	3.35	.....	.....	.....	4.6	7.6	3.26	5.2	7.6	3.94
27	3.05	3.10	.....	.....	3.60	3.85	5.0	7.3	3.40	5.1	7.1	3.88
28	3.00	3.10	.....	.....	.....	3.82	5.3	6.8	3.46	5.0	6.5	3.92
29	3.05	3.00	.....	.....	.....	3.95	5.3	6.2	3.69	5.2	5.9	3.98
30	3.05	3.00	3.35	3.50	.....	4.1	5.1	5.8	3.81	5.6	5.4	3.90
31	3.00	.....	.....	.....	.....	4.25	.....	5.4	.....	5.8	5.0	.....

NOTE.—Discharge relation affected by ice about Nov. 24, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Rum River at Cambridge, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	150	110	.....	.....	.....	.....	428	575	590	108	680	332
2	150	110	.....	.....	.....	.....	560	500	515	88	650	296
3	140	110	.....	.....	.....	.....	800	470	442	92	590	274
4	140	110	.....	.....	.....	.....	800	442	386	108	545	262
5	130	110	.....	.....	.....	.....	680	414	345	195	485	250
6	130	110	.....	.....	.....	.....	560	386	320	239	400	250
7	120	110	.....	.....	.....	.....	428	358	285	274	400	228
8	120	110	.....	.....	.....	.....	414	332	262	400	372	217
9	130	110	.....	.....	.....	.....	386	322	237	515	3o8	195
10	120	110	.....	.....	.....	.....	345	322	206	545	358	184
11	130	110	.....	.....	.....	.....	320	330	193	545	400	184
12	140	110	.....	.....	.....	.....	330	320	162	545	428	195
13	160	110	.....	.....	.....	.....	332	294	147	485	428	195
14	150	110	.....	.....	.....	.....	358	264	124	428	400	262
15	150	110	.....	.....	.....	.....	386	299	119	485	372	308
16	160	110	.....	.....	.....	.....	386	358	101	665	345	285
17	140	110	.....	.....	.....	.....	358	485	97	755	332	250
18	140	110	.....	.....	.....	.....	327	830	101	785	320	228
19	130	110	.....	.....	.....	.....	299	1,040	94	770	372	202
20	136	115	.....	.....	.....	.....	283	1,190	91	740	442	184
21	120	115	.....	.....	.....	.....	283	1,250	86	680	590	171
22	120	115	.....	.....	.....	.....	290	1,220	80	620	530	169
23	120	115	.....	.....	.....	.....	285	1,220	67	530	1,040	164
24	120	115	.....	.....	.....	.....	332	1,320	61	470	1,160	184
25	110	115	.....	.....	.....	.....	456	1,380	51	414	1,220	219
26	110	115	.....	.....	.....	.....	500	1,420	43	414	1,160	215
27	110	115	.....	.....	.....	.....	620	1,320	62	386	1,010	202
28	100	110	.....	.....	.....	.....	710	1,160	64	358	830	221
29	110	110	.....	.....	.....	.....	710	950	101	414	650	235
30	120	110	.....	.....	.....	.....	650	830	113	530	500	217
31	110	.....	.....	.....	.....	.....	.....	710	.....	590	386	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Nov. 23, 1912, by indirect methods for shifting channel; Nov. 24, 1912, to May 28, 1913, from a fairly well-defined rating curve; May 29 to Sept. 30, 1913, by shifting channel methods. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Nov. 24-30, daily discharge; Dec. 1-31, 1912, 100 second-feet; Jan. 1-31, 1913, 69 second-feet; Feb. 1-28, 58 second-feet; and Mar. 1-31, 150 second-feet.

Monthly discharge of Rum River at Cambridge, Minn., for the year ending Sept. 30, 1913.

[Drainage area, 1,160 square miles.]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	160	100	129	B.
November	115	110	111	C.
December	.....	.....	100	C.
January	.....	.....	69	C.
February	.....	.....	58	C.
March	.....	.....	150	D.
April	800	283	454	B.
May	1,420	264	720	B.
June	590	43	182	C.
July	785	88	457	C.
August	1,220	320	573	C.
September	332	164	226	C.
The year	1,420	.....	271	

MINNESOTA RIVER NEAR MONTEVIDEO, MINN.

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

Records available.—July 23, 1909, to September 30, 1913.

Drainage area.—6,300 square miles.

Gage.—Chain gage attached to bridge; read morning and evening to quarter-tenths. Limits of use: Hundredths below 2.0, half-tenths from 2.0 to 3.0, and tenths 3.0 feet above. Datum of gage lowered 2 feet September 16, 1909, and 1 foot additional July 29, 1910, to avoid negative readings.

Channel and control.—Practically permanent.

Discharge measurements.—Made from bridge.

Winter flow.—Determined by measurements made through the ice.

Regulation.—Nearest dam at Granite Falls, but it does not influence this gaging station. No dam above 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 Minnesota gage heights.

Discharge measurements of Minnesota River near Montevideo, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 28	S. B. Soulé	3.16	128	Feb. 21	S. B. Soulé	3.57	*a* 76
Jan. 23	do	3.48	*a* 84	Apr. 23	W. G. Hoyt	5.81	945
Feb. 21	do	3.56	*a* 74	Sept. 16	S. B. Soulé	2.86	219

a Complete ice cover.

Daily gage height, in feet, of Minnesota River near Montevidco, Minn., for the year ending Sept. 30, 1913.*

[Mrs. Mary Hendricks, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.8	2.3	2.35	.....	.....	.....	4.0	5.6	5.2	2.9	2.85	2.9
2	2.7	2.2	2.8	.....	.....	.....	5.8	5.6	5.2	2.9	3.1	3.0
3	2.4	2.2	2.3	.....	.....	.....	5.8	5.6	5.0	2.9	3.0	2.85
4	2.45	2.4	2.4	3.4	.....	.....	5.4	5.3	5.0	2.9	3.2	2.95
5	2.7	2.7	2.45	.....	.....	.....	5.0	5.5	4.9	3.0	2.8	3.1
6	2.4	2.7	2.35	.....	3.4	3.7	4.5	5.5	4.8	2.8	2.8	2.9
7	2.5	2.7	2.35	.....	.....	.....	4.3	5.4	4.7	2.85	2.8	2.75
8	2.8	2.35	2.4	.....	.....	.....	4.8	5.2	4.4	2.8	2.5	3.2
9	2.6	2.45	2.3	.....	.....	.....	5.3	5.2	4.3	2.7	2.7	3.2
10	2.3	2.4	2.5	.....	.....	.....	5.3	5.0	4.4	2.7	2.45	2.95
11	2.6	2.4	2.7	3.4	.....	.....	5.4	4.8	4.3	2.75	2.5	2.7
12	2.8	2.7	2.45	.....	.....	.....	5.4	4.8	4.1	2.65	2.6	2.95
13	2.5	2.7	2.65	.....	3.6	.....	5.3	4.9	4.0	2.5	2.65	2.95
14	2.5	2.5	2.8	.....	.....	.....	5.5	4.9	3.9	2.6	2.75	2.6
15	2.8	2.5	2.85	.....	.....	.....	6.0	4.8	3.7	2.65	2.55	2.85
16	2.75	2.6	3.2	.....	.....	.....	6.1	4.7	3.8	2.7	2.65	2.65
17	2.8	2.3	3.2	.....	.....	.....	6.0	4.6	3.7	2.55	2.45	2.7
18	2.7	2.4	2.85	3.5	.....	.....	6.2	4.6	3.4	2.55	2.9	2.7
19	2.7	2.6	3.1	.....	.....	.....	5.9	4.8	3.4	2.65	3.1	2.6
20	2.2	2.6	3.1	.....	3.6	3.6	5.8	4.9	3.3	2.55	3.0	2.7
21	2.6	2.7	2.9	.....	3.6	.....	5.9	5.2	3.4	2.9	3.0	2.65
22	2.85	2.6	2.8	.....	.....	.....	5.8	5.3	3.2	3.2	3.1	2.7
23	2.7	2.3	3.2	3.6	.....	.....	5.8	5.4	3.2	3.3	2.9	2.5
24	2.15	2.4	3.2	.....	.....	.....	5.9	5.6	3.3	3.2	2.95	2.4
25	2.3	2.3	3.1	.....	.....	.....	5.9	5.6	3.2	2.95	3.2	2.5
26	2.75	2.6	3.0	.....	.....	.....	6.0	5.6	3.2	2.85	3.2	2.5
27	2.6	2.8	3.2	.....	3.7	.....	5.8	5.5	3.2	2.8	3.2	2.45
28	2.4	2.8	3.2	.....	.....	3.7	6.0	5.5	3.2	3.2	3.4	2.4
29	2.7	2.65	.....	.....	.....	.....	5.8	5.4	2.8	3.1	3.4	2.55
30	2.9	2.7	.....	3.8	.....	.....	5.7	5.5	3.1	2.9	3.3	2.6
31	2.7	.....	.....	.....	.....	.....	.....	5.5	.....	2.8	2.55	.....

NOTE.—Discharge relation affected by ice about Nov. 26, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	181	120	.....	.....	.....	.....	418	870	745	210	202	210
2	168	108	.....	.....	.....	.....	934	870	745	210	242	226
3	132	108	.....	.....	.....	.....	934	870	685	210	226	202
4	138	132	.....	.....	.....	.....	807	776	685	210	260	218
5	168	168	.....	.....	.....	.....	685	838	656	226	194	242
6	132	168	.....	.....	.....	.....	543	838	627	194	194	210
7	144	168	.....	.....	.....	.....	490	807	599	202	194	186
8	181	126	.....	.....	.....	.....	627	745	516	194	148	260
9	156	138	.....	.....	.....	.....	776	745	490	178	178	260
10	120	132	.....	.....	.....	.....	776	685	516	178	141	218
11	156	132	.....	.....	.....	.....	807	627	490	186	148	178
12	181	168	.....	.....	.....	.....	807	627	442	170	162	218
13	144	168	.....	.....	.....	.....	776	656	418	148	170	218
14	144	144	.....	.....	.....	.....	838	656	396	162	186	162
15	181	144	.....	.....	.....	.....	1,000	627	354	170	155	202
16	174	156	.....	.....	.....	.....	1,030	599	374	178	170	170
17	181	120	.....	.....	.....	.....	1,000	571	354	155	141	178
18	168	132	.....	.....	.....	.....	1,070	571	296	155	210	178
19	168	156	.....	.....	.....	.....	967	627	296	170	242	162
20	108	156	.....	.....	.....	.....	934	656	278	155	226	178
21	156	168	.....	.....	.....	.....	967	745	296	210	226	170
22	188	156	.....	.....	.....	.....	934	776	260	260	242	178
23	168	120	.....	.....	.....	.....	934	807	260	278	210	148
24	102	132	.....	.....	.....	.....	967	870	278	260	218	134
25	120	120	.....	.....	.....	.....	967	870	260	218	260	148
26	174	.....	.....	.....	.....	.....	1,000	870	260	202	260	148
27	156	.....	.....	.....	.....	.....	934	838	260	194	260	141
28	132	.....	.....	.....	.....	.....	1,000	838	260	260	296	134
29	168	.....	.....	.....	.....	.....	934	807	194	242	296	155
30	194	.....	.....	.....	.....	.....	902	838	242	210	278	162
31	168	.....	.....	.....	.....	.....	.....	838	.....	194	155	.....

NOTE.—Daily discharge computed from two rating curves well defined above 400 second-feet and fairly well defined below this point. Revised rating curve used May 23 to Sept. 30 based on discharge measurement made Sept. 16. Discharge estimated, because of ice, from gage heights, observer's notes, 4 discharge measurements, and climatic records as follows: Nov. 26–30, 125 second-feet; Dec. 1–31, 125 second-feet; Jan. 1–23, 102 second-feet; Jan. 24–31, 82 second-feet; Feb. 1–21, 77 second-feet; Feb. 22–28, 73 second-feet; and Mar. 1–31, 150 second-feet.

Monthly discharge of Minnesota River near Montevideo, Minn., for the year ending Sept. 30, 1913.

[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	194	102	156	0.025	0.03	B.
November	.....	.....	[a]139	.022	.02	C.
December	.....	.....	125	.020	.02	C.
January	.....	.....	96.8	.015	.02	C.
February	.....	.....	76.0	.012	.01	C.
March	.....	.....	150	.024	.03	C.
April	1,070	418	859	.136	.15	B.
May	870	571	753	.120	.14	A.
June	745	194	418	.066	.07	A.
July	278	148	200	.032	.04	B.
August	296	141	209	.033	.04	B.
September	260	134	186	.030	.03	B.
The year	1,070	.....	282	.045	.60	

[a] Differs from value published in "Report of the water-resources investigation of Minnesota, 1911–1912," because of estimate of flow Nov. 26 to 30 made from information obtained after publication of Minnesota report.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

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, 1913.

Drainage area.—14,600 square miles.

Gage.—Chain gage; read once daily to tenths. Gage checked with wye level April 24, 1914, and found to read 0.09 foot too high; cause, settlement of gage. Settlement is assumed to have occurred gradually since the previous checking of the gage with level April 3, 1913.

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

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

Winter flow.—Determined by measurements made through the ice.

Regulation.—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, but it is such a small part of the entire discharge at the Mankato station that the effect of such regulation is slight.

Maximum and minimum flow.—The highest known stage of the river occurred in 1881 and is shown by a well-marked line in Mankato. The stage was approximately 27 feet above the zero of the present gage. This estimate was corroborated by M. B. Haynes, city engineer, of Mankato, who stated 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. Since the establishment of the gage the highest stage recorded was 21.2 feet on June 26, 1908. The lowest stage recorded was 0.5 in 1911 when the flow was about 89 second-feet for a considerable time.

Accuracy.—Measurements made during earlier years indicated changing conditions of flow, and accordingly the discharge for years previous to 1907 was obtained largely by the indirect method. These results can not be considered as accurate as the later ones, which were based on well-defined rating curves.

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, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 16[a]	S. B. Soulé	1.47	234	Apr. 3[c]	S. B. Soulé	3.27	1,570
Jan. 21[b]	do	1.57	122	Sept. 19[d]	do	[e]1.43	323
Mar. 5[b]	do	1.74	140				

[a] Made under complete ice cover; river about 10 per cent open at control.
[b] Complete ice cover.
[c] Made from highway bridge about 2 miles below gage.
[d] Made by wading at a section about 300 feet below gage.
[e] Any error that may have existed in gage Sept. 19, 1913, entered also into gage height of discharge measurement made on that date.

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.2	1.3	1.1	1.4	1.8	1.6	4.5	4.7	4.9	4.1	2.2	1.5
2	1.2	1.3	1.1	1.4	1.5	1.6	3.7	4.7	4.8	5.0	2.2	1.5
3	1.2	1.2	1.0	1.5	1.3	1.7	3.2	4.5	4.3	3.5	2.2	1.5
4	1.2	1.2	1.3	1.5	1.2	1.7	3.0	4.3	4.5	3.7	2.1	1.6
5	1.2	1.2	1.3	1.5	1.1	1.7	2.7	4.8	4.4	3.6	2.0	1.6
6	1.2	1.3	1.3	1.5	1.1	1.7	2.9	4.9	4.1	3.4	2.0	1.6
7	1.2	1.3	1.3	1.5	1.4	1.8	3.2	4.8	4.0	3.2	2.0	1.6
8	1.2	1.3	1.3	1.5	1.5	1.8	3.4	5.0	3.9	3.1	2.2	1.6
9	1.3	1.3	1.3	1.4	1.5	2.6	3.3	4.3	3.6	3.0	2.3	1.5
10	1.3	1.2	1.4	1.4	1.5	3.0	3.1	4.2	3.3	2.7	2.3	1.5
11	1.2	1.1	1.4	1.4	1.5	3.3	4.0	4.2	3.3	2.6	2.2	1.7
12	1.4	1.2	1.4	1.4	1.5	3.8	4.3	4.1	3.2	2.7	1.9	1.7
13	1.4	1.2	1.4	1.2	1.5	3.5	5.5	3.9	3.2	2.7	1.8	1.6
14	1.4	1.3	1.4	1.2	1.4	3.7	5.8	4.1	3.1	2.6	1.8	1.6
15	1.3	1.3	1.4	1.2	1.4	3.9	6.6	4.3	3.1	2.6	1.7	1.6
16	1.3	1.2	1.3	1.2	1.4	3.2	6.5	4.1	3.0	2.5	1.7	1.5
17	1.3	1.2	1.3	1.2	1.5	4.1	6.6	4.6	2.8	2.5	1.7	1.5
18	1.3	1.1	1.4	1.2	1.7	2.9	6.4	4.5	2.7	2.4	1.5	1.5
19	1.3	1.2	1.4	1.1	1.7	2.4	6.3	5.0	2.6	2.4	1.5	1.5
20	1.3	1.2	1.4	1.1	1.8	2.6	5.4	5.4	2.6	2.3	1.9	1.5
21	1.3	1.2	1.4	1.1	1.8	2.6	5.5	5.7	2.8	2.2	2.0	1.5
22	1.3	1.2	1.4	1.1	1.8	2 3	5.0	5.5	2.5	2.1	2.0	1.5
23	1.3	1.2	1.4	1.2	1.7	2.2	4.2	5.7	2.4	2.1	1.9	1.4
24	1.3	1.0	1.3	1.2	1.7	3.0	4.8	5.6	2.4	2.1	1.9	1.4
25	1.3	1.0	1.3	1.2	1.5	2.6	5.1	6.3	2.7	2.1	1.8	1.5
26	1.3	1.1	1.3	1.4	1.5	2.3	4.9	5.9	2.9	2.1	1.8	1.5
27	1.3	1.1	1.3	1.5	1.5	2.5	5.9	5.2	3.4	2.1	1.7	1.5
28	1.3	1.1	1.3	1.6	1.5	3.4	5.0	5.4	3.9	2.1	1.8	1.5
29	1.3	1.2	1.4	1.6	.....	3.7	5.2	5.7	5.0	2.4	1.8	1.4
30	1.3	1.2	1.4	2.0	.....	3.9	4.9	5.6	4.8	2.3	1.7	1.4
31	1.3	.....	1.4	2.0	.....	4.2	.....	5.5	.....	2.3	1.5	.....

NOTE.—Discharge relation affected by ice about Dec. 1, 1912, to Mar. 17, 1913. Gage heights not corrected for errors due to settlement of gage. See station description.

Daily discharge, in second-feet, of Minnesota River near Mankato, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	270	320	.....	.....	.....	.....	2,750	2,950	3,170	2,350	775	360
2	270	320	.....	.....	.....	.....	1,960	2,950	3,060	3,280	775	360
3	270	270	.....	.....	.....	.....	1,520	2,750	2,550	1,780	775	360
4	270	270	.....	.....	.....	.....	1,360	2,550	2,750	1,960	710	415
5	270	270	.....	.....	.....	.....	1,120	3,060	2,650	1,860	650	415
6	270	320	.....	.....	.....	.....	1,280	3,170	2,350	1,690	650	415
7	270	320	.....	.....	.....	.....	1,520	3,060	2,250	1,520	650	415
8	270	320	.....	.....	.....	.....	1,690	3,280	2,150	1,440	775	415
9	320	320	.....	.....	.....	.....	1,600	2,550	1,860	1,360	840	360
10	320	270	.....	.....	.....	.....	1,440	2,450	1,600	1,120	840	360
11	270	225	.....	.....	.....	.....	2,250	2,450	1,600	1,050	775	470
12	370	270	.....	.....	.....	.....	2,550	2,350	1,520	1,120	590	470
13	370	270	.....	.....	.....	.....	3,900	2,150	1,520	1,120	530	415
14	370	320	.....	.....	.....	.....	4,310	2,350	1,440	1,050	530	415
15	320	320	.....	.....	.....	.....	5,460	2,550	1,440	1,050	470	415
16	320	270	.....	.....	.....	.....	5,310	2,350	1,360	980	470	360
17	320	270	.....	.....	.....	.....	5,460	2,850	1,200	980	470	360
18	320	225	.....	.....	.....	1,280	5,160	2,750	1,120	910	360	360
19	320	270	.....	.....	.....	910	5,010	3,280	1,050	910	360	360
20	320	270	.....	.....	.....	1,050	3,770	3,770	1,050	840	590	360
21	320	270	.....	.....	.....	1,050	3,900	4,170	1,200	775	650	360
22	320	270	.....	.....	.....	840	3,280	3,900	980	710	650	360
23	320	270	.....	.....	.....	775	2,450	4,170	910	710	590	310
24	320	180	.....	.....	.....	1,360	3,060	4,030	910	710	590	310
25	320	180	.....	.....	.....	1,050	3,400	5,010	1,120	710	530	360
26	320	225	.....	.....	.....	840	3,170	4,450	1,280	710	530	360
27	320	225	.....	.....	.....	980	4,450	3,520	1,090	710	470	360
28	320	225	.....	.....	.....	1,690	3,280	3,770	2,150	710	530	360
29	320	270	.....	.....	.....	1,960	3,520	4,170	3,280	910	530	310
30	320	270	.....	.....	.....	2,150	3,170	4,030	3,060	840	470	310
31	320	.....	.....	.....	.....	2,450	.....	3,900	.....	840	360	.....

NOTE.—Daily discharge computed from two fairly well-defined rating curves. Discharge estimated, because of ice, from gage heights, observer's notes, 3 discharge measurements, and climatic records, as follows: Dec. 1–25, 250 second-feet; Dec. 26–31, 220 second-feet; Jan. 1–20, 161 second-feet; Jan. 21–31, 124 second-feet; Feb. 1–28, 131 second-feet; and Mar. 1–17, 350 second-feet. Low-water section of rating curve for last part of year ending Sept. 30, 1913, based on discharge measurement made on Sept. 19, 1913, and is therefore applicable to the gage heights as read by the observer.

Monthly discharge of Minnesota River near Mankato, Minn., for the year ending Sept. 30, 1913.

[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	370	270	310	0.021	0.02	B.
November	320	180	270	.018	.02	B.
December	.....	.....	244	.017	.02	C.
January	.....	.....	148	.010	.01	C.
February	.....	.....	131	.009	.01	D.
March	2,450	.....	785	.054	.06	C.
April	5,460	1,120	3,100	.212	.24	B.
May	5,010	2,150	3,250	.223	.26	B.
June	3,280	910	1,810	.124	.14	A.
July	3,280	710	1,180	.081	.09	A.
August	840	360	596	.041	.05	B.
September	470	310	375	.026	.03	A.
The year	5,460	.....	1,020	.070	.95	

LAC QUI PARLE RIVER AT LAC QUI PARLE, MINN.

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

Records available.—April 27, 1910, to September 30, 1913.

Drainage area.—838 square miles.

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

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

Discharge measurements.—Made from bridge.

Winter flow.—Observations discontinued during winter. Estimate for winter of 1912–13 based on flow of Minnesota River at Montevideo and the Chippewa near Watson, and the discharge measurement on February 22.

Regulation.—No dams control flow at the present time.

Accuracy.—Records only fair because of slight shifting of channel and rating curves only fairly defined.

Discharge measurements of Lac Qui Parle River at Lac Qui Parle, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 22	S. B. Soulé		[a] 0.1	Sept. 15	S. B. Soulé	0.37	[b] 0.49
Apr. 22	W. G. Hoyt	2.44	170	15	do	.37	[b] 0.53

[a] River almost frozen completely to bed. [b] 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, 1913.

[C. A. Gould, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.80	0.88					8.8	2.4	2.3	1.02	0.80	0.42
2	.85	.88					8.6	2.4	2.1	.95	.70	.45
3	.85	.88					4.0	2.3	2.05	.90	.70	.85
4	.88	.85					3.3	2.3	2.0	1.05	.65	1.05
5	.90	.85					3.0	2.3	1.9	1.40	.60	.78
6	.90	.82					2.55	2.25	1.85	1.18	.60	.62
7	.88	.90					2.3	2.2	1.8	1.30	.60	.55
8	.88	.90					2.35	2.1	1.65	1.6	.58	.48
9	.88	.90					2.35	2.0	1.6	1.55	.55	.45
10	.88	.90					2.25	2.0	1.55	1.5	.55	.45
11	.85	.90					2.2	2.0	1.45	1.38	.55	.45
12	.88	.88					2.0	1.9	1.40	1.32	.52	.41
13	.85	.88					2.15	1.85	1.40	1.25	.55	.40
14	.85	.88					2.7	1.8	1.28	1.12	.55	.40
15	.85	.90					5.4	1.8	1.20	1.10	.55	.38
16	.85	.90					5.6	1.9	1.15	1.22	.52	.35
17	.85	.85					4.8	1.9	1.10	1.15	.52	.35
18	.90	.75					3.8	2.05	1.02	1.22	.82	.35
19	.90	.85					3.2	2.0	.98	1.22	.70	.30
20	.98	.88					2.85	2.1	1.08	1.30	.82	.30
21	.98	.90					2.65	2.15	1.10	1.32	.70	.30
22	.88	.88					2.45	2.65	1.05	1.32	.62	.28
23	.90	.95					2.45	3.4	1.42	1.30	.60	.28
24	.90	.82					2.4	3.5	1.6	1.20	.55	.35
25	.90	.85					2.6	3.1	1.6	1.15	.55	.32
26	.88	1.00					3.3	2.85	1.6	1.11	.52	.30
27	.88						3.6	2.7	1.48	1.10	.50	.30
28	.85						3.3	2.7	1.38	1.05	.50	.30
29	.88						2.9	2.8	1.12	1.00	.45	.30
30	.82						2.6	2.6	1.12	.90	.45	.30
31	.85							2.4		.88	.42	

NOTE.—Discharge relation affected by ice about Nov. 26, 1912, to Apr. 3, 1913.

Daily discharge, in second-feet, of Lac Qui Parle River at Lac Qui Parle, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9	12	.....	.....	.....	.....	.....	162	149	26	14	1.3
2	11	12	.....	.....	.....	.....	.....	162	124	22	10	1.8
3	11	12	.....	.....	.....	.....	.....	149	118	19	10	16
4	12	11	.....	.....	.....	.....	301	149	112	28	8.0	18
5	13	11	.....	.....	.....	.....	253	149	101	53	6.0	13
6	13	10	.....	.....	.....	.....	184	142	96	37	6.0	6.8
7	12	13	.....	.....	.....	.....	149	136	91	45	6.0	4.2
8	12	13	.....	.....	.....	.....	156	124	76	71	5.3	2.2
9	12	13	.....	.....	.....	.....	156	112	71	66	4.2	1.8
10	12	13	.....	.....	.....	.....	142	112	66	62	4.2	1.8
11	11	13	.....	.....	.....	.....	136	112	58	51	4.2	1.8
12	12	12	.....	.....	.....	.....	112	101	53	47	3.2	1.2
13	11	12	.....	.....	.....	.....	130	96	53	42	4.2	1.0
14	11	12	.....	.....	.....	.....	206	91	44	32	4.2	1.0
15	11	13	.....	.....	.....	.....	660	91	38	31	4.2	.9
16	11	13	.....	.....	.....	.....	696	101	34	39	3.2	.6
17	11	11	.....	.....	.....	.....	553	101	31	34	3.2	.6
18	13	8	.....	.....	.....	.....	383	118	26	39	15	.6
19	13	11	.....	.....	.....	.....	285	112	24	39	10	.3
20	16	12	.....	.....	.....	.....	229	124	30	45	15	.3
21	16	13	.....	.....	.....	.....	198	130	31	47	10	.3
22	12	12	.....	.....	.....	.....	169	198	28	47	6.8	.3
23	13	15	.....	.....	.....	.....	169	317	55	45	6.0	.3
24	13	10	.....	.....	.....	.....	162	333	71	38	4.2	.6
25	13	11	.....	.....	.....	.....	191	269	71	34	4.2	.4
26	12	.....	.....	.....	.....	.....	301	229	71	32	3.2	.3
27	12	.....	.....	.....	.....	.....	349	206	60	31	2.5	.3
28	11	.....	.....	.....	.....	.....	301	206	51	28	2.5	.3
29	12	.....	.....	.....	.....	.....	237	221	32	25	1.8	.3
30	10	.....	.....	.....	.....	.....	191	191	32	19	1.8	.3
31	11	.....	.....	.....	.....	.....	.....	162	.....	18	1.3	.....

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. Discharge estimated, because of ice, from one discharge measurement, climatic records, and comparison with the flow of Minnesota River near Montevideo, as follows: Nov. 26–30, 9 second-feet; Dec. 1–31, 1912, 5 second-feet; Jan. 1–31, 1913, 4 second-feet; Feb. 1–28, 1 second-foot; Mar. 1–31 10 second-feet: and April 1–3, 200 second-feet.

Monthly discharge of Lac Qui Parle River at Lac Qui Parle, Minn., for the year ending Sept. 30, 1913.

[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	16	9	12.0	0.014	0.02	D.
November	15	.....	11.4	.014	.02	D.
December	.....	.....	5	.0060	.007	
January	.....	.....	4	.0048	.006	
February	.....	.....	1	.0012	.001	
March	.....	.....	10	.012	.01	
April	696	112	253	.302	.34	B.
May	333	91	158	.189	.22	B.
June	149	24	63.2	.075	.08	B.
July	71	18	38.5	.046	.05	B.
August	15	1.3	5.95	.0071	.008	C.
September	28	.3	2.95	.0035	.004	C.
The year	696	.....	47.1	.056	.77	

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 mouth of river, and about 2 miles below mouth of Dry Weather Creek.

Records available.—July 6, 1909, to September 30, 1913.

Drainage area.—1,940 square miles.

Gage.—Chain gage attached to bridge; read in the afternoon 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.—Slightly shifting during flood stages.

Discharge measurements.—Made from bridge and by wading.

Winter flow.—During period of ice in 1912–13 based on direct relation between flow at Montevideo and Watson supplemented by one discharge measurement.

Regulation.—Some slight regulation may have been due at one time 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 dam at Montevideo.

Accuracy.—Records good; based on a fairly well-defined curve.

Discharge measurements of Chippewa River near Watson, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 22	S. B. Soulé	(a)	2.8
Apr. 22	W. G. Hoyt	5.17	120
Sept. 15	S. B. Soulé	4.97	94

a Measurement made near the mouth of river. Gage not visited.

Daily gage height, in feet, of Chippewa River near Watson, Minn., for the year ending Sept. 30, 1913.

[Clifford Bonde, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.70	4.62	.....	.....	.....	.....	5.0	5.3	5.8	4.29	5.5	5.05
2	4.70	4.65	.....	.....	.....	.....	4.22	5.35	5.65	4.25	5.4	5.4
3	4.68	4.68	.....	.....	.....	.....	4.62	5.2	.....	.....	5.3	5.8
4	4.65	4.68	.....	.....	.....	.....	4.45	5.2	5.45	4.50	5.25	.....
5	4.60	4.65	.....	.....	.....	.....	4.55	5.25	.....	4.48	5.2	.....
6	4.62	4.55	.....	.....	.....	.....	4.82	5.3	5.3	4.48	5.15	5.1
7	4.65	4.65	.....	.....	.....	.....	4.90	.....	5.2	4.48	5.1	5.0
8	4.65	4.60	.....	.....	.....	.....	5.2	5.2	5.1	4.48	5.1	5.0
9	4.68	4.60	.....	.....	.....	.....	5.3	5.3	5.0	4.42	5.05	5.0
10	4.68	4.62	.....	.....	.....	.....	6.0	5.2	4.90	4.35	5.1	4.95
11	4.70	4.61	.....	.....	.....	.....	5.9	5.2	4.88	4.42	5.1	5.2
12	4.72	4.58	.....	.....	.....	.....	5.4	5.2	4.85	4.40	4.95	5.1
13	4.70	4.60	.....	.....	.....	.....	5.5	5.2	4.80	4.38	5.0	5.0
14	4.68	4.62	.....	.....	.....	.....	5.4	5.2	4.72	4.40	4.90	5.0
15	4.68	4.62	.....	.....	.....	.....	5.35	5.3	4.70	4.42	4.88	4.98
16	4.68	4.60	.....	.....	.....	.....	5.4	5.4	4.68	4.58	4.88	4.95
17	4.68	4.68	.....	.....	.....	.....	5.4	5.5	4.60	4.60	4.90	4.92
18	4.68	4.70	.....	.....	.....	.....	5.3	5.65	4.45	4.72	5.0	4.88
19	4.70	4.70	.....	.....	.....	.....	5.2	5.9	4.55	4.90	4.95	4.85
20	4.68	4.60	.....	.....	.....	.....	5.2	6.0	4.75	5.0	5.2	4.82
21	4.65	4.58	.....	.....	.....	.....	5.2	6.1	3.55	5.10	5.2	.....
22	4.65	4.55	.....	.....	.....	.....	5.2	6.2	4.50	5.1	5.25	4.82
23	4.62	4.60	.....	.....	.....	.....	5.2	6.2	4.45	.....	5.3	4.85
24	4.62	4.62	.....	.....	.....	.....	5.3	6.3	4.40	5.3	5.4	4.88
25	4.62	4.71	.....	.....	.....	.....	5.3	6.3	4.42	5.45	5.4	4.82
26	4.61	4.70	.....	.....	.....	.....	5.3	6.4	4.45	5.5	5.45	4.80
27	4.61	4.70	.....	.....	.....	.....	5.4	6.4	4.42	5.55	5.4	4.82
28	4.62	4.68	.....	.....	.....	.....	5.4	6.3	4.35	5.5	5.35	4.82
29	4.60	4.65	.....	.....	.....	.....	5.4	6.2	4.30	5.6	5.3	4.85
30	4.60	4.62	.....	.....	.....	.....	5.35	6.0	4.35	5.6	5.2	4.75
31	4.65	.....	.....	.....	.....	5.05	.....	5.8	.....	5.5	5.1	.....

NOTE.—Discharge relation affected by ice about Nov. 25, 1912, to Apr. 3, 1913.

Daily discharge, in second-feet, of Chippewa River near Watson, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	65	59	.....	.....	.....	.....	35	137	210	36	165	105
2	65	61	.....	.....	.....	.....	40	144	188	34	151	151
3	63	63	.....	.....	.....	.....	55	124	a 173	a 42	137	210
4	61	63	.....	.....	.....	.....	46	124	158	49	130	a 177
5	57	61	.....	.....	.....	.....	53	130	a 148	48	124	a 144
6	59	53	.....	.....	.....	.....	78	137	137	48	118	111
7	61	61	.....	.....	.....	.....	87	a 130	124	48	111	99
8	61	57	.....	.....	.....	.....	124	124	111	48	111	99
9	63	57	.....	.....	.....	.....	137	137	99	43	105	99
10	63	59	.....	.....	.....	.....	240	124	87	39	111	93
11	65	58	.....	.....	.....	.....	225	124	85	43	111	124
12	67	55	.....	.....	.....	.....	151	124	82	42	93	111
13	65	57	.....	.....	.....	.....	165	121	76	41	99	99
14	63	59	.....	.....	.....	.....	151	124	68	42	87	99
15	63	59	.....	.....	.....	.....	144	137	66	43	85	97
16	63	57	.....	.....	.....	.....	151	151	64	55	85	93
17	63	63	.....	.....	.....	.....	151	165	57	57	87	89
18	63	65	.....	.....	.....	.....	137	188	46	68	99	85
19	65	65	.....	.....	.....	.....	124	225	53	87	93	82
20	63	57	.....	.....	.....	.....	124	240	71	99	124	78
21	61	55	.....	.....	.....	.....	124	256	53	111	124	a 78
22	61	53	.....	.....	.....	.....	124	272	49	111	130	78
23	59	57	.....	.....	.....	.....	124	272	46	a 124	137	82
24	59	59	.....	.....	.....	.....	137	288	42	137	151	85
25	59	.....	.....	.....	.....	.....	137	288	43	158	151	78
26	58	.....	.....	.....	.....	.....	137	304	46	165	158	76
27	58	.....	.....	.....	.....	.....	151	304	43	172	151	78
28	59	.....	.....	.....	.....	.....	151	288	39	165	144	78
29	57	.....	.....	.....	.....	.....	151	272	36	180	137	82
30	57	.....	.....	.....	.....	.....	144	240	39	180	124	71
31	61	.....	.....	.....	.....	.....	.....	210	.....	165	111	.....

a Interpolated.

NOTE.—Daily discharge computed from two well-defined rating-curves. Curve used Apr. 4 to Sept. 30 based on nine discharge measurements made in 1913 and 1914. Discharge estimated, because of ice, from one discharge measurement and the flow of Minnesota River near Montevideo and of Lac Qui Parle River at Lac Qui Parle, as follows: Nov. 25-30, 59 second-feet; Dec. 1-31, 45 second-feet; Jan. 1-31, 23 second-feet; Feb. 1-28, 9 second-feet; and Mar. 1-31, 30 second-feet.

Monthly discharge of Chippewa River near Watson, Minn., for the year ending Sept. 30, 1913.

[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	67	57	61.5	0.032	0.04	B.
November	65	.....	58.9	.030	.03	C.
December	.....	.....	45	.023	.03	C.
January	.....	.....	23	.012	.01	D.
February	.....	.....	9	.0046	.005	D.
March	.....	.....	30	.016	.02	D.
April	240	.....	127	.066	.07	B.
May	304	124	191	.098	.11	A.
June	210	36	84.6	.044	.05	A.
July	180	34	86.5	.045	.05	A.
August	165	85	121	.062	.07	A.
September	210	71	101	.052	.06	A.
The year	304	.....	78.5	.040	.54	

REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

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

Records available.—July 2, 1909, to September 30, 1913.

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 from 3.0 to 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 gage; practically permanent.

Discharge measurements.—Made from bridge; at low stages by wading at different sections.

Winter flow.—Affected by ice; observations discontinued.

Regulation.—Flow natural; no dams above gaging station. Below station a dam at Redwood Falls creates a pond extending a considerable distance upstream, but backwater does not reach station.

Accuracy.—Records should be reliable as conditions are favorable for excellent results.

Discharge measurements of Redwood River near Redwood Falls, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 24	S. B. Soulé	2.32	67	Sept. 17	S. B. Soulé	1.64	2.6
July 17	B. J. Peterson	2.01	27	17	.....do	1.64	2.6

NOTE.—Measurements made by wading.

Daily gage height, in feet, of Redwood River near Redwood Falls, Minn., for the year ending Sept. 30, 1913.

[Wallace Stuart, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.75	2.05	.....	.....	.....	.....	2.42	2.35	2.25	1.72	1.79	1.78
2	1.85	2.05	.....	.....	.....	.....	2.45	2.30	2.20	1.70	1.74	1.78
3	1.90	2.02	.....	.....	.....	.....	2.47	2.20	2.20	1.70	1.69	1.78
4	1.90	2.00	.....	.....	.....	.....	2.47	2.15	2.10	1.80	1.69	1.78
5	1.75	1.92	.....	.....	.....	.....	2.47	2.10	2.10	1.78	1.69	1.76
6	1.95	2.00	.....	.....	.....	.....	2.37	2.10	2.05	1.78	1.74	1.77
7	1.95	2.00	.....	.....	.....	.....	2.32	2.08	2.00	1.75	1.67	1.72
8	2.00	2.00	.....	.....	.....	.....	2.32	2.08	1.98	1.80	1.69	1.72
9	2.00	2.00	.....	.....	.....	.....	2.35	2.05	1.95	1.90	1.64	1.72
10	1.88	.....	.....	.....	.....	.....	2.37	2.05	1.90	2.00	1.61	1.75
11	2.00	1.95	.....	.....	.....	.....	2.37	2.05	1.90	2.10	1.59	1.72
12	2.10	2.00	.....	.....	.....	.....	2.37	2.02	1.90	2.10	1.59	1.69
13	2.10	2.00	.....	.....	.....	.....	2.37	2.02	1.90	2.10	1.59	1.67
14	2.00	1.95	.....	.....	.....	.....	2.39	2.05	1.88	2.10	1.69	1.67
15	1.85	1.90	.....	.....	.....	.....	2.47	2.10	1.90	2.08	1.69	1.67
16	1.95	2.00	.....	.....	.....	.....	2.49	2.05	1.85	2.05	1.69	1.67
17	1.95	1.95	.....	.....	.....	.....	2.52	2.02	1.85	2.00	1.73	1.65
18	2.00	1.95	.....	.....	.....	.....	2.57	2.02	1.85	.....	1.76	1.65
19	2.10	1.95	.....	.....	.....	.....	2.62	2.08	1.82	1.95	1.68	1.62
20	1.95	1.90	.....	.....	.....	.....	2.57	2.08	1.80	1.90	1.68	1.62
21	2.00	1.98	.....	.....	.....	.....	2.47	2.10	1.80	1.90	1.73	1.60
22	2.05	2.00	.....	.....	.....	.....	2.47	2.10	1.78	1.90	1.73	1.60
23	2.05	2.00	.....	.....	.....	.....	2.32	2.12	1.80	1.90	1.73	1.65
24	2.05	1.98	.....	.....	.....	.....	2.27	2.15	1.80	1.88	1.78	1.65
25	1.90	1.90	.....	.....	.....	.....	2.40	2.20	1.80	1.85	1.78	1.65
26	1.96	1.98	.....	.....	.....	.....	2.40	2.25	1.80	1.82	1.78	1.65
27	2.05	1.95	.....	.....	.....	.....	2.38	2.30	1.78	1.79	1.78	1.62
28	2.00	1.98	.....	.....	.....	.....	2.35	2.30	1.75	1.79	1.78	1.65
29	2.05	2.00	.....	.....	.....	.....	2.35	2.30	1.78	1.79	1.78	1.62
30	1.96	1.88	.....	.....	.....	.....	2.30	2.25	1.78	1.79	1.78	1.60
31	2.00	.....	.....	.....	.....	.....	.....	2.30	.....	1.79	1.78	.....

NOTE.—Discharge relation affected by ice about Dec. 1, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Redwood River near Redwood Falls, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	8.5	32	.....	.....	.....	.....	97	80	60	6	9	8
2	14	32	.....	.....	.....	.....	104	69	50	5	7	8
3	17	29	.....	.....	.....	.....	110	50	50	5	5	8
4	17	26	.....	.....	.....	.....	110	42	34	9	5	8
5	8.5	19	.....	.....	.....	.....	110	34	34	8	5	7
6	22	26	.....	.....	.....	.....	84	34	28	8	7	8
7	22	26	.....	.....	.....	.....	73	32	23	7	4	6
8	26	26	.....	.....	.....	.....	73	32	21	9	5	6
9	26	26	.....	.....	.....	.....	80	28	19	15	3	6
10	16	a 24	.....	.....	.....	.....	84	28	15	23	2	7
11	26	22	.....	.....	.....	.....	84	28	15	34	2	6
12	39	26	.....	.....	.....	.....	84	25	15	34	2	5
13	39	26	.....	.....	.....	.....	84	25	15	34	2	4
14	26	22	.....	.....	.....	.....	90	28	14	34	5	4
15	14	17	.....	.....	.....	.....	110	34	15	32	5	4
16	22	26	.....	.....	.....	.....	114	28	12	28	5	4
17	22	22	.....	.....	.....	.....	122	25	12	23	6	4
18	26	22	.....	.....	.....	.....	136	25	12	a 21	7	4
19	39	22	.....	.....	.....	.....	150	32	10	19	4	3
20	22	17	.....	.....	.....	.....	136	32	9	15	4	3
21	26	24	.....	.....	.....	.....	110	34	9	15	6	2
22	32	26	.....	.....	.....	.....	110	34	8	15	6	2
23	32	26	.....	.....	.....	.....	73	37	9	15	6	4
24	32	24	.....	.....	.....	.....	63	42	9	14	8	4
25	17	17	.....	.....	.....	.....	92	50	9	12	8	4
26	22	24	.....	.....	.....	.....	92	60	9	10	8	4
27	32	22	.....	.....	.....	.....	87	69	8	9	8	3
28	26	24	.....	.....	.....	.....	80	69	7	9	8	4
29	32	26	.....	.....	.....	.....	80	69	8	9	8	3
30	22	16	.....	.....	.....	.....	69	60	8	9	8	2
31	26	.....	.....	.....	.....	.....	.....	69	.....	9	8	.....

a Estimated.

NOTE.—Daily discharge computed from a fairly well-defined rating curve. Discharge, December 1–31, 1912, estimated, because of ice, from discharge of adjacent drainage areas, at 10 second-feet.

Monthly discharge of Redwood River near Redwood Falls, Minn., for the year ending Sept. 30, 1913.

[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	39	8.5	24.2	0.034	0.04	B.
November	32	16	23.9	.034	.04	C.
December			10	.014	.02	
April	150	63	96.4	.137	.15	B.
May	80	25	42.1	.060	.07	B.
June	60	7	18.2	.026	.03	B.
July	34	5	16.0	.023	.03	B.
August	9	2	5.7	.0081	.009	C.
September	8	2	4.8	.0068	.008	C.

COTTONWOOD RIVER NEAR NEW ULM, MINN.

Location.—In sec. 31, T. 10 N., R. 30 W., at Alwin highway bridge, 2 miles southeast of New Ulm, 15 miles below mouth of Sleepy Eye Creek, the nearest tributary.

Records available.—July 2, 1909, to September 30, 1913.

Drainage area.—1,190 square miles.

Gage.—Chain gage attached to bridge; read morning and evening to quarter-tenths. Limits of use: Hundredths below 2.0, half-tenths from 2.0 to 3.5, and tenths above 3.5 feet. Datum of gage lowered 2.28 feet August 12, 1909. All readings prior to that date corrected so that all gage heights refer to new datum.

Channel and control.—Slightly shifting as shown by low-water measurements.

Discharge measurements.—Made from bridge and during extreme low water by wading.

Winter flow.—Estimates during frozen period based on discharge measurements.

Regulation.—Flow not regulated; no dams above station and no effect from backwater from dam at New Ulm.

Accuracy.—See footnote to monthly discharge table.

Discharge measurements of Cottonwood River near New Ulm, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Dec. 27	S. B. Soulé	1.93	[a] 9.7	July 18	B. J. Peterson	1.80	[b] 68
Jan. 22	do	2.76	[a] 2.1	Sept. 18	S. B. Soulé	1.04	[b] 13.0
Apr. 24	W. G. Hoyt	2.73	229	18	do	1.04	[b] 12.8

[a] Complete ice cover.
[b] Measurement made by wading at a section a short distance below the gage.

Daily gage height, in feet, of Cottonwood River near New Ulm, Minn., Oct. 1, 1912, to Dec. 13, 1913.

[Esther Alwin, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.20	1.25	.....	.....	.....	.....	3.3	2.5	2.75	2.5	1.45	1.26	1.18	1.19	1.30
2	1.20	1.25	2.0	2.0	.....	.....	3.35	2.5	2.6	2.4	1.42	1.22	1.16	1.28	1.30
3	1.18	1.25	.....	.....	.....	.....	3.35	2.5	2.55	2.3	1.42	1.20	1.15	1.30	1.30
4	1.12	1.25	.....	.....	.....	.....	3.3	2.45	2.4	2.45	1.42	1.15	1.15	1.30	1.30
5	1.10	1.25	.....	.....	.....	.....	3.3	2.45	2.15	2.3	1.42	1.10	1.12	1.30	1.30
6	1.12	1.25	.....	.....	2.95	3.1	3.15	2.4	2.1	2.3	1.42	1.05	1.10	1.30	1.30
7	1.16	1.25	.....	.....	.....	.....	2.75	2.4	1.95	2.2	1.42	1.05	1.10	1.32	1.10
8	1.18	1.25	.....	.....	.....	.....	2.1	2.35	1.92	2.1	1.42	1.09	1.10	1.35	1.40
9	1.14	1.25	2.3	2.3	.....	.....	2.2	2.25	1.82	2.1	1.42	1.12	1.10	1.08	1.40
10	1.12	1.25	.....	.....	.....	.....	2.2	2.1	1.80	2.0	1.40	1.11	1.18	1.10	1.42
11	1.12	1.25	.....	.....	.....	.....	2.25	2.05	1.75	1.98	1.38	1.10	1.15	1.10	1.42
12	1.18	1.25	.....	.....	.....	.....	2.3	2.05	1.72	1.92	1.34	1.08	1.15	1.10	1.42
13	1.26	1.25	.....	.....	3.0	5.6	2.45	1.95	1.65	1.90	1.32	1.08	1.15	1.10	1.42
14	1.28	1.25	.....	.....	.....	.....	2.65	1.95	1.78	1.90	1.32	1.06	1.15	1.10	.....
15	1.29	1.25	.....	.....	.....	.....	3.2	2.0	1.70	1.88	1.32	1.08	1.15	1.30	.....
16	1.30	1.25	2.6	2.6	.....	.....	4.3	2.05	1.49	1.85	1.32	1.08	1.15	1.30	.....
17	1.35	1.28	.....	.....	.....	.....	4.7	2.15	1.48	1.80	1.30	1.06	1.18	1.30	.....
18	1.35	1.28	.....	.....	.....	.....	4.5	2.2	1.40	1.75	1.28	1.06	1.20	1.30	.....
19	1.30	1.28	.....	.....	.....	.....	3.8	2.25	1.35	1.70	1.28	1.12	1.20	1.30	.....
20	1.28	1.28	.....	.....	3.0	3.8	3.4	2.3	1.54	1.68	1.32	1.11	1.20	1.30	.....
21	1.28	1.28	.....	.....	.....	.....	3.1	2.35	1.51	1.62	1.40	1.05	1.20	1.32	.....
22	1.28	1.28	.....	2.8	.....	.....	3.0	2.65	1.48	1.60	1.48	1.00	1.20	1.32	.....
23	1.28	1.28	2.7	2.7	.....	.....	2.95	3.05	1.48	1.58	1.52	1.02	1.20	1.32	.....
24	1.28	1.39	.....	.....	.....	.....	2.95	3.1	1.56	1.52	1.64	1.06	1.20	1.34	.....
25	1.26	1.48	.....	.....	.....	.....	3.2	3.05	1.94	1.50	1.62	1.10	1.20	1.32	.....
26	1.25	1.50	.....	.....	.....	.....	3.3	3.0	2.5	1.46	1.52	1.10	1.20	1.32	.....
27	1.25	1.50	1.93	.....	3.05	.....	3.2	3.0	3.25	1.41	1.42	1.09	1.20	1.32	.....
28	1.25	1.48	.....	.....	.....	.....	3.0	2.95	3.6	1.40	1.40	1.08	1.20	1.30	.....
29	1.25	1.48	.....	.....	.....	.....	2.9	2.9	3.2	1.40	1.35	1.12	1.28	1.30	.....
30	1.25	1.48	2.8	2.8	.....	.....	2.65	2.8	2.85	1.45	1.32	1.15	1.21	1.30	.....
31	1.25	.....	.....	.....	.....	.....	.....	2.8	.....	1.45	1.30	.....	1.28	.....	.....

NOTE.—Discharge relation affected by ice about Nov. 24, 1912, to Apr. 7, 1913, and Dec. 7–13, 1913.

Daily discharge, in second-feet, of Cottonwood River near New Ulm, Minn., Oct. 1, 1912, to Dec. 6, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	17	20	.....	.....	.....	.....	.....	174	233	174	35	22	17	18	24
2	17	20	.....	.....	.....	.....	.....	174	196	154	33	19	16	23	24
3	16	20	.....	.....	.....	.....	.....	174	185	136	33	18	16	24	24
4	13	20	.....	.....	.....	.....	.....	164	154	164	33	16	16	24	24
5	12	20	.....	.....	.....	.....	.....	164	113	136	33	14	15	24	24
6	13	20	.....	.....	.....	.....	.....	154	106	136	33	13	14	24	24
7	15	20	.....	.....	.....	.....	.....	154	86	120	33	13	14	25	.....
8	16	20	.....	.....	.....	.....	106	145	82	106	33	14	14	28	.....
9	14	20	.....	.....	.....	.....	120	128	70	106	33	15	14	14	.....
10	13	20	.....	.....	.....	.....	120	106	68	92	31	14	17	14	.....
11	13	20	.....	.....	.....	.....	128	99	63	90	30	14	16	14	.....
12	16	20	.....	.....	.....	.....	136	99	60	82	27	14	16	14	.....
13	21	20	.....	.....	.....	.....	164	86	53	80	25	14	16	14	.....
14	23	20	.....	.....	.....	.....	208	86	66	80	25	13	16	14	.....
15	23	20	.....	.....	.....	.....	370	92	58	78	25	14	16	24	.....
16	24	20	.....	.....	.....	.....	830	99	38	74	25	14	16	24	.....
17	28	23	.....	.....	.....	.....	1,010	113	37	68	24	13	17	24	.....
18	28	23	.....	.....	.....	.....	920	120	31	63	23	13	18	24	.....
19	24	23	.....	.....	.....	.....	605	128	28	58	23	15	18	24	.....
20	23	23	.....	.....	.....	.....	445	136	43	56	25	14	18	24	.....
21	23	23	.....	.....	.....	.....	336	145	40	50	31	13	18	25	.....
22	23	23	.....	.....	.....	.....	304	208	37	48	37	12	18	25	.....
23	23	23	.....	.....	.....	.....	289	320	37	46	41	12	18	25	.....
24	23	.....	.....	.....	.....	.....	289	336	44	41	52	13	18	27	.....
25	21	.....	.....	.....	.....	.....	370	320	85	39	50	14	18	25	.....
26	20	.....	.....	.....	.....	.....	406	304	174	36	41	14	18	25	.....
27	20	.....	.....	.....	.....	.....	370	304	388	32	33	14	18	25	.....
28	20	.....	.....	.....	.....	.....	304	289	525	31	31	14	18	24	.....
29	20	.....	.....	.....	.....	.....	274	274	370	31	28	15	23	24	.....
30	20	.....	.....	.....	.....	.....	208	246	260	35	25	16	19	24	.....
31	20	.....	.....	.....	.....	.....	.....	246	.....	35	24	.....	23	.....	.....

NOTE.—Daily discharge computed from two well-defined rating curves. Curve used Apr. 8 to Dec. 6, 1913, based on measurements made during that period. Discharge estimated, because of ice, from gage heights, observer's notes, 2 discharge measurements, and climatic records, as follows: Nov. 24–30, 23 second-feet; Dec. 1–26, 16 second-feet; Dec. 27–31, 1912, 10 second-feet; Jan. 1–31, 1913, 4 second-feet; Feb. 1–28, 3 second-feet; Mar. 1–31, 50 second-feet; and Apr. 1–7, 70 second-feet.

Monthly discharge of Cottonwood River near New Ulm, Minn., Oct. 1, 1911, to Dec. 6, 1913.

[Drainage area, 1,190 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1911–12.						
October	679	26	279	0.234	0.27	C.
November	116	.....	60.9	.051	.06	D.
December	.....	.....	55.0	.046	.05	D.
January	.....	.....	20	.017	.02	D.
February	.....	.....	15	.013	.01	D.
March	.....	.....	90	.076	.09	C.
April	.....	.....	233	.196	.22	C.
May	250	68	123	.103	.12	B.
June	97	24	51.0	.043	.05	B.
July	91	15	31.0	.026	.03	B.
August	50	12	23.6	.020	.02	C.
September	23	10	15.8	.013	.01	C.
The year	679	.....	83.4	.070	.95	
1912–13.						
October	28	12	19.4	.016	.02	C.
November	.....	.....	21.4	.018	.02	C.
December	.....	.....	15	.013	.01	C.
January	.....	.....	4	.0034	.004	D.
February	.....	.....	3	.0025	.003	D
March	.....	.....	50	.042	.05	D.
April	1,010	.....	293	.246	.27	C.
May	336	86	180	.151	.17	B.
June	525	28	124	.104	.12	B.
July	174	31	79.9	.067	.08	A.
August	52	23	31.5	.026	.03	B.
September	22	12	14.4	.012	.01	A.
The year	1,010	.....	69.8	.059	.79	
1913.						
October	23	14	17.1	.014	.02	B.
November	28	14	22.2	.019	.02	B.
December 1–6	24	24	24	.020	.004	B.

NOTE.—Estimates of "Discharge in second-feet per square mile" and "Run-off (depth in inches)" for 1912 supersede those published in Water-Supply Paper 325, which were computed from an erroneous value of the drainage area. Estimates for October, November, and December, 1911, are republished to complete the data for the climatic year.

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

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

Records available.—January 10, 1902, to June 30, 1905; January 1, 1910, to September 30, 1913. Data for 1903 published in Water-Supply Paper 98, pages 176–177, under St. Croix River, near Taylors Falls, Minn. Daily and monthly discharge for 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.—Determinations based on kilowatt output of dynamo and exciters plus the flow over the dam and spillway, which are considered as a weir.

Accuracy.—Records not checked by engineers of United States Geological Survey, but are believed reliable.

Cooperation.—Records furnished by Minneapolis General Electric Co.

Daily discharge, in second-feet, of St. Croix River near St. Croix Falls, Wis., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,830	1,790	1,610	760	1,420	1,630	3,190	4,940	2,500	3,030	3,480	2,410
2	1,760	1,920	1,540	1,270	1,170	1,020	3,280	4,470	3,980	1,450	3,160	2,660
3	1,600	1,510	1,350	1,590	1,410	1,400	5,060	4,080	6,400	2,060	2,390	3,490
4	1,780	1,630	1,940	1,670	1,340	1,270	5,890	4,480	6,260	1,260	3,420	3,260
5	1,960	1,520	1,920	1,250	1,190	1,120	6,370	5,480	4,630	1,240	3,380	3,050
6	1,530	1,780	1,740	1,200	1,210	1,220	6,580	4,580	3,240	1,230	3,150	2,910
7	1,340	1,630	1,360	1,270	1,160	1,280	7,190	3,610	3,200	2,820	3,380	1,790
8	2,360	1,740	1,070	1,480	1,400	1,440	8,420	4,810	1,700	3,320	3,070	2,780
9	2,060	1,750	1,360	1,190	1,200	935	8,610	3,790	3,020	3,260	3,130	2,860
10	1,740	1,590	1,190	1,560	1,250	1,360	7,460	3,870	3,370	3,350	1,660	2,730
11	1,750	1,770	1,260	1,440	1,230	1,640	7,020	3,990	3,380	3,320	2,420	2,680
12	1,960	1,600	1,240	1,190	1,140	1,690	6,160	3,470	3,340	3,160	2,860	2,610
13	1,690	1,590	1,230	1,500	1,130	2,240	5,470	3,290	3,070	2,290	2,790	2,560
14	2,020	1,660	1,430	1,300	1,140	2,520	5,900	3,520	2,880	4,410	2,450	1,560
15	2,090	1,560	1,650	1,230	1,320	2,590	6,290	3,080	1,700	4,560	1,910	2,580
16	2,100	1,740	1,440	1,380	1,070	1,270	6,270	3,120	2,730	5,450	2,440	2,830
17	2,090	1,340	1,680	1,130	1,280	971	6,950	4,410	2,520	4,380	1,540	2,740
18	2,060	1,640	1,530	1,820	1,190	1,900	5,400	3,100	2,400	6,030	2,440	2,670
19	2,000	1,560	1,410	1,120	1,160	1,800	6,100	4,950	2,500	6,200	2,500	2,200
20	1,840	1,630	1,610	1,450	1,330	2,060	6,220	6,870	2,310	5,620	2,530	2,600
21	1,900	1,630	1,790	1,260	1,310	1,990	6,120	6,550	2,410	5,230	2,550	1,550
22	1,720	1,630	1,440	1,310	1,430	2,570	5,990	8,980	1,570	4,280	2,750	1,910
23	1,830	1,720	1,350	1,340	1,150	1,330	5,780	8,590	2,350	3,420	2,660	2,060
24	1,750	1,460	1,850	1,310	1,350	1,800	7,000	8,560	2,600	3,670	1,620	2,880
25	1,840	1,520	1,220	1,500	1,270	1,830	7,500	6,290	2,070	3,950	2,620	1,730
26	2,080	876	1,790	1,140	1,380	1,730	7,120	6,780	2,100	3,660	2,670	2,550
27	1,580	1,190	1,500	1,280	1,280	2,230	8,640	5,480	1,830	1,830	3,040	2,530
28	1,700	1,300	1,690	1,320	1,280	1,850	8,350	5,090	2,010	3,080	3,260	1,660
29	1,800	949	1,480	1,260	.....	2,590	6,520	4,380	1,490	3,600	3,340	2,760
30	1,760	1,350	1,450	1,300	.....	1,420	6,140	3,600	3,100	3,720	3,350	2,740
31	1,710	.....	1,100	1,340	.....	2,560	.....	3,510	.....	3,910	2,010	.....

Monthly discharge of St. Croix River near St. Croix Falls, Wis., for the year ending Sept. 30, 1913.

[Drainage area, 5,930 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
October	2,360	1,340	1,850	0.312	0.36
November	1,920	876	1,550	.261	.29
December	1,940	1,070	1,490	.251	.29
January	1,820	760	1,330	.224	.26
February	1,430	1,070	1,260	.212	.22
March	2,590	935	1,720	.290	.33
April	8,640	3,190	6,430	1.08	1.20
May	8,980	3,080	4,890	.825	.95
June	6,400	1,490	2,890	.487	.54
July	6,200	1,230	3,510	.592	.68
August	3,480	1,540	2,710	.457	.53
September	3,490	1,550	2,510	.423	.47
The year	8,980	760	2,680	.452	6.12

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

KETTLE RIVER NEAR SANDSTONE, MINN.

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

Records available.—October 18, 1908, to September 30, 1913.

Drainage area.—825 square miles.

Gage.—Staff gage in two sections fastened to vertical rock wall; read once daily to half-tenths. Limits of use: Half-tenths below and tenths above 3.5 feet. Gage 50 feet above decided rapids. Datum subsequent to April 25, 1912, may differ not more than about 0.02 foot from that of previous years.

Channel and control.—Bedrock; permanent.

Winter flow.—Rapids freeze and cause backwater during extremely cold weather.

Regulation.—Station not affected by nearest dam at Sandstone, 3 miles below.

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

No discharge measurements were made during the year ending September 30, 1913.

Daily gage height, in feet, of Kettle River near Sandstone, Minn., for the year ending Sept. 30, 1913.

[F. L. Betts, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.35	1.3	.....	1.2	.....	.....	2.2	3.4	3.2	2.3	2.7	1.7
2	1.3	1.3	.....	1.2	.....	.....	2.7	3.3	3.1	2.2	2.7	1.7
3	1.25	1.3	.....	1.25	.....	.....	2.95	3.2	3.1	2.2	2.6	1.6
4	1.2	1.3	.....	1.25	.....	.....	2.9	3.3	3.0	2.2	2.5	1.6
5	1.3	1.3	.....	.....	.....	.....	2.8	3.3	3.0	3.9	2.4	1.6
6	1.3	1.3	.....	.....	1.0	1.05	2.9	3.2	2.9	4.7	2.3	1.5
7	1.35	1.3	.....	.....	.....	.....	3.15	3.1	2.9	4.9	2.2	1.5
8	1.3	1.3	.....	.....	.....	.....	3.2	3.0	2.8	4.7	2.2	1.4
9	1.25	1.3	.....	1.4	.....	.....	3.25	2.8	2.8	4.7	2.1	1.4
10	1.2	1.3	.....	.....	.....	.....	3.15	2.8	2.7	4.7	2.0	1.4
11	1.25	1.3	.....	.....	.....	.....	3.05	2.7	2.7	4.7	1.9	1.5
12	1.5	1.3	.....	.....	.....	.....	2.95	2.7	2.6	4.6	1.9	2.1
13	1.45	1.3	.....	.....	1.0	.....	3.1	2.6	2.5	4.6	1.8	2.1
14	1.4	1.3	.....	.....	.....	.....	3.7	2.6	2.4	4.5	1.7	2.1
15	1.4	1.3	.....	.....	.....	.....	3.7	2.8	2.3	4.4	1.7	2.1
16	1.35	1.3	.....	1.3	.....	1.0	3.7	3.4	2.3	4.3	1.8	2.0
17	1.35	1.25	.....	.....	.....	1.0	3.6	5.1	2.3	4.3	2.0	2.0
18	1.35	1.2	.....	.....	.....	.95	3.5	5.0	2.2	4.2	2.2	1.9
19	1.35	1.2	.....	.....	.....	1.0	3.5	4.8	2.1	4.2	2.2	1.9
20	1.35	1.15	.....	.....	1.0	1.05	3.4	4.6	2.0	4.0	2.1	1.8
21	1.35	1.1	.....	.....	.....	1.0	3.3	4.9	1.9	4.0	2.1	1.8
22	1.35	1.05	.....	.....	.....	1.05	3.3	5.2	1.9	3.8	2.1	1.7
23	1.3	1.0	.....	1.2	.....	1.0	3.4	5.3	1.9	3.6	2.0	1.7
24	1.3	1.0	.....	.....	.....	1.0	3.7	5.0	1.8	3.4	2.0	1.7
25	1.3	.95	.....	.....	.....	1.05	4.0	4.6	1.8	3.2	2.0	1.8
26	1.25	.9	.....	.....	1.0	1.1	4.2	4.3	2.3	3.1	1.9	1.9
27	1.3	.8	.....	.....	.....	1.25	4.3	3.9	2.4	3.0	1.9	1.9
28	1.3	.8	.....	.....	.....	1.15	4.3	3.8	2.3	3.0	1.9	1.9
29	1.3	.75	.....	.....	.....	1.1	3.9	3.6	2.3	2.9	1.8	1.9
30	1.3	.7	.....	1.0	.....	1.3	3.5	3.6	2.3	2.9	1.8	1.9
31	1.3	.....	.....	.....	.....	1.65	.....	3.4	.....	2.8	1.8	.....

NOTE.—Discharge relation affected by ice about Dec. 1, 1912, to Mar. 15, 1913.

Daily discharge, in second-feet, of Kettle River near Sandstone, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	124	112	.....	.....	.....	.....	420	1,170	1,010	465	675	216
2	112	112	.....	.....	.....	.....	675	1,090	935	420	675	216
3	101	112	.....	.....	.....	.....	832	1,010	935	420	620	186
4	90	112	.....	.....	.....	.....	800	1,090	865	420	565	186
5	112	112	.....	.....	.....	.....	735	1,090	865	1,610	515	186
6	112	112	.....	.....	.....	.....	800	1,010	800	2,440	465	160
7	124	112	.....	.....	.....	.....	972	935	800	2,720	420	160
8	112	112	.....	.....	.....	.....	1,010	865	735	2,440	420	136
9	101	112	.....	.....	.....	.....	1,050	735	735	2,440	375	136
10	90	112	.....	.....	.....	.....	972	735	675	2,440	330	136
11	101	112	.....	.....	.....	.....	900	675	675	2,440	288	160
12	160	112	.....	.....	.....	.....	832	675	620	2,320	288	375
13	148	112	.....	.....	.....	.....	935	620	565	2,320	250	375
14	136	112	.....	.....	.....	.....	1,430	620	515	2,200	216	375
15	136	112	.....	.....	.....	.....	1,430	735	465	2,090	216	375
16	124	112	.....	.....	.....	52	1,430	1,170	465	1,990	250	330
17	124	101	.....	.....	.....	52	1,340	3,000	465	1,990	330	330
18	124	90	.....	.....	.....	44	1,260	2,860	420	1,890	420	288
19	124	90	.....	.....	.....	52	1,260	2,580	375	1,890	420	288
20	124	80	.....	.....	.....	61	1,170	2,320	330	1,700	375	250
21	124	70	.....	.....	.....	52	1,090	2,720	288	1,700	375	250
22	124	61	.....	.....	.....	61	1,090	3,160	288	1,520	375	216
23	112	52	.....	.....	.....	52	1,170	3,300	288	1,340	330	216
24	112	52	.....	.....	.....	52	1,430	2,860	250	1,170	330	216
25	112	44	.....	.....	.....	61	1,700	2,320	250	1,010	330	250
26	101	37	.....	.....	.....	70	1,890	1,990	465	935	288	288
27	112	24	.....	.....	.....	101	1,990	1,610	515	865	288	288
28	112	24	.....	.....	.....	80	1,990	1,520	465	865	288	288
29	112	18	.....	.....	.....	70	1,610	1,340	465	800	250	288
30	112	12	.....	.....	.....	112	1,260	1,340	465	800	250	288
31	112	.....	.....	.....	.....	201	.....	1,170	.....	735	250	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated, because of ice, from gage heights, observer's notes, climatic records, and discharge of Rum and Snake Rivers, as follows: Dec. 1–31, 80 second-feet; Jan. 1–31, 60 second-feet; Feb. 1–28, 40 second-feet; and Mar. 1–15, 50 second-feet.

Monthly discharge of Kettle River near Sandstone, Minn., for the year ending Sept. 30, 1913.

[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	160	90	117	0.142	0.16	B.
November	112	12	84.9	.103	.11	C.
December	.....	.....	80	.097	.11	D.
January	.....	.....	60	.073	.08	D.
February	.....	.....	40	.048	.05	D.
March	201	.....	62.0	.075	.09	C.
April	1,990	420	1,180	1.43	1.60	A.
May	3,300	620	1,560	1.89	2.18	B.
June	1,010	250	566	.686	.77	A.
July	2,720	420	1,560	1.89	2.18	A.
August	675	216	370	.448	.52	A.
September	375	136	248	.301	.34	A.
The year	3,300	.....	498	.604	8.19	

SNAKE RIVER AT MORA, MINN.

Location.—In sec. 14, T. 39 N., R. 24 W., at the highway bridge three-fourths of a mile south of Mora, above mouth of Ann River.

Records available.—June 11, 1909, to June 30, 1913, when station was discontinued in favor of a better location at Pine City.

Drainage area.—422 square miles.

Gage.—Vertical staff; read morning and evening to tenths; occasional readings taken to quarter-tenths. Limits of use: Hundredths below 6.5, half-tenths from 6.5 to 8.0, and tenths above 8.0 feet.

Channel and control.—Shifting.

Winter flow.—Determined by measurements made through the ice.

Regulation.—Flow at station not regulated except for possible slight effect from logging dams at Knife Lake outlet and White Pine. Below Pine City flow regulated to some extent by operation of power plant at that place.

Accuracy.—Records considered only fair owing to shifting channel.

Discharge measurements of Snake River at Mora, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	S. B. Soulé	5.94	*a* 33	Jan. 29	S. B. Soulé	6.66	*b* 24.7
24	do	5.94	*a* 36	Feb. 26	do	6.66	*b* 21.8
Dec. 31	do	6.41	*b* 31	Apr. 18	do	7.08	203
Jan. 29	do	6.66	*b* 24.5	May 22	W. G. Hoyt	11.19	1,680

a Measurement made by wading.

b Complete ice cover at control.

Daily gage height, in feet, of Snake River at Mora, Minn., for the period Oct. 1, 1912, to June 30, 1913.

[Alice Lasher, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.05	5.92	5.95	.....	.....	.....	9.2	7.8	7.55
2	6.00	5.95	.....	6.3	.....	.....	9.0	7.75	7.4
3	6.00	5.92	.....	.....	.....	.....	8.9	7.65	7.2
4	6.00	5.92	.....	.....	.....	.....	8.8	7.65	7.0
5	5.95	5.95	5.95	.....	.....	6.8	8.4	7.65	6.9
6	5.90	5.94	.....	.....	6.5	.....	8.1	7.55	6.75
7	5.91	5.92	.....	.....	.....	.....	7.65	7.45	6.65
8	5.90	5.92	.....	.....	.....	.....	7.45	7.35	6.6
9	5.91	5.92	.....	6.4	.....	.....	7.25	7.35	6.5
10	5.92	5.92	.....	.....	.....	.....	7.05	7.25	6.46
11	5.90	5.92	.....	.....	.....	.....	6.85	7.05	6.37
12	6.10	5.92	6.1	.....	.....	.....	6.85	7.0	6.27
13	6.05	5.92	.....	.....	6.75	7.3	6.95	6.95	6.21
14	6.00	5.90	.....	.....	.....	.....	7.05	7.05	6.16
15	6.00	5.92	.....	.....	.....	.....	7.1	7.35	6.16
16	6.00	5.95	.....	6.8	.....	.....	7.05	9.1	6.11
17	6.00	5.88	.....	.....	.....	.....	7.05	10.2	6.06
18	6.00	5.90	.....	.....	.....	.....	7.05	10.7	6.06
19	6.00	5.90	.....	.....	.....	.....	7.05	10.2	6.06
20	5.98	5.90	6.5	.....	7.0	6.95	7.1	9.9	6.06
21	5.95	5.91	.....	.....	.....	.....	7.05	10.2	6.06
22	6.00	5.90	.....	.....	.....	.....	7.1	11.1	6.06
23	6.00	5.90	.....	6.6	.....	.....	7.2	11.0	5.98
24	5.95	6.08	.....	.....	.....	.....	7.5	10.8	5.96
25	5.95	6.00	.....	.....	.....	.....	8.2	10.0	5.96
26	5.95	6.00	6.48	.....	6.7	.....	8.8	9.6	5.96
27	5.95	.....	.....	.....	6.65	6.95	8.6	9.1	5.98
28	5.95	.....	.....	.....	.....	.....	8.6	8.6	5.96
29	5.94	.....	.....	6.7	.....	.....	8.2	8.2	5.96
30	5.91	.....	.....	6.7	.....	.....	8.0	7.95	5.96
31	5.91	.....	6.41	.....	.....	.....	.....	7.9	.....

NOTE.—Discharge relation affected by ice about Nov. 24, 1912, to Apr. 13, 1913.

Daily discharge, in second-feet, of Snake River at Mora, Minn., for the period Oct. 1, 1912, to June 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	43	34						392	322
2	40	36						378	282
3	40	34						350	232
4	40	34						350	190
5	36	36						350	172
6	33	35						322	146
7	34	34						295	130
8	33	34						269	122
9	34	34						269	108
10	34	34						244	103
11	33	34						200	91
12	47	34						190	79
13	43	34						181	72
14	40	33					200	200	67
15	40	34					210	269	67
16	40	36					200	820	61
17	40	32					200	1,260	56
18	40	33					200	1,460	56
19	40	33					200	1,260	56
20	38	33					210	1,140	56
21	36	34					200	1,260	56
22	40	33					210	1,640	56
23	40	33					232	1,590	48
24	36						308	1,500	46
25	36						510	1,180	46
26	36						710	1,020	46
27	36						640	820	48
28	36						640	640	46
29	35						510	510	46
30	34						450	435	46
31	34							420	

NOTE.—Daily discharge 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: Nov. 24–30, 33 second-feet; Dec. 1–31, 32 second-feet; Jan. 1–31, 28 second-feet; Feb. 1–28, 23 second-feet; Mar. 1–31, 35 second-feet; and Apr. 1–13, 120 second-feet.

Monthly discharge of Snake River at Mora, Minn., for the year ending Sept. 30, 1913.

[Drainage area, 422 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	47	33	37.6	0.089	0.10	B.
November			33.7	.080	.09	B.
December			32	.076	.09	C.
January			28	.066	.08	C.
February			23	.055	.06	C.
March			35	.083	.10	C.
April	710		246	.583	.65	C.
May	1,640	181	684	1.62	1.87	B.
June	322	46	98.4	.223	.26	C.

SNAKE RIVER NEAR PINE CITY, MINN.

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

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

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.

Channel and control.—Bed of stream rock and coarse cobblestones; control practically permanent.

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

Determination of flow.—Estimates made by adding to the flow through the turbines the flow over the crest of the dam as determined from readings of the staff gage. (See "Gage.") Flow through turbines determined from gate openings and head, which are read hourly.

Regulation.—Power plant at station operated with a varying light and power load which at low stages produces a decided fluctuation in discharge.

Accuracy.—Conditions favorable for estimating the waste by means of the river gage; estimates of flow through the wheels probably not so good, but, in view of the fact that they are based upon 24 readings of gate openings daily, it is believed that the records should be fair to good with 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, 1913.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		100	322	517	16		412	180	175
2		97	295	479	17		449	108	252
3		90	268	418	18		486	199	238
4		53	272	380	19		461	219	213
5		115	265	333	20		447	211	275
6		89	164	332	21		488	266	204
7		186	119	314	22		434	342	241
8		215	228	331	23		388	414	190
9		223	218	285	24		335	474	235
10		227	127	272	25		322	654	250
11		274	213	267	26	113	332	728	234
12		309	200	251	27	109	279	750	223
13		292	186	228	28	102	281	766	168
14		256	188	180	29	46	332	713	190
15		265	129	258	30	102	322	634	230
					31		330	524	

Monthly discharge of Snake River near Pine City, Minn., for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 26–30	113	46	94.4	0.103	0.02	B.
July	488	53	287	.314	.36	B.
August	766	108	335	.366	.42	B.
September	517	168	272	.297	.33	B.

CANNON RIVER AT WELCH, MINN.

Location.—At highway bridge at Welch, just below a very small tributary and 3 miles above mouth of Belle Creek.

Records available.—June 7, 1909, to September 30, 1913.

Drainage area.—1,290 square miles.

Gage.—Chain gage attached to bridge; read morning and evening to quarter-tenths. Limits of use: Hundredths below 5.5, half-tenths from 5.5 to 7.0, and tenths above 7.0 feet.

Channel and control.—Practically permanent.

Discharge measurements.—Made from the bridge; measurements corrected for angle of current.

Winter flow.—Determined by measurements made through the ice.

Regulation.—Flow regulated to a greater or less extent by each of the 11 developed power plants above station; also by dam at outlet of Cannon Lake.

Maximum flow.—In April, 1888, the high water reached the eaves of the wheelhouse at the mill, 20.1 feet above datum of present gage. It is said that this high water was not caused by ice gorging.

Accuracy.—Records only fair owing to daily fluctuation caused by operation of power plants.

Discharge measurements of Cannon River at Welch, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	W. G. Hoyt	5.66	217	Apr. 10	W. G. Hoyt	6.09	363
Feb. 3	S. B. Soulé	5.34	*a* 102	Sept. 10	S. B. Soulé	5.56	199
Mar. 7	do	6.41	*a* 245				

a Complete ice cover.

Daily gage height, in feet, of Cannon River at Welch, Minn., for the year ending Sept. 30, 1913.

[Esther Norell, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.40	5.48	5.40	.....	.....	.....	7.2	5.9	5.6	5.55	5.6	5.65
2	5.44	5.65	5.5	5.35	.....	.....	6.75	5.85	5.7	5.65	5.6	5.5
3	5.44	5.49	5.6	.....	5.34	.....	6.35	6.0	5.8	5.65	5.35	5.95
4	5.52	5.31	5.7	.....	.....	.....	6.35	6.0	5.75	5.55	5.55	5.7
5	5.85	5.5	5.6	.....	.....	6.35	6.6	6.1	5.8	5.65	5.6	5.65
6	5.01	5.5	5.5	.....	5.65	.....	6.7	5.85	5.65	6.2	5.7	5.65
7	5.09	5.5	5.7	.....	.....	6.4	6.5	5.7	5.7	5.7	5.65	5.6
8	5.5	5.48	5.25	.....	.....	.....	6.25	5.75	5.32	5.85	5.6	5.7
9	5.38	5.55	5.40	5.5	.....	.....	6.15	5.8	5.41	5.95	5.6	5.8
10	5.35	5.38	5.65	.....	.....	.....	6.1	5.75	5.5	5.65	5.42	5.7
11	5.5	5.6	5.8	.....	.....	.....	6.3	5.48	5.65	5.6	5.65	5.8
12	5.7	5.6	5.75	.....	.....	.....	6.45	5.85	5.55	5.75	5.75	5.7
13	5.48	5.65	5.5	.....	6.3	5.95	6.6	5.8	5.6	5.9	5.75	5.7
14	5.40	5.5	5.65	.....	.....	.....	6.65	5.7	5.6	5.45	5.75	5.55
15	5.7	5.65	5.30	.....	.....	.....	6.55	5.75	5.65	5.7	5.7	5.65
16	5.5	5.6	5.7	5.6	.....	.....	6.3	5.8	5.26	5.6	5.55	5.65
17	5.40	5.30	5.65	.....	.....	.....	6.25	6.15	5.65	5.55	5.35	5.75
18	5.39	5.28	5.55	.....	.....	5.8	6.1	6.15	5.5	5.55	5.7	5.75
19	5.41	5.6	5.6	.....	6.5	6.1	6.1	6.3	5.65	5.6	5.9	5.75
20	5.28	5.6	5.6	.....	.....	5.75	6.0	6.6	5.20	5.40	5.7	5.8
21	5.5	5.65	5.5	.....	.....	6.1	6.15	6.85	5.6	5.5	5.8	5.47
22	5.55	5.42	5.5	.....	.....	6.2	6.0	6.95	4.81	5.55	5.85	5.7
23	5.55	5.38	5.45	5.65	.....	6.4	5.9	6.8	5.05	5.6	5.8	5.8
24	5.38	5.48	5.5	.....	.....	9.9	5.85	6.75	5.5	5.55	5.49	5.7
25	5.41	5.5	5.20	.....	.....	8.8	5.85	6.5	5.45	5.6	5.8	5.8
26	5.41	5.6	5.30	.....	6.55	7.9	5.8	6.5	5.7	5.55	5.75	5.7
27	5.30	5.65	5.55	.....	.....	7.2	5.65	6.45	5.7	5.37	5.7	5.65
28	5.5	5.7	5.5	.....	.....	7.3	5.75	6.4	5.35	5.5	5.7	5.48
29	5.44	5.35	5.25	.....	.....	7.4	5.9	6.3	5.35	5.7	5.7	5.55
30	5.48	5.6	5.20	5.8	.....	7.5	5.95	6.2	5.55	5.85	5.7	4.99
31	5.5	.....	5.40	.....	.....	7.4	.....	6.1	.....	5.8	5.7	.....

NOTE.—Discharge relation affected by ice about Dec. 1, 1912, to Mar. 17, 1913.

Daily discharge, in second-feet, of Cannon River at Welch, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	147	165	.....	.....	.....	.....	851	294	208	195	208	222
2	156	209	.....	.....	.....	.....	631	279	236	222	208	182
3	156	168	.....	.....	.....	.....	458	324	264	222	144	309
4	175	128	.....	.....	.....	.....	458	324	250	195	195	236
5	271	170	.....	.....	.....	.....	563	359	264	222	208	222
6	78	170	.....	.....	.....	.....	608	279	222	397	236	222
7	90	170	.....	.....	.....	.....	520	236	236	236	222	208
8	170	165	.....	.....	.....	.....	417	250	137	279	208	236
9	143	182	.....	.....	.....	.....	378	264	159	309	208	264
10	136	143	.....	.....	.....	.....	359	250	182	222	161	236
11	170	195	.....	.....	.....	.....	437	177	222	208	222	264
12	223	195	.....	.....	.....	.....	499	279	195	250	250	236
13	165	209	.....	.....	.....	.....	563	264	208	294	250	236
14	147	170	.....	.....	.....	.....	586	236	208	169	250	195
15	223	209	.....	.....	.....	.....	542	250	222	236	236	222
16	170	195	.....	.....	.....	.....	437	264	123	208	195	222
17	147	126	.....	.....	.....	.....	417	378	222	195	144	250
18	145	122	.....	.....	.....	264	359	378	182	195	236	250
19	149	195	.....	.....	.....	359	359	437	222	208	294	250
20	122	195	.....	.....	.....	250	324	563	110	156	236	264
21	170	209	.....	.....	.....	359	378	678	208	182	264	174
22	182	152	.....	.....	.....	397	324	726	47	195	279	236
23	182	143	.....	.....	.....	478	294	654	82	208	264	264
24	143	165	.....	.....	.....	2,710	279	631	182	195	179	236
25	149	170	.....	.....	.....	1,850	279	520	169	208	264	264
26	149	195	.....	.....	.....	1,240	264	520	236	195	250	236
27	126	209	.....	.....	.....	851	222	499	236	149	236	222
28	170	223	.....	.....	.....	903	250	478	144	182	236	177
29	156	136	.....	.....	.....	956	294	437	144	236	236	195
30	165	195	.....	.....	.....	1,010	309	397	195	279	236	72
31	170	.....	.....	.....	.....	956	.....	359	.....	264	236	.....

NOTE.—Daily discharge computed from two fairly well defined rating curves. Rating curve used prior to Mar. 18, 1913, revised on basis of discharge measurements made subsequent to that date. Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 1–31, 170 second-feet; Jan. 1–31, 100 second-feet; Feb. 1–28, 110 second-feet; and Mar. 1–17, 247 second-feet.

Monthly discharge of Cannon River at Welch, Minn., for the year ending Sept. 30, 1913.

[Drainage area, 1,290 square miles.]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	271	78	160	B.
November	223	122	176	B.
December	.....	.....	170	C.
January	.....	.....	100	D.
February	.....	.....	110	C.
March	2,710	.....	541	C.
April	851	222	422	B.
May	726	177	387	B.
June	264	47	190	B.
July	397	149	223	B.
August	294	144	226	B.
September	309	72	227	B.
The year	2,710	47	245	

CHIPPEWA RIVER AT CHIPPEWA FALLS, WIS.

Location.—At highway bridge at Chippewa Falls, Wis., 2,500 feet below mouth of Duncan Creek entering from the right.

Records available.—June 22, 1888, to September 30, 1913. The gage was originally established by the Chippewa Lumber & Boom Co., which has kept a continuous record since 1899. 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. Gage heights as published have been obtained from the following sources: Fargo Engineering Co., from certified blue-print copies of records kept by the Chippewa Lumber & Boom Co., June 22, 1888, to November 21, 1899; United States Weather Bureau, March to September, 1905, 1907, 1908; April to July, 1909; Chippewa Lumber & Boom Co., October 1 to December 31, 1911; United States Geological Survey. Gage read from January to June, 1912, by Chippewa Lumber & Boom Co.; March to July, 1912, by United States Weather Bureau; December, 1912, by Chippewa Valley Railway, Light & Power Co. For the period March to June, covered by two records, the mean has been used.

Drainage area.—5,600 square miles (revised since last report).

Gage.—Staff gage painted on one of the cylindrical piers at right end of bridge; graduated to feet and inches but published to feet and tenths; read morning and evening to hundredths. Limits of use: Half-tenths below 2.0 feet. On August 19, 1913, gage was found in error by the following amounts, the gage reading too high:

Point on gage.		Error.
Ft.	*in.*	*Foot.*
27	3.1	+0.03
26	4.2	+ .03
16	10.2	+ .12
12	0	+ .15
7	1	+ .12
2	2	+ .12

No corrections have been applied to gage heights published in the following table, as error has probably existed ever since gage was painted on the pier; date unknown. It should be noted that any error in the gage enters also into the gage heights of discharge measurements.

Channel and control.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The river reached a stage of 26.03 feet December 6, 1896; 26.94 feet September 10, 1884, according to high-water marks on the door of the office of the Chippewa Lumber & Boom Co.; 13.5 feet September 16 and 17, 1903, according to the United States Weather Bureau.

Winter flow.—Ice forms at gage section but river is more or less open below. Notes regarding ice at gage section do not correctly indicate the extent of backwater.

Regulation.—Operation of power plant about half a mile above dam may affect flow somewhat, but greatest fluctuation is caused by operation of larger power plants above, notably the Brunet Falls Manufacturing Co., at Cornell, Wis. Operation of small reservoirs in the headwater also may affect flow somewhat.

Accuracy.—Affected somewhat by operation of power plants and during the winter by ice. Channel appears to be permanent, and a well-defined rating curve has been developed for all stages above 1.0 foot.

Cooperation.—Gage heights during 1913 furnished through courtesy of Chippewa Valley Railway, Light & Power Co.

The following discharge measurement was made by B. J. Peterson August 20, 1913: Gage height, 3.27 feet; discharge, 8,060 second-feet.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1888.					1888.				
1		3.3	2.6	1.6	16		1.7	3.7	
2		a 5.0	1.8		17		1.9	3.4	1.5
3		2.8	2.2	1.5	18			3.4	1.5
4		2.6	3.0	1.5	19		a 8.2		1.5
5		2.1		1.5	20			a 5.9	1.5
6		2.5	5.2	1.5	21		2.5	2.7	1.5
7		2.7	5.3	1.5	22	7.8		2.3	1.5
8		3.0	5.1	1.5	23	7.0	1.7	2.1	
9		3.4	5.0		24		1.7	2.0	2.3
10		3.1	5.7	1.5	25	5.8	1.9	2.0	1.8
11		a 6.7	5.3	1.5	26	5.2	1.8		
12		2.8		1.5	27	4.6	1.7	1.8	1.5
13		1.7	4.7	1.5	28	4.1	1.7	1.8	1.5
14		1.4	4.3	1.5	29	4.0	1.7	1.8	1.3
15			4.1	1.5	30	3.7	2.0	1.7	
					31		a 4.9	1.7	

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1888–89.												
1	1.9						2.2	3.0	4.3	2.9	0.8	0.8
2	1.5						2.1	3.1	1.0	3.6	.9	.9
3	1.4						1.9	3.3	2.0	3.5	.8	.9
4	.8						1.5	3.1	3.3			.9
5	1.3						1.7		3.9	a 6.2	.8	a 6.2
6	1.0						1.8	3.3	4.2	3.9	.9	.6
7								3.6	a 7.0		.8	.5
8	1.5						1.9	a 7.4	3.8	2.8	.8	.5
9	1.4	a 7.0					a 5.8	4.1		.9	.7	.7
10	1.4	1.8					2.3	2.5	1.5	1.0	.8	.8
11	1.4	1.8					1.5	5.0	3.9	1.0		.8
12	1.4	1.8					1.7		2.8	1.8	1.0	.8
13	1.0						2.0	4.6	3.1	2.1	1.0	.8
14								a 7.8	3.0			.8
15	1.8						2.5	4.7	3.2	a 5.2	.9	
16	1.5						2.7	1.8		2.5	.8	a 5.2
17	1.3						2.4	4.5	3.9	.6	.8	1.0
18	1.0						2.5	5.9	3.3	.6	.7	1.0
19	2.2						2.5		3.5	.8	a 3.9	.8
20	1.8						a 6.6	5.9	3.8	.8	1.6	.9
21							3.0	a 7.7	a 6.0		1.6	.9
22	1.8						1.5	6.0	4.3	1.0	1.0	
23	1.8						2.2	4.0	2.5	1.0	1.0	.9
24	1.8						3.5	2.4	4.0	1.1	.9	1.0
25	1.5						3.7	4.6	4.4	1.0		.9
26							4.0	4.5	4.6	1.1	a 5.0	.8
27							4.4	4.2	4.6	1.0	1.5	1.0
28								3.5	a 7.0	.6	.3	1.0
29	1.8					2.8	4.1	3.5	5.0	a 3.4	.6	
30	1.8					2.7	3.0			.6	.8	1.0
31	1.5							a 5.1		.8	.8	

a Flood for log driving.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1889–90.												
1	1.6	—0.2						3.2		.7	1.0	1.4
2	1.0							3.3	4.8	1.5	1.0	1.4
3	.8							3.0	4.9	2.4		.9
4	.9						3.2	2.4	4.9		.8	2.2
5	.8						2.5	a 4.2	5.3	2.1	.8	4.2
6								4.4	6.7	2.1	.8	4.6
7	.7						3.0	.8	7.0	2.0	.8	
8	.6						4.8	1.4	6.8	2.0	.8	4.7
9	.6						6.3	1.5	6.8	2.0	1.0	4.6
10	.6						6.7	a 4.7	6.0	2.0	5.5	4.2
11	.5						7.3	1.5	6.4	1.0	5.5	4.3
12	.5						8.4	.5	6.0	a 4.3	5.2	2.5
13							9.0	.8	5.8		4.8	1.4
14	.6						8.9	1.8	5.0	1.0	2.7	
15	.5						8.4	1.9		1.0	2.3	2.0
16	.6						7.2	1.8	4.1	2.2	2.9	2.0
17	.6						6.5	a 4.5	4.0	3.6		1.9
18	.5						6.5	1.7	3.4	3.2	2.1	1.9
19	.5						6.3	1.0	3.0	a 5.1	2.0	2.0
20							5.6	2.1	2.8		2.1	3.0
21	.5						5.5	3.4	2.5	1.0	3.4	4.0
22	.5						5.5	4.0		1.0	3.3	4.0
23	.5						5.3	4.6	2.1	1.0	3.0	3.5
24	.5						5.3	a 7.5	2.1	1.5		3.0
25	.4						5.0		a 4.5	1.6	2.1	2.5
26	.3						5.3	5.7	1.5	a 4.1	2.4	2.3
27							5.1	6.2	.9		2.4	a 5.5
28	.3						4.4	5.0	.9	1.0	2.4	
29	.0						4.4	5.0		1.0	a 3.6	1.8
30	.0						3.6	4.4	.7	1.0	2.9	1.1
31	.0							a 6.9		1.0		
1890–91.												
1	1.4	1.1						5.6	.5	1.3	.0	.0
2	1.4	1.1						4.6	1.0	1.4		.4
3	1.2	1.1							1.1	1.4	.5	.3
4	1.2	1.0						4.0	1.6	1.0	.9	— .3
5	1.2	2.3						a 4.6	2.0	1.1	.9	— .3
6	1.2	1.7						3.5	1.4	1.1	.8	a 2.3
7	1.0	1.1						2.3		.9	.7	.4
8	1.1	.8						1.6	1.9	.9	.9	.0
9	1.0							2.5	1.9	.9		.0
10	1.0	.7						2.5	1.9	.9	.4	.0
11	.8							2.5	2.0	a 4.8	.4	.0
12								2.4	2.3		.3	.0
13	1.4						3.3	a 6.4	2.5	.0	.3	
14	3.0						4.4	1.9		.0	.3	.0
15	4.6						5.5	2.1	2.0	.0	.0	.0
16	4.8						6.1	1.5	2.1	.0		— .1
17	a 7.1						7.3		1.8	.0	.0	— .1
18	4.6						7.4	2.5	1.9	.0	.0	— .1
19								2.3	1.6		a 1.8	.0
20	3.6						8.5	2.3	a 5.5	.0	1.0	.0
21	3.1						7.8	a 5.6		.3	.3	.0
22	2.8						7.6	1.7	.8	.3	.3	— .1
23	1.0						8.9	1.0	1.0	.9		— .1
24	1.2						9.0		.9	.9	.3	— .1
25	1.4						8.5	1.3	1.9	.9	.0	— .2
26								1.9	1.9		.3	— .2
27	2.1						7.1	1.8	1.5	.3	.3	— .2
28	1.1						6.8	1.8		.0	.3	— .2
29	1.1						5.7	a 5.5	1.4	.3	.3	— .2
30	1.3						5.5	4.9	1.3	.3		— .2
31	1.1									.0	.0	

a Flood for log driving.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1891–92.												
1	−0.2	.....	.....	.....	.....	.....	1.0	.2	5.0	6.8	2.8	0.3
2	− .1	0.4	.....	.....	.....	.....	2.0	2.2	4.6	5.2	2.3	.2
3	.1	.4	.....	.....	.....	.....	5.3	3.0	4.0	6.2	2.2	.2
4	.2	.4	.....	.....	.....	.....	6.0	4.0	4.1	6.0	2.0	1.3
5	.3	.4	.....	.....	.....	.....	7.0	4.2	3.5	5.8	.8	.3
6	1.1	.4	.....	.....	.....	.....	6.7	4.5	3.3	4.8	a5.6	.4
7	1.3	.4	.....	.....	.....	.....	7.2	4.7	4.2	4.1	.0	.3
8	.5	.....	.....	.....	.....	.....	6.5	5.1	5.5	3.2	.6	.4
9	.2	.4	.....	.....	.....	.....	5.5	4.1	5.5	3.8	.9	.5
10	.5	.4	.....	.....	.....	.....	.....	5.1	5.0	1.0	.9	.6
11	.6	.4	.....	.....	.....	.....	4.3	4.6	4.8	2.2	.9	.9
12	.8	.3	.....	.....	.....	.....	2.0	4.8	4.2	.7	1.3	1.0
13	1.0	.3	.....	.....	.....	.....	2.5	5.1	4.0	1.5	1.3	1.2
14	.9	.2	.....	.....	.....	.....	2.1	5.2	3.8	1.6	.5	.8
15	.8	.....	.....	.....	.....	.....	2.0	5.2	3.2	2.0	.7	1.2
16	.7	.2	.....	.....	.....	.....	1.9	6.2	3.4	a6.7	.8	1.0
17	a5.3	.....	.....	.....	.....	.....	.....	6.5	4.8	.2	.8	1.0
18	.....	.....	.....	.....	.....	.....	1.8	6.8	5.8	.5	.5	.8
19	.6	.....	.....	.....	.....	.....	1.6	6.5	5.7	1.8	.5	1.0
20	.6	.....	.....	.....	.....	.....	1.2	9.8	5.8	2.0	a2.8	.8
21	1.2	.....	.....	.....	.....	.....	1.6	11.2	5.7	1.8	.0	.7
22	.8	.....	.....	.....	.....	.....	2.0	10.9	5.2	.8	.0	.5
23	.2	.....	.....	.....	.....	.....	a5.9	9.8	5.0	a6.0	.0	.5
24	.2	.....	.....	.....	.....	.....	.5	7.8	4.8	.5	.0	.5
25	.....	.....	.....	.....	.....	.....	.8	7.2	4.0	.5	.0	.2
26	.3	.....	.....	.....	.....	.....	1.0	6.6	3.3	.6	a2.2	.3
27	.3	.....	.....	.....	.....	.....	1.1	6.2	6.9	.8	.3	.3
28	.4	.....	.....	.....	.....	.....	2.1	5.7	9.4	3.4	.2	.3
29	.4	.....	.....	.....	.....	.....	2.2	.....	9.2	4.4	.2	.3
30	.4	.....	.....	.....	.....	.....	a5.9	5.5	8.2	4.0	.2	.3
31	a4.8	.....	.....	.....	.....	.....	.....	5.7	.....	3.2	.2	.....
1892–93.												
1	.2	.3	.....	.....	.....	.....	.....	7.2	4.3	a5.9	.5	.4
2	.2	.3	.....	.....	.....	.....	.....	7.5	3.7	.1	.5	.3
3	.2	.3	.....	.....	.....	.....	2.8	8.0	2.9	.2	1.1	.3
4	.2	.3	.....	.....	.....	.....	3.1	8.0	3.0	.2	.8	.3
5	.1	.3	.....	.....	.....	.....	3.7	7.3	2.9	1.2	.5	.2
6	.1	.3	.....	.....	.....	.....	4.3	6.2	3.8	1.8	.7	.4
7	.1	.3	.....	.....	.....	.....	4.4	5.3	3.6	2.1	1.5	.4
8	.1	.2	.....	.....	.....	.....	4.6	6.2	a6.1	2.1	.8	.4
9	.0	.2	.....	.....	.....	.....	4.7	5.7	1.8	2.8	.8	.2
10	.1	.....	.....	.....	.....	.....	5.6	6.2	1.8	2.2	.4	.2
11	.1	.....	.....	.....	.....	.....	5.8	8.3	1.6	a5.4	.5	.2
12	.1	.....	.....	.....	.....	.....	6.5	11.7	1.6	.3	.4	.2
13	.1	.....	.....	.....	.....	.....	7.6	11.8	2.5	.8	.3	.2
14	.1	.....	.....	.....	.....	.....	8.2	10.7	1.8	2.7	.3	.2
15	.1	.....	.....	.....	.....	.....	7.2	9.8	1.8	2.7	.2	.2
16	.1	.....	.....	.....	.....	.....	6.3	9.2	a5.6	2.4	.2	.2
17	.1	.....	.....	.....	.....	.....	5.8	7.8	.0	2.3	.2	.2
18	.2	.....	.....	.....	.....	.....	5.0	7.3	.5	2.4	.2	.3
19	.2	.....	.....	.....	.....	.....	5.2	6.2	1.5	1.8	.2	.3
20	.3	.....	.....	.....	.....	.....	5.2	6.1	1.5	1.8	.2	.2
21	.3	.....	.....	.....	.....	.....	5.0	4.3	1.6	1.8	.2	.2
22	.3	.....	.....	.....	.....	.....	5.1	4.8	2.5	a3.8	.2	.1
23	.3	.....	.....	.....	.....	.....	4.3	4.7	2.0	.5	.2	.1
24	.3	.....	.....	.....	.....	.....	3.8	5.8	a5.7	.5	.3	.1
25	.4	.....	.....	.....	.....	.....	4.2	7.0	.0	.2	.3	.1
26	.5	.....	.....	.....	.....	.....	5.3	8.2	1.5	.2	.4	.1
27	.4	.....	.....	.....	.....	.....	7.4	7.8	2.1	.4	.4	.1
28	.3	.....	.....	.....	.....	.....	9.1	6.3	2.6	.6	.5	.1
29	.3	.....	.....	.....	.....	.....	8.8	7.2	2.6	.5	.5	.1
30	.3	.....	.....	.....	.....	.....	8.7	5.8	2.5	.5	.5	.1
31	.3	.....	.....	.....	.....	.....	.....	a7.5	.....	.5	.5	.....

a Flood for log driving.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1893–94.												
1	0.0	0.1	.....	.....	.....	.....	.....	4.5	2.9	1.2	0.0	0.2
2	.0	.....	.....	.....	.....	.....	2.7	5.5	a 4.8	1.2	.3	.2
3	.0	.....	.....	.....	.....	.....	2.2	5.8	1.2	1.1	.3	.2
4	.0	.....	.....	.....	.....	.....	3.2	7.0	1.3	.8	.3	.2
5	.2	.....	.....	.....	.....	2.3	3.2	7.7	2.5	.7	.8	.2
6	.2	.....	.....	.....	.....	2.7	3.8	8.2	3.7	.7	.4	.2
7	.6	.....	.....	.....	.....	2.8	3.7	8.3	1.2	.7	.4	.2
8	.6	.2	.....	.....	.....	3.3	4.0	8.2	2.0	.7	.6	.2
9	2.0	.2	.....	.....	.....	3.8	3.8	7.0	a 4.3	.7	.5	.0
10	1.8	.1	.....	.....	.....	3.3	3.9	6.2	1.6	.7	.5	.2
11	1.7	.1	.....	.....	.....	.....	3.8	5.8	1.4	.7	.5	.2
12	1.2	.1	.....	.....	.....	2.9	3.8	5.5	1.3	.7	.2	.2
13	1.2	.1	.....	.....	.....	2.8	3.9	5.8	1.2	.6	.5	.2
14	1.0	.1	.....	.....	.....	3.0	4.7	6.8	1.2	.5	.4	.2
15	1.0	.1	.....	.....	.....	3.1	4.9	7.3	1.2	.5	.4	.2
16	.8	.1	.....	.....	.....	2.8	6.1	14.0	a 6.6	.4	.3	.2
17	.2	.0	.....	.....	.....	3.3	6.8	11.7	.0	.3	.3	.2
18	.1	.0	.....	.....	.....	.....	7.8	10.8	1.2	.3	.3	.2
19	.2	.0	.....	.....	.....	5.1	8.9	10.2	1.2	.3	.3	.2
20	.1	.0	.....	.....	.....	5.7	10.2	8.3	1.3	.3	.3	.2
21	a 7.0	— .1	.....	.....	.....	6.8	10.4	7.3	1.8	.2	.2	.2
22	.0	.0	.....	.....	.....	7.7	10.2	6.3	1.8	.2	.3	.3
23	.0	.....	.....	.....	.....	7.3	9.0	5.2	1.8	.2	.2	.2
24	.0	.....	.....	.....	.....	7.2	7.6	4.8	1.8	.2	.2	.4
25	.2	.....	.....	.....	.....	.....	7.2	4.7	1.8	.2	.0	.4
26	.2	.....	.....	.....	.....	3.5	6.5	4.2	1.8	.2	.3	.3
27	.1	.....	.....	.....	.....	3.2	5.8	4.0	2.0	.2	.2	.3
28	a 6.5	.....	.....	.....	.....	3.8	4.9	3.7	1.8	.2	.2	.3
29	.0	.....	.....	.....	.....	3.5	4.7	3.6	1.5	.1	.2	.3
30	.0	.....	.....	.....	.....	3.1	5.2	3.3	1.5	.0	.2	.0
31	.0	.....	.....	.....	.....	3.2	.....	3.1	.....	..0	.2	.....
1894–95.												
1	.0	1.2	.....	.....	.....	.....	.8	2.0	a 6.0	1.2	1.2	— .5
2	.0	1.4	.....	.....	.....	.....	.5	1.9	.0	1.3	.2	— .5
3	.1	1.4	.....	.....	.....	.....	.5	2.0	3.1	2.1	a 5.5	.2
4	.2	1.4	.....	.....	.....	.....	.5	3.5	3.6	2.1	.0	a 3.0
5	.0	1.3	.....	.....	.....	.....	.5	4.2	4.0	.7	.0	2.8
6	.0	1.4	.....	.....	.....	.....	.4	4.0	3.2	a 5.1	.2	2.5
7	.0	1.4	.....	.....	.....	.....	.....	3.8	2.5	1.1	.3	2.5
8	.1	1.5	.....	.....	.....	.....	1.0	3.7	a 5.1	1.5	.3	.....
9	.2	1.5	.....	.....	.....	.....	1.6	3.8	.7	1.2	.3	.2
10	.2	1.5	.....	.....	.....	.....	1.1	3.5	2.5	.8	1.0	.2
11	.2	1.3	.....	.....	.....	.....	1.2	3.2	3.4	1.8	.....	.2
12	.2	.8	.....	.....	.....	.....	1.6	6.4	6.2	2.4	1.8	.2
13	.2	.8	.....	.....	.....	.....	1.8	5.8	6.8	a 5.3	1.5	.2
14	.2	.6	.....	.....	.....	.....	1.3	5.6	5.2	.....	1.4	.2
15	.2	.6	.....	.....	.....	.....	.5	4.8	6.2	2.5	1.4	.....
16	.0	.5	.....	.....	.....	.....	1.0	4.4	.....	2.4	a 5.5	.2
17	.0	.3	.....	.....	.....	.....	.8	3.6	4.3	2.8	.8	.2
18	.1	.3	.....	.....	.....	.....	1.2	3.2	3.2	2.8	.2	.3
19	.1	.3	.....	.....	.....	.....	.8	2.6	4.2	2.8	.5	.8
20	.0	.....	.....	.....	.....	.....	.4	a 6.2	2.2	2.8	.2	.8
21	.0	.....	.....	.....	.....	.....	.4	1.6	1.6	2.3	.3	1.0
22	.1	.....	.....	.....	.....	.....	.4	2.1	a 5.1	2.5	a 1.3	1.7
23	.2	.....	.....	.....	.....	.....	1.0	2.0	.....	2.7	.3	4.7
24	.2	.....	.....	.....	.....	.....	.5	1.8	2.2	2.8	.3	5.9
25	.6	.....	.....	.....	.....	.....	.5	a 6.2	2.4	2.1	.4	5.7
26	.9	.....	.....	.....	.....	.....	.7	.2	3.2	2.1	.5	4.8
27	.7	.....	.....	.....	.....	.....	a 4.3	.8	2.5	a 3.8	.4	3.8
28	.9	.....	.....	.....	.....	.....	.....	1.2	2.0	.2	.4	2.3
29	1.5	.....	.....	.....	.....	.....	.2	1.5	a 5.8	1.1	.2	2.3
30	.8	.....	.....	.....	.....	.....	1.4	1.1	1.2	1.5	— .4	2.3
31	1.1	.....	.....	.....	.....	.....	.....	1.6	.....	1.3	— .5	.....

a Flood for log driving.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1889—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1895–96.												
1	1.2	0.0	.....	.....	.....	.....	.....	6.8	3.6	2.0	1.5	0.8
2	.8	— .3	.....	.....	.....	.....	.....	6.5	4.2	a5.2	.....	.8
3	1.1	— .3	.....	.....	.....	.....	.....	7.5	4.0	.8	1.5	.8
4	1.2	— .3	.....	.....	.....	.....	.....	8.0	3.0	2.0	1.5	.8
5	.9	.1	.....	.....	.....	.....	.....	7.2	3.0	2.0	1.5	.8
6	.8	.2	.....	.....	.....	.....	.....	6.5	2.9	2.8	1.5	.....
7	.8	.2	.....	.....	.....	.....	.....	5.8	a5.6	2.8	1.3	.1
8	.8	.2	.....	.....	.....	.....	.....	5.8	3.8	2.2	1.3	2.4
9	.7	.2	.....	.....	.....	.....	.....	3.8	5.3	a4.8	.....	1.4
10	.2	.....	.....	.....	.....	.....	.....	4.1	6.0	1.8	a3.9	1.2
11	a4.8	.2	.....	.....	.....	.....	.....	5.1	5.1	2.0	2.0	1.0
12	.5	.2	.....	.....	.....	.....	.....	3.8	4.3	1.5	1.8	1.8
13	.....	.2	.....	.....	.....	.....	4.6	3.8	a5.0	1.5	2.5	.....
14	.3	.2	.....	.....	.....	.....	7.8	4.8	a4.8	1.2	2.6	1.2
15	.3	.2	.....	.....	.....	.....	9.5	5.9	.....	1.8	1.9	1.5
16	.4	.0	.....	.....	.....	.....	10.7	7.8	3.0	2.3	.....	.8
17	.3	.0	.....	.....	.....	.....	11.0	6.5	4.0	2.3	.5	.0
18	.2	.....	.....	.....	.....	.....	11.2	7.2	4.0	4.5	.5	.5
19	.3	— .2	.....	.....	.....	.....	12.0	7.6	4.0	1.5	.5	.8
20	.3	.....	.....	.....	.....	.....	11.9	7.2	a6.0	1.6	.5	.....
21	.2	.....	.....	.....	.....	.....	11.2	7.2	3.5	1.2	.....	1.4
22	.2	.....	.....	.....	.....	.....	9.6	4.8	3.2	1.2	1.2	1.2
23	.2	.....	.....	.....	.....	.....	8.5	5.2	2.8	1.6	.....	1.0
24	.2	.....	.....	.....	.....	.....	7.5	4.8	3.2	1.5	.8	1.1
25	.2	.....	.....	.....	.....	.....	7.3	4.1	4.0	2.2	.8	1.1
26	.2	.....	.....	.....	.....	.....	7.2	4.5	4.2	1.5	.....	a2.0
27	.....	.....	.....	.....	.....	.....	7.0	4.2	a5.5	1.7	.9	.....
28	.2	.....	.....	.....	.....	.....	7.5	4.0	2.2	1.3	.9	1.0
29	.1	.....	.....	.....	.....	.....	7.0	3.9	2.0	1.3	1.0	.8
30	.0	.....	.....	.....	.....	.....	7.0	5.8	2.2	1.5	.....	.8
31	— .2	.....	.....	.....	.....	.....	.....	3.0	.....	1.3	1.0	.....
1896–97.												
1	0.8	.....	21.2	.....	.....	.....	13.8	5.8	2.5	4.5	5.0	1.0
2	.8	4.0	22.4	.....	.....	.....	17.0	5.3	2.8	4.0	4.5	1.0
3	.8	4.1	23.8	.....	.....	.....	15.2	4.8	5.2	3.2	4.0	1.8
4	.....	3.8	24.5	.....	.....	.....	10.5	4.2	7.0	4.0	4.0	1.8
5	.8	3.5	23.0	.....	.....	.....	10.6	3.8	a8.8	3.2	3.8	1.8
6	.8	3.5	20.0	.....	.....	.....	10.5	3.8	6.0	3.0	3.0	1.8
7	1.0	.....	19.6	.....	.....	.....	9.3	3.0	5.5	3.0	3.0	1.8
8	1.0	.....	17.5	.....	.....	.....	8.5	3.2	5.8	2.5	2.8	1.8
9	1.0	3.8	.....	.....	.....	.....	7.8	2.8	5.0	1.2	2.8	a6.0
10	.8	3.0	.....	.....	.....	.....	7.2	3.2	5.2	a3.1	2.5	1.5
11	.....	2.5	.....	.....	.....	.....	6.5	a3.5	5.5	1.0	2.2	1.5
12	.5	2.0	.....	.....	.....	.....	6.2	2.8	5.4	2.0	2.2	.3
13	.5	.....	.....	.....	.....	.....	5.8	3.2	4.5	2.0	2.2	1.8
14	.8	.....	.....	.....	.....	.....	5.8	3.2	4.3	1.2	2.2	2.0
15	.5	.....	.....	.....	.....	.....	6.0	a5.4	4.0	1.5	3.0	2.2
16	.8	.....	.....	.....	.....	.....	6.5	2.8	a5.8	1.2	1.5	2.0
17	.....	.....	.....	.....	.....	.....	6.5	2.0	4.3	1.2	1.7	1.5
18	.....	.....	.....	.....	.....	.....	6.0	2.5	7.2	.8	1.5	1.5
19	1.0	.....	.....	.....	.....	.....	6.0	2.8	7.5	1.5	1.5	1.5
20	1.0	.....	.....	.....	.....	8.5	5.6	4.2	6.3	1.2	1.5	1.5
21	1.0	.....	.....	.....	.....	8.3	5.2	6.0	6.0	1.5	a5.2	1.5
22	1.0	.....	.....	.....	.....	8.5	5.0	a7.6	4.5	1.2	1.2	1.5
23	1.0	.....	.....	.....	.....	8.7	5.2	5.0	4.5	1.8	1.5	1.3
24	.8	.....	.....	.....	.....	9.3	5.3	5.2	4.4	1.8	1.3	1.2
25	.8	.....	.....	.....	.....	8.8	5.0	5.2	4.1	1.8	1.5	1.2
26	.8	.....	.....	.....	.....	9.0	4.6	5.2	3.8	2.2	1.2	.5
27	.8	13.7	.....	.....	.....	8.5	4.7	4.8	2.8	5.8	1.2	.5
28	.8	13.7	.....	.....	.....	8.8	4.3	4.2	2.8	7.2	1.2	1.9
29	.8	10.5	.....	.....	.....	9.7	4.8	a6.0	3.5	6.5	.5	1.0
30	2.0	16.0	.....	.....	.....	11.1	5.7	1.5	4.2	6.5	.5	1.0
31	2.5	.....	.....	.....	.....	13.8	.....	2.0	.....	5.2	1.0	.....

a Flood for log driving.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for the year ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1897–98.												
1	1.2	1.2	.....	.....	.....	.....	3.8	2.8	3.8	3.2	1.0	1.0
2	1.2	1.2	.....	.....	.....	.....	3.5	2.8	3.8	3.2	1.0	1.0
3	1.0	1.2	.....	.....	.....	.....	3.2	3.8	3.3	3.2	1.0	1.0
4	1.2	1.2	.....	.....	.....	.....	3.0	4.0	a6.2	3.2	1.0	.5
5	1.0	1.2	.....	.....	.....	.....	2.8	3.8	1.2	3.2	1.0	.5
6	1.7	1.2	.....	.....	.....	.....	2.5	3.5	2.0	3.2	1.0	.8
7	1.5	1.2	.....	.....	.....	.....	2.0	a5.3	1.5	3.2	a2.6	.8
8	1.0	1.2	.....	.....	.....	.....	2.0	1.8	3.0	4.0	1.2	1.0
9	a3.3	1.2	.....	.....	.....	.....	2.0	1.5	3.8	a5.3	1.0	.5
10	.8	1.2	.....	.....	.....	.....	2.0	3.0	3.0	1.7	.8	.5
11	.8	1.2	.....	.....	.....	.....	2.0	3.0	a6.4	2.0	.5	.5
12	.8	1.2	.....	.....	.....	.....	2.2	3.0	1.5	2.5	.5	1.0
13	1.0	1.2	.....	.....	.....	.....	2.5	2.8	1.8	2.5	.5	.8
14	.8	1.0	.....	.....	.....	.....	3.0	a5.2	3.8	2.2	a1.6	1.0
15	.8	1.0	.....	.....	.....	.....	2.8	1.5	4.0	2.0	1.0	.7
16	1.5	1.0	.....	.....	.....	.....	2.5	1.5	4.5	a3.8	1.0	.8
17	2.0	1.2	.....	.....	.....	.....	2.5	1.8	4.0	.5	1.0	1.0
18	2.5	1.0	.....	.....	.....	.....	2.2	2.0	a5.4	1.0	a2.5	1.0
19	2.5	1.0	.....	.....	.....	.....	3.0	2.2	3.0	1.0	1.5	1.0
20	2.5	1.0	.....	.....	.....	.....	2.5	2.5	2.0	1.5	1.5	.....
21	2.3	1.0	.....	.....	.....	.....	3.0	a5.8	2.5	1.8	1.2	.....
22	2.2	1.0	.....	.....	.....	.....	3.2	2.0	2.8	1.5	1.5	.....
23	6.3	.....	.....	.....	.....	.....	5.5	2.0	2.8	a4.0	1.2	.8
24	1.7	.....	.....	.....	.....	.....	4.2	1.8	2.8	.2	1.0	.8
25	2.0	.....	.....	.....	.....	.....	4.0	2.5	a4.8	1.0	1.2	.0
26	2.0	.....	.....	.....	.....	.....	3.8	2.8	1.8	1.0	1.0	1.0
27	1.5	.....	.....	.....	.....	.....	3.5	2.0	2.0	1.0	1.0	1.0
28	1.5	.....	.....	.....	.....	.....	3.2	a6.8	3.0	1.0	1.0	.....
29	1.5	.....	.....	.....	.....	3.5	3.2	5.3	3.5	1.2	1.0	.....
30	1.2	.....	.....	.....	.....	4.0	3.0	4.8	3.2	1.0	1.0	.....
31	1.2	.....	.....	.....	.....	4.2	.....	4.2	.....	1.0	1.0	.....
1898–99.												
1	.....	.8	.....	.....	.....	.....	.....	7.33	2.50	5.71	1.58	1.17
2	.7	.8	.....	.....	.....	.....	.....	7.50	3.33	1.00	6.50	1.00
3	1.0	.8	.....	.....	.....	.....	.....	7.50	5.75	1.67	1.00	1.00
4	1.0	1.0	.....	.....	.....	.....	.....	7.75	3.50	1.83	1.25	1.00
5	1.0	.8	.....	.....	.....	.....	.....	6.75	4.08	2.00	1.50	1.17
6	1.0	.8	.....	.....	.....	.....	.....	8.75	4.83	2.25	.75	1.17
7	1.0	.8	.....	.....	.....	.....	1.00	5.67	4.83	2.17	1.50	1.17
8	1.0	.8	.....	.....	.....	.....	1.42	4.50	4.75	4.79	1.50	1.17
9	1.0	.8	.....	.....	.....	.....	2.50	4.25	5.67	1.50	1.50	1.25
10	1.0	1.0	.....	.....	.....	.....	2.67	3.50	6.50	1.50	1.50	1.33
11	1.1	.8	.....	.....	.....	.....	3.17	3.33	3.00	1.83	1.50	1.67
12	1.1	.8	.....	.....	.....	.....	3.29	4.00	2.50	1.83	1.33	1.75
13	1.2	.....	.....	.....	.....	.....	4.47	6.12	4.83	4.16	1.00	1.67
14	1.2	.8	.....	.....	.....	.....	6.25	1.83	5.50	.....	1.00	1.67
15	1.5	.8	.....	.....	.....	.....	6.00	2.00	7.00	.....	1.50	1.33
16	1.2	.8	.....	.....	.....	.....	6.33	2.75	6.67	1.00	1.00	4.25
17	1.3	.8	.....	.....	.....	.....	6.33	4.50	5.75	1.33	1.00	.....
18	1.5	.8	.....	.....	.....	.....	5.25	6.25	4.12	.33	1.00	1.00
19	1.2	.8	.....	.....	.....	.....	5.00	6.50	3.75	.33	6.12	1.25
20	1.2	.8	.....	.....	.....	.....	5.00	8.38	4.75	1.08	1.50	1.25
21	1.2	.8	.....	.....	.....	.....	5.25	4.00	4.00	1.42	1.50	1.00
22	1.2	.....	.....	.....	.....	.....	5.25	4.33	4.00	1.42	1.25	1.00
23	.....	.....	.....	.....	.....	.....	4.83	3.83	3.67	1.42	1.33	1.00
24	1.1	.....	.....	.....	.....	.....	4.50	3.25	6.54	1.58	1.17	.....
25	.8	.....	.....	.....	.....	.....	4.00	3.25	1.83	2.00	1.17	1.17
26	.8	.....	.....	.....	.....	.....	3.75	3.00	1.83	2.00	1.00	1.08
27	.8	.....	.....	.....	.....	.....	2.34	5.58	2.00	1.83	1.00	1.00
28	.8	.....	.....	.....	.....	.....	4.00	3.50	2.25	1.83	1.33	1.00
29	.8	.....	.....	.....	.....	.....	8.50	4.00	2.30	1.17	1.17	1.08
30	.....	.....	.....	.....	.....	.....	4.83	3.50	2.58	.....	1.17	1.08
31	.8	.....	.....	.....	.....	.....	.....	3.75	.....	1.58	1.17	.....

a Floods for log driving.

Daily gage heighi, in feet, of Chippewa River at Chippewa Falls, Wis., for the year ending Sept. 30, 1913.

[August Flug, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1							5.2	4.5	4.0	1.0	3.0	1.5
2							7.2	4.5	4.0	1.0	2.2	1.15
3				1.5	1.2	0.9	10.0	4.0	3.5	.65	2.0	1.15
4							11.0	3.8	3.5	1.0	2.0	1.5
5							10.0	3.8	3.0	3.3	1.8	1.8
6				1.5			8.0	3.5	2.3	7.7	1.7	1.5
7					1.2	.9	7.7	3.2	2.3	7.2	1.5	1.7
8							6.7	3.0	4.0	6.0	1.5	1.35
9							6.2	2.8	3.8	5.2	1.35	1.35
10				1.5	1.0	1.2	5.5	2.5	3.3	5.2	1.35	1.35
11							5.3	2.7	3.0	4.8	1.15	1.35
12							4.5	2.7	2.8	4.8	1.15	1.15
13							5.2	2.3	2.7	4.0	1.35	1.15
14					1.0	3.4	6.0	2.3	2.5	4.0	1.35	1.15
15							6.3	2.3	2.3	3.8	1.15	1.15
16			1.5				7.2	2.7	2.3	3.5	1.0	1.15
17				1.5	.9	2.0	6.5	3.3	2.0	3.7	1.0	1.15
18							7.7	4.3	2.0	3.3	1.0	1.0
19							7.8	4.7	2.0	3.2	1.5	.85
20			1.5	1.4			7.5	4.7	2.0	3.5	3.3	1.0
21					.9	2.6	7.0	5.0	1.8	3.2	3.3	1.15
22							6.5	6.3	1.5	2.8	3.3	1.5
23			1.5				6.2	6.8	1.35	2.3	2.7	1.5
24				1.4	.9	2.5	6.2	6.3	1.35	2.2	2.5	1.7
25							6.0	5.3	1.7	2.2	2.0	1.7
26							6.0	5.0	1.15	2.0	2.0	2.2
27			1.5	1.3			5.8	4.3	1.15	2.0	1.7	2.3
28					.9	2.7	5.3	3.7	1.0	2.2	1.7	2.5
29							5.0	3.8	1.0	3.0	1.35	2.3
30			1.5				5.0	4.0	1.0	3.2	1.15	2.0
31				1.2		4.3		4.0		3.5	1.5	

NOTE.—Discharge relation probably affected by ice about Dec. 16, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1888.					1888.				
1		7,840	5,900	3,410	16		3,640	9,000	3,180
2		13,000	3,870	3,240	17		4,110	8,130	3,180
3		6,440	4,850	3,180	18		5,000	8,130	3,180
4		5,900	7,000	3,180	19		24,200	8,700	3,180
5		4,600	10,300	3,180	20		8,400	15,900	3,180
6		5,630	13,600	3,180	21		5,630	6,170	3,180
7		6,170	13,900	3,180	22	22,800	4,140	5.110	3,180
8		7,000	13,300	3,180	23	19,800	3,640	4,600	4,140
9		8,130	13,000	3,180	24	17,700	3,640	4,350	5,110
10		7,280	15,200	3,180	25	15,600	4,110	4,350	3,870
11		18,700	13,900	3,180	26	13,600	3,870	4,110	3,520
12		6,440	13,000	3,180	27	11,700	3,640	3,870	3,180
13		3,640	12,000	3,180	28	10,200	3,640	3,870	3,180
14		2,960	10,800	3,180	29	9,870	3,640	3,870	2,740
15		3,300	10,200	3,180	30	9,000	4,350	3,640	3,420
					31		12,600	3,640	

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1888-89.												
1	4,110						4,850	7,000	10,800	6,720	1,750	1,750
2	3,180						4,600	7,280	2,120	8,710	1,930	1,930
3	2,960						4,110	7,840	4,350	8,420	1,750	1,930
4	1,750						3,180	7,280	7,840	8,420	1,750	1,930
5	2,740						3,640	7,560	9,580	17,000	1,750	17,000
6	2,120						3,870	7,840	10,500	9,580	1,930	1,430
7	2,650						3,990	8,710	19,800	8,010	1,750	1,300
8	3,180						4,110	21,300	9,290	6,440	1,750	1,300
9	2,960	19,800					15,600	10,200	6,240	1,930	1,580	1,580
10	2,960	3,870					5,110	5,630	3,180	2,120	1,750	1,750
11	2,960	3,870					3,180	13,000	9,580	2,120	1,940	1,750
12	2,960	3,870					3,640	12,400	6,440	3,870	2,120	1,750
13	2,120						4,350	11,700	7,280	4,600	2,120	1,750
14	3,000						4,990	22,800	7,000	5,400	2,020	1,750
15	3,870						5,630	12,000	7,560	13,600	1,930	1,750
16	3,180						6,170	3,870	8,570	5,630	1,750	13,600
17	2,740						5,370	11,400	9,580	1,430	1,750	2,120
18	2,120						5,630	15,900	7,840	1,430	1,580	2,120
19	4,850						5,630	15,900	8,420	1,750	9,580	1,750
20	3,870						18,400	15,900	9,290	1,750	3,410	1,930
21	3,870						7,000	22,400	16,300	1,940	3,410	1,930
22	3,870						3,180	16,300	10,800	2,120	2,120	1,930
23	3,870						4,850	9,870	5,630	2,120	2,120	1,930
24	3,870						8,420	5,370	9,870	2,320	1,930	2,120
25	3,180						9,000	11,700	11,100	2,120	2,300	1,930
26	3,350						9,870	11,400	11,700	2,320	13,000	1,750
27	3,520						11,100	10,500	11,700	2,120	3,180	2,120
28	3,700						10,600	8,420	19,800	1,430	1,090	2,120
29	3,870					6,440	10,200	8,420	13,000	8,130	1,430	2,120
30	3,870					6,170	7,000	8,500	9,860	1,430	1,750	2,120
31	3 180							13,300		1,750	1,750	
1889-90.												
1	2,120	730						7,560	14,000	1,580	2,120	2,960
2	2,120							7,840	12,300	3,180	2,120	2,960
3	1,750							7,000	12,600	5,370	1,940	1,930
4	1,930						7,560	5,370	12,600	4,980	1,750	4,850
5	1,750						5,630	10,500	13,900	4,600	1,750	10,500
6	1,660						6,320	11,100	18,700	4,600	1,750	11,700
7	1,580						7,000	1,750	19,800	4,350	1,750	11,800
8	1,430						12,300	2,960	19,100	4,350	1,750	12,000
9	1,430						17,300	3,180	19,100	4,350	2,120	11,700
10	1,430						18,700	12,000	16,300	4,350	14,600	10,500
11	1,300						20,900	3,180	17,700	2,120	14,600	10,800
12	1,300						25,000	1,300	16,300	10,800	13,600	5,630
13	1,360						27,200	1,750	15,600	3,000	12,300	2,960
14	1,430						26,900	3,870	13,000	2,120	6,170	3,660
15	1,300						25,000	4,110	11,600	2,120	5,110	4,350
16	1,430						20,500	3,870	10,200	4,850	6,720	4,350
17	1,430						18,000	11,400	9,870	8,710	5,660	4,110
18	1,300						18,000	3,640	8,130	7,560	4,600	4,110
19	1,300						17,300	2,120	7,000	13,300	4,350	4,350
20	1,300						14,900	4,600	6,440	3,000	4,600	7,000
21	1,300						14,600	8,130	5,630	2,120	8,130	9,870
22	1,300						14,600	9,870	5,120	2,120	7,840	9,870
23	1,300						13,900	11,700	4,600	2,120	7,000	8,420
24	1,300						13,900	21,600	4,600	3,180	5,800	7,000
25	1,190						13,000	18,400	11,400	3,410	4,600	5,630
26	1,090						13,900	15,200	3,180	10,200	5,370	5,110
27	1,090						13,300	17,000	1,930	3,000	5,370	14,600
28	1,090						11,100	13,000	1,930	2,120	5,370	5,000
29	860						11,100	13,000	1,760	2,120	8,710	3,870
30	860						8,710	11,100	1,580	2,120	6,720	2,320
31	860							19,500		2,120	4,000	

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1890–91.												
1	2,960	2,320	.....	.....	.....	.....	.....	14,900	1,300	2,740	860	860
2	2,960	2,320	.....	.....	.....	.....	.....	11,700	2,120	2,960	1,080	1,190
3	2,530	2,320	.....	.....	.....	.....	.....	10,800	2,320	2,960	1,300	1,090
4	2,530	2,120	.....	.....	.....	.....	.....	9,870	3,410	2,120	1,930	670
5	2,530	5,110	.....	.....	.....	.....	.....	11,700	4,350	2,320	1,930	670
6	2,530	3,640	.....	.....	.....	.....	.....	8,420	2,960	2,320	1,750	5,110
7	2,120	2,320	.....	.....	.....	.....	.....	5,110	3,540	1,930	1,580	1,190
8	2,320	1,750	.....	.....	.....	.....	.....	3,410	4,110	1,930	1,930	860
9	2,120	1,660	.....	.....	.....	.....	.....	5,630	4,110	1,930	1,560	860
10	2,120	1,580	.....	.....	.....	.....	.....	5,630	4,110	1,930	1,190	860
11	1,750	.....	.....	.....	.....	.....	.....	5,630	4,350	12,300	1,190	860
12	2,360	.....	.....	.....	.....	.....	.....	5,370	5,110	1,000	1,090	860
13	2,960	.....	.....	.....	.....	.....	7,840	17,700	5,630	860	1,090	860
14	7,000	.....	.....	.....	.....	.....	11,100	4,110	4,990	860	1,090	860
15	11,700	.....	.....	.....	.....	.....	14,600	4,600	4,350	860	860	860
16	12,300	.....	.....	.....	.....	.....	16,600	3,180	4,600	860	860	790
17	20,200	.....	.....	.....	.....	.....	20,900	4,400	3,870	860	860	790
18	11,700	.....	.....	.....	.....	.....	21,300	5,630	4,110	860	860	790
19	10,200	.....	.....	.....	.....	.....	23,400	5,110	3,410	860	3,870	860
20	8,710	.....	.....	.....	.....	.....	25,400	5,110	14,600	860	2,120	860
21	7,280	.....	.....	.....	.....	.....	22,800	14,900	2,700	1,090	1,090	860
22	6,440	.....	.....	.....	.....	.....	22,000	3,640	1,750	1,090	1,090	790
23	2,120	.....	.....	.....	.....	.....	26,900	2,120	2,120	1,930	1,090	790
24	2,530	.....	.....	.....	.....	.....	27,200	2,430	1,930	1,930	1,090	790
25	2,960	.....	.....	.....	.....	.....	25,400	2,740	4,110	1,930	860	730
26	3,780	.....	.....	.....	.....	.....	22,800	4,110	4,110	1,510	1,090	730
27	4,600	.....	.....	.....	.....	.....	20,200	3,870	3,180	1,090	1,090	730
28	2,320	.....	.....	.....	.....	.....	19,100	3,870	3,070	860	1,090	730
29	2,320	.....	.....	.....	.....	.....	15,200	14,600	2,960	1,090	1,090	730
30	2,740	.....	.....	.....	.....	.....	14,600	12,600	2,740	1,090	980	730
31	2,320	.....	.....	.....	.....	.....	.....	2,000	.....	860	860	.....
1891–92.												
1	730	2,000	.....	.....	.....	.....	2,120	1,010	13,000	19,100	6,440	1,090
2	790	1,190	.....	.....	.....	.....	4,350	4,850	11,700	13,600	5,110	1,010
3	930	1,190	.....	.....	.....	.....	13,900	7,000	9,870	17,000	4,350	1,010
4	1,010	1,190	.....	.....	.....	.....	16,300	9,870	10,200	16,300	4,350	2,740
5	1,090	1,190	.....	.....	.....	.....	19,800	10,500	8,420	15,600	1,750	1,090
6	2,320	1,190	.....	.....	.....	.....	18,700	11,400	7,840	12,300	14,900	1,190
7	2,740	1,190	.....	.....	.....	.....	20,500	12,000	10,500	10,200	860	1,090
8	1,300	1,190	.....	.....	.....	.....	18,000	13,300	14,600	7,560	1,430	1,190
9	1,010	1,190	.....	.....	.....	.....	14,600	10,200	14,600	9,290	1,930	1,300
10	1,300	1,190	.....	.....	.....	.....	12,700	13,300	13,000	2,120	1,930	1,430
11	1,430	1,190	.....	.....	.....	.....	10,800	11,700	12,300	4,850	1,930	1,930
12	1,750	1,090	.....	.....	.....	.....	4,350	12,300	10,500	1,580	2,740	2,120
13	2,120	1,090	.....	.....	.....	.....	5,630	13,300	9,870	3,180	2,740	2,530
14	1,930	1,010	.....	.....	.....	.....	4,600	13,600	9,290	3,410	1,300	1,750
15	1,750	1,010	.....	.....	.....	.....	4,350	13,600	7,560	4,350	1,580	2,530
16	1,580	1,010	.....	.....	.....	.....	4,110	17,000	8,130	18,700	1,750	2,120
17	13,900	.....	.....	.....	.....	.....	3,990	18,000	12,300	1,010	1,750	2,120
18	1,500	.....	.....	.....	.....	.....	3,870	19,100	15,600	1,300	1,300	1,750
19	1,430	.....	.....	.....	.....	.....	3,410	18,000	15,200	3,870	1,300	2,120
20	1,430	.....	.....	.....	.....	.....	2,530	30,300	15,600	4,350	6,440	1,750
21	2,530	.....	.....	.....	.....	.....	3,410	35,800	15,200	3,870	860	1,580
22	1,750	.....	.....	.....	.....	.....	4,350	34,600	13,600	1,750	860	1,300
23	1,010	.....	.....	.....	.....	.....	15,900	30,300	13,000	16,300	860	1,300
24	1,010	.....	.....	.....	.....	.....	1,300	22,800	12,300	1,300	860	1,300
25	1,050	.....	.....	.....	.....	.....	1,750	20,500	9,870	1,300	860	1,010
26	1,090	.....	.....	.....	.....	.....	2,120	18,400	7,840	1,430	4,850	1,090
27	1,090	.....	.....	.....	.....	.....	2,320	17,000	19,500	1,750	1,090	1,090
28	1,190	.....	.....	.....	.....	.....	4,600	15,200	28,800	8,130	1,010	1,090
29	1,190	.....	.....	.....	.....	.....	4,850	14,900	28,000	11,100	1,010	1,090
30	1,190	.....	.....	.....	.....	.....	15,900	14,600	24,200	9,870	1,010	1,090
31	12,300	.....	.....	.....	.....	.....	.....	15,200	.....	7,560	1,010	.....

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1892–93.												
1	1,010	1,090						20,500	10,800	15,900	1,300	1,190
2	1,010	1,090						21,600	9,000	930	1,300	1,090
3	1,010	1,090					6,440	23,500	6,720	1,010	2,320	1,090
4	1,010	1,090					7,280	23,500	7,000	1,010	1,750	1,090
5	930	1,090					9,000	20,900	6,720	2,530	1,300	1,010
6	930	1,090					10,800	17,000	9,290	3,870	1,580	1,190
7	930	1,090					11,100	13,900	8,710	4,600	3,180	1,190
8	930	1,010					11,700	17,000	16,600	4,600	1,750	1,190
9	860	1,010					12,000	15,200	3,870	6,440	1,750	1,010
10	930						14,900	17,000	3,870	4,850	1,190	1,010
11	930						15,600	24,600	3,410	14,200	1,300	1,010
12	930						18,000	37,800	3,410	1,090	1,190	1,010
13	930						22,000	38,200	5,630	1,750	1,090	1,010
14	930						24,200	33,800	3,870	6,170	1,090	1,010
15	930						20,500	30,300	3,870	6,170	1,010	1,010
16	930						17,300	28,000	14,900	5,370	1,010	1,010
17	930						15,600	22,800	860	5,110	1,010	1,010
18	1,010						13,000	20,900	1,300	5,370	1,010	1,090
19	1,010						13,600	17,000	3,180	3,870	1,010	1,090
20	1,090						13,600	16,600	3,180	3,870	1,010	1,010
21	1,090						13,000	10,800	3,410	3,870	1,010	1,010
22	1,090						13,300	12,300	5,630	9,290	1,010	930
23	1,090						10,800	12,000	4,350	1,300	1,010	930
24	1,090						9,290	15,600	15,200	1,300	1,090	930
25	1,190						10,500	19,800	860	1,010	1,090	930
26	1,300						13,900	24,200	3,180	1,010	1,190	930
27	1,190						21,300	22,800	4,600	1,190	1,190	930
28	1,090						27,600	17,300	5,900	1,430	1,300	930
29	1,090						26,500	20,500	5,900	1,300	1,300	930
30	1,090						26,100	15,600	5,630	1,300	1,300	930
31	1,090							21,600		1,300	1,300	
1893–94.												
1	860	930					6,860	11,400	6,720	2,530	860	1,010
2	860						6,170	14,600	12,300	2,530	1,090	1,010
3	860						4,850	15,600	2,530	2,320	1,090	1,010
4	860						7,560	19,800	2,740	1,750	1,090	1,010
5	1,010					5,110	7,560	22,400	5,630	1,580	1,750	1,010
6	1,010					6,170	9,290	24,200	9,000	1,580	1,190	1,010
7	1,430					6,440	9,000	24,600	2,530	1,580	1,190	1,010
8	1,430	1,010				7,840	9,870	24,200	4,350	1,580	1,430	1,010
9	4,350	1,010				9,290	9,290	19,800	10,800	1,580	1,300	860
10	3,870	930				7,840	9,580	17,000	3,410	1,580	1,300	1,010
11	3,640	930				7,280	9,290	15,600	2,960	1,580	1,300	1,010
12	2,530	930				6,720	9,290	14,600	2,740	1,580	1,010	1,010
13	2,530	930				6,440	9,580	15,600	2,530	1,430	1,300	1,010
14	2,120	930				7,000	12,000	19,100	2,530	1,300	1,190	1,010
15	2,120	930				7,280	12,600	20,900	2,530	1,300	1,190	1,010
16	1,750	930				6,440	16,600	47,300	18,400	1,190	1,090	1,010
17	1,010	860				7,840	19,100	37,800	860	1,090	1,090	1,010
18	930	860				10,000	22,800	34,200	2,530	1,090	1,090	1,010
19	1,010	860				13,300	26,900	31,900	2,530	1,090	1,090	1,010
20	930	860				15,200	31,900	24,600	2,740	1,090	1,090	1,010
21	19,800	790				19,100	32,700	20,900	3,870	1,010	1,010	1,010
22	860	860				22,400	31,900	17,300	3,870	1,010	1,090	1,090
23	860					20,900	27,200	13,600	3,870	1,010	1,010	1,010
24	860					20,500	22,000	12,300	3,870	1,010	1,010	1,190
25	1,010					14,000	20,500	12,000	3,870	1,010	860	1,190
26	1,010					8,420	18,000	10,500	3,870	1,010	1,090	1,090
27	930					7,560	15,600	9,870	4,350	1,010	1,010	1,090
28	18,000					9,290	12,600	9,000	3,870	1,010	1,010	1,090
29	860					8,420	12,000	8,710	3,180	930	1,010	1,090
30	860					7,280	13,600	7,840	3,180	860	1,010	860
31	860					7,560		7,280		860	1,010	

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1894–95.												
1	860	2,530	.....	.....	.....	.....	1,750	4,350	16,300	2,530	2,530	570
2	860	2,960	.....	.....	.....	.....	1,300	4,110	860	2,740	1,010	570
3	930	2,960	.....	.....	.....	.....	1,300	4,350	7,280	4,600	14,600	1,010
4	1,010	2,960	.....	.....	.....	.....	1,300	8,420	8,710	4,600	860	7,000
5	860	2,740	.....	.....	.....	.....	1,300	10,500	9,870	1,580	860	6,440
6	860	2,960	.....	.....	.....	.....	1,190	9,870	7,560	13,300	1,010	5,630
7	860	2,960	.....	.....	.....	.....	1,660	9,290	5,630	2,320	1,090	5,630
8	930	3,180	.....	.....	.....	.....	2,120	9,000	13,300	3,180	1,090	3,320
9	1,010	3,180	.....	.....	.....	.....	3,410	9,290	1,580	2,530	1,090	1,010
10	1,010	3,180	.....	.....	.....	.....	2,320	8,420	5,630	1,750	2,120	1,010
11	1,010	2,740	.....	.....	.....	.....	2,530	7,560	8,130	3,870	3,000	1,010
12	1,010	1,750	.....	.....	.....	.....	3,410	17,700	17,000	5,370	3,870	1,010
13	1,010	1,750	.....	.....	.....	.....	3,870	15,600	19,100	13,900	3,180	1,010
14	1,010	1,430	.....	.....	.....	.....	2,740	14,900	13,600	6,000	2,960	1,010
15	1,010	1,430	.....	.....	.....	.....	1,300	12,300	17,000	5,630	2,960	1,010
16	860	1,300	.....	.....	.....	.....	2,120	11,100	13,500	5,370	14,600	1,010
17	860	1,090	.....	.....	.....	.....	1,750	8,710	10,800	6,440	1,750	1,010
18	930	1,090	.....	.....	.....	.....	2,530	7,560	7,560	6,440	1,010	1,090
19	930	1,090	.....	.....	.....	.....	1,750	5,900	10,500	6,440	1,300	1,750
20	860	.....	.....	.....	.....	.....	1,190	17,000	4,850	6,440	1,010	1,750
21	860	.....	.....	.....	.....	.....	1,190	3,410	3,410	5,110	1,090	2,120
22	930	.....	.....	.....	.....	.....	1,190	4,600	13,300	5,630	2,740	3,640
23	1,010	.....	.....	.....	.....	.....	2,120	4,350	5,000	6,170	1,090	12,000
24	1,010	.....	.....	.....	.....	.....	1,300	3,870	4,850	6,440	1,090	15,900
25	1,430	.....	.....	.....	.....	.....	1,300	17,000	5,370	4,600	1,190	15,200
26	1,930	.....	.....	.....	.....	.....	1,580	1,010	7,560	4,600	1,300	12,300
27	1,580	.....	.....	.....	.....	.....	10,800	1,750	5,630	9,290	1,190	9,290
28	1,930	.....	.....	.....	.....	.....	2,000	2,530	4,350	1,010	1,190	5,110
29	3,180	.....	.....	.....	.....	.....	1,010	3,180	15,600	2,320	1,010	5,110
30	1,750	.....	.....	.....	.....	.....	2,960	2,320	2,530	3,180	620	5,110
31	2,320	.....	.....	.....	.....	.....	.....	3,410	.....	2,740	570	.....
1895–96.												
1	2,530	860	.....	.....	.....	.....	.....	19,100	8,710	4,350	3,180	1,750
2	1,750	670	.....	.....	.....	.....	.....	18,000	10,500	13,600	3,180	1,750
3	2,320	670	.....	.....	.....	.....	.....	21,600	9,870	1,750	3,180	1,750
4	2,530	670	.....	.....	.....	.....	.....	23,500	7,000	4,350	3,180	1,750
5	1,930	930	.....	.....	.....	.....	.....	20,500	7,000	4,350	3,180	1,750
6	1,750	1,010	.....	.....	.....	.....	.....	18,000	6,720	6,440	3,180	1,340
7	1,750	1,010	.....	.....	.....	.....	.....	15,600	14,900	6,440	2,740	930
8	1,750	1,010	.....	.....	.....	.....	.....	15,600	9,290	4,850	2,740	5,370
9	1,580	1,010	.....	.....	.....	.....	.....	9,290	13,900	12,300	2,800	2,960
10	1,010	1,010	.....	.....	.....	.....	.....	10,200	16,300	3,870	9,580	2,530
11	12,300	1,010	.....	.....	.....	.....	.....	13,300	13,300	4,350	4,350	2,120
12	1,300	1,010	.....	.....	.....	.....	.....	9,290	10,800	3,180	3,870	3,870
13	1,200	1,010	.....	.....	.....	.....	11,700	9,290	13,000	3,180	5,630	3,200
14	1,090	1,010	.....	.....	.....	.....	22,800	12,300	12,300	2,530	5,900	2,530
15	1,090	1,010	.....	.....	.....	.....	29,200	15,900	9,000	3,870	4,110	3,180
16	1,190	860	.....	.....	.....	.....	33,800	22,800	7,000	5,110	2,700	1,750
17	1,090	860	.....	.....	.....	.....	35,000	18,000	9,870	5,110	1,300	860
18	1,010	800	.....	.....	.....	.....	35,800	20,500	9,870	11,400	1,300	1,300
19	1,090	730	.....	.....	.....	.....	39,000	22,000	9,870	3,180	1,300	1,750
20	1,090	.....	.....	.....	.....	.....	38,600	20,500	16,300	3,410	1,300	2,360
21	1,010	.....	.....	.....	.....	.....	35,800	20,500	8,420	2,530	860	2,960
22	1,010	.....	.....	.....	.....	.....	29,500	12,300	7,560	2,530	2,530	2,530
23	1,010	.....	.....	.....	.....	.....	25,400	13,600	6,440	3,410	2,140	2,120
24	1,010	.....	.....	.....	.....	.....	21,600	12,300	7,560	3,180	1,750	2,320
25	1,010	.....	.....	.....	.....	.....	20,900	10,200	9,870	4,850	1,750	2,320
26	1,010	.....	.....	.....	.....	.....	20,500	11,400	10,500	3,180	1,840	4,350
27	1,010	.....	.....	.....	.....	.....	19,800	10,500	14,600	3,640	1,930	2,300
28	1,010	.....	.....	.....	.....	.....	21,600	9,870	4,850	2,740	1,930	2,120
29	930	.....	.....	.....	.....	.....	19,800	9,580	4,350	2,740	2,120	1,750
30	860	.....	.....	.....	.....	.....	19,800	15,600	4,850	3,180	2,120	1,750
31	730	.....	.....	.....	.....	.....	.....	7,000	.....	2,740	2,120	.....

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1896–97.												
1	1,750	7,750	.....	.....	.....	.....	46,500	15,600	5,630	11,400	13,000	2,120
2	1,750	9,870	.....	.....	.....	.....	60,100	13,900	6,440	9,870	11,400	2,120
3	1,750	10,200	.....	.....	.....	.....	52,400	12,300	13,600	7,560	9,870	3,870
4	1,750	9,290	.....	.....	.....	.....	33,000	10,500	19,800	9,870	9,870	3,870
5	1,750	8,420	.....	.....	.....	.....	33,400	9,290	26,500	7,560	9,290	3,870
6	1,750	8,420	.....	.....	.....	.....	33,000	9,290	16,300	7,000	7,000	3,870
7	2,120	8,710	.....	.....	.....	.....	28,400	7,000	14,600	7,000	7,000	3,870
8	2,120	9,000	.....	.....	.....	.....	25,400	7,560	15,600	5,630	6,440	3,870
9	2,120	9,290	.....	.....	.....	.....	22,800	6,440	13,000	2,530	6,440	16,300
10	1,750	7,000	.....	.....	.....	.....	20,500	7,560	13,600	7,280	5,630	3,180
11	1,520	5,630	.....	.....	.....	.....	18,000	8,420	14,600	2,120	4,850	3,180
12	1,300	4,350	.....	.....	.....	.....	17,000	6,440	14,200	4,350	4,850	1,090
13	1,300	.....	.....	.....	.....	.....	15,600	7,560	11,400	4,350	4,850	3,870
14	1,750	.....	.....	.....	.....	.....	15,600	7,560	10,800	2,530	4,850	4,350
15	1,300	.....	.....	.....	.....	.....	16,300	14,200	9,870	3,180	7,000	4,850
16	1,750	.....	.....	.....	.....	.....	18,000	6,440	15,600	2,530	3,180	4,350
17	1,870	.....	.....	.....	.....	.....	18,000	4,350	10,800	2,530	3,640	3,180
18	2,000	.....	.....	.....	.....	.....	16,300	5,630	20,500	1,750	3,180	3,180
19	2,120	.....	.....	.....	.....	.....	16,300	5,630	21,600	3,180	3,180	3,180
20	2,120	.....	.....	.....	.....	25,400	14,900	10,500	17,300	2,530	3,180	3,180
21	2,120	.....	.....	.....	.....	24,600	13,600	16,300	16,300	3,180	13,600	3,180
22	2,120	.....	.....	.....	.....	25,400	13,000	22,000	11,400	2,530	2,530	3,180
23	2,120	.....	.....	.....	.....	26,100	13,600	13,000	11,400	3,870	3,180	2,740
24	1,750	.....	.....	.....	.....	28,400	13,900	13,600	11,100	3,870	2,740	2,530
25	1,750	.....	.....	.....	.....	26,500	13,000	13,600	10,200	3,870	3,180	2,530
26	1,750	.....	.....	.....	.....	27,200	11,700	13,600	9,290	4,850	2,530	1,300
27	1,750	.....	.....	.....	.....	25,400	12,000	12,300	6,440	15,600	2,530	1,300
28	1,750	.....	.....	.....	.....	26,500	10,800	10,500	6,440	20,500	2,530	4,110
29	1,750	.....	.....	.....	.....	29,900	12,300	16,300	8,420	18,000	1,300	2,120
30	4,350	.....	.....	.....	.....	35,400	15,200	3,180	10,500	18,000	1,300	2,120
31	5,630	.....	.....	.....	.....	46,500	.....	4,350	.....	13,600	2,120	.....
1897–98.												
1	2,530	2,530	.....	.....	.....	.....	9,290	6,440	9,290	7,560	2,120	2,120
2	2,530	2,530	.....	.....	.....	.....	8,420	6,440	9,290	7,560	2,120	2,120
3	2,120	2,530	.....	.....	.....	.....	7,560	9,290	7,840	7,560	2,120	2,120
4	2,530	2,530	.....	.....	.....	.....	7,000	9,870	17,000	7,560	2,120	1,300
5	2,120	2,530	.....	.....	.....	.....	6,440	9,290	2,530	7,560	2,120	1,300
6	3,640	2,530	.....	.....	.....	.....	5,630	8,420	4,350	7,560	2,120	1,750
7	3,180	2,530	.....	.....	.....	.....	4,350	13,900	3,180	7,560	5,900	1,750
8	2,120	2,530	.....	.....	.....	.....	4,350	3,870	7,000	9,870	2,530	2,120
9	7,840	2,530	.....	.....	.....	.....	4,350	3,180	9,290	13,900	2,120	1,300
10	1,750	2,530	.....	.....	.....	.....	4,350	7,000	7,000	3,640	1,750	1,300
11	1,750	2,530	.....	.....	.....	.....	4,350	7,000	17,700	4,350	1,300	1,300
12	1,750	2,530	.....	.....	.....	.....	4,850	7,000	3,180	5,630	1,300	2,120
13	2,120	2,530	.....	.....	.....	.....	5,630	6,440	3,870	5,630	1,300	1,750
14	1,750	2,120	.....	.....	.....	.....	7,000	13,600	9,290	4,850	3,410	2,120
15	1,750	2,120	.....	.....	.....	.....	6,440	3,180	9,870	4,350	2,120	1,580
16	3,180	2,120	.....	.....	.....	.....	5,630	3,180	11,400	9,290	2,120	1,750
17	4,350	2,530	.....	.....	.....	.....	5,630	3,870	9,870	1,300	2,120	2,120
18	5,630	2,120	.....	.....	.....	.....	4,850	4,350	14,200	2,120	5,630	2,120
19	5,630	2,120	.....	.....	.....	.....	7,000	4,850	7,000	2,120	3,180	2,120
20	5,630	2,120	.....	.....	.....	.....	5,630	5,630	4,350	3,180	3,180	2,030
21	5,110	2,120	.....	.....	.....	.....	7,000	15,600	5,630	3,870	2,530	1,940
22	4,850	2,120	.....	.....	.....	.....	7,560	4,350	6,440	3,180	3,180	1,840
23	17,300	.....	.....	.....	.....	.....	14,600	4,350	6,440	9,870	2,530	1,750
24	3,640	.....	.....	.....	.....	.....	10,500	3,870	6,440	1,010	2,120	1,750
25	4,350	.....	.....	.....	.....	.....	9,870	5,630	12,300	2,120	2,530	860
26	4,350	.....	.....	.....	.....	.....	9,290	6 440	3,870	2,120	2,120	2,120
27	3,180	.....	.....	.....	.....	.....	8,420	4,350	4,350	2,120	2,120	2,120
28	3,180	.....	.....	.....	.....	.....	7,560	19,100	7,000	2,120	2,120	2,010
29	3,180	.....	.....	.....	.....	8,420	7,560	13,900	8,420	2,530	2,120	1,900
30	2,530	.....	.....	.....	.....	9,870	7,000	12,300	7,560	2,120	2,120	1,800
31	2,530	.....	.....	.....	.....	10,500	.....	10,500	.....	2,120	2,120	.....

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1899—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1898–99.												
1	1,690	1,750	.....	.....	.....	.....	.....	21,600	5,510	15,500	3,290	2,390
2	1,580	1,750	.....	.....	.....	.....	.....	22,300	7,800	2,030	18,400	2,030
3	2,120	1,750	.....	.....	.....	.....	.....	22,300	15,600	3,500	2,030	2,030
4	2,120	2,120	.....	.....	.....	.....	.....	23,300	8,300	3,870	2,560	2,030
5	2,120	1,750	.....	.....	.....	.....	.....	19,400	10,000	4,280	3,110	2,390
6	2,120	1,750	.....	.....	.....	.....	.....	27,200	12,400	4,880	1,660	2,390
7	2,120	1,750	.....	.....	.....	.....	.....	15,300	12,400	4,690	3,110	2,390
8	2,120	1,750	.....	.....	.....	.....	.....	11,400	12,200	12,300	3,110	2,390
9	2,120	1,750	.....	.....	.....	.....	.....	10,600	15,300	570	3,110	2,560
10	2,120	2,120	.....	.....	.....	.....	5,950	8,300	18,400	3,110	3,110	2,740
11	2,320	1,750	.....	.....	.....	.....	7,330	7,800	6,850	3,870	3,110	3,500
12	2,320	1,750	.....	.....	.....	.....	7,680	9,800	5,510	3,870	2,740	3,680
13	2,530	1,750	.....	.....	.....	.....	11,300	17,000	12,400	10,300	2,030	3,500
14	2,530	1,750	.....	.....	.....	.....	17,500	3,870	14,700	1,500	2,030	3,500
15	3,180	1,750	.....	.....	.....	.....	16,600	4,280	20,400	1,800	3,110	2,740
16	2,530	1,750	.....	.....	.....	.....	17,800	6,160	19,100	2,030	2,030	10,600
17	2,740	1,750	.....	.....	.....	.....	17,800	11,400	15,600	2,740	2,030	1,800
18	3,180	1,750	.....	.....	.....	.....	13,900	17,500	10,200	1,120	2,030	2,030
19	2,530	1,750	.....	.....	.....	.....	13,000	18,400	9,050	1,120	17,000	2,560
20	2,530	1,750	.....	.....	.....	.....	13,000	25,800	12,200	2,200	3,110	2,560
21	2,530	1,750	.....	.....	.....	.....	13,900	9,800	9,800	2,930	3,110	2,030
22	2,530	.....	.....	.....	.....	.....	13,900	10,800	9,800	2,930	2,560	2,030
23	2,420	.....	.....	.....	.....	.....	12,400	9,290	8,810	2,930	2,740	2,030
24	2,320	.....	.....	.....	.....	.....	11,400	7,560	18,600	3,290	2,390	2,210
25	1,750	.....	.....	.....	.....	.....	9,800	7,560	3,870	4,280	2,390	2,390
26	1,750	.....	.....	.....	.....	.....	9,050	6,850	3,870	4,280	2,030	2,200
27	1,750	.....	.....	.....	.....	.....	5,110	15,000	4,280	3,870	2,030	2,030
28	1,750	.....	.....	.....	.....	.....	9,800	8,300	4,880	3,870	2,740	2,030
29	1,750	.....	.....	.....	.....	.....	26,200	9,800	5,010	2,390	2,390	2,200
30	1,750	.....	.....	.....	.....	.....	12,400	8,300	5,720	2,840	2,390	2,200
31	1,750	.....	.....	.....	.....	.....	.....	9,050	.....	3,290	2,390	.....

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1910–1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1909–10.												
1	2,120	3,870	10,500	7,000	3,300	2,740	6,440	4,850	4,110	1,580	1,930	1,750
2	2,120	4,350	9,580	7,000	3,180	2,960	6,170	5,110	3,870	2,740	1,430	2,120
3	1,930	8,130	8,710	7,000	2,960	2,740	5,630	4,110	3,870	1,580	1,580	2,320
4	1,840	9,870	9,290	6,720	2,850	2,960	5,370	3,870	9,290	1,930	1,750	1,930
5	2,220	9,580	8,130	6,440	2,740	2,960	5,630	3,640	3,640	2,530	1,930	1,580
6	2,220	9,000	7,560	6,440	2,640	3,070	5,900	3,870	4,110	1,580	1,580	2,320
7	2,320	8,130	7,000	6,170	2,530	3,300	6,170	3,640	3,410	790	860	3,410
8	2,220	7,000	6,440	6,170	2,530	3,410	5,900	3,410	3,180	730	1,750	3,180
9	2,220	6,440	6,440	6,440	2,850	3,520	6,170	3,180	3,180	670	1,580	2,530
10	2,020	5,370	6,440	6,440	2,850	3,760	5,110	2,960	2,960	620	1,190	2,120
11	2,530	4,350	6,170	7,000	2,530	3,990	4,350	2,960	2,740	790	1,300	1,750
12	3,180	4,600	5,900	6,440	2,530	4,110	4,600	2,960	2,120	620	860	2,530
13	3,180	6,440	5,900	5,900	2,960	4,110	4,110	2,740	2,530	570	1,010	2,120
14	3,410	13,600	5,900	5,630	2,850	3,990	3,870	2,960	2,320	2,120	860	2,320
15	3,300	21,300	5,630	5,630	2,740	3,760	4,110	2,120	2,740	620	1,010	2,530
16	3,300	20,500	5,900	5,370	2,740	3,640	3,870	2,740	2,120	570	1,430	2,740
17	3,070	18,400	6,170	5,370	2,640	3,300	3,410	2,960	2,530	490	1,300	2,530
18	3,180	14,200	5,630	4,850	2,530	3,300	3,180	4,850	2,740	670	1,580	1,300
19	3,300	11,400	5,900	4,350	2,530	3,870	4,600	8,420	2,120	620	1,750	3,410
20	3,070	11,700	7,000	4,230	2,740	4,350	5,370	9,870	2,740	570	1,930	3,180
21	2,960	11,700	6,720	3,640	2,740	4,850	9,580	8,710	2,320	530	1,010	1,190
22	3,520	9,580	6,440	3,300	2,320	8,130	8,710	9,000	2,120	530	1,090	1,090
23	3,410	7,280	7,000	3,180	2,420	7,840	7,560	9,290	1,750	570	1,580	2,120
24	3,640	7,560	7,000	3,070	2,850	7,000	6,440	9,000	2,120	460	1,430	1,930
25	3,640	7,280	6,440	3,070	2,960	8,130	6,720	8,420	2,320	790	1,580	1,300
26	3,870	7,560	7,000	3,520	2,740	8,130	7,560	8,130	1,580	2,120	1,430	2,530
27	4,110	8,130	7,000	3,760	2,740	7,840	5,630	7,840	2,120	2,320	1,300	1,930
28	3,870	9,580	7,000	3,870	2,960	7,000	5,900	7,000	2,120	2,530	860	2,120
29	3,870	11,700	6,440	3,640	.....	7,000	5,370	5,110	1,750	2,320	1,930	1,930
30	3,870	12,300	7,000	3,410	.....	7,000	5,630	2,530	1,580	1,750	2,120	2,120
31	3,410	.....	7,000	3,410	.....	6,440	.....	4,350	.....	1,010	1,930	.....
1910–11.												
1	2,530	1,580	1,580	1,580	1,930	1,580	5,370	4,110	3,870	1,300	.....	.....
2	2,320	1,580	1,580	1,580	1,750	1,580	5,110	4,110	4,850	1,190	.....	.....
3	2,320	1,580	1,430	1,580	1,580	1,580	4,600	4,110	4,850	1,190	.....	.....
4	2,420	1,580	1,360	1,580	1,580	1,580	4,350	4,350	4,850	1,430	.....	.....
5	2,530	1,580	1,300	1,580	1,660	1,580	3,870	4,350	5,900	1,750	.....	.....
6	2,640	1,580	1,300	1,580	1,840	1,580	3,870	4,110	9,870	1,580	.....	.....
7	2,530	1,580	1,360	1,580	1,930	1,660	3,640	4,110	10,200	1,580	.....	.....
8	2,420	1,580	1,430	1,580	1,750	1,750	3,640	4,110	6,440	1,580	.....	.....
9	2,320	1,580	1,360	1,580	1,750	1,750	3,640	2,960	5,630	1,750	.....	.....
10	2,420	1,580	1,300	1,580	1,580	1,930	3,410	3,180	5,370	2,120	.....	.....
11	2,320	1,580	1,300	1,580	1,580	2,120	3,870	4,350	3,870	2,120	.....	.....
12	2,420	1,580	1,300	1,580	1,580	2,850	2,530	3,640	3,870	2,120	.....	.....
13	2,320	1,580	1,300	1,580	1,580	3,180	6,170	2,740	2,740	1,750	.....	.....
14	2,320	1,500	1,300	1,580	1,580	2,850	8,420	2,740	2,530	1,750	.....	.....
15	2,320	1,430	1,300	1,580	1,580	2,960	5,370	3,640	3,410	1,300	.....	.....
16	1,360	1,430	1,300	1,580	1,580	3,410	7,000	4,110	2,740	1,090	.....	.....
17	2,320	1,430	1,300	1,580	1,580	3,640	6,440	4,110	2,530	1,190	.....	.....
18	1,300	1,430	1,300	1,580	1,580	3,640	5,900	4,110	2,320	1,090	.....	.....
19	1,500	1,430	1,430	1,580	1,750	3,640	5,630	4,110	2,320	1,090	.....	.....
20	1,750	1,300	1,580	1,580	1,750	3,410	5,900	4,350	1,930	1,190	.....	.....
21	1,750	1,300	1,750	1,580	1,750	3,300	8,130	7,280	1,750	1,190	.....	.....
22	1,430	1,300	1,580	1,580	1,750	3,410	6,440	10,500	1,750	1,190	.....	.....
23	1,580	1,300	1,430	1,580	1,750	3,520	6,170	9,870	1,580	1,090	.....	.....
24	1,580	1,300	1,580	1,580	1,750	3,990	6,440	11,400	1,580	1,190	.....	.....
25	1,580	1,300	1,580	1,580	1,750	4,350	5,900	11,400	1,580	1,190	.....	.....
26	1,580	1,300	1,580	1,580	1,580	4,600	5,110	9,290	1,580	1,300	.....	.....
27	1,580	1,300	1,430	1,580	1,580	4,600	5,370	7,000	1,580	1,300	.....	.....
28	1,580	1,360	1,430	1,580	1,580	4,350	4,600	6,440	1,430	1,300	.....	.....
29	1,580	1,430	1,430	2,120	.....	6,440	3,870	5,630	1,430	1,430	.....	.....
30	1,580	1,500	1,580	2,120	.....	6,170	4,110	4,600	1,300	1,090	.....	.....
31	1,580	.....	1,580	2,120	.....	6,440	.....	3,870	.....	1,300	.....	.....

Daily discharge, in second-feet, of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1910–1913—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	2,220	4,350	.....	.....	.....	.....	4,850	12,300	10,800	2,530	.....	.....
2	2,320	3,300	.....	.....	.....	.....	5,110	10,800	9,870	2,120	.....	.....
3	4,350	2,220	.....	.....	.....	.....	6,170	9,870	9,290	2,120	.....	.....
4	7,280	2,220	.....	.....	.....	.....	6,170	11,400	7,560	2,960	.....	.....
5	7,280	2,220	.....	.....	.....	.....	9,000	20,500	7,560	2,530	.....	.....
6	21,600	2,220	.....	.....	.....	.....	13,600	28,800	7,000	2,120	.....	.....
7	33,400	2,220	.....	.....	.....	.....	17,300	28,800	6,440	2,120	.....	.....
8	33,000	2,220	.....	.....	.....	.....	22,400	23,900	5,900	2,120	.....	.....
9	25,400	2,320	.....	.....	.....	.....	21,300	19,800	5,900	2,120	.....	.....
10	18,000	2,320	.....	.....	.....	.....	17,300	15,600	4,850	2,530	.....	.....
11	14,600	2,320	.....	.....	.....	.....	14,600	13,000	4,350	2,120	.....	.....
12	10,200	2,320	.....	.....	.....	.....	13,000	10,500	3,870	2,120	.....	.....
13	7,280	2,320	.....	.....	.....	.....	12,300	9,580	3,520	2,740	.....	.....
14	7,280	2,220	.....	.....	.....	.....	12,000	8,130	3,640	2,530	.....	.....
15	7,000	2,220	.....	.....	.....	.....	12,600	7,280	3,870	2,530	.....	.....
16	8,420	2,220	.....	.....	.....	.....	13,300	7,000	3,640	2,120	.....	.....
17	16,300	.....	.....	.....	.....	.....	14,600	6,440	3,990	2,120	.....	.....
18	18,400	.....	.....	.....	.....	.....	12,000	7,000	4,110	1,930	.....	.....
19	20,200	.....	.....	.....	.....	.....	12,000	6,170	5,110	1,930	.....	.....
20	16,600	.....	.....	.....	.....	.....	10,500	6,440	4,850	1,930	.....	.....
21	14,600	.....	.....	.....	.....	.....	9,000	6,170	4,850	1,580	.....	.....
22	13,000	.....	.....	.....	.....	.....	12,300	6,440	4,350	1,580	.....	.....
23	10,200	.....	.....	.....	.....	.....	17,000	23,500	3,870	1,580	.....	.....
24	9,870	.....	.....	.....	.....	.....	16,300	27,600	3,870	2,530	.....	.....
25	8,420	.....	.....	.....	.....	.....	13,000	20,500	3,870	3,870	.....	.....
26	7,280	.....	.....	.....	.....	.....	13,000	14,900	3,410	12,300	.....	.....
27	7,000	.....	.....	.....	.....	.....	14,200	12,000	3,070	9,000	.....	.....
28	7,000	.....	.....	.....	.....	.....	16,300	20,500	2,850	6,170	.....	.....
29	4,600	.....	.....	.....	.....	.....	17,000	23,500	2,640	5,110	.....	.....
30	4,350	.....	.....	.....	.....	.....	14,600	20,500	2,120	3,640	.....	.....
31	4,350	.....	.....	.....	.....	.....	.....	16,300	.....	3,180	.....	.....
1912–13.												
1	.....	.....	.....	.....	.....	.....	13,600	11,400	9,870	2,120	7,000	3,180
2	.....	.....	.....	.....	.....	.....	20,500	11,400	9,870	2,120	4,850	2,420
3	.....	.....	.....	.....	.....	.....	31,100	9,870	8,420	1,500	4,350	2,420
4	.....	.....	.....	.....	.....	.....	35,000	9,290	9,420	2,120	4,350	3,180
5	.....	.....	.....	.....	.....	.....	31,100	9,290	7,000	7,840	3,870	3,870
6	.....	.....	.....	.....	.....	.....	23,500	8,420	5,110	22,400	3,640	3,180
7	.....	.....	.....	.....	.....	.....	22,400	7,560	5,110	20,500	3,180	3,640
8	.....	.....	.....	.....	.....	.....	18,700	7,000	9,870	16,300	3,180	2,850
9	.....	.....	.....	.....	.....	.....	17,000	6,440	9,290	13,600	2,850	2,850
10	.....	.....	.....	.....	.....	.....	14,600	5,630	7,840	13,600	2,850	2,850
11	.....	.....	.....	.....	.....	.....	13,900	6,170	7,000	12,300	2,420	2,850
12	.....	.....	.....	.....	.....	.....	11,400	6,170	6,440	12,300	2,420	2,420
13	.....	.....	.....	.....	.....	.....	13,600	5,110	6,170	9,870	2,850	2,420
14	.....	.....	.....	.....	.....	.....	16,300	5,110	5,630	9,870	2,850	2,420
15	.....	.....	.....	.....	.....	.....	17,300	5,110	5,110	9,290	2,420	2,420
16	.....	.....	.....	.....	.....	.....	20,500	6,170	5,110	8,420	2,120	2,420
17	.....	.....	.....	.....	.....	.....	18,000	7,840	4,350	9,000	2,120	2,420
18	.....	.....	.....	.....	.....	.....	22,400	10,800	4,350	7,840	2,120	2,120
19	.....	.....	.....	.....	.....	.....	22,800	12,000	4,350	7,560	3,180	1,840
20	.....	.....	.....	.....	.....	.....	21,600	12,000	4,350	8,420	7,840	2,120
21	.....	.....	.....	.....	.....	.....	19,800	13,000	3,870	7,560	7,840	2,420
22	.....	.....	.....	.....	.....	.....	18,000	17,300	3,180	6,440	7,840	3,180
23	.....	.....	.....	.....	.....	.....	17,000	19,100	2,850	5,110	6,170	3,180
24	.....	.....	.....	.....	.....	.....	17,000	17,300	2,850	4,850	5,630	3,640
25	.....	.....	.....	.....	.....	.....	16,300	13,900	3,640	4,850	4,350	3,640
26	.....	.....	.....	.....	.....	.....	16,300	13,000	2,420	4,350	4,350	4,850
27	.....	.....	.....	.....	.....	.....	15,600	10,800	2,420	4,350	3,640	5,110
28	.....	.....	.....	.....	.....	.....	13,900	9,000	2,120	4,850	3,640	5,630
29	.....	.....	.....	.....	.....	.....	13,000	9,290	2,120	7,000	2,850	5,110
30	.....	.....	.....	.....	.....	.....	13,000	9,870	2,120	7,560	2,420	4,350
31	.....	.....	.....	.....	.....	.....	.....	9,870	.....	8,420	3,180	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined above 1,930 second-feet (gage height 0.9 foot). Below 1,930 second-feet the rating curve is simply an extension and estimates of discharge below this value should therefore be used with extreme caution. See "Gage," in station description.

Monthly discharge of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1888.				
July	24,200	2,960	6,620	.....
August	15,900	3,640	8,330	.....
September	5,110	2,740	3,310	.....
1888–89.				
October	4,850	1,750	3,240	.....
April	18,400	3,180	6,580	.....
May	22,800	3,870	11,300	.....
June	19,800	2,120	9,500	.....
July	17,000	1,430	4,730	.....
August	13,000	1,090	2,580	.....
September	17,000	1,300	2,740	.....
1889–90.				
October	2,120	860	1,380	.....
April 4–30	27,200	5,630	15,400	.....
May	21,600	1,300	8,630	.....
June	19,800	1,580	10,500	.....
July	13,300	1,580	4,320	.....
August	14,600	1,750	5,750	.....
September	14,600	1,930	6,800	.....
1890–91.				
October	20,200	1,750	4,940	.....
November 1–10	5,110	1,580	2,510	.....
April 13–30	27,200	7,840	19,900	.....
May	17,700	2,000	6,930	.....
June	14,600	1,300	3,870	.....
July	12,300	860	1,860	.....
August	3,870	860	1,300	.....
September	5,110	670	979	.....
1891–92.				
October	13,900	730	2,180	.....
November 1–16	2,000	1,010	1,190	.....
April	20,500	1,300	8,170	.....
May	35,800	1,010	16,100	.....
June	28,800	7,560	13,400	.....
July	19,100	1,010	7,550	.....
August	14,900	860	2,600	.....
September	2,740	1,010	1,530	.....
1892–93.				
October	1,300	860	1,020	.....
November 1–9	1,090	1,010	1,070	.....
April 3–30	27,600	6,440	15,300	.....
May	38,200	10,800	21,100	.....
June	16,600	860	6,030	.....
July	15,900	930	3,970	.....
August	3,180	1,010	1,320	.....
September	1,190	930	1,020	.....
1893–94.				
October	19,800	860	2,610	.....
March 5–31	22,400	5,510	10,200	.....
April	32,700	4,850	15,200	.....
May	47,300	7,280	18,900	.....
June	18,400	860	4,610	.....
July	2,530	860	1,360	.....
August	1,750	860	1,120	.....
September	1,190	860	1,030	.....
1894–95.				
October	3,180	860	1,180	.....
November 1–19	3,180	1,090	2,280	.....
April	10,800	1,010	2,210	.....
May	17,700	1,010	7,850	.....
June	19,100	860	8,880	.....
July	13,900	1,010	5,040	.....
August	14,600	570	2,420	.....
September	15,900	570	4,320	.....

Monthly discharge of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1913—Continued.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1895-96.				
October	12,300	730	1,680	.....
November 1–19	1,010	670	903	.....
April 13–30	39,000	11,700	26,700	.....
May	23,500	7,000	15,100	.....
June	16,300	4,350	9,820	.....
July	13,600	1,750	4,590	.....
August	9,580	860	2,900	.....
September	5,370	860	2,310	.....
1896–97.				
October	5,630	1,300	2,020	.....
November 1–12	10,200	4,350	8,160	.....
March 20–31	46,500	24,600	28,900	.....
April	60,100	10,800	21,700	.....
May	22,000	3,180	10,200	.....
June	26,500	5,630	13,100	.....
July	20,500	1,750	6,860	.....
August	13,600	1,300	5,360	.....
September	16,300	1,090	3,550	.....
1897–98.				
October	17,300	1,750	3,810	.....
November 1–22	2,530	2,120	2,380	.....
April	14,600	4,350	6,940	.....
May	19,100	3,180	7,650	.....
June	17,700	2,530	7,860	.....
July	13,900	1,010	5,040	.....
August	5,900	1,300	2,460	.....
September	2,120	1,300	860	.....
1898–99.				
October	3,180	1,580	2,220	.....
November 1–21	2,120	1,750	1,790	.....
April 10–30	26,200	5,110	12,700	.....
May	27,200	3,870	13,100	.....
June	20,400	3,870	10,600	.....
July	15,500	570	3,940	.....
August	18,400	1,660	3,540	.....
September	10,600	1,800	2,710	.....
1899–1900.				
October	20,800	1,300	4,710	.....
November	5,950	2,560	3,480	.....
April 7–30	40,400	4,690	16,000	.....
May	17,500	2,560	7,180	.....
June	10,700	1,660	2,610	.....
July	23,300	2,120	6,810	.....
August	29,800	3,110	9,800	.....
September	44,800	5,510	17,700	.....
1900–01.				
October	45,500	4,280	15,600	.....
November 1–24	31,300	4,880	11,500	.....
March 26–31	9,800	7,950	8,870	.....
April	21,300	5,510	14,800	.....
May	17,300	3,110	6,480	.....
June	16,600	2,030	5,210	.....
July	15,000	1,700	7,900	.....
August	18,400	2,030	5,490	.....
September	6,850	2,030	3,030	.....
1901–02.				
October	16,600	1,300	5,270	.....
November 1–19	5,510	2,030	3,710	.....
March 10–31	8,060	3,680	6,330	.....
April	23,300	2,030	6,830	.....
May	17,000	3,870	9,470	.....
June	23,300	2,000	6,960	.....
July	15,000	1,700	5,160	.....
August	8,420	1,540	2,250	.....
September	8,780	1,700	2,300	.....

Monthly discharge of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1913—Continued.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1902–03.				
October	6,630	1,700	2,520	.....
November	28,200	4,000	9,890	.....
December 1–9	3,870	2,030	2,730	.....
March 18–31	32,800	8,300	17,100	.....
April	26,600	6,630	10,200	.....
May	41,900	13,700	22,700	.....
June	25,600	1,300	7,050	.....
July	34,700	2,030	12,400	.....
August	22,600	3,000	6,900	.....
September	45,900	4,280	16,400	.....
1903–04.				
October	24,200	4,280	11,700	.....
November 1–19	4,280	2,560	3,330	.....
April 6–30	20,500	8,540	12,900	.....
May	33,300	6,850	15,100	.....
June	21,400	4,280	11,000	.....
July	20,400	3,000	7,220	.....
August	11,500	1,300	2,900	.....
September	23,300	1,300	7,380	.....
1904–05.				
October	39,600	3,110	14,600	.....
November	13,900	2,560	4,690	.....
March, 23–31	30,200	4,280	14,900	.....
April	25,400	2,450	9,720	A.
May	26,600	4,760	11,800	A.
June	64,400	4,760	21,600	A.
July	27,000	3,110	9,530	A.
August	8,600	2,450	4,780	A.
September	22,300	3,340	7,650	A.
1905–06.				
October	14,700	2,560	7,890	.....
November	6,160	3,680	4,870	.....
December, 1–21	5,510	4,280	4,630	.....
April	38,500	10,300	23,400	.....
May	22,000	3,110	11,400	.....
June	24,100	2,000	8,660	.....
July	13,000	1,700	4,660	.....
August	16,800	1,870	5,820	.....
September	19,400	1,700	5,930	.....
1906–07.				
October	13,300	2,030	5,780	.....
November	9,290	4,280	7,050	.....
March, 17–31	36,400	3,570	15,200	A.
April	30,200	6,300	13,900	A.
May	18,800	8,000	11,400	A.
June	9,800	4,520	6,280	A.
July	8,300	2,030	3,970	A.
August	2,670	1,750	2,230	A.
September	32,300	1,430	8,220	A.
1907–08.				
October	6,300	2,240	3,240	A.
November	3,110	1,830	2,630	A.
December	.....	.....	1,600	C.
January	.....	.....	1,360	C.
February	.....	.....	1,300	C.
March	3,800	.....	1,950	B.
April	27,800	2,890	12,300	A.
May	24,200	7,710	15,700	A.
June	18,400	4,040	8,880	A.
July	5,260	2,670	3,670	A.
August	4,040	2,030	2,730	A.
September	2,670	1,430	1,990	A.
The year	27,800	.....	4,780	

Monthly discharge of Chippewa River at Chippewa Falls, Wis., for the years ending Sept. 30, 1888–1913—Continued.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1908–09.				
October	2,890	1,580	2,200	A.
November	2,890	1,750	2,210	A.
December	.....	.....	1,500	D.
January	.....	.....	1,360	C.
February	.....	.....	1,180	C.
March	.....	.....	1,250	C.
April	16,600	.....	7,820	B.
May	26,200	4,760	15,200	A.
June	21,900	3,800	8,020	A.
July	9,800	1,830	4,060	A.
August	6,300	2,030	3,600	A.
September	3,110	1,750	2,360	A.
The year	26,200	.....	4,250	
1909–10.				
October	4,110	1,840	3,000	A.
November	21,300	3,870	9,700	A.
December	10,500	5,630	6,940	B.
January	7,000	3,070	5,110	C.
February	3,300	2,320	2,750	D.
March	8,130	2,740	4,810	C.
April	9,580	3,180	5,640	B.
May	9,870	2,120	5,180	A.
June	9,290	1,580	2,870	B.
July	2,740	460	1,200	D.
August	2,120	860	1,450	C.
September	3,410	1,090	2,200	B.
The year	21,300	460	4,240	
1910–11.				
October	2,640	1,300	1,990	B.
November	1,580	1,300	1,460	C.
December	1,750	1,300	1,430	C.
January	2,120	1,580	1,630	D.
February	1,930	1,580	1,680	D.
March	6,440	1,580	3,210	C.
April	8,420	2,530	5,160	B.
May	11,400	2,740	5,310	B.
June	10,200	1,300	3,520	B.
July	2,120	1,090	1,410	C.
1911–12.				
October	33,400	2,220	12,000	B.
November 1–16	4,350	2,220	2,450	B.
April	22,400	4,850	13,100	A.
May	28,800	6,170	14,700	A.
June	10,800	2,120	5,030	B.
July	12,300	1,580	3,090	B.
1912–13.				
April	35,000	11,400	18,800	A.
May	19,100	5,110	9,850	A.
June	9,870	2,120	5,380	B.
July	22,400	1,500	8,460	A.
August	7,840	2,120	3,950	B.
September	5,630	1,840	3,170	B.

NOTE.—Monthly discharge values for the years ending Sept. 30, 1899–1909 differ from those previously published in the United States Geological Survey Water Supply Papers on account of revising the daily discharge estimates for stages below gage height 0.8 foot.

RED CEDAR RIVER AT CEDAR FALLS, WIS.

Location.—At a highway bridge in the vicinity of Cedar Falls, Wis., immediately below the power plant of the Chippewa Valley Railway, Light & Power Co., 4½ miles above the crossing of the Chicago, St. Paul, Minneapolis & Omaha Railway.

Records available.—April 1, 1909, to September 30, 1913.

Drainage area.—Not measured.

Gage.—Staff gage fastened to bridge pier; read morning and evening to tenths.

Channel and control.—Heavy gravel and probably permanent.

Discharge measurements.—None have been made at this station.

Winter flow.—Practically no ice forms in the vicinity of the gage, owing to high temperature of the water coming from the reservoir.

Regulation.—Daily fluctuations caused by operation of the power plant above the gage.

Cooperation.—All gage heights furnished by the Chippewa Valley Railway, Light & Power Co.

Daily gage height, in feet, of Red Cedar River at Cedar Falls, Wis., for the year ending Sept. 30, 1913.

[Frank Wilkinson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.6	2.3	2.2	2.6	2.6	2.5	5.5	2.9	2.8	2.3	2.55	2.4
2	2.6	2.3	2.2	2.5	2.0	2.0	5.55	2.9	2.9	2.0	2.5	2.4
3	2.6	2.4	2.3	2.5	2.6	2.5	5.6	3.0	2.85	2.0	2.3	2.4
4	2.6	2.4	2.3	2.5	2.6	2.6	5.75	2.5	2.8	1.45	2.4	2.6
5	2.6	2.5	2.4	2.0	2.5	2.5	5.55	2.8	2.8	2.1	2.4	2.6
6	2.5	2.5	2.3	2.4	2.5	2.5	4.8	2.8	2.75	4.0	2.45	2.5
7	2.5	2.5	2.2	2.4	2.4	2.45	4.35	2.8	2.7	4.2	2.4	2.4
8	2.5	2.5	2.2	2.5	2.45	2.5	4.15	2.75	2.65	3.9	2.4	2.4
9	2.5	2.5	2.4	2.5	1.6	2.0	3.85	2.7	2.6	3.55	2.4	2.4
10	2.5	2.5	2.3	2.4	2.5	2.8	3.3	2.7	2.6	3.2	2.3	2.4
11	2.5	2.5	2.35	2.3	2.4	2.55	3.6	2.0	2.5	3.0	2.4	2.4
12	2.7	2.6	2.4	2.1	2.45	3.35	3.7	2.3	2.5	3.2	2.4	2.5
13	2.8	2.4	2.4	2.3	2.45	3.8	3.5	2.4	2.5	2.6	2.3	2.4
14	2.9	2.5	2.4	2.3	2.45	4.4	3.5	2.5	2.5	2.9	2.4	2.1
15	2.8	2.5	[a].6	2.4	2.5	4.4	3.5	2.75	2.6	3.0	2.4	2.4
16	2.8	2.5	2.4	2.4	1.6	3.95	3.5	2.95	2.7	3.0	2.4	2.35
17	2.7	2.4	2.4	2.4	2.4	3.8	3.5	3.05	2.7	3.1	2.3	2.4
18	2.6	2.4	2.4	2.3	2.4	3.35	3.5	3.3	2.6	3.1	2.4	2.4
19	2.6	2.4	2.3	2.3	2.45	3.25	3.5	3.45	2.6	3.1	2.4	2.4
20	2.6	2.4	2.4	2.4	2.45	4.05	3.35	3.6	2.6	2.7	2.4	2.4
21	2.5	2.4	2.5	2.4	2.4	4.1	3.3	4.0	2.6	2.65	2.4	2.4
22	2.4	2.4	2.4	2.3	2.5	3.9	3.3	4.05	2.25	2.6	2.5	2.4
23	2.4	2.4	2.4	2.4	1.8	4.15	3.3	4.0	2.65	2.6	2.45	2.4
24	2.3	2.3	2.5	2.4	2.3	4.4	3.3	3.8	2.6	2.6	2.25	2.5
25	2.3	2.3	2.5	2.4	2.45	4.4	3.2	3.45	2.6	2.6	2.4	2.5
26	2.3	2.3	2.6	2.0	2.4	4.15	3.2	3.35	2.6	2.6	2.4	2.6
27	2.3	2.2	2.5	2.4	2.45	4.1	2.8	3.3	2.6	2.4	2.4	2.5
28	2.3	2.2	2.5	2.5	2.4	3.9	3.1	3.25	2.6	2.6	2.4	2.3
29	2.3	2.2	[a]1.6	2.6	.....	4.2	3.1	3.2	2.4	2.9	2.4	2.4
30	2.3	2.3	2.5	2.5	.....	5.1	3.0	3.1	2.6	2.65	2.4	2.4
31	2.3	.....	2.5	2.4	.....	.....	.....	3.0	.....	2.55	2.4	.....

[a] Turbines in power house above the station shut down.

NOTE.—Discharge relation probably not affected by ice during the year ending Sept. 30, 1913.

RED CEDAR RIVER AT MENOMINEE, WIS.

Location.—About 900 feet below the power house of the Wisconsin & Minnesota Light & Power Co., about 13 miles above confluence of Red Cedar and Chippewa rivers. Wilson Creek discharges from the right into service reservoir just above station.

Records available.—June 16, 1907, to September 5, 1908; May 9 to September 30, 1913.

Drainage area.—1,810 square miles.

Gage.—Barrett & Lawrence recording gage installed May 9, 1913, over wooden intake and well on the right bank of the river about 1 mile above highway bridge located about 200 rods west of the Chicago & Northwestern Railway station west of Menominee. Gage used from June 16, 1907, to September 5, 1908, was attached to this bridge. No determined relation between datums of the gages.

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

Discharge measurements.—Made from highway bridge to which old gage was fastened.

Winter flow.—Discharge relation not affected by ice, as the relatively high temperature of the water coming from the service reservoir immediately above the gage prevents ice from forming on the control section below.

Regulation.—Flow controlled by dams at Menominee and at Cedar Falls, also by natural storage in the headwaters. Operation of the power plants of the Chippewa Valley Railway, Light & Power Co., at Menominee and Cedar Falls and of smaller plants on the tributaries to Red Cedar River above Menominee causes considerable diurnal fluctuation in stage.

Accuracy.—Records excellent, as rating curve has been carefully developed and the recording gage enables the mean stage to be accurately determined.

Cooperation.—Recording gage installed and gage heights furnished by Wisconsin & Minnesota Light & Power Co. Discharge measurements and computations made by United States Geological Survey in cooperation with Railroad Commission of Wisconsin.

Discharge measurements of Red Cedar River at Menominee, Wis., during the year ending Sept. 30, 1913.

Date.	Made by—	[a] Gage height.	Discharge.	Date.	Made by—	[a] Gage height.	Discharge
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 18	W. G. Hoyt	2.22	667	Mar. 20	S. B. Soulé	3.80	3,070
18	do	2.52	1,060	May 7	do	2.78	1,410
20	S. B. Soulé	3.42	2,350				

[a] Hook gage located at the recording gage.

Daily gage height, in feet, of Red Cedar River at Menominee, Wis., for the year ending Sept. 30, 1913.

[B. & L. recording gage.]

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	2.88	2.51	2.56	2.25	16	2.80	2.60	2.90	2.50	2.51
2	.....	2.83	2.44	2.49	2.45	17	2.74	2.64	2.92	2.43	2.46
3	.....	2.77	2.34	2.23	2.48	18	3.15	2.52	2.88	2.30	2.37
4	.....	2.52	2.26	2.35	2.43	19	3.34	2.41	2.83	2.35	2.44
5	.....	2.44	2.73	2.33	2.49	20	3.46	2.40	2.54	2.36	2.42
6	.....	2.53	3.92	2.36	2.54	21	3.29	2.43	2.69	2.49	2.28
7	.....	2.52	3.90	2.37	2.30	22	3.82	2.12	2.57	2.49	2.49
8	.....	2.45	3.77	2.42	2.46	23	3.36	2.34	2.53	2.54	2.48
9	2.12	2.67	3.48	2.47	2.46	24	3.36	2.50	2.57	2.29	2.45
10	2.52	2.53	3.05	2.20	2.47	25	3.20	2.50	2.61	2.55	2.41
11	2.45	2.41	2.91	2.42	2.39	26	3.19	2.44	2.56	2.58	2.56
12	2.49	2.36	2.88	2.42	2.30	27	3.09	2.38	2.27	2.56	2.52
13	2.62	2.40	2.48	2.31	2.56	28	3.02	2.54	2.48	2.53	2.12
14	2.56	2.39	2.85	2.42	2.27	29	2.87	2.49	2.58	2.47	2.46
15	2.60	2.10	2.93	2.52	2.44	30	3.07	2.46	2.51	2.44	2.42
						31	3.21	.....	2.73	2.13	.....

Daily discharge, in second-feet, of Red Cedar River at Menominee, Wis., for the year ending Sept. 30, 1913.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	1,550	1,030	1,100	710	16	1,430	1,150	1,580	1,020	1,030
2	.....	1,480	942	1,010	955	17	1,350	1,210	1,610	929	988
3	.....	1,390	818	686	994	18	1,960	1,050	1,550	772	854
4	.....	1,050	720	830	929	19	2,250	903	1,480	830	942
5	.....	940	1,330	806	1,010	20	2,450	890	1,070	842	916
6	.....	1,060	3,330	842	1,070	21	2,170	929	1,280	1,010	746
7	.....	1,050	3,260	854	770	22	3,110	554	1,110	1,010	1,010
8	.....	955	3,010	916	968	23	2,290	818	1,060	1,070	994
9	554	1,250	2,490	981	968	24	2,290	1,020	1,110	758	952
10	1,050	1,060	1,800	650	981	25	2,030	1,020	1,160	1,080	903
11	955	903	1,600	916	878	26	2,020	942	1,100	1,120	1,120
12	1,010	842	1,550	916	770	27	1,860	866	734	1,100	1,050
13	1,180	890	990	782	1,120	28	1,760	1,070	994	1,060	554
14	1,120	878	1,500	916	734	29	1,540	1,010	1,120	991	968
15	1,150	530	1,620	1,050	942	30	1,840	968	1,030	942	916
						31	2,050	.....	1,330	566	.....

NOTE.—Daily discharge computed from a rating curve well defined between 530 and 7,730 second-feet (gage heights 2.1 to 5.7 feet).

Monthly discharge of Red Cedar River at Menomonie, Wis., for the year ending Sept. 30, 1913.

[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.		
May 9–31	3,110	554	1,710	0.945	0.81	A.
June	1,550	530	1,010	.558	.62	A.
July	3,300	720	1,460	.807	.93	A.
August	1,120	566	915	.506	.58	A.
September	1,120	554	925	.511	.57	A.

ZUMBRO RIVER AT ZUMBRO FALLS, MINN.

Location.—At the highway bridge at Zumbro Falls, about 8 miles below mouth of South Branch.

Records available.—June 8, 1909, to September 30, 1913.

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 from 5.0 to 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 an extremely cold period, ice forming below the gage causes backwater. The river is fed, however, by springs in the vicinity of the gage and the warmer water gradually wears away the ice. Gage is read daily during the winter and close inspection of gage heights and temperature records furnish basis for necessary corrections to estimates of daily discharge.

Maximum flow.—The high water of June, 1908, is marked by a spike in a telegraph pole near the railroad station at Zumbro Falls. This spike is 26.7 feet above the datum of the gage. 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 flood of 1908.

Regulation.—The effect of 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, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	Sec.-ft.			Feet.	Sec.-ft.
Feb. 7	S. B. Soulé	4.86	[a] 124	June 26	Hoyt & Peterson	10.10	[b] 2,930
Apr. 1	W. G. Hoyt	6.12	586	Sept. 26	S. B. Soulé	5.01	199
1	do	6.12	576	26	do	5.01	195

[a] About one-fourth ice cover at gage; very little ice at control. [b] Measurement made by surface method.

Daily gage height, in feet, of Zumbro River at Zumbro Falls, Minn., for the year ending Sept. 30, 1913.

[A. H. Sugg, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.98	5.0	5.1	4.90	5.0	4.90	6.2	5.2	5.3	5.75	5.25	4.88
2	4.98	4.99	5.1	4.90	4.90	.....	6.9	5.2	5.3	5.6	5.15	4.90
3	4.96	5.0	5.0	4.85	4.90	4.89	7.5	5.25	5.2	5.5	5.1	4.92
4	4.90	4.99	5.05	4.85	4.90	4.86	6.9	5.3	5.2	5.75	5.05	4.91
5	4.94	4.99	5.1	4.80	4.90	4.89	6.4	5.35	5.2	6.2	5.0	4.86
6	4.92	4.95	5.15	4.80	4.90	4.90	6.05	5.35	5.15	6.6	4.99	4.80
7	4.89	4.99	4.95	4.85	4.90	4.89	5.85	5.3	5.15	6.15	5.0	4.80
8	4.95	4.96	.....	4.90	4.90	4.92	5.75	5.25	5.1	5.8	4.98	4.80
9	4.89	4.99	.....	4.90	4.90	7.8	5.7	5.2	5.0	5.6	5.0	4.85
10	4.94	4.98	6.05	4.85	4.90	11.2	5.7	5.2	5.0	5.5	5.05	4.85
11	4.96	4.98	5.9	4.85	5.0	11.0	5.75	5.15	4.96	5.5	5.4	4.92
12	5.05	5.0	.....	4.85	5.0	9.5	6.2	5.15	4.98	5.55	5.35	4.84
13	5.2	5.15	5.4	4.85	4.80	8.2	6.5	5.2	5.0	5.6	5.3	4.85
14	5.2	5.35	5.2	4.85	4.80	10.6	6.3	5.2	4.96	5.65	5.2	4.85
15	5.2	5.4	5.05	4.85	4.90	8.7	6.0	5.5	4.88	5.8	5.1	4.79
16	5.15	5.25	5.0	4.85	4.90	7.5	5.8	5.9	4.81	5.5	5.05	4.78
17	5.1	5.2	5.0	4.90	4.90	6.4	5.7	6.3	4.82	5.4	5.0	4.80
18	5.1	5.15	4.99	4.90	5.1	6.2	5.6	6.6	4.81	5.35	4.98	4.81
19	5.1	5.2	5.0	4.90	5.45	6.9	5.55	6.45	4.80	5.3	5.0	5.0
20	5.05	5.1	4.96	4.95	5.2	6.8	5.45	6.25	5.0	5.2	5.0	5.0
21	5.05	5.1	4.75	4.90	5.1	6.2	5.45	6.5	4.96	5.2	5.4	4.90
22	5.05	5.1	4.75	4.90	4.80	5.7	5.5	6.6	4.95	5.2	5.05	4.84
23	5.05	5.1	4.86	4.90	4.85	5.9	5.4	6.4	4.94	5.1	5.0	4.86
24	5.0	5.05	4.95	4.90	4.90	12.4	5.4	6.1	5.1	5.15	5.0	4.94
25	5.0	5.0	5.0	4.90	5.0	10.4	5.4	5.9	9.7	5.1	4.99	5.0
26	5.0	5.0	4.96	4.90	5.0	8.0	5.4	5.8	9.7	5.1	4.98	4.98
27	5.05	5.0	4.92	4.90	4.95	6.8	5.3	5.7	7.9	5.0	4.99	4.98
28	5.0	5.05	4.91	4.90	4.90	6.5	5.35	5.7	7.0	5.0	4.96	4.94
29	5.0	5.0	4.95	4.90	.....	6.6	5.3	5.6	6.3	5.6	4.90	4.94
30	5.0	4.98	4.85	4.95	.....	6.5	5.25	5.5	5.85	5.7	4.96	4.92
31	5.0	.....	4.99	5.1	.....	6.3	.....	5.4	.....	5.5	4.90	.....

NOTE.—Discharge relation probably affected by ice about Dec. 4–15, Jan. 7 to Feb. 14, and Feb. 23 to Mar. 8.

Daily discharge, in second-feet, of Zumbro River at Zumbro Falls, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	186	190	210	164	.....	.....	612	246	276	433	261	169
2	186	188	210	164	.....	.....	930	246	276	378	232	172
3	183	190	190	156	.....	.....	1,240	261	246	342	218	176
4	172	188	.....	156	.....	.....	930	276	246	433	206	174
5	179	188	.....	150	.....	.....	698	292	246	612	193	166
6	176	181	.....	150	.....	.....	550	292	232	788	191	156
7	170	188	.....	.....	.....	.....	471	276	232	591	193	156
8	181	183	.....	.....	.....	.....	433	261	218	452	189	156
9	170	188	.....	.....	.....	1,400	414	246	193	378	193	164
10	179	186	.....	.....	.....	3,770	414	246	193	342	206	164
11	183	186	.....	.....	.....	3,610	433	232	185	342	308	176
12	200	190	.....	.....	.....	2,480	612	232	189	360	292	162
13	232	221	.....	.....	.....	1,640	742	246	193	378	276	164
14	232	269	.....	.....	.....	3,300	654	246	185	396	246	164
15	232	282	.....	.....	164	1,940	530	342	169	452	218	155
16	221	244	190	.....	164	1,240	452	490	158	342	206	154
17	210	232	190	.....	164	698	414	654	159	308	193	156
18	210	221	188	.....	206	612	378	788	158	292	189	158
19	210	232	190	.....	308	930	360	720	156	276	193	193
20	200	210	183	.....	232	882	325	633	193	246	193	193
21	200	210	149	.....	206	612	325	742	185	246	308	172
22	200	210	149	.....	150	414	342	788	182	246	206	162
23	200	210	166	.....	.....	490	308	698	180	218	193	166
24	190	200	181	.....	.....	4,730	308	570	218	232	193	180
25	190	190	190	.....	.....	3,140	308	490	2,620	218	191	193
26	190	190	183	.....	.....	1,520	308	452	2,620	218	189	189
27	200	190	176	.....	.....	882	276	414	1,460	193	191	189
28	190	200	174	.....	.....	742	292	414	980	193	185	180
29	190	190	181	.....	.....	788	276	378	654	378	172	180
30	190	186	164	.....	.....	742	261	342	471	414	182	176
31	190	.....	188	.....	.....	654	.....	308	.....	342	172	.....

NOTE.—Daily discharge Oct. 1 to Dec. 31 computed from a fairly well defined rating curve. Daily discharge Mar. 9 to Sept. 30 computed from a rating curve well defined between 156 and 3,610 second-feet (gage heights 4.8 and 11.0 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, and climatic records as follows: Dec. 4–15, 185 second-feet; Jan. 7–31, 140 second-feet; Feb. 1–14, 127 second-feet; Feb. 23–28, 136 second-feet; and Mar. 1–8, 160 second-feet.

Monthly discharge of Zumbro River at Zumbro Falls, Minn., for the years ending Sept. 30, 1912–13.

[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.		
1912.						
October	8,340	147	1,500	1.34	1.54	B.
November	520	200	350	.312	.35	A.
December	3,840	202	573	.512	.59	B.
January	.....	.....	245	.219	.25	C.
February	269	232	242	.216	.23	B.
March	5,200	221	993	.887	1.02	A.
April	2,320	566	1,200	1.07	1.19	A.
May	5,860	325	846	.755	.87	A.
June	442	210	294	.262	.29	A.
July	462	200	303	.271	.31	A.
August	442	190	241	.215	.25	A.
September	232	176	198	.177	.20	A.
The year	8,340	.....	585	.522	7.09	
1913.						
October	232	170	195	.174	.20	A.
November	282	181	204	.182	.20	A.
December	.....	.....	183	.163	.19	B.
January	.....	.....	143	.128	.15	C.
February	308	.....	149	.133	.14	C.
March	4,730	.....	1,240	1.11	1.28	B.
April	1,240	261	487	.435	.49	A.
May	788	232	414	.370	.43	A.
June	2,620	156	456	.407	.45	B.
July	788	193	356	.318	.37	A.
August	308	172	212	.189	.22	A.
September	192	154	170	.152	.17	A.
The year	4,730	.....	353	.315	4.29	

NOTE.—Estimates of "Discharge in second-feet per square mile" and "Run-off (depth in inches)" for 1912 supersede those published in Water-Supply Paper 325, which were computed from an erroneous value of the drainage area. Estimates for October, November, and December, 1911, are republished to complete the data for the climatic year.

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 mouth of river, 6 miles below mouth of Middle Branch.

Records available.—June 16, 1911, to September 30, 1913.

Drainage area.—821 square miles.

Gage.—Chain gage attached to bridge; read morning and evening to quarter-tenths Limits of use: Hundredths below 2.5, half-tenths from 2.5 to 3.5, and tenths above 3.5 feet.

Channel and control.—Well-defined riffle a short distance below gage; channel practically permanent.

Discharge measurements.—Made from highway bridge.

Winter flow.—River freezes over in vicinity of gage, but rapids below remain partly open, so that backwater effect is small. Discharge measurements are made to aid in making estimates for the winter period.

Regulation.—Flow at gage not noticeably affected by operation of small power plants above.

Discharge measurements of South Branch of Zumbro River near Zumbro Falls, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 6	S. B. Soulé	2.14	[a] 82	June 25	B. J. Peterson	7.18	[b] 3,500
Apr. 2	W. G. Hoyt	2.67	363	Sept. 25	S. B. Soulé	2.00	136

[a] Almost completely frozen over at control.
[b] Velocity determined by surface method.

Daily gage height, in feet, of South Branch of Zumbro River near Zumbro Falls, Minn., for the year ending Sept. 30, 1913.

[W. M. Whipple, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.96	1.99	2.01	1.94	.....	.....	2.75	2.18	2.25	2.55	2.18	1.92
2	1.96	1.99	2.06	1.89	.....	.....	2.7	2.19	2.16	2.38	2.11	1.99
3	1.99	1.99	2.09	1.84	.....	.....	2.95	2.18	2.14	2.31	2.06	1.96
4	1.94	1.99	2.04	1.86	.....	.....	3.05	2.18	2.11	2.42	2.04	1.98
5	1.94	1.96	2.01	1.89	.....	.....	2.85	2.21	2.13	2.6	2.06	1.94
6	1.99	1.94	2.04	1.86	2.15	2.12	2.65	2.18	2.09	3.2	2.01	1.98
7	2.01	1.96	2.04	1.84	.....	.....	2.48	2.18	2.06	2.8	2.01	1.96
8	1.96	1.94	1.99	1.85	.....	3.7	2.34	2.18	2.00	2.55	2.08	1.94
9	1.99	1.96	2.01	.....	.....	7.2	2.13	2.16	1.98	2.38	2.06	1.99
10	1.99	1.94	2.01	.....	.....	6.5	2.10	2.12	1.99	2.28	2.20	1.96
11	1.96	1.94	2.02	.....	.....	6.6	2.48	2.13	1.98	2.25	2.35	1.99
12	2.06	1.99	1.94	.....	.....	5.4	2.7	2.09	2.00	2.32	2.24	1.96
13	2.19	2.08	1.91	.....	2.2	4.7	2.9	2.08	2.03	2.36	2.19	1.99
14	2.14	2.19	1.96	.....	.....	5.6	2.8	2.06	2.03	2.5	2.14	1.94
15	2.09	2.14	1.99	.....	.....	4.8	2.55	2.41	1.98	2.55	2.10	1.91
16	2.08	2.14	1.96	2.25	.....	3.3	2.45	2.65	1.93	2.31	2.06	1.91
17	2.09	2.09	1.99	.....	.....	2.9	2.38	2.9	1.95	2.26	2.05	1.91
18	2.06	2.04	1.96	.....	.....	2.85	2.33	3.05	1.95	2.19	2.02	1.91
19	2.01	2.05	1.99	.....	.....	3.15	2.28	2.8	1.95	2.14	2.02	1.98
20	2.01	2.06	1.95	.....	.....	3.1	2.23	2.7	1.97	2.10	2.01	2.01
21	2.04	2.01	1.82	.....	2.28	2.65	2.19	2.95	2.04	2.11	2.24	1.96
22	2.01	2.01	1.91	.....	.....	2.49	2.19	3.05	1.98	2.09	2.04	1.94
23	2.01	2.04	1.94	2.1	.....	2.38	2.23	2.85	1.95	2.06	2.01	1.99
24	2.01	2.01	1.92	.....	.....	8.2	2.19	2.65	2.43	2.05	2.00	2.04
25	1.98	1.99	1.96	.....	.....	6.2	2.19	2.55	6.1	2.05	1.99	2.04
26	1.99	1.99	1.91	.....	.....	4.2	2.19	2.45	5.8	2.06	1.99	2.01
27	2.00	1.99	1.94	.....	2.15	3.3	2.19	2.41	4.2	2.06	2.01	2.01
28	1.99	2.01	1.89	.....	.....	3.1	2.19	2.36	3.4	2.02	1.95	2.01
29	2.01	1.96	1.84	.....	.....	3.0	2.22	2.31	2.85	2.85	1.96	1.96
30	1.99	2.00	1.86	2.12	.....	2.95	2.22	2.27	2.65	2.44	1.95	1.99
31	1.96	.....	1.91	.....	.....	2.8	.....	2.27	.....	2.35	1.91	.....

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

Daily discharge, in second-feet, of South Branch of Zumbro River near Zumbro Falls Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	103	112	118	96	.....	.....	399	176	202	317	176	90
2	103	112	135	82	.....	.....	378	180	169	250	152	112
3	112	112	145	71	.....	.....	484	176	162	224	135	103
4	96	112	128	75	.....	.....	528	176	152	266	128	109
5	96	103	118	82	.....	.....	441	187	158	337	135	96
6	112	96	128	75	.....	.....	358	176	145	595	118	109
7	118	103	128	71	.....	.....	289	176	135	420	118	103
8	103	96	112	73	.....	.....	235	176	115	317	141	96
9	112	103	118	.....	.....	.....	158	169	109	250	135	112
10	112	96	118	.....	.....	2,940	148	155	112	213	183	103
11	103	96	122	.....	.....	3,030	289	158	109	202	239	112
12	135	112	96	.....	.....	1,960	378	145	115	228	198	103
13	180	141	87	.....	.....	1,440	462	141	125	243	180	112
14	162	180	103	.....	.....	2,130	420	135	125	297	162	96
15	145	162	112	.....	.....	1,510	317	262	109	317	148	87
16	141	162	103	.....	.....	640	278	358	93	224	135	87
17	145	145	112	.....	.....	462	250	462	100	205	132	87
18	135	128	103	.....	.....	441	231	528	100	180	122	87
19	118	132	112	.....	.....	572	213	420	100	162	122	109
20	118	135	100	.....	.....	550	194	378	106	148	118	118
21	128	118	66	.....	.....	358	180	484	128	152	198	103
22	118	118	87	.....	.....	293	180	528	109	145	128	96
23	118	128	96	.....	.....	250	194	441	100	135	118	112
24	118	118	90	.....	.....	4,590	180	358	270	132	115	128
25	109	112	103	.....	.....	2,670	180	317	2,580	132	112	128
26	112	112	87	.....	.....	1,130	180	278	2,310	135	112	118
27	115	112	96	.....	.....	640	180	262	1,130	135	118	118
28	112	118	82	.....	.....	550	180	243	690	122	100	118
29	118	103	71	.....	.....	505	190	224	441	441	103	103
30	112	115	75	.....	.....	484	190	209	358	274	100	112
31	103	.....	87	.....	.....	420	.....	209	.....	239	87	.....

NOTE.—Discharge interpolated for days when gage was not read. 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 discharge of 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 feet). Discharge estimated, because of ice, from gage heights, observer's notes, discharge measurements, climatic records, and discharge of adjacent drainage areas, as follows: Jan. 9–31, 80 second-feet; Feb. 1–28, 90 second-feet; and Mar. 1–9, 500 second-feet.

Monthly discharge of South Branch of Zumbro River near Zumbro Falls, Minn., for the year ending Sept. 30, 1913.

[Drainage area, 821 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	180	96	120	0.146	0.17	B.
November	180	96	120	.146	.16	B.
December	145	66	104	.127	.15	C.
January	.....	.....	79.5	.097	.11	C.
February	.....	.....	90	.110	.11	C.
March	4,590	.....	1,030	1.25	1.44	C.
April	528	148	276	.336	.37	A.
May	528	135	267	.325	.37	A.
June	2,580	93	355	.432	.48	B.
July	595	122	240	.292	.34	A.
August	239	87	138	.168	.19	B.
September	128	87	106	.129	.14	C.
The year	4,590	.....	246	.300	4.03	

ROOT RIVER NEAR HOUSTON, MINN.

Location.—In sec. 34, T. 104 N., R. 6 W., at highway bridge 1 mile east of Houston and 1 mile above mouth of South Root River, which is ordinarily a relatively insignificant stream, but during heavy rains floods considerable area.

Records available.—May 28, 1909, to September 30, 1913.

Drainage area.—1,560 square miles.

Gage.—Vertical staff, read 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 is shifting, scouring out during floods and gradually filling in afterwards; nearly permanent at low stages.

Discharge measurements.—Made from bridge.

Winter flow.—Gage readings discontinued during ice period of 1913; flow estimated from that of North Branch Root near Lanesboro, there being a well-defined open-water relation between these stations.

Regulation.—No dam below 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 thus the dam has no influence on the gage heights at Houston.

Accuracy.—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 section of the rating curve, based on discharge measurements made 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 rating curve for 1911. Maximum gage height, 10.8 feet, occurred on August 14, 1911, discharge about 15,200 second-feet. Because of shifting channel the results can not be considered better than fair.

Discharge measurements of Root River near Houston, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 31	S. B. Soulé	3.28	1,050	Sept. 24	B. J. Peterson	1.20	296
June 28	do	1.88	552				

Daily gage height, in feet, of Root River near Houston, Minn., for the year ending Sept. 30, 1913.

[Olaf Larson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.4	1.4	1.4	.....	.....	.....	3.0	1.4	1.7	1.4	1.8	1.2
2	1.4	1.4	1.7	.....	.....	.....	2.8	1.4	1.6	1.3	1.7	1.3
3	1.3	1.4	1.5	.....	.....	.....	3.0	1.4	1.5	1.3	1.6	1.3
4	1.3	1.4	1.5	.....	.....	.....	3.2	1.6	1.5	4.1	1.5	1.3
5	1.3	1.4	1.5	.....	.....	.....	2.9	1.5	1.4	3.7	1.4	1.3
6	1.3	1.4	1.6	.....	.....	.....	2.6	1.5	1.4	2.4	1.4	1.2
7	1.3	1.4	1.3	.....	.....	.....	2.5	1.4	1.4	1.9	1.3	1.2
8	1.3	1.4	1.4	.....	.....	.....	2.4	1.4	1.4	1.7	1.3	1.2
9	1.3	1.4	2.8	.....	.....	.....	2.2	1.4	1.4	1.5	1.5	1.2
10	1.3	1.3	.....	.....	.....	.....	2.3	1.4	1.3	1.4	2.6	1.2
11	1.3	1.4	.....	.....	.....	.....	2.3	1.4	1.3	1.6	2.1	1.2
12	1.8	1.4	.....	.....	.....	.....	2.5	1.4	1.3	2.1	2.0	1.2
13	1.9	1.6	.....	.....	.....	.....	2.7	1.3	1.2	2.0	1.7	1.2
14	1.8	1.5	.....	.....	.....	.....	2.5	1.5	1.2	3.4	1.6	1.3
15	1.7	1.6	.....	.....	.....	.....	2.4	1.7	1.3	2.9	1.5	1.2
16	1.6	1.6	.....	.....	.....	.....	2.2	1.7	1.2	2.0	1.5	1.2
17	1.5	1.5	.....	.....	.....	.....	2.1	2.0	1.2	1.7	1.5	1.2
18	1.5	1.4	.....	.....	.....	.....	2.0	2.3	1.2	1.6	1.4	1.2
19	1.4	1.4	.....	.....	.....	.....	1.9	2.2	1.2	1.6	1.4	1.2
20	1.5	1.4	.....	.....	.....	.....	1.8	2.4	1.7	1.5	1.4	1.6
21	1.5	1.4	.....	.....	.....	.....	1.8	2.7	1.6	1.4	1.6	1.3
22	1.5	1.5	.....	.....	.....	3.6	1.8	2.6	1.4	1.4	1.4	1.2
23	1.4	1.4	.....	.....	.....	3.1	1.7	2.5	1.3	1.4	1.3	1.2
24	1.4	1.4	.....	.....	.....	8.8	1.7	2.4	1.3	1.4	1.4	1.2
25	1.4	1.4	.....	.....	.....	9.0	1.6	2.2	2.1	1.3	1.3	1.4
26	1.4	1.4	.....	.....	.....	5.3	1.6	2.1	1.4	1.3	1.3	1.4
27	1.4	1.4	.....	.....	.....	4.1	1.6	2.1	1.5	1.4	1.3	1.4
28	1.4	1.2	.....	.....	.....	3.4	1.5	2.1	1.9	1.3	1.3	1.3
29	1.4	1.3	.....	.....	.....	3.8	1.5	1.9	1.7	2.5	1.2	1.2
30	1.4	1.3	.....	.....	.....	3.7	1.5	1.8	1.5	3.4	1.2	1.4
31	1.4	.....	.....	.....	.....	3.3	.....	1.7	.....	2.2	1.3	.....

NOTE.—Discharge relation affected by ice about Dec. 9, 1912, to Mar. 22, 1913.

Daily discharge, in second-feet, of Root River near Houston, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	405	405	405	.....	.....	.....	930	405	482	405	507	301
2	405	405	482	.....	.....	.....	851	405	456	380	471	325
3	380	405	430	.....	.....	.....	930	405	430	380	440	325
4	380	405	430	.....	.....	.....	1,010	456	430	1,440	410	322
5	380	405	430	.....	.....	.....	890	430	405	1,230	379	322
6	380	405	456	.....	.....	.....	776	430	405	703	379	296
7	380	405	380	.....	.....	.....	739	405	405	537	350	296
8	380	405	405	.....	.....	.....	703	405	405	482	350	296
9	380	405	.....	.....	.....	.....	632	405	405	430	404	294
10	380	380	.....	.....	.....	.....	667	405	380	405	791	294
11	380	405	.....	.....	.....	.....	667	405	380	456	595	292
12	509	405	.....	.....	.....	.....	739	405	380	598	557	292
13	537	456	.....	.....	.....	.....	813	380	356	566	459	290
14	509	430	.....	.....	.....	.....	739	430	356	1,100	428	313
15	482	456	.....	.....	.....	.....	703	482	380	890	396	290
16	456	456	.....	.....	.....	.....	632	482	356	566	396	288
17	430	430	.....	.....	.....	.....	598	566	356	494	393	288
18	430	405	.....	.....	.....	.....	566	667	356	462	366	285
19	405	405	.....	.....	.....	.....	537	632	356	459	366	285
20	430	405	.....	.....	.....	.....	509	703	482	428	363	385
21	430	405	.....	.....	.....	.....	509	813	456	396	419	305
22	430	430	.....	.....	.....	.....	509	776	405	396	360	283
23	405	405	.....	.....	.....	970	482	739	380	396	334	283
24	405	405	.....	.....	.....	5,840	482	703	380	393	360	281
25	405	405	.....	.....	.....	6,090	456	632	598	366	332	327
26	405	405	.....	.....	.....	2,200	456	598	405	363	332	327
27	405	405	.....	.....	.....	1,440	456	598	430	390	330	327
28	405	356	.....	.....	.....	1,100	430	598	537	360	330	303
29	405	380	.....	.....	.....	1,280	430	537	482	770	305	281
30	405	380	.....	.....	.....	1,230	430	509	430	1,180	303	327
31	405	.....	.....	.....	.....	1,050	.....	482	.....	646	327	.....

NOTE.—Daily discharge Oct. 1, 1912, to July 16, 1913, computed from a well-defined rating curve. Daily discharge Sept. 24–30 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). Indirect method used from July 17 to Sept. 23. Discharge estimated, because of ice, from climatic records and open-water relation between flow of North Branch of Root River near Lanesboro and of Root River near Houston, as follows: Dec. 9–31, 1912, 285 second-feet; Jan. 1–31, 240 second-feet; Feb. 1–28, 250 second-feet; Mar. 1–10, 1480 second-feet; and Mar. 11–22, 1,930 second-feet.

Monthly discharge of Root River near Houston, Minn., for the year ending Sept. 30, 1913.

[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	537	380	417	0.267	0.31	B.
November	456	356	408	.262	.29	B.
December	.....	.....	322	.206	.24	D.
January	.....	.....	240	.154	.18	D.
February	.....	.....	250	.160	.17	D.
March	6,090	.....	1,910	1.22	1.41	D.
April	1,010	430	642	.412	.46	B.
May	813	380	525	.337	.39	B.
June	598	356	415	.266	.30	B.
July	1,440	360	583	.374	.43	B.
August	791	303	404	.259	.30	C.
September	385	281	304	.195	.22	B.
The year	6,090	.....	538	.345	4.70	

NORTH BRANCH OF ROOT RIVER NEAR LANESBORO, MINN.

Location.—In sec. 6, T. 103 N., R. 9 W., in Fillmore County, at first highway bridge 1 mile above junction of North and South branches, 2 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, 1913.

Drainage area.—647 square miles.

Gage.—Chain gage; read morning and evening to quarter-tenths. Limit of uses: Hundredths below 2.5, half-tenths from 2.5 to 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. One thousand feet back from the right bank is an old channel through which the river formerly flowed. At a stage of 6 feet the flow commences through this old channel. At extreme flood stage the right bank is overflowed for a width of one-fourth mile.

Discharge measurements.—Made from the bridge. At extreme flood stages measurements can be made from the railroad bridge just above the junction with South Branch.

Winter flow.—Determined by measurements. Discharge relation affected by ice.

Accuracy.—Information obtained since the preparation of estimates of discharge for 1912 indicates that the rating curve used for the year ending September 30, 1913, should also have been used from May 26 to December 8, 1912. Estimates of discharge as computed from the revised rating curve are about 6 per cent larger at gage height 2 feet and about 5 per cent smaller at gage height 3 feet than those published in Water-Supply Paper 325 for period subsequent to May 26, 1912. Conditions at this station are favorable for accurate results; estimates should be reliable.

Discharge measurements of North Branch of Root River near Lanesboro, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 25	S. B. Soulé	2.41	[a] 93.7	June 27	S. B. Soulé	2.57	333
Mar. 4	....do	2.59	[a] 85.7	Sept. 24	B. J. Peterson	1.86	93.8
Apr. 1	....do	2.59	347				

[a] Complete ice cover.

Daily gage height, in feet, of North Branch of Root River at Lanesboro, Minn., for the year ending Sept. 30, 1913.

[K. E. Hoium, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.06	2.05	2.05	.....	.....	.....	2.55	2.08	2.18	2.18	2.24	1.72
2	2.08	2.05	2.10	2.0	.....	.....	2.49	2.08	2.18	2.12	2.19	1.80
3	2.08	2.05	2.08	.....	.....	.....	2.95	2.10	2.15	2.08	2.14	1.72
4	2.05	2.05	2.05	.....	.....	2.6	2.85	2.25	2.12	2.32	2.10	1.69
5	2.04	2.05	2.15	.....	.....	.....	2.5	2.22	2.12	2.75	2.04	1.70
6	2.05	2.02	2.20	.....	2.5	1.6	2.45	2.25	2.12	2.31	2.04	1.72
7	2.05	2.02	2.16	.....	.....	.....	2.38	2.25	2.20	2.18	2.01	1.78
8	2.05	2.00	2.12	.....	.....	.....	2.35	2.18	2.10	2.08	2.28	1 70
9	2.02	2.02	2.08	2.2	.....	5.3	2.25	2.12	2.12	2.05	2.15	1.71
10	2.02	2.02	2.05	.....	.....	5.4	2.20	2.12	2.12	2.08	2.41	1.88
11	2.05	2.02	2.06	.....	.....	4.1	2.40	2.12	2.11	2.18	2.25	1.80
12	2.18	2.09	2.06	.....	.....	4.3	2.7	2.16	2.11	2.6	2.15	1.78
13	2.5	2.18	2.05	.....	2.5	4.5	2.95	2.18	2.02	2.30	2.12	1.70
14	2.30	2.14	2.05	.....	.....	9.9	2.55	2.22	2.02	[a]3.3	2.10	1.72
15	2.20	2.15	2.05	.....	.....	5.8	2.45	2.28	2.00	2.30	2.05	1.80
16	2.16	2.15	2.06	2.4	.....	3.45	2.38	2.45	2.01	2.22	2.05	1.80
17	2.12	2.15	2.02	.....	.....	2.9	2.32	2.7	2.00	2.12	2.10	1.80
18	2.12	2.19	1.98	.....	.....	2.9	2.29	2.8	2.01	2.08	2.08	1.78
19	2.15	2.22	1.98	.....	.....	5.6	2.22	2.6	2.02	2.02	2.08	1.85
20	2.15	2.35	.....	.....	2.9	3.8	2.22	2.6	2.22	2.02	2.02	1.85
21	2.19	2.28	.....	.....	.....	2.95	2.22	3.0	2.22	2 02	2.02	1.82
22	2.21	2.22	.....	.....	.....	2.5	2.19	2.8	2.19	1.98	2.08	1.82
23	2.10	2.15	.....	2.5	.....	2.5	2.19	2.75	2.15	2.02	2.05	1.81
24	2.05	2.12	.....	.....	.....	7.0	2.12	2.65	2.20	2.08	2.08	1.89
25	2.05	2.11	.....	2.4	.....	5.0	2.15	2.5	2.25	2.00	2.02	1.94
26	2.05	2.11	1.9	.....	.....	3.4	2.16	2.48	2.31	1.98	2.02	2.00
27	2.05	2.09	.....	.....	2.6	2.85	2.12	2.45	2.45	1.98	2.02	1.98
28	2.05	2.05	.....	.....	.....	2.7	2.08	2.38	2.38	2.05	1.96	1.90
29	2.05	2.05	.....	.....	.....	3.1	2.08	2.28	2.25	2.8	1.92	1.85
30	2.05	2.00	.....	2.3	.....	2.8	2.04	2.22	2.18	2.5	1.92	2.15
31	2.05	.....	.....	.....	.....	2.8	.....	2.00	.....	2.30	1.92	.....

[a] Gage height probably correct; rain on July 13.

NOTE.—Discharge relation affected by ice about Dec. 9, 1912, to Mar. 10, 1913.

Daily discharge, in second-feet, of North Branch of Root River near Lanesboro, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	150	147	147	.....	.....	.....	326	156	188	188	208	62
2	156	147	162	.....	.....	.....	301	156	188	168	191	79
3	156	147	156	.....	.....	.....	514	162	178	156	175	62
4	147	147	147	.....	.....	.....	463	212	168	236	162	56
5	144	147	178	.....	.....	.....	305	201	168	414	144	58
6	147	138	194	.....	.....	.....	286	212	168	233	144	62
7	147	138	181	.....	.....	.....	259	212	194	188	135	75
8	147	132	168	.....	.....	.....	248	188	162	156	222	58
9	138	138	.....	.....	.....	2,590	212	168	168	147	178	60
10	138	138	.....	.....	.....	2,700	194	168	168	156	270	99
11	147	138	.....	.....	.....	1,340	266	168	165	188	212	79
12	188	159	.....	.....	.....	1,530	391	181	165	347	178	75
13	305	188	.....	.....	.....	1,720	514	188	138	229	168	58
14	229	175	.....	.....	.....	8,800	326	201	138	715	162	62
15	194	178	.....	.....	.....	3,160	286	222	132	229	147	79
16	181	178	.....	.....	.....	813	259	286	135	201	147	79
17	168	178	.....	.....	.....	488	236	391	132	168	162	79
18	168	191	.....	.....	.....	488	226	438	135	156	156	75
19	178	201	.....	.....	.....	2,940	201	347	138	138	156	92
20	178	248	.....	.....	.....	1,070	201	347	201	138	138	92
21	191	222	.....	.....	.....	514	201	541	201	138	138	84
22	198	201	.....	.....	.....	305	191	438	191	126	156	84
23	162	178	.....	.....	.....	305	191	414	178	138	147	82
24	147	168	.....	.....	.....	4,660	168	369	194	156	156	102
25	147	165	.....	.....	.....	2,260	178	305	212	132	138	115
26	147	165	.....	.....	.....	779	181	297	233	126	138	132
27	147	159	.....	.....	.....	463	168	286	286	126	138	126
28	147	147	.....	.....	.....	391	156	259	259	147	121	104
29	147	147	.....	.....	.....	596	156	222	212	438	110	92
30	147	132	.....	.....	.....	438	144	201	188	305	110	178
31	147	.....	.....	.....	.....	438	.....	132	.....	229	110	.....

NOTE.—Daily discharge from Oct. 1 to Dec. 8, 1912, differs from that published in Water-Supply Paper 325 on account of a revision of the rating curve. See "Accuracy" in station description. Daily discharge computed from a rating curve well defined between 79 and 4,660 second-feet (gage heights 1.8 and 7.0 feet). Discharge estimated because of ice from gage heights, observer's notes, discharge measurements, and climatic records, as follows: Dec. 9–31, 120 second-feet; Jan. 1–31, 100 second-feet; Feb. 1–28, 102 second-feet; and Mar. 1–8, 100 second-feet.

Monthly discharge of North Branch of Root River near Lanesboro, Minn., for the years ending Sept. 30, 1912–13.

[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.		
1912.						
October	4,320	167	994	1.54	1.78	A.
November	376	171	275	.425	.47	A.
December	3,160	175	459	.709	.82	B.
January	.....	.....	180	.278	.32	C.
February	.....	.....	150	.232	.25	C.
March	7,640	.....	820	1.27	1.46	C.
April	3,400	329	895	1.38	1.54	A.
May	5,090	196	595	.920	1.06	B.
June	514	162	231	.357	.40	B.
July	1,240	162	287	.444	.51	A.
August	248	132	171	.264	.30	A.
September	259	132	166	.257	.29	A.
The year	7,640	.....	437	.675	9.20	
1913.						
October	305	138	166	.257	.30	A.
November	248	132	165	.255	.28	A.
December	.....	.....	132	.204	.24	C.
January	.....	.....	100	.155	18	C.
February	.....	.....	102	.158	.16	C.
March	8,800	.....	1,280	1.98	2.28	C.
April	514	144	258	.399	.45	A.
May	541	132	260	.402	.46	A.
June	286	132	179	.277	.31	A.
July	715	126	213	.329	.38	A.
August	270	110	159	.246	.28	A.
September	178	56	84.7	.131	.15	B.
The year	8,800	.....	260	.396	5.47	

NOTE.—Estimates for 1912 supersede those published in Water-Supply Paper 325. See "Accuracy" in station description.

UPPER IOWA RIVER NEAR DECORAH, IOWA.

Location.—At highway bridge in village of Freeport, which is 3 miles below Decorah and about 4 miles above upper power plant of the Upper Iowa Power Co. Nearest tributary, Trout Creek, enters from right about 1 mile above station.

Records available.—August 28 to September 30, 1913.

Drainage area.—551 square miles.

Gage.—Chain gage attached to bridge; read 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.—Flow regulated to some extent by operation of a number of small grist mills above the station.

Cooperation.—Gage heights furnished by the Upper Iowa Power Co.

Data insufficient for estimates of discharge.

Discharge measurements of Upper Iowa River near Decorah, Iowa, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 6	W. G. Hoyt	2.36	[a] 72.8
27	S. B. Soulé	2.34	[a] 68

[a] Made by wading.

Daily gage height, in feet, of Upper Iowa River near Decorah, Iowa, for the year ending Sept. 30, 1913.

[Charles Savoy, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1		2.20	11		2.20	21		2.30
2		2.25	12		2.20	22		2.30
3		2.25	13		2.15	23		2.30
4		2.22	14		2.15	24		2.24
5		2.22	15		2.15	25		2.34
6	2.36	2.20	16		2.15	26		2.35
7		2.20	17		2.25	27	2.25	2.30
8		2.20	18		2.20	28	2.22	2.25
9		2.20	19		2.20	29	2.22	2.28
10		2.15	20		2.45	30	2.22	2.30
						31	2.20	

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 mouth of Pelican River.

Records available.—December 1, 1905, to September 30, 1913.

Drainage area.—1,110 square miles.

Gage.—Standard chain gage fastened to upstream side of bridge; read once daily to tenths. Checked by wye levels August 13, 1913, and found in error; gage heights from November 27 to December 31, 1910 (published in Water-Supply Paper 285), for 1911 (published in Water-Supply Paper 305), and from January 1 to September 18, 1912 (published in Water-Supply Paper 325), should be corrected by subtracting 0.13 foot; all gage heights from September 19 to 30, 1912 (published in Water-Supply Paper 325), should be corrected by adding 0.12 foot. Gage heights subsequent to September 30, 1912, should be used as published in the following tables.

Channel and control.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Owing to the relatively high temperature of the water coming from the service reservoirs, little ice forms in the vicinity of the gage.

Regulation.—Flow is regulated by the reservoirs of the Rhinelander Power Co.'s plant near Rhinelander and the plant at Otter Rapids, and is also modified by storage reservoirs in the headwaters operated by the Upper Wisconsin Valley Improvement Co.

Accuracy.—Results impaired by fluctuations due to the operation of the power plants and at times by backwater caused by grass in the stream. Records only fair.

Discharge measurements of Wisconsin River near Rhinelander, Wis., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 13	B. J. Peterson	3.19	[a] 1,070
14	....do	3.14	[a] 1,010

[a] Large quantity of grass in channel.

Daily gage height, in feet, of Wisconsin River near Rhinelander, Wis., for the year ending Sept. 30, 1913.

[G. N. Kramer, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.4	3.3	2.1	2.7	2.4	2.7	3.2	3.8	3.4	2.5	3.7	3.4
2	3.5	3.5	3.7	2.6	2.1	2.1	2.9	3.5	3.7	2.8	3.2	3.1
3	3.1	2.8	3.5	2.5	2.3	2.8	3.9	3.5	3.7	2.5	3.8	3.5
4	3.3	3.5	3.3	2.5	2.3	2.9	3.5	2.7	3.5	2.1	3.1	3.7
5	3.7	3.9	3.5	2.5	2.4	2.6	3.9	3.3	3.7	2.7	3.0	3.4
6	2.5	3.7	3.7	2.6	2.4	2.8	3.9	2.9	3.5	2.0	2.9	3.1
7	3.2	3.5	3.5	2.4	2.3	2.9	3.8	3.0	3.5	2.5	3.4	2.5
8	3.6	3.6	2.5	2.3	2.3	2.6	3.8	2.6	2.5	2.9	3.7	3.4
9	3.7	3.5	3.4	2.4	2.0	2.9	3.6	2.9	3.8	2.7	3.2	3.0
10	3.3	3.1	3.7	2.5	2.6	2.8	4.0	2.9	3.6	3.1	2.1	3.4
11	3.2	3.4	3.2	2.5	2.4	2.8	3.8	2.1	3.4	2.8	2.7	3.0
12	3.6	3.6	3.3	2.1	2.3	2.7	3.6	2.9	3.6	3.2	2.8	3.0
13	2.2	3.5	3.5	2.6	2.3	2.7	2.2	3.0	3.2	2.1	3.2	3.3
14	3.4	3.4	3.5	2.3	2.2	2.5	3.8	2.7	3.3	3.7	3.1	2.1
15	3.7	3.4	2.3	2.4	2.6	3.0	3.8	3.0	2.3	4.0	3.3	3.0
16	3.3	3.3	3.5	2.4	1.7	2.9	4.0	3.0	2.4	3.9	2.9	2.9
17	3.4	2.9	3.3	2.4	2.5	2.6	3.8	2.7	2.6	3.6	1.8	2.9
18	3.2	3.5	3.4	2.4	2.3	2.7	3.6	2.3	2.7	3.8	3.3	2.9
19	3.6	3.5	3.2	2.1	2.3	3.0	3.9	3.6	2.4	4.0	3.3	2.7
20	2.9	3.6	3.3	2.5	2.9	2.9	3.8	3.9	2.7	2.3	2.9	3.0
21	3.5	3.4	3.1	2.1	2.2	2.6	3.8	3.8	2.6	3.1	3.1	2.5
22	3.5	3.6	2.8	2.1	2.3	3.1	3.6	3.6	2.0	2.9	3.1	3.5
23	3.3	3.4	3.0	2.3	2.6	3.0	4.0	3.4	2.4	2.8	3.3	3.7
24	3.4	2.8	2.8	2.3	2.4	3.0	3.8	3.5	2.6	3.3	1.9	3.5
25	3.6	3.5	3.0	2.4	2.7	2.7	4.0	3.6	2.6	3.1	3.3	3.8
26	3.4	3.4	2.7	2.1	2.8	2.7	3.5	3.6	2.7	3.8	3.3	3.8
27	2.7	3.5	3.0	2.3	2.3	3.0	3.6	3.7	2.6	3.5	3.5	3.4
28	3.4	3.3	3.0	2.4	2.5	2.8	3.8	3.7	2.4	4.5	3.1	2.8
29	3.6	3.3	2.8	2.3	.....	3.3	3.8	3.6	2.1	4.5	3.0	3.6
30	3.3	3.2	2.7	2.4	.....	3.2	3.7	3.7	2.9	4.5	3.4	3.6
31	3.6	.....	2.8	2.4	.....	3.2	.....	3.8	.....	3.9	2.1	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1913.

Daily discharge, in second-feet, of Wisconsin River near Rhinelander, Wis., for the years ending Sept. 30, 1910–1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1909–10.												
1	535	1,520	1,300	1,100	1,100	1,200	1,400	913	750	604	675	469
2	1,000	1,400	1,300	1,100	1,100	1,300	1,630	1,400	604	604	604	1,000
3	188	1,520	1,520	1,400	1,400	1,860	469	1,200	750	38	535	750
4	535	1,520	1,520	829	1,400	1,200	1,100	1,300	750	18	535	66
5	535	1,740	1,200	1,520	1,520	1,860	1,630	1,300	291	604	535	347
6	291	1,520	913	1,300	604	535	1,740	1,400	1,000	604	535	750
7	913	1,300	675	829	1,520	1,300	1,630	1,200	675	1,200	66	604
8	913	1,300	675	1,630	1,000	1,000	1,630	406	1,100	675	535	750
9	1,000	1,300	675	1,100	913	750	1,300	1,200	829	604	535	750
10	238	1,100	913	1,100	1,400	675	469	604	675	38	750	750
11	1,000	1,300	1,000	1,300	1,100	829	1,200	913	675	675	604	291
12	1,000	1,300	1,100	1,300	1,400	1,100	1,300	604	18	675	535	750
13	750	1,520	1,000	1,400	1,100	469	1,100	604	750	604	675	750
14	913	1,400	1,000	1,300	1,000	1,100	829	604	829	604	469	829
15	750	2,220	913	1,400	1,200	829	1,100	238	604	675	604	913
16	829	1,860	1,000	1,100	1,740	1,100	1,200	750	604	750	675	829
17	142	1,520	913	1,000	1,000	1,000	604	913	604	18	604	829
18	1,000	1,740	1,100	1,400	1,520	1,100	1,300	604	604	675	604	38
19	913	1,740	829	1,100	1,630	1,000	1,300	913	18	675	469	675
20	1,300	1,860	1,000	1,300	535	347	913	1,100	604	535	406	750
21	1,000	1,630	1,000	1,300	1,740	1,000	1,300	1,200	604	675	38	604
22	1,200	1,740	1,200	1,100	1,630	1,200	1,100	675	604	675	469	469
23	1,000	1,630	1,000	1,200	1,200	1,300	1,000	1,300	535	469	469	469
24	1,000	1,100	1,200	1,000	1,630	1,520	535	1,200	604	291	535	469
25	829	1,400	1,000	913	1,740	1,520	913	1,300	604	469	535	38
26	829	913	1,000	1,100	1,740	1,520	1,300	1,400	18	469	604	535
27	1,000	1,980	1,200	913	1,100	604	1,300	1,300	535	750	604	535
28	1,000	1,520	1,300	829	1,740	1,740	1,400	1,200	535	535	291	604
29	1,000	1,630	1,100	829	.....	1,520	1,630	535	535	675	469	604
30	913	1,400	1,000	1,100	.....	1,200	1,520	1,200	604	535	469	604
31	291	.....	1,200	1,100	.....	1,300	.....	1,100	.....	291	469	.....

Daily discharge, in second-feet, of Wisconsin River near Rhinelander, Wis., for the years ending Sept. 30, 1910–1913—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1910–11.												
1	604	675	469	535	829	675	1,400	675	1,100	535	1,630	1,520
2	291	750	406	829	604	675	1,200	604	1,300	347	2,100	1,300
3	535	604	188	750	535	604	1,300	1,000	1,100	406	1,980	535
4	469	604	188	675	469	604	1,000	675	347	291	1,980	675
5	469	535	291	675	406	238	1,000	750	913	913	1,980	1,860
6	1,100	291	535	829	406	675	1,000	675	913	1,300	675	1,980
7	604	675	750	675	347	675	1,000	188	1,000	1,520	1,980	1,630
8	675	675	604	347	1,300	829	1,000	469	1,100	1,200	1,980	1,520
9	238	604	469	750	1,300	750	347	535	913	238	1,860	1,630
10	604	675	535	750	750	1,740	1,300	469	1,000	1,200	2,100	469
11	604	675	535	604	913	1,100	1,200	675	291	1,300	1,980	1,520
12	604	675	469	829	406	347	1,200	604	750	1,200	1,860	1,740
13	535	347	535	750	535	750	1,300	604	675	1,100	347	1,740
14	406	604	535	750	675	829	1,200	469	604	1,100	2,100	1,860
15	406	675	535	535	750	1,100	1,200	1,000	604	1,000	1,630	1,520
16	238	675	750	750	750	750	347	829	675	291	1,630	1,630
17	535	675	675	829	829	750	1,200	829	535	1,400	1,980	406
18	535	604	535	675	913	1,000	1,200	750	291	1,520	1,740	1,740
19	535	604	469	829	469	291	1,630	1,100	675	913	1,740	1,630
20	604	238	604	1,100	750	1,000	1,200	1,740	604	1,400	469	1,630
21	604	535	535	1,300	1,000	1,100	1,300	604	675	1,100	2,220	1,630
22	604	535	469	406	913	1,000	1,630	1,980	604	1,200	2,100	1,520
23	291	535	535	913	1,000	1,100	750	1,860	535	291	2,100	1,520
24	535	604	347	829	1,300	1,200	1,200	1,740	675	2,820	1,860	469
25	535	604	291	1,300	1,300	1,200	1,200	2,220	291	1,860	2,220	1,400
26	535	535	535	1,100	913	347	1,100	2,220	675	1,630	2,220	1,520
27	913	291	829	1,000	1,000	1,520	1,400	829	604	1,300	675	1,630
28	750	675	913	913	1,000	1,630	1,300	604	750	1,400	1,860	1,630
29	913	469	675	829	.....	1,400	829	1,000	750	1,520	1,860	1,740
30	347	535	604	1,100	.....	1,520	406	1,100	535	188	1,980	1,630
31	675	.....	829	829	.....	1,400	.....	1,000	.....	2,220	1,980	.....
1911–12.												
1	1,520	1,860	675	.....	.....	.....	1,100	1,630	2,220	1,410	1,630	1,300
2	1,740	1,740	604	.....	.....	.....	1,520	1,630	1,860	1,300	1,740	3,070
3	1,740	1,740	750	.....	.....	.....	1,520	1,300	1,630	1,300	1,860	3,980
4	1,630	1,100	675	.....	.....	.....	1,740	1,860	1,300	604	1,200	3,720
5	1,630	913	829	.....	.....	.....	2,220	1,630	1,980	1,400	1,740	4,110
6	2,220	1,400	604	.....	.....	.....	2,580	1,740	1,740	1,630	1,980	4,370
7	2,940	1,300	829	.....	.....	.....	2,820	1,630	1,630	347	2,460	3,850
8	3,460	1,200	750	.....	.....	.....	2,340	1,520	1,520	1,400	3,070	3,070
9	3,850	1,200	829	.....	.....	.....	2,700	1,630	1,200	1,520	3,850	3,590
10	3,590	1,100	1,200	.....	.....	.....	2,700	1,860	1,300	1,630	4,370	3,330
11	3,330	1,200	1,400	.....	.....	.....	2,700	1,980	1,400	1,300	4,890	3,070
12	3,330	1,000	1,860	.....	.....	.....	2,820	1,200	1,520	1,400	4,370	3,070
13	2,940	1,100	1,630	.....	.....	.....	2,820	1,300	1,630	1,300	4,370	3,070
14	2,940	829	1,630	.....	.....	.....	1,740	1,740	1,000	238	4,110	3,070
15	1,980	750	1,630	.....	.....	.....	2,700	1,630	1,100	1,400	3,850	1,200
16	2,940	750	1,860	.....	.....	.....	2,700	1,200	535	1,630	3,980	2,100
17	2,820	750	1,400	.....	.....	.....	2,580	1,740	1,200	1,520	3,720	1,860
18	2,940	750	1,630	.....	.....	.....	2,580	1,630	1,200	1,200	1,200	1,860
19	2,220	913	1,860	.....	.....	.....	2,220	1,100	1,630	1,300	3,460	1,630
20	1,980	675	1,630	.....	.....	.....	1,860	1,520	1,100	1,630	3,070	1,520
21	3,330	750	1,520	.....	.....	.....	1,980	1,630	1,200	347	3,200	1,740
22	3,850	829	1,520	.....	.....	.....	2,100	1,300	1,400	1,200	3,070	1,300
23	3,200	675	1,630	.....	.....	.....	1,860	1,630	291	1,200	2,940	1,400
24	3,070	750	1,860	.....	.....	.....	1,740	1,740	1,300	1,300	2,820	1,520
25	2,700	913	2,100	.....	.....	.....	1,740	1,860	1,630	1,630	1,400	1,860
26	2,940	1,100	1,860	.....	.....	.....	1,630	1,740	1,300	1,630	2,580	1,860
27	3,330	750	1,300	.....	.....	.....	1,520	1,630	1,200	1,860	2,820	1,520
28	2,940	1,000	1,520	.....	.....	.....	1,630	1,630	1,200	1,200	3,070	1,520
29	2,700	829	1,630	.....	.....	.....	2,820	1,860	1,100	1,980	2,820	1,200
30	2,580	675	1,630	.....	.....	.....	2,580	2,100	406	1,630	2,700	1,740
31	1,520	.....	1,520	.....	.....	.....	.....	1,980	.....	1,630	2,820	.....

Daily discharge, in second-feet, of Wisconsin River near Rhinelander, Wis., for the years ending Sept. 30, 1910–1913—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912-13.												
1	1,740	1,630	535	1,000	750	1,000	1,520	2,220	1,740	675	1,630	1,300
2	1,860	1,860	2,100	913	535	535	1,200	1,860	2,100	913	1,100	1,000
3	1,400	1,100	1,860	829	675	1,100	2,340	1,860	2,100	675	1,740	1,400
4	1,630	1,860	1,630	829	675	1,200	1,860	1,000	1,860	406	1,000	1,630
5	2,100	2,340	1,860	829	750	913	2,340	1,630	2,100	829	913	1,300
6	829	2,100	2,100	913	750	1,100	2,340	1,200	1,860	347	829	1,000
7	1,520	1,860	1,860	750	675	1,200	2,220	1,300	1,860	675	1,300	535
8	1,980	1,980	829	675	675	913	2,220	913	829	1,000	1,630	1,300
9	2,100	1,860	1,740	750	469	1,200	1,980	1,200	2,220	829	1,100	913
10	1,630	1,400	2,100	829	913	1,100	2,460	1,200	1,980	1,200	291	1,400
11	1,520	1,740	1,520	829	750	1,100	2,220	535	1,740	913	675	1,000
12	1,980	1,980	1,630	535	675	1,000	1,980	1,200	1,980	1,300	750	1,000
13	604	1,860	1,860	913	675	1,000	604	1,300	1,520	406	1,100	1,300
14	1,740	1,740	1,860	675	604	829	2,220	1,000	1,630	1,860	1,000	347
15	2,100	1,740	675	750	913	1,300	2,220	1,300	675	2,220	1,200	1,000
16	1,630	1,630	1,860	750	291	1,200	2,460	1,300	675	1,980	829	913
17	1,740	1,200	1,630	750	829	913	2,220	1,000	829	1,630	142	913
18	1,520	1,860	1,740	750	675	1,000	1,980	675	913	1,860	1,200	913
19	1,980	1,860	1,520	535	675	1,300	2,340	1,980	675	2,100	1,200	750
20	1,200	1,980	1,630	829	1,200	1,200	2,220	2,340	913	469	829	1,000
21	1,860	1,740	1,400	535	604	913	2,220	2,220	829	1,100	1,000	604
22	1,860	1,980	1,100	535	675	1,400	1,980	1,980	406	913	1,000	1,520
23	1,630	1,740	1,300	675	913	1,300	2,460	1,740	675	829	1,200	1,740
24	1,740	1,100	1,100	675	750	1,300	2,220	1,860	829	1,300	188	1,520
25	1,980	1,860	1,300	750	1,000	1,000	2,460	1,980	829	1,100	1,200	1,860
26	1,740	1,740	1,000	535	1,100	1,000	1,860	1,980	913	1,860	1,200	1,860
27	1,000	1,860	1,300	675	675	1,300	1,980	2,100	829	1,520	1,400	1,400
28	1,740	1,630	1,300	750	829	1,100	2,220	2,100	675	2,700	1,000	829
29	1,980	1,630	1,100	675	.....	1,630	2,220	1,980	469	2,700	913	1,630
30	1,630	1,520	1,000	750	.....	1,520	2,100	2,100	1,100	2,700	1,300	1,630
31	1,980	.....	1,100	750	.....	1,520	.....	2,220	.....	1,980	291	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 469 and 3,070 second-feet (gage heights 2.0 and 4.5 feet) and poorly defined beyond those points. Daily discharge, Oct. 1 to Dec. 31, 1909, differ from that published in Water-Supply Paper 265 on account of a revision of the rating table.

Monthly discharge of Wisconsin River near Rhinelander, Wis., for the years ending Sept. 30, 1910–1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1909–10.				
October	1,300	142	800	B.
November	2,220	913	1,520	B.
December	1,520	675	1,060	C.
January	1,630	829	1,160	C.
February	1,740	535	1,310	C.
March	1,860	347	1,130	B.
April	1,740	469	1,190	B.
May	1,400	238	986	B.
June	1,100	18	597	B.
July	1,200	18	539	B.
August	750	38	513	B.
September	1,000	38	594	B.
The year	2,220	18	947	
1910–11.				
October	1,100	238	558	B.
November	750	238	573	B.
December	913	188	537	C.
January	1,300	347	806	C.
February	1,300	347	799	C.
March	1,740	238	929	B.
April	1,630	347	1,110	B.
May	2,220	188	961	B.
June	1,300	291	716	B.
July	2,820	188	1,120	B.
August	2,220	347	1,770	B.
September	1,980	406	1,440	B.
The year	2,820	188	944	
1911–12.				
October	3,850	1,520	2,710	B.
November	1,860	675	1,020	B.
December	2,100	604	1,370	C.
April	2,820	1,100	2,190	B.
May	2,100	1,100	1,630	B.
June	2,220	291	1,320	B.
July	1,980	238	1,320	B.
August	4,890	1,200	2,940	B.
September	4,370	1,200	2,420	B.
1912–13.				
October	2,100	604	1,680	B.
November	2,340	1,100	1,750	B.
December	2,100	535	1,470	C.
January	1,000	535	740	C.
February	1,200	469	739	C.
March	1,630	535	1,130	C.
April	2,460	604	2,090	B.
May	2,340	535	1,590	C.
June	2,220	406	1,260	C.
July	2,700	347	1,320	B.
August	1,740	142	1,000	B.
September	1,860	347	1,180	B.
The year	2,460	142	1,330	

NOTE.—See footnote to table of daily discharge. Monthly discharge, October, November, and December, 1909, differ from that published in Water-Supply Paper 265 on account of a revision of the rating curve. Discharge in "Second-feet per square mile" and "Run-off (depth in inches on drainage area)" are not published because they are believed to be misleading. See "Regulation" is station description.

WISCONSIN RIVER AT MERRILL, WIS.

Location.—At highway bridge at east end of the city of Merrill, 1,000 feet below power house and dam of Merrill Electric Railway & Power Co., and half a mile below the mouth of Prairie River coming in from right.

Records available.—November 17, 1902, to September 30, 1913.

Drainage area.—2,630 square miles.

Gage.—Chain gage installed June 17, 1903; read twice daily from January to July, inclusive, and once daily—in the morning—from August to December. Datum unchanged since June 17, 1903. Records obtained from staff gage previously used doubtful. Because of an error in the gage, determined on August 15, 1913, gage heights from January 1 to December 31, 1912 (published in Water-Supply Paper 325), should be corrected by subtracting 0.07 foot. Gage heights from October 1 to December 31, 1912, have been corrected and should be used as published in the following table.

Channel and control.—Heavy gravel and rock; may scour in high water; probably permanent at other stages.

Discharge measurements.—Made from highway bridge.

Winter flow.—Little ice forms at the gage but ice forms on the right bank of the river below 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, named in order:

Merrill: Merrill Electric Light & Railway Co.
Tomahawk: Tomahawk Pulp & Paper Co.
Tomahawk: Tomahawk Tannery Co.
Kings: Tomahawk 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. Besides the regulation of the above plants, the Wisconsin Valley Improvement Co. operates 17 storage reservoirs in the Wisconsin basin above Merrill, having a capacity of over 4,000,000,000 cubic feet.

Floods.—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 preceding 24 hours 11.25 inches of rain had fallen in the vicinity of Merrill. C. B. Stewart,[1] consulting engineer, Madison, estimated the run-off of the 700 square miles between Merrill and Tomahawk at 65 second-feet per square mile, and that from the entire drainage area above Merrill, at 17 second-feet per square mile. In the basin above Tomahawk, however, little rain had fallen.

Accuracy.—Accuracy of records impaired by diurnal fluctuations caused by the operation of power plants, in the winter by ice, and in the spring possibly by logs lodging on the control and causing backwater.

Cooperation.—Station maintained in cooperation with the United States Weather Bureau, the Wisconsin Valley Improvement Co., and the Railroad Commission of Wisconsin.

---

[1] Stewart, C. B., Investigation of flood flow on the watershed upper Wisconsin River: Western Soc. Eng. Jour., vol. 23, no. 4, April, 1913.

The following discharge measurement was made by B. J. Peterson August 15, 1913: Gage height, 4.65 feet, discharge, 1,850 second-feet.

Daily gage height, in feet, of Wisconsin River at Merrill, Wis., for the year ending Sept. 30, 1913.

[A. F. Lueck, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.2	5.0	5.5	4.9	5.0	4.6	7.2	6.5	7.2	4.7	6.7	4.9
2	5.3	4.9	5.6	5.1	5.0	4.4	7.8	6.3	6.7	5.0	5.9	4.9
3	5.4	4.6	5.5	5.1	4.7	4.5	9.0	6.2	6.6	4.8	6.0	5.4
4	5.2	4.9	6.1	4.6	4.8	4.5	8.7	6.2	6.6	5.0	5.6	4.8
5	5.0	5.0	6.3	5.0	4.8	4.6	8.5	6.5	6.4	5.0	5.2	5.5
6	5.4	5.3	5.9	4.6	4.7	4.8	8.1	6.4	6.2	6.0	5.8	4.9
7	5.4	4.9	5.7	5.3	4.8	4.6	8.2	5.8	6.2	5.6	5.5	5.4
8	5.2	4.9	5.6	4.8	4.8	4.4	8.0	6.4	5.9	5.7	5.3	5.1
9	5.5	4.8	5.6	5.0	4.6	4.5	7.6	5.8	5.5	6.4	5.3	5.2
10	5.5	5.0	5.5	5.0	4.9	4.6	7.5	5.8	5.8	6.2	5.2	4.8
11	5.4	4.9	5.7	5.1	4.9	4.8	7.5	5.8	5.6	6.4	5.3	5.2
12	5.4	4.9	5.1	4.9	5.2	4.8	7.3	5.4	6.9	6.6	4.9	5.0
13	6.3	5.6	5.5	5.0	5.0	4.8	7.3	5.6	5.3	6.6	5.2	5.1
14	6.5	5.2	5.5	5.0	4.6	5.5	7.2	5.8	5.6	6.4	5.0	5.0
15	6.1	5.2	5.3	5.0	4.6	4.8	8.2	5.8	6.0	6.4	4.8	4.8
16	5.9	5.3	5.2	4.8	4.7	4.8	8.3	5.7	4.8	5.9	5.1	5.0
17	5.9	5.2	5.5	5.0	4.7	5.1	9.0	6.2	5.0	6.5	4.8	5.3
18	5.9	4.7	5.5	4.8	4.6	4.9	9.1	5.5	5.1	6.4	4.3	4.7
19	6.0	5.1	5.2	4.8	4.6	5.2	9.0	5.7	5.3	6.1	5.3	4.7
20	5.8	4.9	5.0	5.0	4.4	6.0	8.6	5.8	5.2	6.2	5.0	5.0
21	5.4	5.1	5.2	5.0	4.6	6.0	8.2	6.8	5.2	5.6	4.9	5.3
22	5.1	5.1	5.1	5.0	4.6	5.6	7.8	7.2	5.2	5.6	5.3	5.9
23	5.3	5.0	4.9	4.8	4.8	5.3	7.9	7.1	3.8	5.2	5.3	5.7
24	5.4	5.0	5.2	4.8	3.95	5.2	7.8	6.8	5.0	5.4	5.0	6.0
25	5.3	4.8	5.1	4.8	4.9	5.5	7.8	6.6	4.8	5.7	4.7	6.4
26	5.0	5.0	4.9	4.8	4.4	5.6	7.4	6.0	4.9	5.8	4.8	6.0
27	5.1	4.9	4.7	4.6	4.4	5.8	7.6	6.5	5.0	8.1	4.8	6.4
28	5.0	4.9	4.9	4.5	5.0	5.5	7.0	6.0	5.4	8.4	4.7	6.2
29	5.2	5.0	4.5	4.9	.....	6.0	6.6	6.4	4.8	8.2	5.1	5.7
30	5.0	5.0	4.7	4.7	.....	6.4	6.4	7.3	5.0	7.4	4.9	6.0
31	4.9	.....	5.1	4.8	.....	7.0	.....	7.2	.....	6.9	4.4	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1913. Gage heights, Oct. 1 to Dec. 31, 1912, differ from those published in Water-Supply Paper 325 on account of an error in the gage. See "Gage."

Daily discharge, in second-feet, of Wisconsin River at Merrill, Wis., for the years ending Sept. 30, 1910–1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1909–10.												
1	1,470	1,080	4,460	1,940	2,150	2,010	3,510	4,000	2,700	1,060	602	1,440
2	1,300	2,240	4,100	1,820	2,150	2,300	3,700	3,510	1,880	1,010	602	1,440
3	1,080	3,320	3,870	2,150	2,150	2,080	3,600	3,420	1,820	670	1,380	1,440
4	985	3,760	3,870	2,220	2,380	2,220	2,610	2,780	1,620	522	1,160	1,320
5	850	3,320	3,210	2,010	2,380	2,300	2,300	2,080	1,110	455	1,220	1,440
6	1,600	3,530	3,760	2,220	2,080	2,610	5,060	2,010	602	602	1,010	1,220
7	1,540	3,640	2,390	2,220	1,940	2,780	6,540	1,820	1,820	390	1,010	1,010
8	1,080	3,210	2,010	2,220	1,380	2,220	6,070	2,010	1,560	602	720	1,060
9	1,300	2,640	2,240	2,250	2,150	2,080	5,170	2,220	1,940	1,270	912	1,270
10	1,240	2,560	2,240	2,220	2,150	1,680	4,310	2,150	2,010	1,220	1,010	1,620
11	1,410	2,920	2,160	2,380	1,940	1,940	3,800	2,010	1,680	1,160	440	1,500
12	1,240	4,820	2,010	2,150	2,150	1,940	3,140	1,820	1,440	624	1,060	1,380
13	1,470	5,180	1,940	2,010	2,010	1,940	3,900	1,880	1,620	1,010	402	1,160
14	1,410	5,430	2,310	2,080	1,820	2,150	3,600	1,440	1,500	1,160	960	1,680
15	1,410	5,430	1,940	2,080	1,880	2,960	2,700	1,270	1,220	1,060	624	2,300
16	1,540	8,620	1,940	2,220	2,220	2,700	3,050	1,330	1,110	1,220	785	1,750
17	1,470	7,360	2,080	2,010	1,940	2,610	3,510	1,220	695	1,010	1,010	1,010
18	1,410	5,550	1,940	2,220	1,940	2,300	4,100	2,870	1,220	912	1,010	1,220
19	810	4,940	1,870	2,150	2,150	2,610	4,520	3,420	1,220	865	1,060	752
20	1,410	5,300	1,940	2,220	2,010	2,780	4,420	4,420	624	1,010	1,010	1,320
21	1,800	4,820	1,660	2,010	1,820	4,310	4,840	4,310	752	624	912	1,110
22	2,010	4,220	2,080	2,080	2,220	4,520	4,730	4,420	960	1,060	581	1,160
23	1,870	4,100	1,730	2,010	2,150	4,310	4,100	4,620	647	1,110	1,060	912
24	1,470	3,980	1,600	2,150	2,380	3,800	4,310	4,200	670	865	912	785
25	1,410	3,760	1,800	1,620	2,080	3,700	3,420	3,420	1,060	1,110	1,160	1,010
26	1,470	3,210	2,080	1,940	2,380	4,200	4,200	3,140	470	1,110	1,160	1,160
27	1,470	3,640	2,310	2,150	2,150	4,000	4,950	3,230	414	1,060	1,320	1,380
28	1,870	4,340	2,160	2,380	1,880	3,510	4,950	3,900	1,110	1,110	1,060	1,270
29	1,600	5,430	2,160	1,820	.....	3,600	4,730	2,610	1,110	1,110	960	752
30	1,540	5,060	1,940	1,820	.....	4,100	4,310	1,750	1,110	1,060	1,060	1,500
31	1,130	.....	1,660	2,010	.....	4,840	.....	2,220	.....	1,110	1,500	.....
1910–11.												
1	1,500	1,010	912	1,160	1,380	1,320	4,950	1,620	3,140	1,010	3,230	1,620
2	1,380	1,270	1,010	1,220	1,270	1,380	4,620	1,560	2,960	960	3,510	1,620
3	1,160	1,750	1,010	1,270	1,440	960	3,900	1,820	2,300	752	3,600	1,620
4	1,680	1,680	912	1,160	1,620	1,750	3,230	2,380	2,150	670	2,530	1,270
5	1,270	1,940	720	1,500	1,160	1,500	3,230	2,610	4,620	624	2,080	1,750
6	1,500	960	825	1,820	825	1,680	3,050	2,700	4,730	1,060	2,010	1,500
7	1,680	960	960	1,440	1,620	1,440	2,780	1,500	4,620	1,880	2,220	2,080
8	1,820	912	960	1,270	1,620	1,620	2,300	1,440	3,050	1,750	2,300	3,700
9	1,380	1,440	865	1,110	1,320	1,110	2,700	2,080	2,700	720	2,530	1,500
10	1,440	1,010	1,010	1,752	2,010	1,160	2,610	2,870	3,050	1,560	2,960	1,620
11	1,380	695	1,110	1,270	1,820	1,750	2,870	2,700	2,080	1,500	2,700	1,880
12	1,220	1,440	1,010	1,220	1,440	1,560	3,900	1,820	1,880	1,680	2,870	1,680
13	1,270	1,220	1,110	1,270	1,160	1,750	4,620	2,080	1,680	1,270	2,870	1,880
14	785	1,620	1,220	1,320	1,320	2,150	4,840	1,750	1,500	1,500	2,960	5,280
15	1,440	1,270	1,220	1,160	1,940	1,940	5,280	1,620	1,320	1,440	1,880	4,420
16	541	1,220	1,110	1,220	1,880	1,820	4,620	3,600	1,380	1,060	1,940	3,600
17	1,010	1,270	1,560	1,560	1,680	2,610	5,390	3,700	1,160	1,060	1,820	6,790
18	1,320	1,270	1,110	1,560	1,620	2,530	4,200	3,420	1,060	1,220	1,380	5,060
19	1,380	1,220	1,270	1,750	1,560	1,750	4,620	3,420	695	2,380	1,820	3,900
20	1,620	1,110	1,270	1,440	1,500	1,750	5,840	5,390	1,060	2,080	1,060	2,870
21	1,270	1,110	1,440	2,080	1,440	2,380	4,730	6,180	1,110	1,380	1,220	3,900
22	1,680	1,010	1,500	1,500	1,270	3,700	4,950	6,300	1,110	2,150	2,010	3,800
23	1,820	865	1,620	1,320	1,270	3,900	5,060	7,180	1,110	1,110	2,610	3,230
24	1,880	960	1,750	1,500	1,270	3,900	4,520	7,180	1,110	2,010	2,450	2,960
25	1,620	912	1,820	1,820	1,560	3,320	3,700	6,920	1,010	1,500	2,150	3,420
26	1,160	1,010	1,440	1,820	1,440	4,000	3,700	5,500	720	2,010	2,300	2,530
27	1,680	1,010	720	1,380	1,560	4,840	4,200	4,950	695	1,940	2,150	3,600
28	1,880	1,060	1,320	1,380	1,380	4,620	1,880	5,390	1,060	1,940	2,530	3,600
29	1,560	1,270	1,380	1,380	.....	5,170	2,610	3,700	1,110	1,940	2,010	4,200
30	1,440	1,010	1,500	1,320	.....	5,390	3,050	3,600	1,110	1,680	1,380	4,950
31	1,620	.....	1,820	1,680	.....	4,620	.....	3,320	.....	1,010	1,680	.....

Daily discharge, in second-feet, of Wisconsin River at Merrill, Wis., for the years ending Sept. 30, 1910–1913—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.												
1	5,720	4,730	.....	.....	.....	.....	960	6,070	5,170	785	2,780	20,100
2	4,950	4,000	.....	.....	.....	.....	3,140	6,070	5,170	752	2,300	23,500
3	6,070	4,520	.....	.....	.....	.....	3,320	5,170	5,170	2,150	1,500	7,590
4	8,560	2,610	.....	.....	.....	.....	4,310	5,610	5,170	2,010	1,500	12,600
5	8,140	2,870	.....	.....	.....	.....	5,170	7,860	5,170	1,620	1,500	8,990
6	18,200	3,700	.....	.....	.....	.....	8,140	7,590	4,950	1,560	2,010	8,990
7	19,000	4,200	.....	.....	.....	.....	9,570	7,590	4,950	1,750	2,960	7,590
8	15,800	3,050	.....	.....	.....	.....	10,800	7,590	4,520	1,750	3,900	7,050
9	12,300	3,900	.....	.....	.....	.....	9,570	6,540	4,310	1,380	5,610	6,300
10	10,500	3,700	.....	.....	.....	.....	8,420	5,170	3,140	1,880	12,000	4,950
11	7,590	3,140	.....	.....	.....	.....	8,700	5,170	1,620	2,150	14,000	4,310
12	7,590	3,900	.....	.....	.....	.....	8,140	5,390	2,300	2,150	13,600	4,100
13	6,790	2,300	.....	.....	.....	.....	8,140	4,730	2,780	1,880	11,100	3,900
14	6,660	2,530	.....	.....	.....	.....	7,050	3,140	2,010	1,620	7,590	4,520
15	6,180	3,420	.....	.....	.....	.....	7,860	5,170	2,300	1,440	7,320	4,520
16	8,000	3,600	.....	.....	.....	.....	8,140	5,840	2,450	1,560	5,840	4,310
17	11,800	2,870	.....	.....	.....	.....	7,590	3,510	2,010	2,010	6,300	4,100
18	11,800	2,960	.....	.....	.....	.....	7,320	4,100	2,780	1,750	5,610	3,700
19	13,000	3,050	.....	.....	.....	.....	6,300	4,520	1,620	1,750	5,610	3,900
20	10,300	3,140	.....	.....	.....	.....	6,070	4,310	2,610	1,160	6,070	3,510
21	8,990	2,780	.....	.....	.....	.....	6,070	4,310	2,610	1,620	5,610	3,700
22	7,590	3,050	.....	.....	.....	.....	8,140	5,390	2,010	1,380	4,950	4,100
23	7,180	3,140	.....	.....	.....	.....	9,570	8,140	2,450	2,450	4,730	3,140
24	6,790	3,230	.....	.....	.....	.....	9,860	9,570	2,150	27,200	4,520	2,960
25	6,790	3,140	.....	.....	.....	.....	7,590	8,420	2,300	15,600	4,520	3,320
26	7,180	3,140	.....	.....	.....	.....	6,540	6,540	2,610	10,200	3,320	3,700
27	6,180	3,050	.....	.....	.....	.....	7,860	8,140	2,780	7,320	4,520	2,450
28	4,840	3,420	.....	.....	.....	.....	7,590	9,280	1,750	4,950	3,900	2,450
29	4,520	3,420	.....	.....	.....	.....	7,320	9,570	1,380	3,510	3,900	1,880
30	4,420	3,420	.....	.....	.....	.....	6,540	8,140	2,450	3,140	4,730	2,780
31	4,840	.....	.....	.....	.....	.....	.....	7,590	.....	2,780	5,170	.....
1912–13.												
1	2,610	2,300	3,140	2,150	2,300	1,750	6,790	5,170	6,790	1,880	5,610	2,150
2	2,780	2,150	3,320	2,450	2,300	1,500	8,420	4,730	5,610	2,300	3,900	2,150
3	2,960	1,750	3,140	2,450	1,880	1,620	12,000	4,520	5,390	2,010	4,100	2,960
4	2,610	2,150	4,310	1,750	2,010	1,620	11,100	4,520	5,390	2,300	3,320	2,010
5	2,300	2,300	4,730	2,300	2,010	1,750	10,500	5,170	4,950	2,300	2,610	3,140
6	2,960	2,780	3,900	1,750	1,880	2,010	9,280	4,950	4,520	4,100	3,700	2,150
7	2,960	2,150	3,510	2,780	2,010	1,750	9,570	3,700	4,520	3,320	3,140	2,960
8	2,610	2,150	3,320	2,010	2,010	1,500	8,990	4,950	3,900	3,510	2,780	2,450
9	3,140	2,010	3,320	2,300	1,750	1,620	7,860	3,700	3,140	4,950	2,780	2,610
10	3,140	2,300	3,140	2,300	2,150	1,750	7,590	3,700	3,700	4,520	2,610	2,010
11	2,960	2,150	3,510	2,450	2,150	2,010	7,590	3,700	3,320	4,950	2,780	2,610
12	2,960	2,150	2,450	2,150	2,610	2,010	7,050	2,960	6,070	5,390	2,150	2,300
13	4,730	3,320	3,140	2,300	2,300	2,010	7,050	3,320	2,780	5,390	2,610	2,450
14	5,170	2,610	3,140	2,300	1,750	3,140	6,790	3,700	3,320	4,950	2,300	2,300
15	4,310	2,610	2,780	2,300	1,750	2,010	9,570	3,700	4,100	4,950	2,010	2,010
16	3,900	2,780	2,610	2,010	1,880	2,010	9,860	3,510	2,010	3,900	2,450	2,300
17	3,900	2,610	3,140	2,300	1,880	2,450	12,000	4,520	2,300	5,170	2,010	2,780
18	3,900	1,880	3,140	2,010	1,750	2,150	12,300	3,140	2,450	4,950	1,380	1,880
19	4,100	2,450	2,610	2,010	1,750	2,610	12,000	3,510	2,780	4,310	2,780	1,880
20	3,700	2,150	2,300	2,300	1,500	4,100	10,800	3,700	2,610	4,520	2,300	2,300
21	2,960	2,450	2,610	2,300	1,750	4,100	9,570	5,840	2,610	3,320	2,150	2,780
22	2,450	2,450	2,450	2,300	1,750	3,320	8,420	6,790	2,610	3,320	2,780	3,900
23	2,780	2,300	2,150	2,010	2,010	2,780	8,700	6,540	865	2,610	2,780	3,510
24	2,960	2,300	2,610	2,010	1,010	2,610	8,420	5,840	2,300	2,960	2,300	4,100
25	2,780	2,010	2,450	2,010	2,150	3,140	8,420	5,390	2,010	3,510	1,880	4,950
26	2,300	2,300	2,150	2,010	1,500	3,320	7,320	4,100	2,150	3,700	2,010	4,100
27	2,450	2,150	1,880	1,750	1,500	3,700	7,860	5,170	2,300	9,280	2,010	4,950
28	2,300	2,150	2,150	1,620	2,300	3,140	6,300	4,100	2,960	10,200	1,880	4,520
29	2,610	2,300	1,620	2,150	.....	4,100	5,390	4,950	2,010	9,570	2,450	3,510
30	2,300	2,300	1,880	1,880	.....	4,950	4,950	7,050	2,300	7,320	2,150	4,100
31	2,150	.....	2,450	2,010	.....	6,300	.....	6,790	.....	6,070	1,500	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 785 and 12,000 second-feet (gage heights 3.7 and 9.0 feet); below 785 second-feet (gage height 3.7 feet), the rating curve is simply an extension, and estimates should be used with caution. No discharge estimates have been made Dec. 1, 1911, to Mar. 31, 1912, as discharge relation was probably seriously affected by ice. Discharge for winter periods of the other years determined from open-water rating, may be too high.

Monthly discharge of Wisconsin River at Merrill, Wis., for the years ending Sept. 30, 1910–1913.

[Drainage area, 2630 square miles.[a]]

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
1909–10.				
October	2,010	810	1,410	C.
November	8,620	1,080	4,250	C.
December	4,460	1,600	2,370	C.
January	2,380	1,620	2,090	D.
February	2,380	1,380	2,070	D.
March	4,840	1,680	2,940	D.
April	6,540	2,300	4,140	C.
May	4,620	1,220	2,760	B.
June	2,700	414	1,260	C.
July	1,270	390	941	C.
August	1,500	402	957	C.
September	2,300	752	1,280	C.
The year	8,620	390	2,200	
1910–11.				
October	1,880	541	1,430	C.
November	1,940	695	1,180	C.
December	1,820	720	1,210	C.
January	2,080	752	1,410	C.
February	2,010	825	1,480	C.
March	5,390	960	2,560	C.
April	5,840	1,880	3,930	C.
May	7,180	1,440	3,560	C.
June	4,730	695	1,910	C.
July	2,380	624	1,450	C.
August	3,600	1,060	2,280	C.
September	6,790	1,270	3,060	C.
The year	7,180	541	2,120	
1911–12.				
October	19,000	4,420	8,650	B.
November	4,730	2,300	3,330	B.
April	10,800	960	7,190	B.
May	9,570	3,140	6,330	B.
June	5,170	1,380	3,090	B.
July	27,200	752	3,650	C.
August	14,000	1,500	5,450	C.
September	23,500	1,880	5,970	C.
1911–23.				
October	5,170	2,150	3,090	B.
November	3,320	1,750	2,320	B.
December	4,730	1,620	2,870	B.
January	2,780	1,620	2,140	D.
February	2,610	1,010	1,910	D.
March	6,300	1,500	2,670	D.
April	12,300	4,950	8,750	B.
May	7,050	2,960	4,630	B.
June	6,790	865	3,390	B.
July	10,200	1,880	4,570	B.
August	5,610	1,380	2,620	B.
September	4,950	1,880	2,930	B.
The year	12,300	865	3,490	

[a] Estimates of discharge in "Second-feet per square mile" and "Run-off (depth in inches on drainage area)" withheld as misleading. See "Regulation" in station description.

NOTE.—See footnote to table of daily discharge.

WISCONSIN RIVER, NEAR NECEDAH, WIS.

Location.—At 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 mouth of Big Roche a Cri Creek (entering from the left).

Records available.—December 2, 1902, to September 30, 1913.

Drainage area.—5,800 square miles.

Gage.—Chain gage attached to bridge. Gage heights for the year 1909 (published in Water-Supply Paper 265) are approximately 0.04 too high; gage heights for 1910 (Water-Supply Paper 285) approximately 0.08 too high; gage heights for 1911 (Water-Supply Paper 305) approximately 0.13 too high; gage heights January to September, 1912 (Water-Supply Paper 325) approximately 0.17 too high; gage heights for October to December, 1912, should be used as given in the following tables; gage heights for 1913 refer to original datum.

Channel and control.—Sandy and shifting.

Floods.—The highest stage recorded at this station is 16.8 feet on October 10, 1911.

Winter flow.—Discharge relation greatly modified by ice which forms at the gage to a thickness of 1 to 2 feet.

Accuracy.—Owing to the fact that the bed of the river shifts considerably, estimates based on occasional discharge measurements should be used with great caution. Discharge measurements made in 1910 and 1913 indicate a change in the discharge relation ranging from about 10 per cent at high stage to about 50 per cent at low water. Estimates of discharge for this period have not been prepared as the data available are not sufficient to warrant their publication.

Cooperation.—Gage heights furnished by courtesy of Wisconsin Valley Improvement Co.

The following discharge measurement was made by B. J. Peterson: August 18, 1913: Gage height, 5.13 feet; discharge, 2,670 second-feet.

Daily gage height, in feet, of Wisconsin River near Necedah, Wis., for the year ending Sept. 30, 1913.

[Michael Coughlin, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.6	5.8	5.3	7.3	6.6	6.5	8.6	8.2	10.0	6.3	9.2	5.2
2	6.4	5.8	5.5	7.1	.....	.....	9.6	8.1	10.1	6.0	8.4	4.9
3	6.3	5.8	6.0	7.0	.....	.....	11.1	7.7	9.6	6.0	6.9	5.5
4	6.0	5.6	6.2	6.9	.....	.....	12.0	7.4	8.3	5.8	7.3	5.2
5	6.1	5.8	7.0	.....	.....	.....	12.7	7.4	8.0	5.8	6.4	5.4
6	6.3	5.2	7.5	.....	.....	.....	13.7	7.4	7.6	6.2	5.9	5.3
7	5.9	5.8	7.7	.....	.....	.....	13.9	7.5	7.4	6.2	6.1	5.6
8	6.2	5.7	7.9	.....	6.4	6.5	13.6	8.4	7.2	6.4	6.0	5.0
9	6.1	5.7	6.6	.....	.....	.....	11.7	8.0	7.2	7.1	6.0	5.5
10	6.2	5.6	6.3	.....	.....	.....	11.1	7.8	6.9	7.4	6.1	5.6
11	6.0	5.4	6.6	6.9	.....	.....	10.1	7.7	7.6	7.6	5.9	5.7
12	6.2	5.8	7.9	.....	.....	.....	10.5	7.6	6.3	7.5	6.1	5.3
13	6.4	5.8	8.3	.....	.....	.....	10.6	7.3	6.2	7.5	5.9	5.3
14	6.2	5.7	8.5	.....	.....	.....	10.6	7.2	6.5	7.5	6.2	5.2
15	7.4	6.1	8.7	.....	.....	8.5	10.6	7.4	6.4	8.4	5.5	5.0
16	7.5	6.1	8.2	.....	6.4	9.7	10.6	7.1	6.2	7.8	5.6	5.2
17	7.2	6.0	8.3	.....	.....	10.6	10.6	7.7	6.7	7.6	5.7	4.9
18	7.1	5.9	8.5	6.7	.....	11.8	10.4	8.9	6.5	7.4	5.7	5.2
19	7.0	6.0	8.1	.....	.....	13.4	10.6	8.7	6.4	7.4	5.6	5.2
20	6.6	5.9	8.2	.....	.....	9.3	10.8	9.0	6.2	7.6	5.2	5.3
21	6.2	5.7	8.3	.....	.....	9.2	10.9	8.7	6.6	7.6	5.2	5.2
22	6.4	5.9	7.3	.....	6.4	9.0	10.6	8.6	7.0	7.5	5.4	5.1
23	6.4	5.8	8.1	.....	.....	9.8	9.9	9.9	7.2	7.4	5.5	5.3
24	6.0	5.8	7.9	.....	.....	9.8	9.8	10.6	6.8	6.7	5.0	5.8
25	6.1	6.2	7.8	6.5	.....	9.3	9.7	10.6	6.8	6.6	5.3	5.8
26	6.3	6.0	7.8	.....	.....	9.3	9.1	9.6	6.3	6.3	5.5	6.4
27	6.2	5.8	7.5	.....	.....	9.0	9.2	8.9	6.4	6.2	5.4	6.3
28	6.0	5.8	7.4	.....	.....	9.0	8.9	8.4	6.3	6.1	5.3	6.6
29	6.2	5.6	7.4	.....	.....	9.4	8.7	8.0	6.8	7.7	5.4	6.4
30	6.0	5.4	7.3	.....	.....	8.2	8.4	8.9	7.3	9.4	5.4	6.4
31	5.8	.....	7.6	.....	.....	8.0	.....	9.0	.....	9.8	5.3	.....

NOTE.—Discharge relation affected by ice about Dec. 1, 1912, to Mar. 20, 1913.

TURKEY RIVER AT GARBER, IOWA.

Location.—At single-span highway bridge at Garber, 800 feet above mouth of Wayne Creek, which enters from the right.

Records available.—August 29 to September 30, 1913.

Drainage area.—1,560 square miles.

Gage.—Chain gage attached to the bridge, read morning and evening to quarter-tenths. Limits of use: Hundredths below 3.0, half-tenths from 3.0 to 4.0, and tenths above 4.0 feet.

Channel and control.—Sand and mud; shifting.

Discharge measurements.—Made from the bridge or, at low water, by wading.

Regulation.—The operation of an electric-light plant and grist mill at Elkader probably produces a slight daily fluctuation.

Floods.—What is probably the highest stage within the past 20 years occurred May 18, 1902, when the river reached a stage indicated by high-water mark on door of A. F. Grafe's residence in Garber about 23.7 feet above gage datum.

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, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 8	W. G. Hoyt	2.80	181
29	B. J. Peterson	2.88	151

Daily gage height, in feet, of Turkey River at Garber, Iowa, for the year ending Sept. 30, 1913.

[E. J. Prolow, observer.]

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1		2.90	11		3.3	21		3.5
2		2.90	12		3.0	22		3.2
3		2.80	13		2.90	23		3.0
4		2.75	14		2.90	24		2.96
5		2.72	15		2.90	25		2.96
6		2.75	16		3.2	26		3.1
7		2.72	17		2.95	27		2.99
8		3.9.	18		2.82	28		2.94
9		3.0	19		2.81	29	2.88	2.90
10		2.81	20		4.1	30	2.92	3.2
						31	2.92	

MAQUOKETA RIVER ABOVE MOUTH OF NORTH FORK OF MAQUOKETA RIVER, NEAR MAQUOKETA, IOWA.

Location.—At the Goddard Bridge, about 6 miles west of Maquoketa, about 1,000 feet above mouth of Punkin Run entering from the right, and about 7 miles above mouth of North Fork of Maquoketa River.

Records available.—August 31 to September 30, 1913.

Drainage area.—957 square miles.

Gage.—Chain gage attached to the bridge; read once daily, in the morning, to half-tenths. Limits of use: Half-tenths below and tenths above 3.0 feet.

Channel and control.—Control not well defined; channel somewhat shifting.

Discharge measurements.—Made from the bridge.

Regulation.—The operation of a grist mill at Canton, about 12 miles upstream, probably produces a slight daily fluctuation at the gage.

Accuracy.—Gage-height record reliable. Data insufficient for estimates of discharge.

The following discharge measurement was made by S. B. Soulé:
August 31, 1913: Gage height, 2.01 feet; discharge, 194 second-feet.

Daily gage height, in feet, of Maquoketa River above mouth of North Fork Maquoketa River near Maquoketa, Iowa, for the year ending Sept. 30, 1913.

[Frank Prindle, observer.]

Day.	Sept.	Day.	Sept.	Day.	Sept.
1	1.95	11	2.0	21	2.2
2	2.0	12	2.0	22	2.2
3	1.9	13	2.1	23	2.2
4	1.95	14	2.05	24	2.15
5	2.0	15	2.0	25	2.1
6	2.0	16	2.1	26	2.15
7	2.1	17	2.0	27	2.1
8	1.9	18	2.15	28	2.1
9	2.0	19	2.1	29	2.0
10	1.95	20	2.1	30	2.1

MAQUOKETA RIVER BELOW MOUTH OF NORTH FORK OF MAQUOKETA RIVER, NEAR MAQUOKETA, IOWA.

Location.—In the southwest corner of the NE. ¼ sec. 17, T. 84 N., R. 3 E., at the Bridgeport Bridge, about 3 miles northeast of Maquoketa, 1,200 feet above the mouth of Mill Creek which enters from the right, and about 2 miles below the mouth of North Fork Maquoketa River.

Records available.—September 1 to 30, 1913.

Drainage area.—1,570 square miles.

Channel and control.—Control not well defined; channel shifting.

Discharge measurements.—Made from bridge.

Regulation.—Practically none.

Accuracy.—Gage-height record reliable; data inadequate for estimates of discharge.

Discharge measurements of Maquoketa River below mouth of North Fork Maquoketa River near Maquoketa, Iowa, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 21	W. G. Hoyt	2.87	564
30	S. B. Soulé	2.30	396

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, 1913.

[John Strodthoff, observer.]

Day.	Sept.	Day.	Sept.	Day.	Sept.
1	2.25	11	2.22	21	2.55
2	2.30	12	2.22	22	2.50
3	2.28	13	2.28	23	2.48
4	2.25	14	2.41	24	2.38
5	2.25	15	2.28	25	2.40
6	2.25	16	2.30	26	2.32
7	2.25	17	2.38	27	2.28
8	2.22	18	2.35	28	2.30
9	2.22	19	2.32	29	2.25
10	2.22	20	2.48	30	2.30

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, 1913.

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.

Channel and control.—Remains of a loose rock dam under the Chicago, Milwaukee & St. Paul Railway bridge, practically permanent, forms the control.

Discharge measurements.—Made from upstream side of bridge.

Floods.—The high water of July, 1892, reached a stage of 28 feet referred to the present gage. According to the observer, this record is probably correct within one-half foot.

Winter flow.—Discharge relaton affected by ice that forms to a thickness of 1 to 2i feet.

Regulation.—The operation of a power plant installed in 1912 at Center City, about 20 miles above the station, may possibly cause some diurnal fluctuation at the gage.

Cooperation.—Gage heights furnished by Frank Dearborn, of Stone City, Iowa.

Discharge measurements of Wapsipinicon River at Stone City, Iowa, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 9	S. B. Soulé	2.95	198
Sept. 2	B. J. Peterson	2.38	71.6

Daily gage height, in feet, of Wapsipinicon River at Stone City, Iowa, for the year ending Sept. 30, 1913.

[Frank Dearborn, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.2	3.05	3.3	3.1	.....	.....	6.6	3.3	6.5	2.80	2.65	2.38
2	3.25	3.0	3.1	.....	.....	.....	6.1	3.3	5.7	2.88	2.62	2.42
3	3.1	3.05	3.1	.....	.....	.....	5.8	3.25	4.9	2.72	2.68	2.36
4	3.05	3.25	3.1	.....	.....	.....	5.6	3.6	4.7	2.70	2.58	2.40
5	3.0	3.05	2.72	.....	2.65	3.1	5.6	4.0	4.4	2.72	2.58	2.38
6	2.88	3.0	2.94	.....	.....	.....	5.3	4.4	4.2	2.68	2.56	2.38
7	2.96	3.0	3.2	.....	.....	.....	5.2	4.6	4.6	3.75	2.36	2.38
8	2.85	2.90	3.2	3.1	.....	.....	5.2	4.7	3.95	2.68	2.35	2.45
9	3.3	3.0	3.15	.....	.....	5.6	5.8	4.6	4.0	3.2	2.44	2.64
10	3.65	2.98	3.2	.....	.....	5.9	6.4	4.3	3.9	2.82	2.55	2.40
11	3.9	3.0	3.2	.....	.....	6.0	6.6	4.0	3.7	2.56	2.48	2.48
12	3.75	2.96	3.15	.....	2.48	6.2	6.6	4.3	3.8	2.55	2.78	2.43
13	4.15	3.3	3.1	.....	.....	6.6	6.7	4.4	3.65	2.52	2.63	2.40
14	3.95	3.5	3.1	.....	.....	7.8	6.4	4.7	3.7	2.56	2.40	2.38
15	3.65	3.45	.....	3.1	.....	9.0	6.1	5.1	3.7	2.58	2.95	2.33
16	3.35	3.5	.....	.....	.....	9.6	5.6	5.0	3.9	2.62	2.80	2.40
17	3.45	3.35	.....	.....	.....	10.1	5.4	5.3	3.55	2.97	2.62	2.40
18	3.3	3.15	3.1	.....	.....	10.4	5.4	5.3	3.5	2.92	2.47	2.42
19	3.3	3.05	.....	.....	2.82	10.5	4.9	4.8	3.3	2.80	2.55	2.58
20	3.25	3.1	.....	.....	.....	9.8	4.7	4.9	3.4	2.56	2.42	2.55
21	3.3	3.1	.....	.....	.....	9.0	4.6	5.8	3.35	2.57	2.52	2.40
22	3.25	3.0	.....	3.0	.....	8.8	4.4	6.5	3.3	2.59	2.70	2.40
23	3.1	3.0	.....	.....	.....	8.4	4.0	7.2	3.35	2.78	2.45	2.45
24	3.2	3.0	.....	.....	.....	10.2	3.85	8.9	3.3	2.72	2.42	2.60
25	3.15	3.0	.....	.....	.....	10.5	3.7	9.3	3.45	2.60	2.35	2.42
26	3.0	2.98	3.1	.....	2.75	10.1	3.5	8.2	3.35	2.56	2.35	2.40
27	3.1	2.95	.....	.....	.....	9.8	3.35	7.9	3.35	2.62	2.33	2.38
28	2.98	2.98	.....	.....	.....	8.6	3.55	8.3	3.95	2.71	2.38	2.38
29	3.15	3.0	.....	2.8	.....	7.4	3.55	9.2	3.35	2.82	2.38	2.40
30	3.0	3.9	.....	.....	.....	7.2	3.35	9.4	2.7	2.70	2.40	2.48
31	3.1	.....	.....	.....	.....	7.1	.....	8.1	.....	2.63	2.42	.....

NOTE.—Discharge relation affected by ice about Dec. 7, 1912, to Mar. 8, 1913.

Daily discharge, in second-feet, of Wapsipinicon River at Stone City, Iowa, for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	295	238	335	.....	.....	.....	2,120	335	2,060	164	126	71
2	315	220	255	.....	.....	.....	1,820	335	1,590	185	119	78
3	255	238	255	.....	.....	.....	1,640	315	1,150	143	133	68
4	238	315	255	.....	.....	.....	1,540	465	1,040	138	110	74
5	220	238	143	.....	.....	.....	1,540	660	875	143	110	71
6	185	220	202	.....	.....	.....	1,370	875	765	133	105	71
7	208	220	.....	.....	.....	.....	1,320	985	985	535	68	71
8	177	190	.....	.....	.....	.....	1,320	1,040	635	133	66	83
9	335	220	.....	.....	.....	1,540	1,640	985	660	295	81	124
10	488	214	.....	.....	.....	1,700	2,000	820	610	169	103	74
11	610	220	.....	.....	.....	1,760	2,120	660	510	105	88	88
12	535	208	.....	.....	.....	1,880	2,120	820	560	103	159	79
13	738	335	.....	.....	.....	2,120	2,180	875	488	96	121	74
14	635	420	.....	.....	.....	2,940	2,000	1,040	510	105	74	71
15	488	398	.....	.....	.....	3,840	1,820	1,260	510	110	205	63
16	355	420	.....	.....	.....	4,320	1,540	1,200	610	119	164	74
17	398	355	.....	.....	.....	4,720	1,420	1,370	442	211	119	74
18	335	275	.....	.....	.....	4,980	1,420	1,370	420	196	87	78
19	335	238	.....	.....	.....	5,070	1,150	1,100	335	164	103	110
20	315	255	.....	.....	.....	4,480	1,040	1,150	375	105	78	103
21	335	255	.....	.....	.....	3,840	985	1,640	355	107	96	74
22	315	220	.....	.....	.....	3,690	875	2,060	335	112	138	74
23	255	220	.....	.....	.....	3,390	660	2,520	355	159	83	83
24	295	220	.....	.....	.....	4,800	585	3,760	335	143	78	114
25	275	220	.....	.....	.....	5,070	510	4,080	398	114	66	78
26	220	214	.....	.....	.....	4,720	420	3,240	355	105	66	74
27	255	205	.....	.....	.....	4,480	355	3,020	355	119	63	71
28	214	214	.....	.....	.....	3,540	442	3,320	635	141	71	71
29	275	220	.....	.....	.....	2,660	442	4,000	355	169	71	74
30	220	610	.....	.....	.....	2,520	355	4,160	138	138	74	88
31	255	.....	.....	.....	.....	2,450	.....	3,160	.....	121	78	.....

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 estimated, because of ice, from gage heights, observer's notes, climatic records, and discharge of adjacent drainage areas, as follows: Dec. 7–31, 1912, 170 second-feet; Jan. 1–31, 1913, 170 second-feet; Feb. 1–28, 140 second-feet; and Mar. 1–8, 300 second-feet.

Monthly discharge of Wapsipinicon River at Stone City, Iowa, for the year ending Sept. 30, 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	738	177	335	0.256	0.30	A.
November	610	190	268	.205	.23	A.
December	.....	.....	184	.140	.16	
January	.....	.....	170	.130	.15	
February	.....	.....	140	.107	.11	
March	5,070	.....	2,670	2.04	2.35	B.
April	2,180	355	1,290	.985	1.10	A.
May	4,160	315	1,700	1.30	1.50	B.
June	2,060	138	625	.477	.53	A.
July	535	96	154	.118	.14	A.
August	205	63	100	.076	.09	A.
September	124	63	80.0	.061	.07	A.
The year	5,070	.....	648	.495	6.73	

IOWA RIVER NEAR IOWA FALLS, IOWA.

Location.—About 1 mile above Iowa Falls and 2 miles below the Northwestern Railway bridge.

Records available.—August 5, 1911, to September 30, 1913.

Drainage area.—Not measured.

Gage.—Vertical staff fastened to a maple tree on the north or left bank of the river, read morning and evening to quarter-tenths. Limits of use: Hundredths below 2.0, half-tenths from 2.0 to 3.0, and tenths above 3.0 feet.

Channel and control.—Rock; permanent.

Discharge measurements.—At low water made by wading in the vicinity of the gage; at high stages from Illinois Central Railroad bridge one-fourth mile from depot. A small creek enters from the left between the bridge and gage.

Winter flow.—Discharge relation affected by ice.

Regulation.—A dam 7 miles above the gage at Alden is used occasionally. It is thought that the flow at the gage is the natural flow of the stream.

Data inadequate for estimates of discharge.

Discharge measurements of Iowa River near Iowa Falls, Iowa, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 7	Lees and Soulé	0.61	28.1	Sept. 4	B. J. Peterson	0.48	10.6
7	do	.61	30.2	4	do	.48	11.1

NOTE.—Measurements made by wading.

Daily gage height, in feet, of Iowa River near Iowa Falls, Iowa, for the year ending Sept. 30, 1913.

[Albert Kulas, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.56	0.85	0.85	0.91	1.2	1.25	1.45	1.20	2.15	0.80	0.55	0.49
2	.72	.86	.85	1.00	1.2	1.2	1.39	1.12	1.95	.78	.60	.51
3	.60	.85	.74	1.04	1.2	1.4	1.38	1.08	1.75	.90	.48	.48
4	.60	.92	.88	.98	1.2	1.4	1.40	1.39	1.55	.82	.50	.49
5	.62	.82	.98	.88	1.25	1.3	1.40	1.6	1.48	.78	.54	.49
6	.62	.72	1.00	1.0	1.2	1.25	1.40	1.7	1.44	.71	.54	.49
7	.62	.68	1.00	1.05	1.15	1.3	1.45	1.65	1.29	.70	.59	.50
8	.72	.90	.94	1.0	1.2	1.8	1.75	1.6	1.26	.70	.44	.60
9	.65	.76	.95	.98	1.3	1.75	2.1	1.6	1.20	.68	.50	.65
10	.71	.78	.80	1.0	1.3	1.8	2.7	1.65	1.18	.65	.50	.50
11	.78	.72	.82	1.05	1.2	2.0	2.95	1.5	1.11	.68	.60	.55
12	.72	.79	.80	1.0	1.2	2.15	3.2	1.48	1.10	.79	.60	.65
13	1.05	.81	.85	1.05	1.3	2.25	3.2	1.5	1.02	.74	.70	.49
14	1.00	.82	.85	1.0	1.3	3.5	3.0	1.6	1.00	.70	.66	.52
15	1.00	.84	.86	1.05	1.3	4.8	2.65	2.05	1.00	.70	.65	.70
16	.94	.82	.90	1.05	1.25	5.1	2.35	2.3	.98	.70	.60	.52
17	.89	.85	.88	1.1	1.2	3.5	2.1	2.4	.94	.70	.62	.64
18	.84	.72	.89	1.1	1.2	2.8	1.9	2.5	.90	.78	.65	.48
19	.80	.66	.90	1.15	1.2	2.1	1.75	2.55	.89	.68	.59	.70
20	.81	.82	.90	1.2	1.2	2.0	1.55	2.7	.88	.44	.60	.65
21	.90	.81	.92	1.2	1.2	1.7	1.5	2.95	.89	.60	.60	.52
22	1.05	.84	.94	1.2	1.3	2.0	1.42	3.1	.88	.62	.65	.72
23	1.00	.88	.91	1.2	1.3	1.4	1.39	3.2	.80	.69	.75	.55
24	.98	.75	.92	1.2	1.25	2.45	1.36	3.3	.80	.68	.75	.62
25	.98	.82	.90	1.2	1.25	2.4	1.36	3.2	.88	.69	.71	.66
26	.94	.69	.90	1.2	1.3	2.4	1.31	3.0	.90	.68	.59	.72
27	.90	.56	.92	1.2	1.25	2.5	1.29	2.9	.89	.68	.68	.75
28	.90	.72	.95	1.2	1.25	1.85	1.31	3.0	.90	.66	.59	.80
29	.88	.90	.92	1.2	.....	1.8	1.31	3.0	.86	.66	.50	.70
30	.88	.78	.95	1.2	.....	1.75	1.28	2.95	.81	.88	.35	.72
31	.85	.....	.99	1.2	.....	1.65	.....	2.5	.....	.58	.45	.....

NOTE.—Discharge relation affected by ice about Dec. 8, 1912, to Mar. 14, 1913. On Mar. 22, 1913, observer reported slush ice below the gage.

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.

Records available.—May 29, 1909, to September 30, 1913.

Drainage area.—425 square miles.

Gage.—Chain gage since May 2, 1913, read to quarter-tenths three times daily when Red Cedar mill (see "Regulation") is in operation and twice daily at other times. Limits of use: Hundredths below 3.0, half-tenths from 3.0 to 4.0, and tenths above 4.0 feet.

Winter flow.—The discharge relation was probably not materially affected by ice during the winter of 1912–13.

Regulation.—Immediately above the station is the power plant known as Red Cedar mill. During the low-water season the water is drawn down 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 has risen 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 vegetation, 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, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 24	S. B. Soulé	2.51	[a]58.4	June 27	S. B. Soulé	4.90	766
Apr. 1	do	3.06	195	Sept. 25	B. J. Peterson	2.71	[c]57.2
May 21	do	4.67	[b]676	25	do	2.75	[c]67.7

[a] Velocities determined by subsurface method.
[b] Slight obstruction from barbed wires in river just below gage.
[c] Large amount of grass at control.

Daily gage height, in feet, of Cedar River near Austin, Minn., for the year ending Sept. 30, 1913.

[J. C. King, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.11	2.45	2.43	2.23	2.34	2.59	3.05	2.56	2.63	2.73	2.72	2.61
2	2.47	2.46	2.36	2.22	1.98	2.29	3.05	2.57	2.74	2.66	2.61	2.62
3	2.47	2.33	2.36	2.23	2.31	2.59	3.5	2.76	2.68	2.61	2.52	2.60
4	2.48	2.40	2.42	2.24	2.33	2.27	3.35	3.15	2.66	2.47	2.58	2.56
5	2.49	2.42	2.42	2.05	2.01	2.25	3.1	3.20	2.64	2.62	2.55	2.40
6	2.33	2.48	2.34	2.40	2.56	2.37	2.92	3.00	2.62	2.53	2.48	2.42
7	2.37	2.43	2.34	2.37	2.01	2.20	2.87	2.89	2.62	2.86	2.46	2.17
8	2.42	2.46	2.30	2.33	2.36	3.85	2.81	2.80	2.47	2.82	2.51	2.55
9	2.44	2.44	2.47	2.05	2.06	4.4	2.79	2.80	2.52	2.67	2.51	2.44
10	2.42	2.31	2.42	2.40	2.28	5.6	3.1	2.74	2.54	2.57	2.69	2.43
11	2.52	2.38	2.23	2.42	2.29	5.7	3.7	2.67	2.52	2.64	2.76	2.44
12	2.60	2.52	2.27	2.05	2.38	4.9	4.1	2.73	2.45	2.65	2.78	2.47
13	2.43	2.66	2.24	2.36	2.52	4.1	3.65	2.66	2.36	2.55	2.70	2.47
14	2.69	2.65	2.21	2.43	2.06	6.7	3.5	2.82	2.45	2.66	2.59	2.21
15	2.59	2.66	2.08	2.36	2.28	5.05	3.15	3.35	2.34	2.58	2.57	2.55
16	2.53	2.64	2.35	1.92	2.19	4.2	3.05	3.8	2.42	2.66	2.55	2.49
17	2.51	2.48	2.47	2.15	2.30	3.45	2.92	4.7	2.42	2.59	2.50	2.49
18	2.51	2.58	2.44	2.37	2.28	3.25	2.85	4.8	2.41	2.62	2.78	2.49
19	2.46	2.56	2.41	2.36	1.98	3.3	2.80	4.3	2.41	2.50	2.62	2.52
20	2.32	2.56	2.27	2.36	2.30	3.05	2.71	4.5	2.50	2.39	2.74	2.57
21	2.55	2.57	2.20	2.25	2.31	2.95	2.77	4.7	2.46	2.53	2.74	2.48
22	2.56	2.48	2.00	2.21	2.66	2.81	2.73	4.5	2.38	2.50	3.25	2.58
23	2.49	2.50	2.39	2.31	2.01	2.76	2.68	4.0	2.46	2.48	3.3	2.50
24	2.45	2.33	2.26	2.30	2.38	6.5	2.71	3.6	2.49	2.46	3.1	2.70
25	2.49	2.53	2.11	2.43	2.22	6.5	2.71	3.3	5.5	2.44	2.95	2.74
26	2.44	2.52	2.35	2.32	2.22	4.5	2.70	3.4	6.7	2.45	2.76	2.71
27	2.36	2.54	2.30	2.44	2.34	3.4	2.64	3.3	4.7	2.37	2.60	2.64
28	2.42	2.37	2.22	2.31	2.00	3.3	2.66	3.15	3.8	2.45	2.58	2.54
29	2.44	2.52	1.97	2.26	.....	3.4	2.62	3.1	3.15	2.54	2.52	2.70
30	2.42	2.58	2.25	2.38	.....	3.35	2.60	2.87	2.93	2.53	2.58	2.67
31	2.47	.....	2.37	2.27	.....	3.25	.....	2.87	.....	2.75	2.47	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1913.

Daily discharge, in second-feet, of Cedar River near Austin, Minn., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7.5	48	45	18	31	74	189	68	83	62	60	42
2	51	50	34	17	4	24	189	70	110	50	42	43
3	51	30	34	18	26	74	310	115	95	42	28	40
4	53	40	43	19	30	22	268	215	90	22	37	34
5	54	43	43	6	5	20	202	228	86	43	32	15
6	30	53	31	40	68	36	155	176	81	30	23	17
7	36	45	31	36	5	15	142	148	81	90	21	4
8	43	50	25	30	34	413	128	125	51	81	26	32
9	46	46	23	6	6	586	122	125	60	51	26	19
10	43	26	21	40	23	1,030	202	110	64	36	54	18
11	60	37	18	43	24	1,070	368	93	60	46	68	19
12	76	60	22	6	37	762	490	108	48	48	72	22
13	45	90	19	34	60	490	353	90	34	32	56	22
14	98	88	16	45	6	1,450	310	130	48	50	38	5
15	74	90	6.3	34	23	819	215	268	31	37	36	32
16	62	86	32	4	14	522	189	398	43	50	32	24
17	58	53	51	11	25	296	155	688	43	38	25	24
18	58	72	46	36	23	241	138	724	42	43	72	24
19	50	68	42	34	4	254	125	554	42	25	43	28
20	28	68	22	34	25	189	102	618	56	14	64	36
21	66	70	15	20	26	163	118	688	50	30	64	23
22	68	53	4.5	16	90	128	108	618	37	25	189	37
23	54	56	38	26	5	115	95	458	50	23	202	25
24	48	30	21	25	37	1,370	102	338	54	21	150	56
25	54	62	7.5	45	17	1,370	102	254	990	19	112	64
26	46	60	32	28	17	618	100	282	1,450	20	68	58
27	34	64	25	46	31	282	86	254	688	13	40	46
28	43	36	17	26	4	254	90	215	398	20	37	31
29	46	60	4.2	21	.....	282	81	202	215	31	28	56
30	43	72	20	37	.....	268	76	142	158	30	37	51
31	51	.....	36	22	.....	241	.....	142	.....	66	22	.....

NOTE.—Daily discharge Oct. 1, 1912, to June 30, 1913, computed from a rating curve well defined between 6.7 and 1,370 second-feet (gage heights 2.1 and 6.5 feet). Daily discharge July 1 to Sept. 30, 1913, computed from a rating curve based on the discharge measurements made on Sept. 25, 1913. The discharge relation was probably affected by backwater from grass during the latter period. Estimates of discharge for January and February may possibly be somewhat too high as the open-water rating curve was used during these months.

Monthly discharge of Cedar River near Austin, Minn., for the year ending Sept. 30, 1913.

[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	98	7.5	50.9	0.120	0.14	B.
November	90	26	56.9	.134	.15	B.
December	51	4.2	26.6	.063	.07	C.
January	46	4	26.5	.062	.07	C.
February	90	4	25.0	.059	.06	D.
March	1,450	15	435	1.02	1.18	C.
April	490	76	177	.416	.46	B.
May	724	68	279	.656	.76	B.
June	1,450	31	178	.419	.47	C.
July	90	13	38.3	.090	.10	C.
August	202	21	58.2	.137	.16	C.
September	64	4	31.6	.074	.08	C.
The year	1,450	4	116	.273	3.70	

NOTE.—See footnote to table of daily discharge.

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, 1913.

Drainage area.—6,320 square miles.

Gage.—An inclined staff gage fastened to posts driven in the right bank of the river in the rear of the Iowa Windmill & Pump Co.'s plant. Gage read once 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 upstream side of the First Avenue bridge.

Winter flow.—Discharge relation affected only slightly by ice, as the current is swift and ice seldom forms across the river for the entire width.

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.

Cooperation.—Gage heights furnished by United States Weather Bureau.

Discharge measurements of Cedar River at Cedar Rapids, Iowa, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 8	S. B. Soulé	3.01	910	Sept. 3	B. J. Peterson	2.78	688
Sept. 3	B. J. Peterson	2.79	[a]733				

[a] Measurement made at Fourteenth Avenue bridge; not a good measuring section.

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.1	3.1	3.0	3.1	3.0	2.8	4.7	3.6	5.0	4.0	2.8	2.9
2	3.2	3.0	2.9	2.9	3.0	3.0	4.6	3.7	4.6	3.8	2.9	2.7
3	3.1	3.1	3.1	2.9	2.9	2.9	4.2	3.5	4.5	3.8	2.8	2.8
4	3.2	3.0	2.8	2.8	3.0	3.0	4.3	3.7	4.3	3.5	2.9	2.7
5	3.1	3.0	2.9	2.9	2.9	2.9	4.3	3.6	4.2	3.6	2.8	2.8
6	3.2	2.9	2.7	2.7	3.0	3.1	4.2	4.2	4.0	3.4	2.9	2.7
7	3.1	3.2	2.8	2.8	2.8	3.0	4.2	4.0	4.1	3.5	2.8	2.8
8	3.2	3.0	2.8	2.7	2.9	3.1	4.3	4.1	3.9	3.3	2.9	2.7
9	3.2	3.1	2.9	2.8	2.7	3.9	4.2	4.1	3.9	3.4	2.8	2.8
10	3.5	2.9	3.0	2.9	2.8	4.0	4.4	4.1	3.7	3.3	3.0	2.7
11	3.4	3.0	3.1	3.1	2.7	4.1	4.5	3.9	3.8	3.4	2.9	2.9
12	3.4	2.9	3.0	3.0	2.8	4.3	4.6	3.9	3.7	3.3	2.9	2.8
13	3.3	3.1	3.1	3.2	2.8	6.5	5.0	3.8	3.7	3.4	3.0	2.9
14	3.3	3.2	3.2	3.1	2.9	6.7	5.0	4.0	3.6	3.3	3.1	2.8
15	3.2	3.4	2.8	3.2	2.8	7.5	4.7	4.2	4.6	3.4	3.0	2.9
16	3.3	3.2	2.7	3.4	3.0	7.6	4.6	4.3	3.7	3.0	3.0	2.7
17	3.1	3.2	2.8	3.7	2.9	7.7	4.4	4.3	3.8	3.1	2.9	2.9
18	3.2	3.0	2.8	3.7	3.0	8.9	4.4	4.3	3.6	3.0	3.0	2.7
19	3.1	3.1	2.9	3.6	2.9	8.7	4.3	4.2	3.7	3.1	2.8	2.8
20	3.2	3.0	2.8	3.2	3.3	7.6	4.3	4.9	3.6	3.0	2.9	2.7
21	3.1	3.1	2.9	3.2	3.2	6.8	4.0	5.0	3.6	3.0	2.8	2.8
22	3.1	2.9	2.8	3.1	3.1	6.7	4.1	5.5	3.6	3.0	2.9	2.7
23	3.0	3.0	2.9	3.1	3.0	6.2	4.0	5.6	3.6	3.1	2.8	2.8
24	3.1	2.9	2.7	3.0	3.0	6.4	4.0	5.9	3.4	3.0	2.9	2.7
25	3.1	2.9	2.8	3.0	2.9	6.9	3.9	5.8	3.5	3.1	2.9	2.8
26	3.2	2.8	2.7	2.9	3.0	6.3	3.9	6.0	3.4	2.9	2.9	2.7
27	3.1	2.9	2.9	3.0	2.9	6.3	3.8	5.7	3.5	3.0	2.8	2.8
28	3.2	2.9	2.8	2.9	2.9	6.5	3.9	5.7	3.5	2.9	2.9	2.7
29	3.1	3.0	3.0	3.1	.....	5.9	3.7	5.5	3.5	3.0	2.8	2.8
30	3.1	2.9	2.9	3.1	.....	5.6	3.8	5.4	3.4	2.9	2.9	2.8
31	3.0	.....	3.1	3.2	.....	5.2	.....	5.1	.....	3.0	2.8	.....

NOTE.—Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1913.

Daily discharge, in second-feet, of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,100	1,100	950	1,100	950	690	5,430	2,070	6,470	3,170	690	810
2	1,260	950	810	810	950	950	5,090	2,320	5,090	2,590	810	580
3	1,100	1,100	1,100	810	810	810	3,790	1,840	4,760	2,590	690	690
4	1,260	950	690	690	950	950	4,110	2,320	4,110	1,840	810	580
5	1,100	950	810	810	810	810	4,110	2,070	3,790	2,070	690	690
6	1,260	810	580	580	950	1,100	3,790	3,790	3,170	1,630	810	580
7	1,100	1,260	690	690	690	950	3,790	3,170	3,480	1,840	690	690
8	1,260	950	690	580	810	1,100	4,110	3,480	2,870	1,440	810	580
9	1,260	1,100	810	690	580	2,870	3,790	3,480	2,870	1,630	690	690
10	1,840	810	950	810	690	3,170	4,430	3,480	2,320	1,440	950	580
11	1,630	950	1,100	1,100	580	3,480	4,760	2,870	2,590	1,630	810	810
12	1,630	810	950	950	690	4,110	5,090	2,870	2,320	1,440	810	690
13	1,440	1,100	1,100	1,260	690	12,000	6,470	2,590	2,320	1,630	950	810
14	1,440	1,260	1,260	1,100	810	12,700	6,470	3,170	2,070	1,440	1,100	690
15	1,260	1,630	690	1,260	690	15,800	5,430	3,790	5,090	1,630	950	810
16	1,440	1,260	580	1,630	950	16,200	5,090	4,110	2,320	950	950	580
17	1,100	1,260	690	2,320	810	16,600	4,430	4,110	2,590	1,100	810	810
18	1,260	950	690	2,320	950	21,400	4,430	4,110	2,070	950	950	580
19	1,100	1,100	810	2,070	810	20,600	4,110	3,790	2,320	1,100	690	690
20	1,260	950	690	1,260	1,440	16,200	4,110	6,120	2,070	950	810	580
21	1,100	1,100	810	1,260	1,260	13,100	3,170	6,470	2,070	950	690	690
22	1,100	810	690	1,100	1,100	12,700	3,480	8,250	2,070	950	810	580
23	950	950	810	1,100	950	10,800	3,170	8,610	2,070	1,100	690	690
24	1,100	810	580	950	950	11,600	3,170	9,710	1,630	950	810	580
25	1,100	810	690	950	810	13,500	2,870	9,340	1,840	1,100	810	690
26	1,260	690	580	810	950	11,200	2,870	10,100	1,630	810	810	580
27	1,100	810	810	950	810	11,200	2,590	8,970	1,840	950	690	690
28	1,260	810	690	810	810	12,000	2,870	8,970	1,840	810	810	580
29	1,100	950	950	1,100	.....	9,710	2,320	8,250	1,840	950	690	690
30	1,100	810	810	1,100	.....	8,610	2,590	7,890	1,630	810	810	690
31	950	.....	1,100	1,260	.....	7,170	.....	6,820	.....	950	690	.....

NOTE.—Daily discharge computed from a rating curve well defined between 600 and 36,000 second-feet. Open-channel rating table applied throughout entire year.

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for the year ending Sept. 30, 1913.

[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	1,840	950	1,230	0.195	0.22	A.
November	1,630	690	993	.157	.18	A.
December	1,260	580	812	.128	.15	B.
January	2,320	580	1,100	.174	.20	B.
February	1,440	580	866	.137	.14	B.
March	21,400	690	8,840	1.40	1.61	B.
April	6,470	2,320	4,060	.642	.72	A.
May	10,100	1,840	5,130	.812	.94	A.
June	6,470	1,630	2,770	.438	.49	A.
July	3,170	810	1,400	.222	.26	A.
August	1,100	690	799	.127	.15	A.
September	810	580	666	.105	.12	A.
The year	21,400	580	2,410	.381	5.18	

DES MOINES RIVER AT JACKSON, MINN.

Location.—At highway bridge half a mile below the dam at Jackson, Minn., 100 yards above the nearest tributary, a small stream entering from the west.

Records available.—May 31, 1909, to December 20, 1913, when station was discontinued.

Drainage area.—1,160 square miles.

Gage.—Vertical staff, read morning and evening 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.—Sandy; shifts during high water.

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

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

Regulation.—A power plant at the dam half a mile above the station develops 35 horsepower under a head of 6½ feet. The plant operates only 6 hours a day on average, but the morning and evening gage heights do not show any appreciable change in the stage of the river.

Discharge measurements of Des Moines River at Jackson, Minn., during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 2	S. B. Soulé	3.24	27.3	May 22	S. B. Soulé	5.07	[a]343
2	....do	3.44	37.7	Sept. 26	B. J. Peterson	3.68	87.9

[a] Slight obstruction caused by a snag at control.

Daily gage height, in feet, of Des Moines River at Jackson, Minn., from Oct. 1, 1912, to Dec. 20, 1913.

[Mrs. Mary Strobel, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	2.78	3.00	.....	.....	.....	3.10	4.25	4.7	3.76	3.66	5.1	3.56	3.25	3.11
2	2.80	2.95	2.98	.....	.....	.....	3.29	4.0	4.65	4.05	3.69	5.1	3.55	3.26	3.05
3	2.78	2.95	2.89	.....	.....	.....	3.21	4.2	4.6	4.05	3.64	5.1	3.51	3.16	3.14
4	2.75	2.90	2.81	.....	.....	.....	3.22	4.15	4.5	4.1	3.61	5.0	3.48	3.06	3.18
5	2.76	2.91	2.80	.....	.....	.....	3.52	4.1	4.4	4.2	3.68	4.9	3.48	3.15	3.19
6	2.76	2.91	.....	.....	.....	.....	3.46	4.0	4.35	4.2	3.56	4.8	3.41	3.20	3.18
7	2.75	2.91	.....	.....	.....	.....	3.72	3.91	4.25	4.05	3.49	4.75	3.45	3.26	3.04
8	2.75	2.89	.....	.....	.....	.....	3.59	3.86	4.2	4.1	3.48	4.65	3.39	3.21	3.10
9	2.91	2.88	.....	.....	.....	.....	3.44	3.88	4.1	4.1	3.58	4.55	3.46	3.21	2.98
10	3.25	2.89	.....	.....	.....	.....	3.74	3.78	4.1	4.0	3.50	4.6	3.49	3.15	3.16
11	3.10	2.90	.....	.....	.....	.....	3.74	3.71	4.0	4.15	3.58	5.05	3.51	3.09	2.98
12	3.05	2.95	.....	.....	.....	.....	4.25	3.61	3.98	4.1	3.60	4.4	3.42	3.28	2.95
13	3.00	2.98	.....	.....	.....	.....	4.50	4.1	3.90	4.05	3.60	4.3	3.34	3.31	2.92
14	2.98	3.00	.....	.....	.....	.....	4.65	4.1	3.88	3.9	3.54	4.2	3.39	3.16	2.91
15	2.94	2.96	.....	.....	.....	.....	4.55	4.25	3.82	3.95	3.56	4.15	3.34	3.24	3.10
16	3.00	2.95	.....	.....	.....	.....	4.25	4.2	3.69	3.89	3.56	4.05	3.42	3.20	3.08
17	3.30	2.95	.....	.....	.....	.....	4.1	4.8	3.72	3.92	3.50	3.92	3.45	3.10	3.16
18	3.10	2.92	.....	.....	.....	.....	4.2	4.4	3.60	3.88	3.40	3.86	3.52	3.00	3.15
19	2.99	2.96	.....	.....	.....	.....	4.2	4.4	3.52	3.88	3.48	3.84	3.32	3.16	3.09
20	2.92	2.96	.....	.....	.....	.....	4.2	4.7	3.70	3.80	4.1	3.84	3.22	3.18	3.22
21	2.89	2.90	.....	.....	.....	.....	4.1	4.95	3.89	3.71	4.4	3.80	3.28	3.22	.....
22	2.85	2.90	.....	.....	.....	.....	4.05	5.0	3.76	3.81	4.35	3.66	3.30	3.22	.....
23	2.85	2.90	.....	.....	.....	.....	4.1	4.85	3.52	3.80	4.55	3.66	3.29	3.18	.....
24	2.82	2.96	.....	.....	.....	.....	4.5	4.75	3.55	3.74	4.65	3.70	3.28	3.09	.....
25	2.80	2.88	.....	.....	.....	.....	4.6	4.8	3.46	3.75	4.75	3.72	3.28	3.02	.....
26	2.81	3.00	.....	.....	.....	.....	4.6	4.95	3.89	3.74	4.8	3.68	3.28	3.18	.....
27	2.80	3.10	.....	.....	.....	.....	4.4	5.1	3.65	3.75	4.85	3.71	3.02	3.18	.....
28	2.80	3.00	.....	.....	.....	.....	4.25	5.0	3.62	3.64	4.9	3.60	3.21	3.10	.....
29	2.80	2.98	.....	.....	.....	.....	4.2	4.95	3.69	3.78	4.9	3.58	3.10	3.11	.....
30	2.79	2.98	.....	.....	.....	.....	4.1	4.85	3.58	3.71	5.0	3.62	3.26	3.18	.....
31	2.78	.....	.....	.....	.....	3.16	.....	4.75	.....	3.65	5.1	.....	3.22	.....	.....

NOTE.—Discharge relation affected by ice about Dec. 6, 1912, to Mar. 31, 1913.

Daily discharge, in second-feet, of Des Moines River at Jackson, Minn., from Oct. 1, 1912, to Dec. 20, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.0	4.8	18	.....	.....	.....	9	170	268	100	86	354	73	37	23
2	5.0	14	16	.....	.....	.....	27	128	258	144	91	354	72	38	17
3	4.8	14	8.6	.....	.....	.....	19	161	248	144	84	354	67	28	26
4	4.5	9.0	5.4	.....	.....	.....	20	152	228	152	79	332	64	18	30
5	4.6	9.9	5.0	.....	.....	.....	53	144	208	170	89	310	64	27	31
6	4.6	9.9	.....	.....	.....	.....	46	128	198	170	73	288	55	32	30
7	4.5	9.9	.....	.....	.....	.....	77	116	179	144	65	278	60	38	16
8	4.5	8.6	.....	.....	.....	.....	61	109	170	152	64	258	53	33	22
9	9.9	8.2	.....	.....	.....	.....	44	112	152	152	76	238	61	33	10
10	48	8.6	.....	.....	.....	.....	81	98	152	136	66	248	65	27	28
11	30	9.0	.....	.....	.....	.....	81	89	136	161	76	343	67	21	10
12	24	14	.....	.....	.....	.....	157	76	133	152	78	208	56	40	8
13	18	16	.....	.....	.....	.....	208	147	120	144	78	188	47	43	6
14	16	18	.....	.....	.....	.....	238	147	117	120	71	170	53	28	5
15	13	14	.....	.....	.....	.....	218	179	109	128	73	161	47	36	22
16	18	14	.....	.....	.....	.....	161	170	91	119	73	144	56	32	20
17	54	14	.....	.....	.....	.....	136	288	95	123	66	123	60	22	28
18	30	11	.....	.....	.....	.....	152	208	78	117	54	114	68	12	27
19	17	14	.....	.....	.....	.....	152	208	68	117	64	112	44	28	21
20	11	14	.....	.....	.....	.....	152	268	92	106	152	112	34	30	34
21	8.6	9.0	.....	.....	.....	.....	136	321	119	93	208	106	40	34	.....
22	7.0	9.0	.....	.....	.....	.....	128	332	100	107	198	86	42	34	.....
23	7.0	9.0	.....	.....	.....	.....	136	299	68	106	238	86	41	30	.....
24	5.8	14	.....	.....	.....	.....	208	278	72	98	258	92	40	21	.....
25	5.0	8.2	.....	.....	.....	.....	228	288	61	99	278	95	40	14	.....
26	5.4	18	.....	.....	.....	.....	228	321	119	98	288	89	40	30	.....
27	5.0	30	.....	.....	.....	.....	198	354	85	99	299	93	14	30	.....
28	5.0	18	.....	.....	.....	.....	170	332	81	84	310	78	33	22	.....
29	5.0	16	.....	.....	.....	.....	161	321	91	103	310	76	22	23	.....
30	4.9	16	.....	.....	.....	.....	144	299	76	93	332	81	38	30	.....
31	4.8	.....	.....	.....	.....	.....	.....	278	.....	85	354	.....	34	.....	.....

NOTE.—Daily discharge determined as follows: Oct. 1 to Dec. 5, 1912, and May 22 to Dec. 20, 1913, from two fairly well-defined rating curves; Apr. 1 to May 21, 1913, by the indirect method for shifting channels.

Monthly discharge of Des Moines River at Jackson, Minn., Oct. 1, 1912, to Dec. 20, 1913.

[Drainage area, 1,160 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
October	54	4.5	12.6	0.011	0.01	C.
November	30	4.8	12.7	.011	.01	C.
April	238	9	128	.110	.12	C.
May	354	76	210	.181	.21	B.
June	268	61	132	.114	.13	B.
July	170	84	123	.106	.12	B.
August	354	54	149	.128	.15	B.
September	354	76	186	.160	.18	B.
October	73	14	50.0	.043	.05	B.
November	43	12	29.0	.025	.03	C.
December 1-20	34	5	20.7	.018	.01	D.

DES MOINES RIVER NEAR FORT DODGE, IOWA.

Location.—At the upper highway bridge, 1 mile upstream from Fort Dodge and just above the Illinois Central Railroad bridge.

Records available.—April 23, 1905, to July 19, 1906, for station at old Swede Town Bridge, about 1 mile farther downstream; August 4, 1911, to October 17, 1913, when station was discontinued, at upper highway bridge.

Drainage area.—Not measured.

Gage.—Chain gage fastened to the outside handrail, downstream side of right span, read once daily to quarter-tenths. Limits of use: Hundredths below 2.0, half-tenths from 2.0 to 3.0, and tenths above 3.0 feet.

Channel and control.—Bed of river composed of sand and gravel; practically permanent.

Winter flow.—Observations discontinued during winter months.

Accuracy.—Heavy rains in the basin of Lizard Creek may cause backwater at the gage and affect the discharge relation. During October, 1913, a temporary dam was built below the station, causing backwater, and the station was abandoned in favor of a new one at Kalo, Iowa. Sufficient discharge measurements have not been made to develop the rating curve above 1,340 second-feet (gage height 3.0 feet) and estimates of discharge above that stage have therefore not been prepared.

Discharge measurements of Des Moines River near Fort Dodge, Iowa, during the period Oct. 1, 1912, to Oct. 17, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 6	S. B. Soulé	1.32	102	Sept. 5	B. J. Peterson	1.58	254
6	do	1.19	71.5	Oct. 14	S. B. Soulé	2.20	[a]158
Sept. 5	B. J. Peterson	1.60	264				

[a] Backwater from dam built about 500 feet below gage during October, 1913.

NOTE.—Measurements made by wading.

Daily gage height, in feet, of Des Moines River near Fort Dodge, Iowa, from Oct. 1, 1912, to Oct. 17, 1913.

[O. C. Hanson, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.30	1.30	.....	.....	.....	.....	.....	2.9	4.8	1.80	1.30	1.50	1.72
2	1.30	1.40	.....	.....	.....	.....	.....	2.8	4.4	1.80	1.30	1.50	1.75
3	1.22	1.42	.....	.....	.....	.....	.....	2.85	4.1	1.82	1.28	1.52	1.80
4	1.30	1.40	.....	.....	.....	.....	.....	3.9	3.7	1.75	1.25	1.55	1.82
5	1.20	1.30	.....	.....	.....	.....	.....	4.6	3.3	1.78	1.30	1.60	1.85
6	1.30	1.22	.....	.....	.....	.....	.....	4.5	3.1	1.75	1.32	1.62	1.88
7	1.15	1.22	.....	.....	.....	.....	.....	4.4	3.0	1.72	1.32	1.65	1.90
8	1.25	1.20	.....	.....	.....	.....	.....	4.1	3.2	1.70	1.32	1.60	1.90
9	1.20	1.20	.....	.....	.....	.....	.....	4.0	3.3	1.70	1.32	1.60	1.92
10	1.20	1.22	.....	.....	.....	.....	.....	3.7	2.95	1.68	1.32	1.62	1.95
11	1.15	1.22	.....	.....	.....	.....	.....	3.5	2.7	1.70	1.35	1.65	1.95
12	1.50	1.25	.....	.....	.....	.....	.....	3.2	2.6	1.72	1.42	1.70	2.10
13	1.35	1.30	.....	.....	.....	.....	.....	3.3	2.4	1.68	1.48	1.70	2.15
14	1.40	1.35	.....	.....	.....	.....	.....	3.6	2.4	1.62	1.40	1.70	2.20
15	1.30	1.40	.....	.....	.....	.....	.....	6.8	2.25	1.60	1.40	1.68	2.20
16	1.40	1.42	.....	.....	.....	.....	.....	7.9	2.2	1.58	1.40	1.70	2.15
17	1.32	1.45	.....	.....	.....	.....	.....	5.6	2.1	1.55	1.38	1.70	2.22
18	1.40	1.42	.....	.....	.....	.....	.....	5.2	2.0	1.52	1.35	1.70	.....
19	1.40	1.40	.....	.....	.....	.....	.....	4.9	1.95	1.50	1.35	1.68	.....
20	1.42	1.40	.....	.....	.....	.....	.....	5.4	1.92	1.48	1.60	1.65	.....
21	1.30	1.40	.....	.....	.....	.....	.....	6.0	1.90	1.45	1.85	1.65	.....
22	1.42	1.42	.....	.....	.....	.....	.....	6.6	1.85	1.40	1.90	1.62	.....
23	1.30	1.40	.....	.....	.....	.....	.....	6.5	1.80	1.42	1.78	1.62	.....
24	1.40	.....	.....	.....	.....	.....	.....	6.4	1.78	1.45	1.70	1.60	.....
25	1.28	.....	.....	.....	.....	.....	.....	6.1	1.75	1.40	1.65	1.62	.....
26	1.30	.....	.....	.....	.....	.....	.....	6.0	1.78	1.40	1.62	1.65	.....
27	1.25	.....	.....	.....	.....	.....	.....	5.6	1.75	1.38	1.60	1.65	.....
28	1.38	.....	.....	.....	.....	.....	.....	5.4	1.70	1.35	1.55	1.60	.....
29	1.40	.....	.....	.....	.....	.....	.....	5.3	1.72	1.32	1.52	1.62	.....
30	1.40	.....	.....	.....	.....	.....	.....	5.2	1.75	1.32	1.50	1.65	.....
31	1.38	.....	.....	.....	.....	.....	.....	5.0	.....	1.32	1.55	.....	.....

NOTE.—Discharge relation probably affected during the greater part of October, 1913, by backwater from dam built about 500 feet below the gage. See "Accuracy" in station description.

Daily discharge, in second-feet, of Des Moines River near Fort Dodge, Iowa, for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	106	106	.....	.....	.....	.....	.....	1,250	.....	395	106	200
2	106	148	.....	.....	.....	.....	.....	1,160	.....	395	106	200
3	80	158	.....	.....	.....	.....	.....	1,210	.....	409	100	212
4	106	148	.....	.....	.....	.....	.....	.....	.....	360	90	230
5	74	106	.....	.....	.....	.....	.....	.....	.....	381	106	260
6	106	80	.....	.....	.....	.....	.....	.....	.....	360	114	273
7	63	80	.....	.....	.....	.....	.....	.....	1,340	339	114	292
8	90	74	.....	.....	.....	.....	.....	.....	.....	325	114	260
9	74	74	.....	.....	.....	.....	.....	.....	.....	325	114	260
10	74	80	.....	.....	.....	.....	.....	.....	1,300	312	114	273
11	63	80	.....	.....	.....	.....	.....	.....	1,080	325	127	292
12	200	90	.....	.....	.....	.....	.....	.....	1,000	339	158	325
13	127	106	.....	.....	.....	.....	.....	.....	840	312	190	325
14	148	127	.....	.....	.....	.....	.....	.....	840	273	148	325
15	106	148	.....	.....	.....	.....	.....	.....	722	260	148	312
16	148	158	.....	.....	.....	.....	.....	.....	685	248	148	325
17	114	174	.....	.....	.....	.....	.....	.....	610	230	140	325
18	148	158	.....	.....	.....	.....	.....	.....	535	212	127	325
19	148	148	.....	.....	.....	.....	.....	.....	500	200	127	312
20	158	148	.....	.....	.....	.....	.....	.....	479	190	260	292
21	106	148	.....	.....	.....	.....	.....	.....	465	174	430	292
22	158	158	.....	.....	.....	.....	.....	.....	430	148	465	273
23	106	148	.....	.....	.....	.....	.....	.....	395	158	381	273
24	148	.....	.....	.....	.....	.....	.....	.....	381	174	325	260
25	100	.....	.....	.....	.....	.....	.....	.....	360	148	292	273
26	106	.....	.....	.....	.....	.....	.....	.....	381	148	273	292
27	90	.....	.....	.....	.....	.....	.....	.....	360	140	260	292
28	140	.....	.....	.....	.....	.....	.....	.....	325	127	230	260
29	148	.....	.....	.....	.....	.....	.....	.....	339	114	212	273
30	148	.....	.....	.....	.....	.....	.....	.....	360	114	200	292
31	140	.....	.....	.....	.....	.....	.....	.....	.....	114	230	.....

NOTE.—Daily discharge computed from a rating curve well defined between 40 and 1,340 second-feet (gage heights 1.0 and 3.0 feet).

See "Accuracy" in station description. Estimates of daily discharge, Oct. 1 to Nov. 23, 1912, differ from those published in Water Supply Paper No. 325 on account of revising the rating curve on basis of additional information obtained during 1913. Estimates prior to Oct. 1, 1912, should be revised by persons using them if thought desirable.

Monthly discharge of Des Moines River near Fort Dodge, Iowa, for the year ending Sept. 30, 1913.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
October	200	63	117	B.
November 1-23	174	74	124	B.
July	409	114	250	B.
August	465	90	192	B.
September	325	200	280	B.

NOTE.—Estimates of monthly discharge for October and November differ from those published in Water-Supply Paper 325 on account of a revision of the rating curve. See "Accuracy in station descritpion."

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 September 30, 1910 (United States Engineer Corps); August 3, 1911, to September 30, 1913.

Drainage area.—14,300 square miles.

Gage.—Chain gage attached to upstream side of bridge; read once daily to half-tenths. Limits of use: Half-tenths below and tenths above 2.0 feet. Gage was originally attached to downstream side of bridge; changed because of repairs to bridge at unknown date.

Channel and control.—Control a gravel riffle 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 downstream side of the bridge.

Winter flow.—Observations discontinued during winter months.

Discharge measurements of Des Moines River at Keosauqua, Iowa, during the year ending Sept. 30, 1913.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 11	S. B. Soulé	0.90	1,340	July 11	Bolster and Egbert	0.94	1,580
13	do	.93	1,370				

Daily gage height, in feet, of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1913.

[Oscar McCrary, observer.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.6	1.2	0.75	.....	.....	.....	.....	.....	5.8	2.4	0.55	0.45
2	.6	1.05	.8	.....	.....	.....	.....	.....	5.5	2.6	.5	.4
3	.6	1.05	.85	.....	.....	.....	.....	.....	5.6	1.5	.5	.4
4	.65	1.0	.9	.....	.....	.....	.....	.....	5.0	1.35	.45	.35
5	.65	1.0	.9	.....	.....	.....	.....	.....	4.6	1.3	.4	.35
6	.....	1.0	.9	.....	.....	.....	.....	.....	4.1	1.25	.4	.35
7	.....	1.0	.85	.....	.....	.....	.....	.....	3.9	1.2	.4	.35
8	.....	.95	.8	.....	.....	.....	.....	.....	3.5	1.15	.35	.3
9	.....	1.0	.7	.....	.....	.....	.....	.....	3.2	1.05	.35	.3
10	.....	.8	.7	.....	.....	.....	.....	.....	3.1	.95	.35	.3
11	.....	.9	.7	.....	.....	.....	.....	4.4	2.7	.95	.55	.4
12	.....	.95	.7	.....	.....	.....	.....	4.2	2.6	.9	.55	.7
13	2.9	.9	.....	.....	.....	.....	.....	4.2	2.4	.85	.65	.4
14	3.3	.95	.....	.....	.....	.....	.....	4.6	2.4	.8	.7	.4
15	3.1	1.25	.....	.....	.....	.....	.....	6.8	2.0	.8	.9	.35
16	2.8	1.3	.....	.....	.....	.....	.....	8.1	2.0	.8	.9	.35
17	2.6	1.25	.....	.....	.....	.....	.....	4.5	1.75	.75	.85	.35
18	2.35	1.2	.....	.....	.....	.....	.....	8.8	1.75	.75	1.35	.4
19	2.0	1.05	.....	.....	.....	.....	.....	9.1	1.55	.7	1.25	.4
20	2.0	1.05	.....	.....	.....	.....	.....	8.8	1.55	.7	.9	.5
21	1.8	1.05	.....	.....	.....	.....	.....	9.2	1.35	.7	.9	.45
22	1.75	1.0	.....	.....	.....	.....	.....	9.2	3.2	.7	.85	.4
23	1.75	1.0	.....	.....	.....	.....	.....	9.0	2.7	.7	.8	.4
24	1.6	.95	.....	.....	.....	.....	.....	9.0	3.0	.65	.75	.4
25	1.5	.9	.....	.....	.....	.....	.....	9.0	3.0	.65	.7	.4
26	1.45	.95	.....	.....	.....	.....	.....	9.1	5.6	.65	.6	.35
27	1.4	.9	.....	.....	.....	.....	.....	8.8	5.3	.65	.6	.35
28	1.5	.85	.....	.....	.....	.....	.....	8.4	4.7	.6	.6	.35
29	1.45	.8	.....	.....	.....	.....	.....	7.6	4.1	.6	.55	.35
30	1.4	.75	.....	.....	.....	.....	.....	7.0	3.6	.55	.5	.4
31	1.35	.....	.....	.....	.....	.....	.....	6.3	.....	.55	.45	.....

NOTE.—Discharge relation affected by ice about Dec. 9–12, 1912.

Daily discharge, in second-feet, of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	860	1,810	1,080	.....	.....	.....	.....	.....	13,700	4,570	980	845
2	860	1,560	1,150	.....	.....	.....	.....	.....	12,800	5,060	910	780
3	860	1,560	1,230	.....	.....	.....	.....	.....	13,100	2,570	910	780
4	930	1,470	1,310	.....	.....	.....	.....	.....	11,500	2,280	845	715
5	930	1,470	1,310	.....	.....	.....	.....	.....	10,400	2,180	780	715
6	.....	1,470	1,310	.....	.....	.....	.....	.....	9,060	2,090	780	715
7	.....	1,470	1,230	.....	.....	.....	.....	.....	8,520	2,000	780	715
8	.....	1,390	1,150	.....	.....	.....	.....	.....	7,440	1,910	715	650
9	.....	1,470	.....	.....	.....	.....	.....	.....	6,630	1,740	715	650
10	.....	1,150	.....	.....	.....	.....	.....	.....	6,360	1,570	715	650
11	.....	1,310	.....	.....	.....	.....	.....	9,870	5,310	1,570	980	780
12	.....	1,390	.....	.....	.....	.....	.....	9,330	5,060	1,490	980	1,190
13	5,770	1,310	.....	.....	.....	.....	.....	9,330	4,570	1,420	1,120	780
14	6,880	1,390	.....	.....	.....	.....	.....	10,400	4,570	1,340	1,190	780
15	6,320	1,900	.....	.....	.....	.....	.....	16,500	3,630	1,340	1,490	715
16	5,500	1,990	.....	.....	.....	.....	.....	20,300	3,630	1,340	1,490	715
17	4,970	1,900	.....	.....	.....	.....	.....	10,100	3,080	1,260	1,420	715
18	4,320	1,810	.....	.....	.....	.....	.....	22,500	3,080	1,260	2,280	780
19	3,460	1,560	.....	.....	.....	.....	.....	23,400	2,670	1,190	2,090	780
20	3,460	1,560	.....	.....	.....	.....	.....	22,500	2,670	1,190	1,490	910
21	3,010	1,560	.....	.....	.....	.....	.....	23,700	2,280	1,190	1,490	845
22	2,900	1,470	.....	.....	.....	.....	.....	23,700	6,630	1,190	1,420	780
23	2,900	1,470	.....	.....	.....	.....	.....	23,100	5,310	1,190	1,340	780
24	2,580	1,390	.....	.....	.....	.....	.....	23,100	6,090	1,120	1,260	780
25	2,380	1,310	.....	.....	.....	.....	.....	23,100	6,090	1,120	1,190	780
26	2,280	1,390	.....	.....	.....	.....	.....	23,400	13,100	1,120	1,050	715
27	2,180	1,310	.....	.....	.....	.....	.....	22,500	12,300	1,120	1,050	715
28	2,380	1,230	.....	.....	.....	.....	.....	21,200	10,700	1,050	1,050	715
29	2,280	1,150	.....	.....	.....	.....	.....	18,800	9,060	1,050	980	715
30	2,180	1,080	.....	.....	.....	.....	.....	17,100	7,710	980	910	780
31	2,080	.....	.....	.....	.....	.....	.....	15,100	.....	980	845	.....

NOTE.—Daily discharge computed from two fairly well defined rating curves. New rating curve used beginning May 11, 1913.

Monthly discharge of Des Moines River at Keosauqua, Iowa, for the year ending Sept. 30, 1913.

[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	6,880	860	2,600	0.182	0.21	B.
November	1,990	1,080	1,480	.103	.11	B.
December 1–8	1,310	1,080	1,220	.085	.03	C.
May 11–31	23,700	9,330	18,500	1.29	1.01	B.
June	13,700	2,280	7,240	.506	.56	B.
July	5,060	980	1,660	.116	.13	B.
August	2,280	715	1,140	.080	.09	B.
September	1,190	650	766	.054	.06	B.

INDEX.