

1963

Surface Water Records of Minnesota



UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY

Prepared in cooperation with the Minnesota Department of Conservation,
Division of Waters; the Minnesota Department of Highways; the
Minnesota Department of Iron Range Resources and Rehabilitation;
and with other State, county, municipal, and Federal agencies

United State Department of the Interior
Geological Survey - Water Resources Division

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OF MINNESOTA

1963

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Minnesota Department of Conservation, Division of Waters
Minnesota Department of Highways
~~Minnesota Department of Iron Range Resources and Rehabilitation~~
~~Hennepin County Board of Commissioners~~
City of Austin, through the Minnesota Division of Waters
City of Rochester, through the Minnesota Division of Waters
Erie Mining Company, through the Minnesota Division of Waters
Hanna Mining Company, through the Minnesota Division of Waters
~~Youngstown Mines Corp., through the Minnesota Division of Waters~~
Corps of Engineers, U. S. Army
U. S. Department of State

Pickands Mather & Co. (Second Creek)

Letter in station file dated Jan 16, 1955 shows tie -
Suggested we use Pickands Mather & Co., through Div. Wat

Eveleth Taconite Company, through Div. Wat

Copies of this report may be obtained from
District Engineer, Surface Water Branch
U. S. Geological Survey
1610 Post Office Building
St. Paul, Minnesota 55101

CALENDAR FOR WATER YEAR 1963

OCTOBER 1962

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SEPTEMBER 1963

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SURFACE WATER RECORDS OF MINNESOTA, 1963

INTRODUCTION

The surface-water records for the 1963 water year for gaging stations, partial-record stations, and miscellaneous sites within the State of Minnesota are given in this report. For convenience there are also included records for a few pertinent gaging stations in bordering states. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of L. R. Sawyer, district engineer, Surface Water Branch, succeeded by D. B. Anderson.

Through September 30, 1960, the records of discharge and stage of streams and contents and stage of lakes or reservoirs were published in an annual series of U.S. Geological Survey water-supply papers entitled "Surface Water Supply of the United States." Since 1951 there have been 20 volumes in the series; each volume covered an area whose boundaries coincided with those of certain natural drainage areas. The records in Minnesota were contained in Parts 4, 5 and 6 of that series.

Beginning with the 1961 water year, streamflow records and related data will be released by the Geological Survey in annual reports on a State-boundary basis. Distribution of these basic-data reports will be limited and primarily for local needs. The records later will be published in Geological Survey water-supply papers at 5-year intervals.

COOPERATION

Cooperative agreements between the U.S. Geological Survey and organizations of the State of Minnesota for the systematic collection of streamflow records began in 1909. Organizations that supplied data are acknowledged in station descriptions. Organizations that assisted in collecting data through cooperative agreements with the Survey are:

Minnesota Department of Conservation,
Division of Waters, Sidney A. Frellsen, director.

Minnesota Department of Highways, James C. Marshall, Commissioner.

Minnesota State Iron Range Resources and Rehabilitation Commission, A. M. De Yoannes, Commissioner.

Hennepin County Board of Commissioners, Richard O. Hansen, chairman.

Assistance in the form of funds or services was given by Corps of Engineers, U.S. Army, in collecting records for 30 gaging stations published in this report.

Several gaging stations in the Hudson Bay and St. Lawrence River basins were maintained by funds appropriated to the United States Department of State.

On waters adjacent to the international boundary, certain gaging stations are maintained by the United States (or Canada) under agreement with Canada (or the United States), and the records are obtained and compiled in a manner equally acceptable in both countries. These stations are designated herein as "International gaging stations."

DEFINITION OF TERMS AND ABBREVIATIONS

The terms of streamflow and other hydrologic data, as used in this report, are defined as follows:

Gaging station is a particular site on a stream, canal, lake or reservoir where systematic observations of gage height or discharge are obtained. When used

in connection with a discharge record, the term is applied only to those gaging stations where a continuous record of discharge is obtained.

Partial-record station is a particular site where limited streamflow data are collected systematically over a period of years for use in hydrologic analyses.

Cubic foot per second (cfs) is the rate of discharge of a stream whose channel is 1 square foot in cross-sectional area and whose average velocity is 1 foot per second.

Cubic feet per second per square mile (cfs/m) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Runoff in inches (in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Acre-foot (ac-ft) is the quantity of water required to cover an acre to the depth of 1 foot and is equivalent to 43,560 cubic feet.

Cfs-day is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, 1.983471 acre-feet, or 646,317 gallons, and represents a runoff of 0.0372 inch from 1 square mile.

Stage-discharge relation is the relation between gage height and the amount of water flowing in a channel, expressed as volume per unit of time.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, a long reach of the channel, or an artificial structure.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is so enclosed by a topographic divide that direct surface runoff from precipitation normally would drain by gravity into the river above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise noted.

WSP is used as an abbreviation for "Water-Supply Paper" in references to previously published reports.

DOWNSTREAM ORDER AND STATION NUMBERS

Stations are listed in the same downstream order used in the water-supply papers. Records are listed in a downstream direction along the main stem with all stations on a tributary entering above a main-stem station listed before that station. If a tributary enters between two main-stem stations, it is listed between them. A similar order is followed listing stations on first rank, second rank, and other ranks of tributaries. To indicate the rank of any tributary on which a gaging station is situated and the stream to which it is immediately tributary, each indention in the listing of gaging stations in the table of contents of this report represents one rank. This downstream order and system of indention shows which gaging stations are on tributaries between any two stations on a main stem and the rank of the tributary on which each gaging station is situated.

As an added means of identification, each gaging station and partial-record station has been assigned a station number. The numbers have been assigned in the same downstream order used in the annual series of water-supply papers. In assigning station numbers, no distinction is made between partial-record stations and continuous-record gaging stations, so that the station number for a partial-record station indicates downstream order position in a list made up of both types of stations. Gaps are left in the numbers to allow for new stations that may be established; hence the numbers are not consecutive.

The complete number for each station, such as 5-3310.00, includes the part number "5" and a six digit station number. In this report, the part number and only the essential digits of the station number are shown. For example, the complete number 5-3310.00 would appear as 5-3310, just to the left of the station name. In this report, the records are listed in downstream order by parts. All records for a drainage basin encompassing more than one State could be arranged in downstream order by assembling pages from the various State reports by station number to include all records in the basin.

EXPLANATION OF DATA

The base data collected at gaging stations consist of records of stage and measurements of discharge. In addition, observations of factors affecting the stage-discharge relation, weather records, and other information are used to supplement base data in determining the daily flow. The records of stage are obtained from a water-stage recorder that gives a continuous record of fluctuations or from direct readings on a nonrecording gage. Measurements of discharge are made with a current meter by the general methods adopted by the Geological Survey on the basis of experience in stream gaging since 1888. These methods are described in Water-Supply Paper 888 and are also outlined in standard textbooks on the measurement of stream discharge.

Rating tables giving the discharge for any stage are prepared from stage-discharge relation curves defined by discharge measurements. If extensions to the rating curves are necessary to define the extremes of discharge, they are made on the basis of indirect measurements of peak discharge (such as slope-area or contracted-opening measurements, or computation of flow over dams or weirs), velocity-area studies, and logarithmic plotting. The application of the daily mean gage height to those rating tables gives the daily mean discharge, from which the monthly and the yearly mean discharge are computed. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on individual discharge measurements and notes by engineers and observers are used in applying the gage heights to the rating tables. If the stage-discharge

relation for a station is temporarily changed by the presence of aquatic growth or debris on the control, the daily mean discharge is computed by what is in effect the shifting-control method.

At some gaging stations the stage-discharge relation is affected by backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in determining discharge. Information required for determining the slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage. For such stations, the rate of change in stage is used as a factor in determining discharge.

At some gaging stations the stage-discharge relation is affected by ice during the winter, and it becomes impossible to compute the discharge in the usual manner. Discharge for periods of ice effect is computed on the basis of the gage-height record and occasional winter discharge measurements, consideration being given to the available information on temperature and precipitation, notes by gage observers and engineers, and comparable records of discharge for other stations in the same or nearby basins.

For some gaging stations there are periods when no gage-height record is obtained or the recorded gage height is so faulty that it cannot be used to compute the daily discharge. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, float is frozen in the well, or for various other reasons. For such periods the daily discharges are estimated on the basis of recorded range in stage, adjoining good record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins.

The data in this report generally comprise a description of the station, a skeleton rating table, and a table showing the daily discharge and monthly and yearly discharge of the stream. Tables of mean daily gage height are included for some stations. Records are published for the water year which begins on October 1 and ends on September 30. A calendar for the 1963 water year is shown on page II to facilitate finding the day of the week for any date.

The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The location of the gaging station and the drainage area are obtained from the most accurate maps available. River mileage given under "Location" for some stations, is that determined and used by the Corps of Engineers unless otherwise noted. Under "Records available" are given periods for which there are published records for the present station or for stations generally equivalent to the present one. Under "Gage" are given the type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available. The references to "datum of 1929" and adjustments of other years are to the datum and adjustments of the U.S. Coast and Geodetic Survey. Under "Average discharge" is given the average discharge for the number of years indicated. It is not given for stations having fewer than five complete years of record or for stations where changes in water development during the period of record cause the figure to have little significance. Under "Extremes" are given the maximum discharge and gage height; the minimum discharge if there is little or no regulation; the minimum daily discharge if there is extensive regulation (also the minimum discharge if useful); and the minimum gage height if it is significant. In the first paragraph, the data given are for the complete current water year unless otherwise specified. In the second paragraph, the data given are for the periods of record within the calendar year dates in the heading (not necessarily those for the complete years indicated by the heading dates). Reliable information concerning major floods that have occurred outside the period of record are given in the third or last paragraph under "Extremes." Unless otherwise qualified, the maximum discharge corresponds to the crest stage obtained by use of a water-stage recorder, a crest-stage indicator, or a nonrecording gage read at the time of the crest. If the maximum gage height did not occur at the same time as the maximum discharge, it is given separately. Information pertaining to the accuracy of the records and to conditions which affect the natural flow at the gaging station is given under "Remarks."

Skeleton rating tables are published for all stations except those for which the daily discharge for the greater part of the open-water period was determined by the shifting-control method, the slope method, or other special methods involving an equivalent adjustment to the gage height of more than one-tenth foot. Skeleton rating tables generally are not published for canals, ditches, or springs.

The daily table gives the discharge corresponding to the daily mean gage height unless there are large or rapid changes in discharge during a day. For days having large or rapid changes, discharge for the day is computed by averaging the mean discharges for several parts of a day. For digital recorders, the daily mean discharge is always the average of the discharges at each punched reading. For stations equipped with nonrecording gages, the daily discharge corresponds to once-daily readings of the gage or to the mean of twice-daily readings; but for periods of rapidly changing stage the discharge is determined from a gage-height graph based on gage readings.

In the table of daily discharge, the figures for the maximum day and the minimum day for each month are underlined only on the first day of its occurrence.

In the monthly summary below the daily table, the line headed "Total" gives the sum of the daily figures; it is the total cfs-days for the month. The line headed "Mean" gives the average flow in cubic feet per second during the month. Discharge for the month may be expressed in cubic feet per second per square mile (line headed "Cfsm"), or in inches (line headed "In."), or in acre-feet (line headed "Ac-ft"). Figures for cubic feet per second per square mile and runoff in inches are omitted if the drainage area includes large noncontributing areas, or if the average annual rainfall on the drainage basin is usually less than 20 inches.

In the yearly summary below the monthly summary, the figures of maximum are the maximum daily discharges, not the momentary discharges when the water was at crest stage. Likewise, the minimums in this summary are the minimum daily discharges.

Peak discharges and the times of their occurrence and corresponding gage heights for most stations are listed below the table of daily and monthly discharge. All independent peaks above the selected base are given. The base discharge, which is given in parentheses, is selected so that an average of about three peaks a year can be presented. Peak discharges are not published for any stream for which the peaks are subject to substantial control by man. Time of day is expressed in 24-hour time, for example, 12:30 a.m. is 0030, 1:30 p.m. is 1330.

Footnotes to the table of daily discharge indicate periods for which discharge was computed or estimated by unusual or special methods because of no gage-height record, ice effect, or other conditions that reduce the degree of accuracy of the records. The footnotes are either reference footnotes, with corresponding symbols used in the table of daily discharge to indicate the days included, or general footnotes, introduced by the word "Note," in which the days included are stated. The methods used in computing data for such footnoted periods have been explained in preceding paragraphs.

For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. For some reservoirs a table showing daily contents or stage is given. A skeleton table of capacity at given stages is published each year for all reservoirs for which records are published on a daily basis, but it is not published for reservoirs for which only monthly data are given.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

The accuracy of streamflow data depends primarily on (1) the stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements, and (2) the accuracy of observations of stage, measurements of discharge, and interpretation of records.

The station description states the degree of accuracy of the records. "Excellent" indicates that, in general, the error in the daily records is believed to be less than 5 percent; "good," less than 10 percent; "fair," less than 15 percent; and "poor," probably more than 15 percent. The records of monthly and yearly mean discharge and runoff are, in general, more nearly accurate than the daily records.

Discharge at some stations, as indicated by the monthly mean, may vary widely from natural runoff, owing to diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff in inches are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur when relatively large negative adjustments are made or when evaporation is large in comparison with the observed discharge.

SUPPLEMENTAL DATA

Data collected at partial-record stations and at miscellaneous sites are given at the end of this report. Data for partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. Discharge measurements at miscellaneous sites are given in a third table.

Information of a more detailed nature than that published for most of the gaging stations is on file in the district office, such as discharge measurements and recorder charts or nonrecording-gage readings. At many gaging stations water samples are collected from the streams for the purpose of making chemical analyses; computing dissolved solids, suspended sediment loads, and particle-size distribution; or measuring water temperatures. For most of these samples the results are published in an annual series of U.S. Geological Survey water-supply papers entitled "Quality of Surface Waters of the United States." Information on the availability of unpublished data, or quality of water records may generally be obtained from the district office.

STREAMS TRIBUTARY TO LAKE SUPERIOR

11

4-105. Pigeon River at Middle Falls, below International Bridge, Minn.

(International gaging station)

Location.--Lat 48°00'44", long 89°36'58", in NE¼ sec.24, T.64 N., R.6 E., on right bank 400 ft upstream from Middle Falls, ¾ miles upstream from mouth, and 5¼ miles downstream from International Bridge.

Drainage area.--600 sq mi.

Records available.--June to October 1921, April to November 1922, March 1923 to September 1963. Published as "at International Bridge" April 1924 to September 1940. Monthly discharge only for some periods, published in WSP 1307.

Gage.--Water-stage recorder. Datum of gage is 789.58 ft above mean sea level, datum of 1929. Prior to Sept. 2, 1936, staff gage and Sept. 2, 1936, to Sept. 30, 1940, wire-weight gage at International Bridge, 5¼ miles upstream at datum 100.24 ft higher.

Average discharge.--40 years (1923-63), 478 cfs.

Extremes.--Maximum discharge during year, 2,850 cfs June 20 (gage height, 5.93 ft); minimum daily, 79 cfs Jan. 30 to Feb. 10; minimum gage height, 0.48 ft Nov. 23.
1923-63: Maximum discharge, 11,000 cfs May 5, 1934 (gage height, 7.6 ft, site and datum then in use), from rating curve extended above 7,000 cfs; minimum, 27 cfs Nov. 4, 1945 (gage height, -0.08 ft).

Remarks.--Records good except those for periods of ice effect, which are fair.

Cooperation.--This station is one of the international gaging stations maintained by the United States under agreement with Canada.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.6	96	3.0	817
1.0	172	4.0	1,320
1.5	302	5.0	2,010
2.0	452	6.0	2,920

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	224	152	172	120	79	89	126	736	674	608	*322	340
2	214	148	172	121	79	90	250	655	629	582	316	311
3	211	143	170	121	79	91	510	626	600	562	316	282
4	208	142	168	121	79	92	620	590	572	527	308	269
5	204	144	162	121	79	93	670	544	544	507	302	255
6	201	152	125	*120	79	94	710	500	655	487	294	247
7	201	155	135	120	79	95	730	504	792	471	285	242
8	198	154	155	119	79	95	720	600	736	452	282	234
9	206	153	140	118	79	95	705	655	670	436	280	229
10	206	152	118	115	79	95	685	608	1,110	433	271	226
11	198	154	108	110	80	96	650	565	2,030	436	266	218
12	194	157	120	105	80	96	640	510	1,630	481	266	214
13	191	159	132	101	80	96	640	491	1,580	541	258	208
14	186	159	138	95	80	96	660	520	1,880	593	252	201
15	189	157	140	93	80	97	690	524	1,660	604	244	198
16	191	157	140	90	80	97	750	500	1,460	568	260	198
17	189	154	138	86	80	98	810	487	1,180	514	266	196
18	186	152	136	86	80	99	790	558	986	474	266	204
19	177	150	135	84	80	100	772	593	1,810	452	255	226
20	172	155	132	83	80	103	748	565	2,650	455	247	252
21	170	157	130	83	81	106	670	537	2,090	443	239	252
22	168	125	129	82	81	107	597	531	1,500	421	237	242
23	165	110	128	82	82	108	*548	500	1,160	399	242	226
24	165	140	126	81	83	109	504	481	986	384	242	*218
25	*165	157	123	81	84	110	478	458	878	369	239	231
26	157	165	122	81	*85	*112	474	440	*813	360	229	260
27	159	*172	120	80	86	114	484	440	764	357	226	260
28	152	170	120	80	87	116	487	584	713	354	263	250
29	154	170	120	80	-	117	558	*943	667	346	*294	242
30	157	170	120	*79	-----	118	756	869	637	340	378	237
31	154	-----	120	79	-----	122	-----	744	-----	325	387	-----
Total	5,712	4,585	4,194	3,019	2,259	3,146	18,432	17,858	34,056	14,281	8,529	7,168
Mean	184	153	135	97.4	80.7	101	614	576	1,135	461	275	239
Cfsm	0.307	0.255	0.225	0.162	0.134	0.168	1.02	0.960	1.89	0.768	0.458	0.398
In.	0.35	0.28	0.26	0.19	0.14	0.19	1.14	1.11	2.11	0.89	0.53	0.44

Calendar year 1962: Max 1,530 Min 104 Mean 325 Cfsm 0.542 In. 7.36
Water year 1962-63: Max 2,650 Min 79 Mean 338 Cfsm 0.563 In. 7.63

Peak discharge (base, 3,000 cfs). No peak above base.

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Oct. 26, Nov. 3-11, 17-25, Dec. 3 to Apr. 18 (no gage-height record Jan. 10-29, Feb. 10-25).

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-145. Baptism River near Beaver Bay, Minn.

Location.--Lat 47°20'15", long 91°12'00", in SE¹/₄ sec. 15, T. 56 N., R. 7 W., on right bank 260 ft upstream from bridge on U. S. Highway 61, 0.2 mile upstream from mouth, 4 miles northeast of Silver Bay, and 7 miles northeast of village of Beaver Bay.

Drainage area.--140 sq mi.

Records available.--October 1927 to September 1963. Monthly discharge only for some periods, published in WSP 1307.

Gage.--Water-stage recorder. Datum of gage is 609.97 ft above mean sea level (Corps of Engineers bench mark). Prior to Oct. 5, 1934, staff gage at same site and datum.

Average discharge.--36 years, 156 cfs.

Extremes.--Maximum discharge during year, 860 cfs Apr. 1 (gage height, 5.14 ft); maximum gage height, 5.47 ft Mar. 30 (backwater from ice); minimum daily discharge, 1.7 cfs Jan. 29 to Feb. 2. " 1927-63: Maximum discharge recorded, 9,350 cfs Aug. 9, 1939 (gage height, 8.11 ft), from rating curve extended above 4,000 cfs; minimum daily, 0.4 cfs Jan. 5, 6, 1940.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 29				Apr. 30 to Sept. 30			
2.0	14	3.3	248	1.7	6.2	2.7	83
2.3	32	3.5	385	1.8	8.5	3.0	146
2.6	59	4.0	840	2.0	16	3.3	270
2.9	106	4.5	1,490	2.2	28	3.6	525
3.1	161			2.4	44	4.0	905

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	61	40	36	15	1.7	4.4	880	204	192	43	26	17
2	54	40	38	16	1.7	4.4	700	184	173	35	22	15
3	49	32	39	16	1.8	4.5	580	180	158	30	18	14
4	46	34	40	15	1.8	4.6	500	173	141	26	14	14
5	44	34	41	15	1.9	4.7	465	155	138	22	13	12
6	43	36	38	*15	2.0	4.7	428	146	136	18	11	12
7	41	38	39	15	2.0	4.7	378	149	134	17	9.5	11
8	43	38	41	15	2.2	4.8	*310	212	146	20	8.3	11
9	44	38	42	15	2.5	4.8	267	238	152	17	10	9.8
10	44	39	43	14	2.7	4.8	228	227	298	15	9.8	9.1
11	44	40	43	11	2.9	5.0	184	200	487	15	8.3	9.5
12	42	40	43	9.2	3.1	5.2	169	184	394	23	16	52
13	41	40	41	7.0	3.2	5.3	152	204	358	32	31	63
14	40	40	39	5.9	3.4	5.3	143	227	333	29	20	58
15	40	40	36	5.5	3.6	5.4	140	208	270	26	16	46
16	38	40	30	5.2	3.7	5.8	169	196	265	22	78	39
17	36	38	24	4.8	3.8	6.2	209	200	212	30	243	42
18	35	35	21	4.5	3.8	6.6	188	277	180	26	184	78
19	33	35	19	4.1	3.8	7.0	184	254	291	26	136	30
20	34	35	18	3.7	3.9	7.3	169	227	440	58	100	27
21	36	30	17	3.4	4.0	7.6	155	232	326	47	76	74
22	36	24	16	3.0	4.0	8.0	128	212	232	62	59	67
23	36	30	18	2.5	4.1	8.4	*116	188	176	51	55	*56
24	36	38	18	2.2	4.1	9.0	104	170	144	40	48	62
25	*37	36	17	2.0	4.2	10	98	155	121	34	41	95
26	32	33	17	1.9	4.3	11	106	141	*115	28	33	83
27	37	*35	17	1.8	*4.3	*15	121	138	93	26	28	71
28	36	34	17	1.8	4.3	90	128	*291	77	40	27	65
29	36	35	16	1.7	—	460	191	349	65	32	*24	71
30	40	36	15	*1.7	-----	605	238	284	53	27	22	59
31	40	-----	15	1.7	-----	705	-----	227	-----	*26	20	-----
Total	1,254	1,083	894	235.6	88.8	2,034.5	7,828	6,432	6,300	943	1,406.9	1,272.4
Mean	40.5	36.1	28.8	7.60	3.17	65.6	261	207	210	30.4	45.4	42.4
Cfsm	0.289	0.258	0.206	0.054	0.023	0.469	1.86	1.48	1.50	0.217	0.324	0.303
In.	0.33	0.29	0.24	0.06	0.02	0.54	2.08	1.71	1.67	0.25	0.37	0.34

Calendar year 1962: Max 1,300 Min 14 Mean 123 Cfsm 0.879 In. 11.97
 Water year 1962-63: Max 880 Min 1.7 Mean 81.6 Cfsm 0.583 In. 7.90

Peak discharge (base, 1,300 cfs).--No peak above base.

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 3-10, 17-27, Dec. 4 to Apr. 5.

STREAMS TRIBUTARY TO LAKE SUPERIOR

13

4-155. Second Creek near Aurora, Minn.

Location.--Lat 47°31'25", long 92°11'35", in SW¼ sec.12, T.58 N., R.15 W., on left bank 0.1 mile downstream from First Creek, 0.4 mile upstream from mouth, and 2.1 miles east of Aurora.

Drainage area.--26.3 sq mi.

Records available.--March 1955 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,410.36 ft above mean sea level, datum of 1929 (levels by Erie Mining Company).

Average discharge.--8 years, 16.5 cfs.

Extremes.--Maximum discharge during year, 194 cfs Apr. 4 (gage height, 5.63 ft); minimum daily, 1.5 cfs Jan. 26 to Feb. 4; minimum gage height, 3.10 ft Feb. 2, 3, 4.
1955-63: Maximum discharge, 213 cfs Apr. 22, 1961; maximum gage height, 5.75 ft Mar. 28, 1957 (back-water from ice); minimum daily discharge, that of Jan. 26 to Feb. 4, 1963; minimum gage height, that of Feb. 2, 3, 4, 1963.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.1	2.0	3.8	25
3.2	3.2	4.0	39
3.3	5.4	4.5	82
3.4	8.0	5.0	136
3.6	15	5.0	196

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	8.9	6.7	6.7	3.1	*1.5	2.0	55	15	23	15	11	12
2	9.6	7.2	6.7	3.2	1.5	*2.0	96	15	24	16	10	12
3	11	6.7	6.7	3.9	1.5	2.0	104	16	24	16	*10	8.9
4	9.6	6.7	6.6	5.4	1.5	2.0	138	16	*22	15	9.2	8.9
5	8.3	6.7	6.5	*6.2	1.6	2.0	92	14	21	13	7.7	*8.3
6	7.5	6.7	6.3	6.4	1.6	2.1	66	13	19	12	7.2	8.0
7	6.7	6.7	6.1	6.4	1.7	2.1	*49	16	17	10	6.2	8.0
8	7.0	6.7	5.8	6.2	1.7	2.2	39	24	17	8.6	5.9	7.5
9	7.2	6.7	5.4	4.2	1.7	2.5	33	21	16	8.0	6.2	7.5
10	7.0	6.7	5.1	3.2	1.8	2.5	28	21	26	8.3	5.4	7.0
11	9.2	6.7	4.8	2.8	1.8	2.7	24	18	30	9.2	5.4	7.5
12	9.6	6.7	4.3	2.7	1.9	3.0	21	17	28	23	9.2	8.0
13	8.6	7.5	3.9	2.7	2.0	3.0	19	21	26	26	11	10
14	7.2	9.2	3.2	2.6	2.2	3.1	18	22	26	25	11	11
15	6.4	9.6	3.2	2.6	2.3	3.1	16	21	24	22	10	9.6
16	6.2	8.0	3.2	2.5	2.4	3.2	17	19	21	18	20	10
17	7.2	7.0	3.2	2.4	2.5	3.3	19	22	18	18	30	9.6
18	7.2	6.7	3.2	2.3	2.5	3.5	17	24	17	17	34	12
19	13	6.7	3.2	2.1	2.5	3.8	18	25	21	17	33	15
20	16	6.7	3.2	1.9	2.5	4.4	18	24	19	16	30	14
21	13	6.5	3.2	1.8	2.4	5.0	17	24	18	15	26	13
22	10	6.1	3.2	1.7	2.4	5.4	16	24	16	13	24	12
23	9.2	5.9	3.2	1.6	2.3	6.0	17	22	13	12	24	12
24	9.9	5.4	3.1	1.6	2.2	20	15	20	13	10	21	13
25	8.3	4.9	3.1	1.6	2.1	60	*14	19	14	9.6	19	13
26	7.0	4.9	3.0	1.5	2.1	59	17	18	22	8.3	19	11
27	*6.7	5.4	3.0	1.5	2.0	56	16	24	*20	9.9	15	9.6
28	7.2	5.7	2.9	1.5	2.0	52	16	32	17	11	13	9.9
29	7.2	*5.9	2.8	1.5	-	47	17	33	14	12	12	10
30	7.2	6.4	2.8	1.5	-----	*46	17	28	14	13	12	9.9
31	6.7	-----	3.0	1.5	-----	47	-----	25	-----	13	11	-----
Total	265.8	199.4	130.6	90.1	56.2	457.9	1,049	653	600	439.9	468.4	308.2
Mean	8.57	6.65	4.21	2.91	2.01	14.8	35.0	21.1	20.0	14.2	15.1	10.3
Cfsm	0.326	0.253	0.160	0.111	0.076	0.563	1.33	0.802	0.760	0.540	0.574	0.392
In.	0.38	0.28	0.18	0.13	0.08	0.65	1.48	0.92	0.85	0.62	0.66	0.44

Calendar year 1962: Max 98 Min 2.2 Mean 17.0 Cfsm 0.646 In. 8.78
Water year 1962-63: Max 138 Min 1.5 Mean 12.9 Cfsm 0.490 In. 6.67

Peak discharge (base, 60 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-4	0930	5.63	194				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 3-5, 8, 21, 22, Dec. 4-9, 11, 12, 20-29, Dec. 31, Jan. 1, 5-7, Jan. 12 to Apr. 5.

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-160. Partridge River near Aurora, Minn.

Location.--Lat 47°31'02", long 92°11'24", in SE¼SW¼ sec.12, T.58 N., R.15 W., on right bank at upstream side of highway bridge, 1,000 ft downstream from Second Creek, 2½ miles east of Aurora, and 2½ miles upstream from mouth.

Drainage area.--156 sq mi.

Records available.--August 1942 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,402.30 ft above mean sea level, datum of 1929. Aug. 5, 1942, to Aug. 25, 1944, staff gage and Aug. 26, 1944, to July 1, 1956, water-stage recorder at site 45 ft downstream at same datum.

Average discharge.--21 years, 121 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 252 cfs Apr. 3 (gage height, 3.58 ft); minimum daily, 3.1 cfs Feb. 28, Mar. 1-3; minimum gage height, 0.88 ft Mar. 2.

1942-63: Maximum discharge, 3,230 cfs May 10, 1950 (gage height, 7.86 ft); minimum, 2.2 cfs Jan. 30, 31, 1961; minimum gage height, that of Mar. 2, 1963.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Flow regulated at times by storage in off-channel Partridge Reservoir, formerly known as Whitewater Lake. Reservoir formed from lake by levees around marsh areas and natural outlet. Available capacity, 20,000 acre-ft between elevations 1,410 ft (natural lake level) and 1,440 ft. Storage began Apr. 9, 1955. Storage in reservoir obtained from Colby Lake during periods of high flow; release from storage returned to Colby Lake to maintain lake elevation during diversion for iron-ore processing. Diversion began Feb. 7, 1956. Some seepage losses from reservoir bypass station.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 14 to Nov. 2, Nov. 6-13, Sept. 9-30)

0.8	2.7	1.8	22
.9	3.2	2.1	33
1.0	3.9	2.4	52
1.2	7.4	2.7	85
1.4	11	3.0	128
1.6	16	3.5	230

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	45	24	29	16	3.9	3.1	111	80	183	56	35	37
2	44	25	30	16	*3.9	*3.1	183	85	177	52	33	32
3	38	24	29	16	3.8	3.1	196	87	170	48	*33	29
4	38	23	28	17	3.8	3.2	153	87	*164	46	31	28
5	38	24	28	*18	3.7	3.3	132	89	157	43	30	*27
6	37	24	27	18	3.7	3.3	106	87	148	40	28	26
7	35	25	27	18	3.8	3.5	*92	93	135	38	25	23
8	35	24	27	18	3.9	3.5	82	115	125	35	24	20
9	34	25	26	16	4.0	3.6	73	117	118	32	23	19
10	33	24	24	15	3.9	3.7	78	125	135	31	22	18
11	34	25	22	12	3.8	3.9	65	126	148	33	27	18
12	34	25	22	12	3.7	4.8	62	125	162	52	34	19
13	31	26	22	11	3.8	5.2	57	132	177	54	35	19
14	29	29	21	11	4.2	5.0	57	133	181	57	34	20
15	29	29	21	11	4.7	4.8	52	130	179	66	35	17
16	27	29	21	11	4.9	5.2	48	118	174	71	41	18
17	27	28	21	10	4.8	6.4	57	120	141	82	59	17
18	26	28	21	8.6	4.7	6.3	53	125	137	73	65	22
19	29	28	20	6.8	4.5	6.6	52	132	141	61	68	24
20	31	28	20	6.2	4.3	6.8	49	139	133	55	67	24
21	29	28	20	5.8	4.1	6.8	59	142	133	52	64	22
22	27	28	20	5.3	3.8	7.5	62	148	125	50	60	21
23	26	28	19	5.1	3.6	9.8	59	144	112	48	57	22
24	26	27	18	4.9	3.6	17	53	139	99	45	55	25
25	26	27	18	4.7	3.5	58	*54	133	93	40	53	26
26	24	27	18	4.5	3.3	75	61	126	97	37	51	24
27	*24	28	17	4.4	3.2	82	60	132	*85	41	48	24
28	24	28	16	4.2	3.1	77	72	151	77	41	46	25
29	25	*28	16	4.1	-	74	74	179	66	40	43	25
30	25	29	16	4.0	-----	*77	73	203	60	39	41	25
31	24	-----	16	4.0	-----	82	-----	196	-----	38	40	-----
Total	954	795	680	318.6	110.0	654.5	2,385	3,938	4,032	1,496	1,307	696
man	30.8	26.5	21.9	10.3	3.93	21.1	79.5	127	134	48.3	42.2	23.2
(*)	+2.4	-0.2	+0.6	-0.4	-0.06	+0.7	+124	+25	+16	+2.3	+5.4	-0.1
Mean*	33.2	26.3	22.5	9.9	3.87	21.8	204	152	150	50.6	47.6	23.1
Cfsm*	0.213	0.169	0.144	0.063	0.025	0.140	1.31	0.974	0.962	0.324	0.305	0.148
In.*	0.25	0.19	0.17	0.07	0.03	0.16	1.46	1.12	1.07	0.37	0.35	0.16

Calendar year 1962: Max 670 Min 7.4 Mean 85.7 Mean* 110 Cfsm* 0.705 In.* 10.26
Water year 1962-63: Max 203 Min 3.1 Mean 47.6 Mean* 62.2 Cfsm* 0.399 In.* 5.40

* Discharge measurement made on this day.

† Change in contents in Partridge Reservoir and diversion to iron-ore processing plant, equivalent in cubic feet per second; furnished by Erie Mining Co.

* Adjusted for change in contents and diversion.

Note.--Stage-discharge relation affected by ice Nov. 3-5, Dec. 3-25, Feb. 3-5, 8-10, 15, 16, Mar. 24-31. No gage-height record Dec. 26 to Jan. 4, Jan. 14 to Feb. 1, Feb. 17 to Mar. 1, July 17-25, Aug. 6 to Sept. 4.

STREAMS TRIBUTARY TO LAKE SUPERIOR

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4-165. St. Louis River near Aurora, Minn.

Location.--Lat 47°29'30", long 92°14'20", in SW¼ sec.22, T.58 N., R.15 W., on left bank at upstream side of highway bridge, three-quarters of a mile downstream from Partridge River and 1¼ miles south of Aurora.

Drainage area.--312 sq mi.

Records available.--August 1942 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,371.24 ft above mean sea level, datum of 1929. Prior to Aug. 26, 1944, chain gage at same site and datum.

Average discharge.--21 years, 232 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 721 cfs Apr. 3 (gage height, 3.20 ft from graph based on gage readings); minimum daily, 14 cfs Jan. 31-Feb. 5; minimum gage height, 0.70 ft Feb. 11, 12.
1942-63: Maximum discharge, 5,380 cfs May 14, 1950 (gage height, 8.37 ft); minimum, 4.0 cfs Oct. 2, 3, 1948 (gage height, 0.30 ft).

Remarks.--Records good except those for periods of ice effect, which are fair. Flow regulated at times by storage in off-channel Partridge Reservoir, formerly known as Whitewater Lake. Reservoir formed from lake by levees around marsh areas and natural outlet. Available capacity 20,000 acre-ft between elevations 1,410 ft (natural lake level) and 1,440 ft. Storage began Apr. 9, 1955. Storage in reservoir obtained from Colby Lake during periods of high flow; release from storage returned to Colby Lake to maintain lake elevation during diversion for iron-ore processing. Diversion began Feb. 7, 1956. Some seepage losses from reservoir enter above station.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.7	26	2.0	237
1.0	52	2.5	394
1.3	89	3.0	615
1.6	140		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	107	66	62	34	*14	*15	416	231	345	165	86	101
2	107	68	63	34	14	15	541	226	342	148	84	100
3	100	66	64	35	14	15	641	226	342	142	81	96
4	96	65	64	*36	14	15	560	220	*335	130	*79	90
5	96	66	63	36	14	15	489	215	329	121	76	*86
6	96	66	62	36	15	16	*384	212	310	116	71	85
7	94	69	61	35	15	16	335	212	295	107	65	81
8	92	66	59	34	15	16	298	243	279	101	60	74
9	92	68	56	32	15	16	273	246	270	97	58	70
10	89	66	53	30	15	16	276	258	307	92	53	66
11	89	65	51	28	15	16	258	264	326	100	50	66
12	86	66	51	25	16	17	249	255	339	130	71	70
13	85	66	50	24	16	18	237	270	342	125	72	62
14	82	69	49	23	17	19	234	279	342	123	66	60
15	82	70	47	21	18	20	226	282	342	132	65	58
16	79	68	47	20	19	21	223	273	342	136	89	60
17	76	65	46	20	20	23	229	279	310	148	100	58
18	76	64	45	19	20	24	220	286	295	127	104	75
19	76	64	45	19	19	27	223	298	314	114	121	81
20	79	64	45	19	19	29	220	304	314	114	129	74
21	77	63	44	18	18	31	220	314	307	112	119	74
22	76	62	43	17	17	31	215	320	289	104	112	69
23	75	60	42	17	17	32	209	317	261	98	107	69
24	74	58	41	17	16	40	201	301	237	95	109	69
25	72	58	40	16	16	65	196	289	223	94	111	71
26	71	58	38	16	16	150	*201	276	231	90	109	68
27	*71	59	37	16	16	175	201	276	*212	96	109	64
28	70	59	36	15	15	155	215	310	196	102	112	65
29	70	*60	35	15	-	*150	229	348	178	96	111	64
30	70	60	34	15	-----	190	226	378	162	94	111	63
31	69	-----	34	14	-----	330	-----	364	-----	92	104	-----
Total	2,574	1,924	1,507	736	455	1,718	8,645	8,572	8,716	3,541	2,794	2,189
Mean	83.0	64.1	48.6	23.7	16.2	55.4	288	277	291	114	90.1	73.0
(∇)	+2.4	-0.2	+0.6	-0.4	-0.1	+0.7	+124	+25	+16	+2	+5.4	-0.1
Mean ∇	85.4	63.9	49.2	23.3	16.1	56.1	412	302	307	116	95.5	72.9
Cfsm ∇	0.274	0.205	0.158	0.075	0.052	0.180	1.32	0.968	0.984	0.372	0.306	0.234
In. ∇	0.32	0.23	0.18	0.09	0.05	0.21	1.47	1.12	1.10	0.43	0.35	0.26
Calendar year 1962:	Max	1,260	Min	22	Mean	185	Mean ∇	209	Cfsm ∇	0.670	In. ∇	9.07
Water year 1962-63:	Max	641	Min	14	Mean	119	Mean ∇	134	Cfsm ∇	0.429	In. ∇	5.81

* Discharge measurement made on this day.

∇ Change in contents in Partridge Reservoir and diversion to iron-ore processing plant, equivalent in cubic feet per second, furnished by Erie Mining Company.

∇ Adjusted for change in contents and diversion.

Note.--Stage-discharge relation affected by ice Oct. 25, Nov. 4, 5, 22, Dec. 4 to Mar. 31 (no gage-height record Dec. 24-29).

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-170. Embarrass River at Embarrass, Minn.

Location.--Lat 47°39'24", long 92°11'51", in NW¼ sec.25, T.60 N., R.15 W., on left bank at Embarrass, 30 ft upstream from highway bridge and 100 ft upstream from railroad bridge.

Drainage area.--93.8 sq mi.

Records available.--August 1942 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,410.36 ft above mean sea level, datum of 1929. Prior to Aug. 28, 1944, chain gage at same site and datum.

Average discharge.--21 years, 65.0 cfs.

Extremes.--Maximum discharge during year, 181 cfs Apr. 6 (gage height, 3.67 ft); minimum daily, 0.9 cfs Jan. 28 to Feb. 5; minimum gage height, 0.63 ft Mar. 7.

1942-63: Maximum discharge, 1,740 cfs May 8, 9, 1950; maximum gage height, 10.92 ft May 9, 1950; minimum daily discharge, that of Jan. 28 to Feb. 5, 1963; minimum gage height, that of Mar. 7, 1963.

Remarks.--Records good except those for periods of ice effect or shifting control, which are fair.

Rating table, water year 1962-63, except periods of ice effect or shifting control (gage height, in feet, and discharge, in cubic feet per second)

0.6	1.2	1.4	32
.7	1.7	1.6	49
.8	3.0	2.0	82
.9	5.2	3.0	142
1.0	8.3	4.0	201
1.2	18		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	15	12	14	3.8	0.9	1.5	113	72	89	26	20	19
2	15	12	14	3.8	.9	1.5	138	70	89	24	17	16
3	14	11	15	3.7	.9	1.5	a148	68	93	21	*15	15
4	14	10	16	*3.7	.9	1.4	a158	65	*86	17	13	*13
5	14	10	16	3.7	.9	1.4	a168	60	86	16	15	12
6	14	10	15	3.7	1.0	1.4	*179	56	84	15	11	12
7	14	11	13	3.7	1.0	1.4	172	57	78	14	9.2	10
8	13	11	12	3.6	1.0	1.4	157	66	70	12	8.7	8.7
9	13	11	11	3.6	1.0	1.4	139	67	68	12	8.3	8.7
10	14	12	10	3.2	1.0	1.4	118	66	120	11	7.3	8.0
11	14	12	9.5	3.0	1.1	1.4	102	64	158	12	6.6	7.3
12	14	12	9.1	2.7	1.1	1.4	90	60	153	28	6.3	7.3
13	17	13	9.0	2.5	1.1	1.4	81	64	136	46	7.3	8.0
14	34	13	8.8	2.4	1.1	1.4	76	75	121	40	8.3	7.6
15	24	13	8.7	2.2	1.2	1.4	72	78	108	36	7.3	7.6
16	17	13	8.6	2.0	1.2	1.4	72	76	96	29	25	7.6
17	14	12	8.6	1.8	1.3	1.5	78	77	82	27	68	7.6
18	12	12	8.5	1.7	1.3	1.5	80	83	74	23	62	10
19	11	12	8.3	1.6	1.3	1.5	78	85	78	19	51	24
20	11	12	7.9	1.5	1.4	1.6	a74	88	83	18	42	24
21	11	11	7.4	1.4	1.4	1.6	a70	94	74	16	35	20
22	11	9.2	6.9	1.3	1.4	1.7	a66	96	63	14	48	18
23	12	9.3	6.5	1.2	1.4	1.8	62	90	54	13	61	15
24	12	9.6	6.0	1.1	1.5	2.1	*49	81	45	11	55	15
25	11	9.8	5.5	1.1	1.5	15	48	74	40	10	44	15
26	11	10	5.3	1.0	1.5	35	55	68	48	9.6	33	15
27	11	11	5.1	1.0	1.5	70	58	66	*48	11	29	13
28	*11	*12	4.8	.9	*1.5	78	58	88	40	29	26	14
29	11	13	4.5	.9	-	*78	63	103	32	34	25	17
30	12	13	4.1	.9	-----	104	69	101	28	29	24	17
31	12	-----	4.0	*.9	-----	113	-----	94	-----	23	22	-----
Total	433	341.9	283.1	69.6	33.3	529.0	2,891	2,352	2,424	645.6	810.3	392.4
Mean	14.0	11.4	9.13	2.25	1.19	17.1	96.4	75.9	80.8	20.8	26.1	13.1
Cfsm	0.149	0.122	0.097	0.024	0.013	0.182	1.03	0.809	0.861	0.222	0.278	0.140
In.	0.17	0.14	0.11	0.03	0.01	0.21	1.15	0.93	0.96	0.26	0.32	0.16

Calendar year 1962: Max 566 Min 3.8 Mean 60.1 Cfsm 0.641 In. 8.70
 Water year 1962-63: Max 179 Min .9 Mean 30.7 Cfsm 0.327 In. 4.45

* Discharge measurement made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Nov. 4-9, 18-25, Dec. 4 to Feb. 26, Mar. 12-25. Shifting-control method used Oct. 14 to Nov. 3, Nov. 10-17, Nov. 26 to Dec. 3, Mar. 26-30, Apr. 28 to July 15, Sept. 18-30.

STREAMS TRIBUTARY TO LAKE SUPERIOR

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4-193. West Swan River near Silica, Minn.

Location.--Lat 47°17'36", long 93°02'30", in SW¼ sec.32, T.56 N., R.21 W., on right bank 10 ft upstream from piling of dismantled bridge and railroad bed of Great Northern Railroad, 2 miles northwest of Silica, 9 miles southwest of Hibbing and 20 miles above confluence of East Swan and West Swan.

Records available.--April to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 1,360 ft (from topographic map). Prior to Aug. 2, 1963 reference point at same site and datum.

Extremes.--Maximum discharge observed during period, 60 cfs June 19 (gage height, 2.75 ft); minimum discharge, 0.3 cfs Aug. 8; minimum gage height observed, 1.21 ft July 10.

Remarks.--Records good except for periods of no gage-height record, which are fair.

Cooperation.--Additional discharge measurements and gage readings furnished by M. A. Hanna Co.

Rating tables, April to September 1963 (gage height, in feet, and discharge, in cubic feet per second)

April 1 to July 10				July 11 to Sept. 30	
1.2	0.4	2.0	22	1.25	0.3
1.3	2.0	2.4	41	1.3	1.0
1.4	4.0	2.8	63	1.4	2.5
1.6	9.0			1.6	6.0
				2.0	17

Discharge, in cubic feet per second, April to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							a 8.0	*6.8	a14	*7.6	*3.3	1.4
2							a16	7.6	a17	4.9	3.0	1.7
3							a50	*7.4	*19	4.0	2.5	2.8
4							a38	a 6.8	14	a2.6	1.9	2.5
5							a30	a 6.2	11	.9	*1.6	*2.3
6							a25	*5.2	*7.9	a1.2	.9	2.5
7							a22	4.9	6.8	a1.5	.7	2.5
8							a20	8.7	a 7.2	*1.9	*.4	3.0
9							a18	*9.3	a15	1.0	1.3	*2.6
10							a16	*9.6	*21	1.0	7.3	2.3
11							a14	a12	26	*.9	3.1	2.8
12							a12	a15	16	4.9	*4.0	4.2
13							a10	*25	11	a5.8	7.4	5.1
14							a 8.0	*27	7.9	a6.1	5.3	4.7
15							a 7.0	21	a 6.4	5.6	*4.0	4.7
16							*13	17	a 5.0	4.9	7.1	*5.8
17							a12	*25	* 3.6	12	12	6.5
18							*11	a21	2.4	*9.4	8.6	8.4
19							*10	a17	.60	5.6	*5.8	*10
20							a 9.4	15	*49	a4.9	4.4	.11
21							a 9.0	17	16	a4.0	*3.5	10
22							* 8.5	13	a11	*3.1	*3.7	9.6
23							6.3	10	a 6.6	2.3	5.3	*8.9
24							*5.4	*9.0	*4.0	1.7	5.6	8.4
25							*4.7	a 8.3	2.4	*2.0	4.2	9.1
26							*4.7	a 7.6	19	1.6	*3.1	*8.1
27							a 5.8	7.1	*12	a3.5	3.5	7.6
28							a 7.2	*26	5.4	a8.6	7.4	7.6
29							*8.7	24	a 6.1	*9.6	*5.1	7.9
30							7.9	a18	a 6.8	4.7	5.4	*7.6
31								11		3.8	1.9	
Total							417.6	418.5	409.5	131.6	133.3	171.6
Mean							13.9	13.5	13.6	4.25	4.30	5.72
Ac-ft							-	-	-	-	-	-

Calendar year : Max Min Mean Ac-ft
Water year : Max Min Mean Ac-ft

* Discharge measurement made on this day.
a No gage-height record.

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-240. St. Louis River at Scanlon, Minn.

Location.--Lat 46°42'12", long 92°25'07", in NW¼ sec.30, T.49 N., R.16 W., on right bank 25 ft downstream from lower bridge on U.S. Highway 61 at Scanlon, 0.6 mile downstream from Minnesota Power & Light Co. powerplant, 3 miles upstream from Thomson Reservoir, and 3.2 miles upstream from Midway River.

Drainage area.--3,430 sq mi, approximately.

Records available.--January 1908 to September 1963. Monthly discharge only for some periods, published in WSP 1307. Published as "near Thomson" 1908-50.

Gage.--Water-stage recorder. Datum of gage is 1,101.23 ft above mean sea level, datum of 1929. Oct. 5, 1909, to Sept. 5, 1914, chain gage 3 miles downstream and 50 ft below powerplant at datum about 420 ft lower. Sept. 6, 1914, to Aug. 4, 1953, powerplant record at Thomson hydroelectric plant.

Average discharge.--55 years, 2,166 cfs (unadjusted).

Extremes.--Maximum discharge during year, 8,710 cfs Apr. 3 (gage height, 6.99 ft); minimum, 80 cfs Aug. 29 (gage height, 1.73 ft).
1908-63: Maximum daily discharge, 37,900 cfs May 9, 1950; maximum gage height, 15.8 ft, May 9, 1950, from Minnesota Highway Department (discharge uncertain); minimum discharge, that of Aug. 29, 1963; minimum daily, 109 cfs Feb. 7, 1924.

Remarks.--Records good. Diurnal fluctuation caused by powerplant upstream. Flow regulated by Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes (combined capacity, 332,160 acre-ft).

Rating table, water year 1962-63 except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 18 to Nov. 2)

2.3	390	4.0	2,100
2.5	515	5.0	3,940
3.0	915	6.0	5,960
3.5	1,440	7.0	8,740

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,130	972	1,080	835	650	613	4,800	1,740	2,940	1,290	825	679
2	1,150	962	1,020	*805	665	613	5,560	1,720	2,760	1,180	735	648
3	1,130	944	1,070	830	620	687	6,830	1,560	*2,600	1,120	703	671
4	1,140	1,060	1,080	835	670	703	7,450	1,550	3,110	1,130	613	585
5	1,130	1,140	1,090	840	680	630	7,080	1,560	2,640	934	550	560
6	1,160	1,050	962	840	670	640	6,660	1,540	2,410	807	489	589
7	1,150	1,030	924	840	645	655	6,060	1,400	2,180	771	482	592
8	1,120	1,000	771	860	670	655	4,780	1,350	2,120	711	426	550
9	1,080	1,030	592	900	700	675	*4,240	1,470	2,120	719	402	564
10	1,070	1,090	444	905	710	685	3,540	1,540	2,640	679	450	522
11	1,100	1,020	762	840	700	625	3,140	1,720	4,320	762	456	482
12	1,080	1,080	744	840	711	640	2,780	1,740	4,780	789	695	489
13	1,010	1,100	944	780	719	675	2,580	1,980	4,300	798	861	496
14	1,020	1,130	924	760	695	630	2,220	3,540	3,600	944	762	482
15	962	1,090	834	705	703	655	2,100	4,160	3,070	1,010	982	502
16	1,040	1,080	865	700	711	640	2,030	3,620	2,690	906	953	543
17	1,000	1,120	900	670	703	625	2,150	3,380	2,310	852	852	536
18	953	1,030	920	670	703	670	2,140	3,620	2,180	780	906	529
19	972	1,070	930	670	679	695	2,090	3,740	2,020	771	1,140	606
20	915	1,060	930	680	711	660	2,020	3,320	2,260	816	1,010	1,150
21	915	1,030	925	670	670	680	1,980	3,090	2,570	807	834	1,280
22	934	917	900	660	660	620	*1,860	2,920	2,360	762	762	1,240
23	953	897	845	640	670	660	1,790	2,790	1,960	679	719	1,020
24	944	1,000	820	620	695	771	1,640	2,570	1,760	627	711	953
25	972	934	815	640	*671	*982	1,490	2,330	1,420	571	719	944
26	*897	*1,080	820	700	695	1,090	1,580	2,090	1,600	571	695	816
27	944	1,150	840	620	687	1,620	1,540	1,930	1,980	508	719	*852
28	906	1,030	820	660	687	2,120	1,530	2,350	*1,830	655	*701	879
29	924	1,050	860	*670	-	2,740	1,590	3,520	1,660	771	718	816
30	982	1,070	850	620	-----	4,080	1,760	3,760	1,380	870	668	771
31	944	-----	830	610	-----	4,800	-----	3,440	-----	*953	703	-----
Total	31,627	31,216	27,111	22,915	19,150	33,234	97,010	77,040	75,570	25,543	22,241	21,346
Mean	1,020	1,040	875	739	684	1,072	3,234	2,485	2,519	824	717	712
(*)	-561	-567	-475	-518	-559	-213	+949	+514	+443	-7	-17	+4
Mean*	459	473	400	221	125	859	4,183	2,999	2,962	817	700	716
Cfs/m*	0.134	0.138	0.117	0.064	0.036	0.250	1.22	0.874	0.864	0.238	0.204	0.209
In. #	0.15	0.15	0.13	0.07	0.04	0.29	1.36	1.01	0.96	0.27	0.24	0.23

Calendar year 1962: Max 13,800 Min 444 Mean 1,608 Mean* 1,635 Cfs/m* 0.477 In.* 6.45
Water year 1962-63: Max 7,450 Min 402 Mean 1,326 Mean* 1,242 Cfs/m* 0.362 In.* 4.90

* Discharge measurement made on this day.

* Change in contents, equivalent in cubic feet per second, in Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes; records furnished by Minnesota Power and Light Co.

Adjusted for change in contents.

Note.--Stage-discharge relation affected by ice Dec. 16 to Feb. 11, Feb. 21-23, Mar. 5-23.

5-300. Otter Tail River near Detroit Lakes, Minn.

Location.--Lat 46°50', long 95°42', in sec.23, T.139 N., R.40 W., on right bank 10 ft upstream from highway bridge, 5 miles downstream from Height of Land Lake, and 7½ miles east of city of Detroit Lakes.

Drainage area.--270 sq mi.

Records available.--March 1937 to September 1963.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,409.49 ft above mean sea level, datum of 1929.

Average discharge.--26 years. 52.0 cfs (37,650 acre-ft per year).

Extremes.--Maximum discharge during year, 157 cfs June 9-10 (gage height, 4.07 ft); maximum gage height, 5.36 ft Jan. 27 (backwater from ice); minimum daily discharge, 10 cfs Feb. 20-22; minimum gage height, 2.77 ft Mar. 5.

1937-63: Maximum discharge, 371 cfs June 26, 1943 (gage height, 4.78 ft, from graph based on partial record); maximum gage height, 6.96 ft Jan. 27, 1950 (backwater from ice); minimum daily discharge, 0.1 cfs Mar. 23, 1940.

Remarks.--Records good except those for period of ice effect, which are fair. Flow partly regulated by dams of Minnesota Department of Conservation on several lakes above station.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.0	12	3.7	78
3.1	17	3.9	117
3.3	30	4.1	164
3.5	50		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	17	16	19	18	14	11	39	54	96	102	27	34
2	17	*16	20	18	14	11	44	54	92	98	35	39
3	*17	16	20	18	13	11	52	55	90	94	31	39
4	17	17	20	18	13	11	52	57	98	90	28	37
5	17	16	19	18	13	11	52	57	83	85	24	36
6	17	16	19	18	13	11	51	57	106	87	24	*35
7	17	17	20	18	*13	11	51	56	126	89	*24	34
8	19	17	20	18	13	11	45	54	131	87	26	33
9	19	17	20	18	13	11	*31	54	138	83	25	33
10	18	17	20	18	13	11	25	54	154	79	24	33
11	18	17	22	*18	13	11	19	50	147	76	28	34
12	18	17	24	17	13	11	15	50	142	*73	52	35
13	17	17	22	17	13	11	20	47	140	70	52	34
14	17	17	20	17	12	*12	23	*47	*135	67	45	32
15	17	17	20	17	12	12	25	47	135	64	40	31
16	15	17	20	17	12	20	29	47	131	54	37	30
17	15	17	20	17	12	25	35	46	128	51	35	30
18	14	18	20	16	12	25	42	45	126	49	33	37
19	14	18	20	16	11	25	45	45	124	47	28	38
20	14	18	20	16	10	22	46	46	122	41	21	38
21	15	17	20	16	10	20	46	47	119	39	22	36
22	17	18	20	15	10	*20	48	47	115	37	29	35
23	17	18	19	15	11	30	47	47	111	34	33	35
24	16	19	19	15	11	35	48	46	106	29	31	33
25	16	19	19	15	11	32	50	46	98	29	30	32
26	16	19	19	15	11	32	50	46	90	26	30	30
27	16	19	19	15	11	34	52	55	96	25	25	30
28	16	20	19	14	11	39	54	68	102	28	36	31
29	16	*19	19	14	-	*37	57	70	100	27	39	31
30	16	19	18	14	-----	37	56	67	100	27	38	*30
31	16	-----	18	14	-----	37	-----	73	-----	26	35	-----
Total	511	525	614	510	338	637	1,249	1,634	3,481	1,813	987	1,015
Mean	16.5	17.5	19.8	16.5	12.1	20.5	41.6	52.7	116	58.5	31.8	33.8
Ac-ft	1,010	1,040	1,220	1,010	670	1,260	2,480	3,240	6,900	3,600	1,960	2,010

Calendar year 1962: Max 302 Min 10 Mean 63.1 Ac-ft 45,690
 Water year 1962-63: Max 154 Min 10 Mean 36.5 Ac-ft 26,400

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Mar. 24 (no gage-height record Jan. 29, 30, Feb. 2-5, 21-26).

RED RIVER OF THE NORTH BASIN

5-405. Pelican River near Fergus Falls, Minn.

Location.--Lat 46°20'10", long 96°07'00", in NE¼ sec.17, T.133 N., R.43 W., on right bank 90 ft downstream from bridge on U. S. Highway 52, 3 miles northwest of Fergus Falls and 7¼ miles upstream from mouth.

Drainage area.--482 sq mi.

Records available.--June 1909 to December 1912, July 1942 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,179.98 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department). June 19, 1909, to Dec. 31, 1912, staff gage at site 1 mile downstream at different datum. July 1, 1942, to Nov. 6, 1955, staff gage at present site and datum.

Average discharge.--23 years (1910-12, 1942-63), 70.4 cfs (50,970 acre-ft per year).

Extremes.--Maximum discharge during year, 230 cfs Mar. 29 (gage height, 4.11 ft); maximum gage height, 4.75 ft Mar. 17 (backwater from ice); minimum daily discharge, 26 cfs Feb. 4-9. 1909-12, 1942-63: Maximum discharge, 756 cfs Mar. 29, 1943 (gage height, 5.53 ft); maximum gage height observed, 5.60 ft Mar. 28, 1950 (backwater from ice); no flow on many days in 1946, 1949-50.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair. Flow affected by storage in lakes above station.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Sept. 27-30)

Oct. 1 to Mar. 31

Apr. 1 to Sept. 30

1.5	21	1.6	37
1.7	35	1.8	56
2.0	70	2.0	81
2.5	153	2.5	164
3.0	259	3.0	260

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	124	90	76	46	28	36	180	121	177	108	64	62
2	124	*92	76	46	28	36	175	120	195	105	66	63
3	*122	90	76	46	28	40	170	116	200	103	68	88
4	122	92	75	46	26	40	165	116	184	100	63	74
5	122	90	72	45	26	40	160	116	182	95	58	*64
6	124	90	70	45	*26	40	155	116	200	92	58	63
7	128	93	68	45	26	42	150	113	200	92	*58	62
8	126	85	65	45	26	42	145	118	182	91	54	62
9	124	88	62	45	26	42	*141	114	200	88	54	61
10	120	88	62	*44	28	42	138	114	191	82	54	50
11	119	98	58	42	28	42	137	114	191	*68	55	50
12	119	95	58	42	28	44	140	118	182	66	55	50
13	117	95	58	42	28	46	138	118	*182	66	53	50
14	117	93	56	40	28	*47	136	*114	178	64	52	52
15	115	92	56	40	28	48	137	113	166	61	51	54
16	112	92	56	40	28	52	159	120	159	67	52	49
17	110	90	54	40	30	52	144	120	148	62	51	50
18	110	82	54	40	30	52	148	120	146	66	53	53
19	109	85	54	40	30	52	146	118	139	64	53	55
20	104	80	54	38	30	56	150	114	128	62	52	55
21	99	80	52	38	30	*62	146	114	125	60	50	48
22	99	85	52	38	30	65	150	105	121	57	53	51
23	98	85	52	36	30	70	132	100	120	60	54	56
24	99	85	50	36	32	75	121	98	118	62	53	56
25	98	85	50	36	32	90	123	89	118	60	53	56
26	96	85	48	34	*33	110	133	89	111	81	53	54
27	96	90	48	34	34	140	126	120	109	85	54	52
28	95	*79	46	32	34	170	135	139	108	82	55	52
29	92	78	46	32	-----	*200	135	137	106	64	55	50
30	93	78	46	30	-----	200	137	120	111	68	57	45
31	90	-----	46	30	-----	190	-----	137	-----	56	60	-----
Total	3,423	2,630	1,796	1,233	811	2,263	4,352	3,581	4,677	2,337	1,721	1,687
Mean	110	87.7	57.9	39.8	29.0	73.0	145	116	156	75.4	55.5	56.2
Ac-ft	6,790	5,220	3,560	2,450	1,610	4,490	8,630	7,100	9,280	4,640	3,410	3,350

Calendar year 1962: Max 351 Min 0.9 Mean 119 Ac-ft 86,271
Water year 1962-63: Max 200 Min 26 Mean 83.6 Ac-ft 60,530

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 8-10, 18-27, Dec. 6 to Mar. 31 (no gage-height record Jan. 21 to Feb. 5, Feb. 14-25). No gage-height record Nov. 29 to Dec. 5, Apr. 1-8, 10-14. Computed from once daily staff-gage readings Nov. 28, Apr. 9, Apr. 15 to Sept. 30.

5-459.5. Orwell Reservoir near Fergus Falls, Minn.

Location.--Lat 46°12'55", long 96°10'40", in SW¼ sec.26, T.132 N., R.44 W., at dam on Otter Tail River at outlet of Orwell Reservoir, 7 miles southwest of Fergus Falls, Minn.

Drainage area.--1,830 sq mi, approximately.

Records available.--March 1953 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,000.00 ft above mean sea level, adjustment of 1912. Gage readings reduced to elevations above mean sea level.

Extremes.--Maximum contents during year, 14,100 acre-ft Oct. 30, Sept. 18 (elevation, 1,070.00 ft); minimum, 1,040 acre-ft May 26 (elevation, 1,048.22 ft).
1953-63: Maximum contents, 16,920 acre-ft June 17, 1962 (elevation, 1,072.38 ft); minimum (after initial filling), 844 acre-ft Aug. 26, 27, 1953 (elevation, 1,046.96 ft).

Remarks.--Reservoir is formed by earth dam with concrete spillway with one taintor gage; storage began in March 1953. Capacity to elevation, 1,070 ft (maximum operating stage) is 14,100 acre-ft of which 13,100 acre-ft is controlled storage above elevation 1,048 ft (minimum operating stage). Dead storage, 210 acre-ft. Figures given herein represent total contents. Reservoir is used for flood control and to increase low flow for water supply and pollution abatement.

Cooperation.--Records furnished by Corps of Engineers.

Month-end elevation and contents, water year October 1962 to September 1963.

Date	Elevation (feet)†	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	1,064.22	8,780	-
Oct. 31.....	1,069.92	14,010	+5,230
Nov. 30.....	1,069.68	13,750	-260
Dec. 31.....	1,065.43	9,740	-4,010
Calendar year 1962.....	-	-	+6,400
Jan. 31.....	1,055.93	3,620	-6,120
Feb. 28.....	1,052.82	2,340	-1,280
Mar. 31.....	1,051.11	1,780	-560
Apr. 30.....	1,049.48	1,320	-460
May 31.....	1,049.35	1,290	-30
June 30.....	1,054.64	3,060	+1,770
July 31.....	1,053.44	2,580	-480
Aug. 31.....	1,064.39	8,910	+6,330
Sept. 30.....	1,069.71	13,780	+4,870
Water year 1962-63.....	-	-	+5,000

† Elevation at 2400.

RED RIVER OF THE NORTH BASIN

5-460. Otter Tail River below Orwell Dam, near Fergus Falls, Minn.

Location.--Lat 46°12'35", long 96°11'05", in NE¼ sec.34, T.132 N., R.44 W., on left bank 0.7 mile downstream from Orwell Dam, 6.1 miles downstream from Dayton Hollow Dam, 8 miles southwest of Fergus Falls, and 11.1 miles downstream from Pelican River.

Drainage area.--1,830 sq mi, approximately.

Records available.--October 1930 to September 1963. Prior to October 1952, published as Otter Tail River below Pelican River, near Fergus Falls. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,029.65 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Oct. 11, 1930, to Nov. 17, 1933, at same site at datum 2.00 ft higher; Nov. 18, 1933, to Mar. 21, 1953, at site 6.1 miles upstream at datum 40.30 ft higher.

Average discharge.--33 years, 257 cfs (186,100 acre-ft per year).

Extremes.--Maximum discharge during year, 745 cfs June 17-18 (gage height, 3.65 ft); minimum, 62 cfs July 19 (gage height, 2.04 ft).
1930-63: Maximum discharge, 1,710 cfs June 17, 1953 (gage height, 5.60 ft, backwater from aquatic vegetation); minimum, 1.0 cfs May 2, 1934, Sept. 30, 1935; minimum daily, 1.6 cfs Feb. 7, 1937.

Remarks.--Records good. Flow regulated by Orwell Reservoir beginning Mar. 21, 1953 (see preceding page) and powerplants upstream.

Rating table, water year 1962-63 (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 13, 14, Aug. 21 to Sept. 25)

2.1	75	3.0	444
2.3	132	3.5	712
2.6	247	4.0	997

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	449	428	316	356	183	206	555	476	508	604	218	75
2	444	*423	316	356	179	222	572	492	513	577	210	78
3	*449	418	316	351	179	226	502	492	465	561	183	78
4	460	418	316	346	176	226	460	486	307	545	195	78
5	455	418	316	346	176	226	444	455	336	518	195	*78
6	455	418	316	346	179	231	444	439	545	465	191	80
7	460	418	316	341	*183	243	444	434	663	402	*191	80
8	455	418	316	341	187	252	439	434	663	413	191	80
9	455	418	316	341	187	256	*439	434	663	408	161	80
10	460	418	316	*341	187	256	439	428	291	402	146	80
11	460	418	316	336	191	243	439	434	90	*402	146	83
12	455	418	312	336	218	231	423	439	92	397	146	83
13	460	397	312	331	218	231	423	434	*267	392	146	120
14	460	372	312	331	218	*235	377	*444	513	392	150	146
15	465	372	312	326	214	235	382	460	658	382	154	150
16	361	377	312	321	214	260	387	465	685	372	154	164
17	292	377	312	297	210	278	397	455	701	336	154	198
18	292	351	312	278	210	265	408	444	740	302	157	231
19	302	316	312	270	206	260	481	428	728	205	157	243
20	307	297	312	260	206	256	492	423	718	243	126	247
21	307	297	312	260	206	252	481	423	701	252	100	247
22	312	297	312	252	202	256	476	423	690	265	103	247
23	312	297	312	252	202	260	476	423	680	274	106	247
24	312	302	307	218	198	288	428	428	663	243	106	247
25	351	316	307	198	198	321	444	428	653	226	106	247
26	387	316	307	198	198	341	449	408	636	239	92	226
27	387	316	302	198	198	316	455	413	626	243	75	198
28	387	*316	326	191	198	439	455	418	620	252	75	187
29	387	316	356	187	-	*508	449	423	626	278	75	187
30	408	316	356	187	-----	497	455	465	620	297	75	187
31	444	-----	351	183	-----	513	-----	492	-----	260	75	-----
Total	12,390	10,979	9,832	8,875	5,521	8,829	13,515	13,740	16,661	11,147	4,359	4,672
Mean	400	366	317	286	197	285	450	443	555	360	141	156
Ac-ft	24,580	21,780	19,500	17,600	10,950	17,510	26,810	27,250	33,050	22,110	8,650	9,270

Calendar year 1962 Max 1,250 Min 64 Mean 469 Ac-ft 339,800
Water year 1962-63: Max 740 Min 75 Mean 330 Ac-ft 239,100

* Discharge measurement made on this day.

5-500. Bois de Sioux River near White Rock, S. Dak.

Location.--Lat 45°51'45", long 96°34'25", in SW 1/4 sec. 27, T.128 N., R.47 W., on left bank just downstream from Big Slough Outlet, 300 ft downstream from White Rock Dam, 4 miles south of White Rock, and 5 miles northwest of Wheaton, Minn.

Drainage area.--1,160 sq mi, approximately.

Records available.--October 1941 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 959.89 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Jan. 14, 1943, staff gage at same site and datum.

Average discharge.--22 years, 81.9 cfs (59,290 acre-ft per year).

Extremes.--Maximum discharge during year, 945 cfs June 18 (gage height, 8.65 ft); minimum, 0.9 cfs Aug. 16. 1941-63: Maximum discharge, 1,620 cfs Aug. 6, 1962 (gage height, 11.52 ft); no flow at times in most years.

Remarks.--Records good except those for period of ice effect, which are fair. Flow regulated by Lake Traverse-Bois de Sioux Flood Control and Water Conservation project (available capacity for flood control, 137,000 acre-ft).

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.0	0.8	4.5	79
3.1	1.3	5.0	149
3.3	5.0	6.0	331
3.5	10	8.0	770
3.7	18	8.7	960
4.0	38		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	69	4.0	13	3.6	4.0	9.7	30	79	52	418	19	3.7
2	69	3.1	9.2	3.6	4.3	9.9	30	67	152	344	22	1.8
3	*69	6.3	14	3.5	4.7	10	37	62	232	302	19	3.7
4	68	3.4	7.6	3.5	5.3	10	36	54	242	287	23	6.4
5	67	5.5	7.0	3.5	6.2	10	39	58	240	132	16	*13
6	66	6.8	6.3	3.5	*7.8	10	36	53	253	77	*15	8.1
7	66	3.3	5.9	3.6	8.2	10	46	43	348	96	12	5.9
8	66	8.1	5.5	3.6	8.5	10	32	32	390	93	13	4.0
9	65	7.1	5.3	*3.6	8.7	10	*28	31	457	88	9.3	4.6
10	65	8.1	5.1	3.6	8.9	10	35	*30	491	86	10	5.0
11	63	7.6	5.0	3.6	8.9	11	74	29	360	*81	9.3	3.9
12	63	8.7	4.9	3.6	8.9	12	78	32	375	79	5.0	1.8
13	64	9.0	4.9	3.5	8.8	13	142	37	*567	31	3.5	5.5
14	65	6.4	4.9	3.5	8.8	*14	151	35	758	6.6	6.4	7.9
15	67	4.2	4.9	3.4	8.7	16	152	35	818	8.7	6.2	2.0
16	60	4.4	4.9	3.4	8.7	17	213	36	888	8.1	3.5	4.4
17	61	7.6	4.8	3.4	8.9	17	225	40	930	7.9	4.6	3.1
18	59	8.7	4.8	3.4	9.1	18	207	37	936	6.8	5.9	1.2
19	37	9.0	4.7	3.4	9.2	18	211	38	903	7.3	3.9	1.2
20	26	11	4.6	3.4	9.1	18	205	40	862	7.9	4.4	1.7
21	25	8.4	4.5	3.4	9.0	*18	204	37	832	6.8	5.5	1.2
22	20	7.6	4.4	3.4	9.0	18	195	36	810	6.4	4.4	2.4
23	21	8.4	4.2	3.5	8.9	19	141	34	790	6.8	4.4	4.4
24	22	9.3	4.0	3.5	8.9	24	106	36	760	6.4	5.2	*2.9
25	21	9.0	3.8	3.5	9.0	29	96	40	680	9.3	5.0	2.7
26	22	12	3.7	3.5	9.1	31	84	36	620	11	7.6	2.6
27	18	13	3.7	3.5	9.3	32	79	38	588	30	5.0	1.8
28	13	*12	3.6	3.6	9.5	29	76	46	513	24	3.5	1.5
29	8.7	10	3.6	3.6	-	*26	75	43	461	23	2.9	1.8
30	4.8	8.7	3.6	3.7	-----	35	71	42	443	22	2.6	1.7
31	*4.8	-----	3.6	3.8	-----	30	-----	55	-----	20	2.7	-----
Total	1,415.3	230.7	170.0	109.2	228.4	544.6	3,134	1,311	16,751	2,333.0	259.8	111.9
Mean	45.7	7.69	5.48	3.52	8.16	17.6	104	42.3	558	75.3	8.38	3.73
Ac-ft	2,810	458	337	217	453	1,080	6,220	2,600	33,230	4,630	515	222

Calendar year 1962: Max 1,600 Min 0 Mean 320 Ac-ft 232,000
 Water year 1962-63: Max 936 Min 1.2 Mean 72.9 Ac-ft 52,770

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Mar. 28.

5-515. Red River of the North at Wahpeton, N. Dak.

Location.--Lat 46°15'55", long 96°35'40", in NE¼ sec.8, T.132 N., R.47 W., on left bank in Wahpeton, 800 ft downstream from confluence of Bois de Sioux and Otter Tail Rivers and at mile 548.6.

Drainage area.--4,010 sq mi, approximately.

Records available.--April 1942 to September 1963. Gage-height records collected in this vicinity since 1917 are contained in reports of U. S. Weather Bureau.

Gage.--Water-stage recorder and concrete and wooden dam. Datum of gage is 943 ft above mean sea level, datum of 1929. Prior to Aug. 6, 1943, U. S. Weather Bureau staff gage 800 ft upstream, converted to present datum. Aug. 6, 1943, to Oct. 27, 1950, chain gage at present site and datum.

Average discharge.--20 years (1943-63), 528 cfs (382,300 acre-ft per year).

Extremes.--Maximum discharge during year, 3,830 cfs June 11 (gage height, 11.38 ft); minimum, 42 cfs Aug. 30 (gage height, 2.36 ft).
1942-63: Maximum discharge, 7,130 cfs Apr. 12, 1952 (gage height, 14.99 ft); minimum, 8 cfs Aug. 25, 1961 (gage height, 2.26 ft).
Maximum stage known, 17.0 ft in spring of 1897.

Remarks.--Records good, except those for period of ice effect, which are fair. Flow regulated by Owell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft M.S.L., 1912 Adj.); Lake Traverse (capacity, 137,000 acre-ft, available for flood control); numerous other controlled lakes and ponds, and several powerplants.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Nov. 22

Nov. 23 to Sept. 30

3.6	184	2.4	46	4.0	370
4.0	296	3.0	134	6.0	1,080
5.0	624	3.5	236	11.0	3,600

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	544	407	346	440	200	190	623	560	912	1,070	325	101
2	530	401	343	440	200	220	651	567	1,490	1,020	275	115
3	527	398	346	440	220	250	651	584	1,450	936	246	86
4	527	398	340	430	220	240	*613	567	1,210	864	232	53
5	527	398	302	430	220	220	574	553	*830	826	223	51
6	530	372	246	410	220	240	686	525	884	721	223	48
7	557	398	150	420	240	270	718	511	1,250	591	212	51
8	561	*407	180	410	240	290	644	*508	1,550	522	210	54
9	544	394	210	*390	240	280	567	481	1,980	518	223	62
10	*540	401	200	300	240	280	522	463	3,430	511	184	76
11	534	401	250	300	200	270	*500	460	3,560	508	158	*83
12	537	401	300	300	240	240	546	475	*2,450	500	154	82
13	537	398	350	340	260	200	560	475	*1,680	486	*150	89
14	537	382	410	360	240	230	567	475	1,450	463	154	104
15	530	353	400	360	280	270	588	484	1,560	427	154	158
16	530	350	400	340	280	270	578	539	1,640	400	158	164
17	420	347	380	320	280	*290	*613	*626	1,670	*382	162	174
18	317	341	360	280	260	300	654	549	1,680	361	162	221
19	305	326	*360	260	240	350	651	514	*1,690	334	164	253
20	302	284	330	240	220	370	672	484	1,660	227	164	278
21	290	263	340	240	220	380	686	472	1,610	234	145	278
22	278	214	340	250	240	420	679	475	1,570	236	126	280
23	278	316	240	250	260	500	665	475	1,520	258	103	280
24	275	397	310	250	240	700	640	475	1,480	275	83	270
25	284	331	340	240	220	800	*588	469	1,430	248	82	272
26	323	346	340	220	*220	*730	560	454	1,340	232	82	272
27	353	352	360	200	200	700	553	494	1,270	305	69	246
28	359	346	350	200	180	700	567	508	1,240	349	48	210
29	356	*352	400	200	-	750	550	475	1,160	364	50	184
30	350	346	450	*200	-----	750	560	475	1,090	367	54	182
31	372	-----	450	220	-----	626	-----	619	-----	373	94	-----
Total	13,454	10,820	10,123	9,680	6,520	12,326	18,226	15,791	47,736	14,908	4,869	4,777
Mean	434	361	327	312	233	398	608	509	1,591	481	157	159
Ac-ft	26,690	21,460	20,080	19,200	12,930	24,450	36,150	31,320	94,680	29,570	9,660	9,480

Calendar year 1963 Max 5,610 Min 60 Mean 1,063 Ac-ft 769,300
Water year 1962-63 Max 3,560 Min 48 Mean 464 Ac-ft 335,700

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 7 to Mar. 30.

5-540. Red River of the North at Fargo, N. Dak.

Location.--Lat 46°51'40", long 96°47'00", in NW¼ sec.18, T.139 N., R.48 W., at city water plant on 4th St. S. in Fargo, 25 miles upstream from mouth of Sheyenne River and at mile 453.

Drainage area.--6,800 sq mi, approximately.

Records available.--May 1901 to September 1963. Published as "at Moorhead, Minn." 1901. Monthly discharge for some periods, published in WSP 1308.

Gage.--Water-stage recorder and concrete control. Datum of gage is 861.8 ft above mean sea level, datum of 1929. Prior to Sept. 1, 1914, staff gage at site 1½ miles downstream at datum 1.0 ft lower. Sept. 1, 1914, to July 31, 1928, staff gage at site 1 mile downstream at datum 9.3 ft higher. Aug. 1, 1928, to Apr. 12, 1959, staff gage at site 1 mile downstream at datum 5.6 ft higher. Aug. 13, 1959, to June 21, 1960, water-stage recorder at site 2 miles upstream at datum 5.6 ft higher. June 22, 1960, to Sept. 30, 1962, water-stage recorder at present site at datum 5.6 ft higher. Since June 22, 1960, auxiliary water-stage recorder 2 miles upstream.

Average discharge.--62 years, 505 cfs (365,600 acre-ft per year, unadjusted); median of yearly mean discharges, 410 cfs (297,000 acre-ft per year, unadjusted).

Extremes.--Maximum discharge during year, 4,930 cfs June 14 (gage height, 19.97 ft); minimum, 52 cfs Sept. 14 (gage height, 13.34 ft).

1901-63: Maximum discharge, 16,300 cfs Apr. 15, 16, 1952; maximum gage height, 28.79 ft Apr. 16, 1952, datum then in use; no flow for many days in each year for period 1932-41.

Maximum stage known, 40.1 ft Apr. 7, 1897, site and datum in use prior to 1914.

Remarks.--Records good except those for the period of ice effect, which are fair. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft M.S.L., 1912 adj.), Lake Traverse (capacity, 137,000 acre-ft, available for flood control), other controlled lakes and ponds and several powerplants. Some small diversions for municipal supply. Figures of daily discharge do not include diversion by City of Fargo.

Rating table, water year 1962-63, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)

13.3	41	14.5	670	17.0	3,230
13.5	102	15.0	1,060	19.0	4,160
14.0	358	16.0	2,110	20.0	4,960

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
v 1	657	414	383	328	179	170	1,290	563	962	1,190	358	110
2	620	420	377	352	183	174	*1,050	563	1,570	1,120	377	114
3	607	457	383	352	174	183	815	569	2,290	1,070	346	92
4	594	463	370	352	170	193	778	575	2,940	1,010	298	92
5	588	470	370	352	174	193	808	594	3,150	938	246	95
6	582	457	358	358	183	204	778	594	*2,650	882	204	92
7	594	470	230	352	183	209	946	588	2,090	838	183	88
8	601	*476	138	346	188	214	1,240	575	2,280	726	204	88
9	607	457	165	346	193	219	1,160	*538	2,410	613	230	75
10	613	470	240	*334	198	235	987	538	2,410	544	198	71
11	*613	470	257	322	204	263	852	519	2,730	519	214	71
12	a610	476	252	292	204	269	*755	507	*3,520	513	214	*63
13	a600	476	269	252	198	257	664	507	*4,210	494	170	57
14	a600	476	304	263	198	240	651	519	4,820	494	*138	52
15	a590	476	328	281	204	230	651	557	4,550	476	142	54
16	a590	470	340	322	209	230	657	*594	3,800	457	151	60
17	588	445	358	328	204	240	657	778	3,230	420	147	71
18	582	439	358	328	204	*240	*651	726	2,560	*401	151	114
19	594	432	*352	322	198	235	651	762	2,190	395	147	130
20	439	420	340	298	193	263	691	705	*1,970	377	138	170
21	395	408	334	263	188	281	698	657	1,870	346	134	224
22	377	377	328	246	183	304	705	620	1,780	269	170	275
23	370	340	310	235	179	358	712	576	1,730	219	174	286
24	346	281	292	240	183	488	705	563	1,640	219	151	292
25	346	275	252	252	188	726	691	557	1,580	235	130	281
26	340	364	246	235	183	338	*677	563	1,520	246	134	281
27	334	408	286	224	*183	*1,100	638	800	1,460	257	122	275
28	370	*389	286	209	174	1,150	601	1,190	1,390	252	170	281
29	395	383	286	193	-	1,090	582	845	1,310	263	193	269
30	414	377	292	193	-----	978	588	670	1,280	286	151	246
31	420	-----	298	183	-----	1,160	-----	613	-----	340	122	-----
Total	15,976	12,736	9,382	8,953	5,302	13,034	23,329	19,525	71,892	16,409	5,907	4,469
Mean	515	425	303	289	189	420	778	630	2,396	529	191	149
Ac-ft	31,690	25,260	18,610	17,760	10,520	25,850	46,270	38,730	142,600	32,550	11,720	8,860
(-)	482	449	475	464	431	479	457	553	627	922	652	540
Mean #	523	432	310	296	197	428	785	639	2,407	544	201	158
Ac-ft #	32,170	25,710	19,080	18,220	10,950	26,330	46,730	39,280	143,200	33,470	12,370	9,400

Calendar year 1962: Max 9,570 Min 58 Mean 1,837 Ac-ft 1,333,000
 Water year 1962-63: Max 4,820 Min 52 Mean 567 Ac-ft 410,400

* Discharge measurement made on this day.

a No gage-height record.

Diversion in acre-ft, by City of Fargo.

- Adjusted for diversion.

Note.--Stage-discharge relation affected by ice Dec. 11 to Mar. 31.

RED RIVER OF THE NORTH BASIN

5-610. Buffalo River near Hawley, Minn.

Location.--Lat 46°51'00", long 96°19'45", near center of SE¼ sec.14, T.139 N., R.45 W., near left downstream end of bridge on farm lane, 2 miles southwest of Hawley.

Drainage area.--322 sq mi.

Records available.--March 1945 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,111.91 ft above mean sea level, datum of 1929. Prior to Jan. 29, 1953, chain gage at bridge 1,800 ft upstream at datum 3.17 ft lower.

Average discharge.--18 years, 70.6 cfs (51,110 acre-ft per year).

Extremes.--Maximum discharge during year, 253 cfs Aug. 12 (gage height, 5.48 ft); minimum daily, 9.0 cfs Jan. 20.

1945-63: Maximum discharge, 1,590 cfs Aug. 5, 1955 (gage height, 9.31 ft); minimum observed, 6.8 cfs July 28, 1945; minimum gage height, 2.55 ft Sept. 5, 1961.

Maximum stage known, about 11.3 ft, present datum, in spring of 1921, from information by local resident.

Remarks.--Records good except those for periods of ice effect, which are poor.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Aug. 11-13, Aug. 28 to Sept. 6)

2.8	14	4.0	93
3.1	26	5.0	206
3.5	50		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	41	29	36	18	9.8	*12	85	58	130	31	14	122
2	41	30	35	18	9.6	12	80	56	158	31	24	118
3	39	31	35	18	9.4	12	100	53	186	31	24	125
4	37	31	35	18	9.4	12	*180	50	163	28	22	123
5	36	29	36	18	9.4	13	195	49	146	26	19	113
6	36	30	32	19	9.4	14	155	47	134	26	18	104
7	36	30	26	19	9.4	15	145	50	125	25	17	95
8	38	29	24	20	9.6	16	135	45	123	25	17	85
9	40	29	22	18	9.4	16	120	44	117	24	26	78
10	39	32	21	19	9.4	16	110	45	137	23	35	69
11	38	33	21	19	9.4	17	*103	44	146	22	44	63
12	36	34	20	18	9.4	17	103	45	136	22	187	56
13	35	34	20	17	9.4	17	93	44	121	23	120	51
14	36	32	20	17	9.4	18	84	45	108	25	85	46
15	36	32	22	15	9.4	18	79	43	96	22	66	43
16	35	30	24	14	9.4	19	80	41	86	21	53	41
17	34	30	20	14	10	19	87	42	77	22	48	38
18	32	28	*20	12	10	20	85	41	70	22	45	37
19	30	29	20	11	10	20	78	39	64	23	41	37
20	30	34	19	10	10	20	74	38	58	20	37	36
21	30	33	19	9.0	10	24	70	39	51	18	32	35
22	31	34	17	9.4	10	30	65	41	45	17	43	33
23	32	31	20	9.4	11	80	*61	*41	41	15	60	32
24	*33	30	20	*9.4	11	100	58	38	37	*14	58	33
25	31	29	19	9.4	11	120	56	37	*34	14	50	33
26	30	31	19	9.4	11	150	56	37	35	14	48	32
27	31	30	19	9.4	11	*140	56	92	39	16	53	30
28	30	*35	19	9.4	12	160	58	125	35	18	*148	32
29	30	36	19	9.6	-	160	62	116	31	18	166	35
30	30	36	18	9.6	-----	105	63	99	29	17	135	*32
31	29	-----	18	9.8	-----	90	-----	91	-----	15	131	-----
Total	1,062	941	715	435.8	278.2	1,482	2,776	1,675	2,758	668	1,866	1,807
Mean	34.3	31.4	23.1	14.1	9.94	47.8	92.5	54.0	91.9	21.5	60.2	60.2
Ac-ft	2,110	1,870	1,420	864	552	2,940	5,510	3,320	5,470	1,320	3,700	3,580

Calendar year 1962: Max 1,390 Min 9.6 Mean 116 Ac-ft 84,010

Water year 1962-63: Max 195 Min 9.0 Mean 45.1 Ac-ft 32,660

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 6-24, Dec. 6 to Apr. 10 (no gage-height record Feb. 12-28, Mar. 15-26, Apr. 10).

5-0615. South Branch Buffalo River at Sabin, Minn.

Location.--Lat 46°46'20", long 96°37'40", in SW¼SW¼ sec.9, T.138 N., R.47 W., near center of span on downstream side of highway bridge, a quarter of a mile downstream from Whiskey Creek and 1 mile east of Sabin.

Drainage area.--522 sq mi.

Records available.--March 1945 to September 1963.

Gage.--Chain gage read once or twice daily. Datum of gage is 902.39 ft above mean sea level, datum of 1929 (levels by Soil Conservation Service). Prior to Aug. 17, 1948, at site 1 mile downstream at different datum.

Average discharge.--18 years, 54.7 cfs (39,600 acre-ft per year).

Extremes.--Maximum discharge during year, 1,420 cfs June 4 (gage height, 13.20 ft); no flow Jan. 4 to Mar. 15. 1945-63: Maximum discharge, 6,340 cfs June 9, 1962 (gage height, 17.04 ft); no flow for many days in most years.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are poor.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	21	19	31	0.2		*0	80	57	a330	a12	1.8	a48
2	22	18	30	.1		0	70	50	521	12	2.6	a48
3	24	19	31	.1		0	a60	46	965	19	a3.2	49
4	23	19	30	0		0	*45	a44	1,330	a12	a3.8	54
5	24	18	28	0		0	55	a42	910	11	4.6	57
6	24	18	22	0		0	a150	39	669	a11	1.7	58
7	a24	20	20	0		0	324	38	553	a12	1.6	54
8	25	a22	18	0		0	315	38	a490	12	1.6	a44
9	25	26	14	0		0	287	41	482	8.9	2.1	37
10	25	a32	10	0		0	*196	45	422	7.6	1.7	30
11	25	41	4.0	0		0	89	a45	339	7.0	a3.0	24
12	26	a42	6.0	0		0	72	a45	315	a6.0	4.4	20
13	a26	a42	4.0	0		0	68	46	282	a5.0	4.1	16
14	a26	a42	3.5	0		0	65	53	232	a4.0	6.9	a12
15	25	a40	a3.2	0		0	59	54	a200	2.5	7.2	a10
16	21	a39	3.0	0		a.1	58	60	a170	2.4	8.4	8.2
17	23	a38	2.8	0		a.2	56	65	a130	1.9	8.4	7.4
18	19	a36	*2.6	0		a.5	63	a120	a100	1.9	4.6	6.9
19	16	a38	a2.4	0		a1.0	56	a170	63	a2.0	2.4	7.2
20	a16	a38	2.2	0		a2.0	55	137	52	a2.2	1.7	8.1
21	a15	a36	2.0	0		5.0	a50	a95	44	a2.4	5.5	a7.5
22	15	a34	2.0	0		10	45	70	a38	2.6	5.8	a7.0
23	15	a32	1.9	0		40	*41	*56	a32	2.4	3.8	6.5
24	16	a32	1.8	*0		a150	40	54	*28	*1.8	a6.0	6.0
25	17	a34	1.6	0		220	37	a50	27	1.2	a9.0	5.8
26	*17	a35	1.4	0		200	40	a60	22	1.2	12	6.4
27	18	a34	1.2	0		*190	44	170	20	a1.2	15	5.8
28	18	a32	1.0	0		150	46	238	a18	1.1	30	a5.4
29	18	*30	a.8	0		115	46	*334	a16	2.3	*37	a5.0
30	18	a30	.6		-----	110	55	385	a14	1.6	48	4.7
31	18	-----	.4	0	-----	a90	-----	318	-----	1.7	a50	-----
Total	645	936	282.4	0.4	0	1,283.8	2,667	3,065	8,814	166.1	297.9	658.9
Mean	20.8	31.2	9.11	0.01	0	41.4	88.9	98.9	294	5.36	9.61	22.0
Ac-ft	1,280	1,860	560	0.8	0	2,550	5,290	6,080	17,480	329	591	1,310

Calendar year 1962: Max 5,750 Min 0 Mean 201 Ac-ft 145,800
 Water year 1962-63: Max 1,330 Min 0 Mean 51.6 Ac-ft 37,330

* Discharge measurement or observation of no flow made this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Nov. 5-7, 9, Dec. 5 to Apr. 5.

RED RIVER OF THE NORTH BASIN

5-620. Buffalo River near Dilworth, Minn.

Location.--Lat 46°57'40", long 96°39'40", in SW¼SE¼ sec.6, T.140 N., R.47 W., on left bank 4½ miles southeast of Kragnes, 6½ miles northeast of Dilworth, and 9 miles downstream from South Branch.

Drainage area.--1,040 sq mi, approximately.

Records available.--March 1931 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Altitude of gage is 870 ft (from topographic map). Prior to Apr. 5, 1937, chain gage at same site and datum.

Average discharge.--32 years, 116 cfs (83,980 acre-ft per year).

Extremes.--Maximum discharge during year, 1,300 cfs June 7 (gage height, 14.76 ft); minimum daily, 5.8 cfs Jan. 25 to Feb. 3.

1931-63: Maximum discharge, 6,140 cfs June 11, 1962 (gage height, 23.56 ft); no flow at times in 1936.

Remarks.--Records good except those for periods of ice effect, which are fair.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	58	50	74	16	5.8	6.1	310	120	654	53	17	209
2	58	52	74	15	5.8	6.1	250	120	745	48	21	204
3	58	53	74	15	5.8	6.0	200	116	784	47	20	196
4	57	53	73	14	5.9	6.0	150	108	908	46	22	190
5	58	53	70	14	6.0	7.0	*210	103	1,130	45	25	188
6	58	56	65	14	6.5	8.0	370	98	1,280	44	24	186
7	58	56	60	13	6.5	9.0	540	96	1,260	42	22	180
8	61	56	55	13	6.5	10	626	92	1,140	42	20	169
9	62	50	50	13	6.5	10	599	89	975	38	18	157
10	63	73	45	12	6.5	12	*482	86	846	32	17	139
11	63	68	38	12	6.5	12	337	88	754	29	24	124
12	64	69	34	11	6.5	13	257	88	658	30	46	112
13	64	77	30	10	6.5	12	228	92	576	30	125	97
14	64	82	26	9.0	6.5	12	209	94	511	29	169	85
15	64	85	24	9.0	6.5	13	189	93	435	29	133	76
16	64	85	22	9.0	6.5	14	171	96	355	28	101	67
17	62	84	22	8.5	6.5	14	160	100	296	29	82	61
18	58	82	*22	8.0	6.2	14	159	99	242	26	71	57
19	56	82	20	7.5	6.2	15	163	135	200	26	64	54
20	53	75	20	7.5	6.2	15	162	213	165	26	58	53
21	51	71	20	7.0	6.1	15	150	204	139	26	53	51
22	48	73	19	7.0	6.1	16	139	158	118	25	50	47
23	47	71	19	6.5	6.1	20	*127	*120	104	23	52	46
24	46	76	19	*6.0	6.0	50	118	104	*89	20	66	45
25	47	76	18	5.8	6.0	160	112	91	81	*18	73	44
26	*48	76	18	5.8	6.0	380	108	84	73	16	76	44
27	50	78	18	5.8	6.1	*470	105	98	68	15	74	43
28	50	74	17	5.8	*6.1	440	108	353	63	14	80	43
29	50	*42	17	5.8	-	410	114	*488	60	15	*145	43
30	50	64	17	5.8	-----	400	118	525	57	16	211	43
31	50	-----	16	5.8	-----	360	-----	562	-----	16	230	-----
Total	1,740	2,042	1,096	297.6	174.4	2,935.2	6,971	4,913	14,766	923	2,189	3,053
Mean	56.1	68.1	35.4	9.60	6.23	94.7	232	158	492	29.8	70.6	102
Ac-ft	3,450	4,050	2,170	590	346	5,820	13,830	9,740	29,290	1,830	4,340	6,060

Calendar year 1962: Max 5,990 Min 9.2 Mean 391 Ac-ft 282,800
 Water year 1962-63: Max 1,280 Min 5.8 Mean 113 Ac-ft 81,520

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Apr. 7.

5-625. Wild Rice River at Twin Valley, Minn.

Location.--Lat 47°16'00", long 96°14'40", in NE¼ sec.27, T.144 N., R.44 W., on left bank 100 ft upstream from highway bridge, three-quarters of a mile northeast of village of Twin Valley, and 2 miles upstream from a small tributary.

Drainage area.--888 sq mi.

Records available.--June 1909 to September 1917, July 1930 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,008.16 ft above mean sea level, datum of 1929 (Corps of Engineers bench mark). June 1909 to September 1917 staff gage at site a quarter of a mile downstream at different datum. July 23, 1930, to Nov. 24, 1934, chain gage at highway bridge 100 ft downstream from present site at present datum. Nov. 25, 1934, to Aug. 2, 1950, water-stage recorder 80 ft upstream from present site at present datum.

Average discharge.--41 years, 158 cfs (114,400 acre-ft per year).

Extremes.--Maximum discharge during year, 1,680 cfs May 30 (gage height, 8.00 ft); minimum daily, 6.4 cfs Mar. 1-4.

1909-17, 1930-63: Maximum discharge, 9,200 cfs July 22, 1909 (gage height, 20.0 ft, site and datum then in use), from rating curve extended above 3,300 cfs; minimum, 0.5 cfs Nov. 4, 1939.

Remarks.--Records good except those for period of ice effect, which are poor. Flow slightly regulated by Rice Lake and many other small lakes above station. Diurnal fluctuation caused by operation of mill at Faith, 17 miles above station.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.7	6.1	2.5	176
1.2	32	3.0	268
1.6	63	6.0	1,000
2.0	105	8.0	1,680

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	71	61	82	16	6.5	*6.4	240	264	1,360	194	58	60
2	71	62	78	16	6.5	6.4	280	242	1,230	181	64	63
3	73	59	84	15	6.5	6.4	300	253	1,220	168	64	63
4	72	58	76	15	6.5	6.4	343	268	1,260	156	64	62
5	73	58	62	14	6.5	6.8	*400	242	1,180	145	66	66
6	74	58	60	14	6.5	8.0	438	230	1,080	138	58	61
7	68	67	65	14	6.5	10	434	222	986	133	56	58
8	78	62	60	14	6.5	12	417	224	908	125	49	52
9	76	52	55	13	6.5	14	424	228	874	117	46	54
10	75	63	50	11	6.5	18	422	242	910	111	43	46
11	74	81	45	10	6.5	20	*405	236	822	106	38	45
12	71	84	40	9.5	6.5	22	389	244	757	109	54	46
13	68	78	38	9.0	6.5	22	369	242	687	108	45	48
14	67	77	35	8.5	6.5	24	354	248	628	113	49	58
15	70	83	35	8.4	6.5	26	336	257	578	106	49	56
16	66	81	36	8.2	6.5	50	325	244	525	105	44	57
17	67	77	37	8.1	6.5	45	321	250	474	132	41	59
18	64	64	*37	8.0	6.5	42	345	257	429	139	26	66
19	68	68	36	7.6	6.5	45	325	261	389	132	40	58
20	65	84	34	7.2	6.5	50	292	242	363	116	40	45
21	59	76	34	7.0	6.5	55	292	230	331	104	35	42
22	68	50	32	6.8	6.5	60	270	242	321	95	44	36
23	65	55	30	*6.6	6.5	100	253	244	270	86	38	38
24	*65	68	28	6.6	6.5	130	*253	*232	255	*80	38	31
25	70	82	26	6.5	6.5	120	250	230	244	72	36	29
26	64	86	24	6.6	6.5	*160	257	230	234	64	48	34
27	61	89	22	6.5	6.5	160	257	472	*248	67	50	30
28	59	*93	22	6.5	6.5	*180	246	913	248	66	*50	28
29	64	86	20	6.5	6.5	200	250	*1,300	226	73	53	26
30	62	86	18	6.5	-----	220	268	1,640	210	71	69	*28
31	62	-----	17	6.5	-----	220	-----	1,480	-----	65	68	-----
Total	2,110	2,148	1,318	299.1	182.0	2,045.4	9,755	12,109	19,247	3,477	1,523	1,445
Mean	68.7	71.6	42.5	9.65	6.50	66.0	325	391	642	112	49.1	48.2
Ac-ft	4,190	4,260	2,610	593	361	4,060	19,350	24,020	38,180	6,900	3,020	2,870

Calendar year 1962: Max 2,640 Min 17 Mean 276 Ac-ft 200,000
 Water year 1962-63: Max 1,640 Min 6.4 Mean 152 Ac-ft 110,400.

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 6 to Apr. 3 (no gage-height record Jan. 31, Feb. 2-28).

RED RIVER OF THE NORTH BASIN

5-640.. Wild Rice River at Hendrum, Minn.

Location.--Lat 47°16'05", long 96°47'50", in SE¼ sec.19, T.144 N., R.48 W., near center of span on downstream side of highway bridge, half a mile east of Hendrum and 4 miles upstream from mouth.

Drainage area.--1,600 sq mi, approximately.

Records available.--March 1944 to September 1963.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 836.75 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Aug. 2, 1949, chain gage at same site and datum.

Average discharge.--19 years, 208 cfs (150,600 acre-ft per year).

Extremes.--Maximum discharge during year, 1,670 cfs June 3 (gage height, 13.89 ft, from floodmarks); minimum daily, 4.7 cfs Feb. 28 to Mar. 4; minimum gage height observed, 1.85 ft Aug. 20.

1944-63: Maximum discharge, 4,660 cfs Apr. 14, 1956 (gage height, 24.26 ft); maximum gage height observed, 27.70 ft Apr. 15, 1947 (backwater from Red River of the North); no flow for some days in 1948-49.

Remarks.--Records good except those for periods of shifting control, which are fair, and those for periods of ice effect or no gage-height record, which are poor. Large part of high flow diverted into Marsh River basin at overflow section ¾ miles east of Ada. Another diversion into Marsh River basin, formed 1½ miles southeast of Ada, diverted water at all stages 1947-51, after which it was closed except for small regulated flow diverted at same point. Amount of diversion not known.

Rating tables, water year 1962-63, except periods of ice effect and shifting control (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 4

Apr. 5 to Sept. 30

1.2	22	1.8	28	6.0	310
2.0	57	2.0	36	8.0	527
3.0	115	2.5	59	11.0	1,020
5.0	290	3.0	89	13.0	1,460
8.0	653	4.0	156	13.7	1,620

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	95	72	112	19	6.4	4.7	500	312	1,550	240	75	89
2	93	73	109	18	6.4	4.7	*480	313	a1,580	223	80	a94
3	93	72	101	17	6.3	4.7	500	292	1,610	a210	70	98
4	91	73	102	16	6.2	4.7	440	289	1,480	a190	66	107
5	91	74	95	15	6.1	4.8	724	a290	1,420	179	59	105
6	94	74	90	15	6.2	5.0	911	292	1,370	166	50	113
7	93	76	80	15	6.2	5.0	a920	274	*1,290	160	39	98
8	94	74	75	14	6.2	5.5	941	263	1,190	152	42	83
9	94	73	70	13	6.2	5.5	773	259	a1,120	142	55	64
10	96	100	60	12	6.2	5.5	*629	265	1,040	133	48	69
11	95	118	55	11	6.0	5.8	556	266	1,020	127	53	57
12	94	106	50	10	6.0	6.0	505	a270	996	134	61	48
13	92	97	48	10	6.0	8.0	467	274	863	125	89	45
14	88	103	46	9.5	5.8	8.0	a440	274	814	117	89	38
15	86	100	44	9.5	5.8	9.0	410	277	775	122	70	36
16	85	97	42	9.0	5.8	12	393	283	a710	124	56	64
17	85	103	42	9.0	5.8	15	377	275	636	117	36	64
18	82	a110	40	8.5	5.6	15	368	271	567	143	35	64
19	79	120	*38	8.5	5.6	20	378	a272	515	141	32	64
20	79	115	36	8.0	5.4	25	391	272	455	128	30	62
21	79	120	34	8.0	5.4	40	358	271	407	119	36	58
22	78	110	32	7.5	5.2	50	339	257	372	110	37	56
23	75	80	30	7.0	5.2	60	329	*259	a330	100	35	44
24	74	80	28	6.8	5.0	a120	*310	267	309	91	49	44
25	73	85	26	*6.6	5.0	300	296	264	297	*87	44	44
26	*73	85	25	6.6	4.8	*400	294	a264	291	79	34	40
27	73	100	24	6.6	4.8	420	293	263	269	76	44	35
28	72	120	23	6.5	4.7	430	a295	386	*271	61	*62	33
29	72	*125	22	6.5	-	460	305	956	272	70	73	27
30	70	118	21	6.5	-----	500	306	1,230	263	76	76	32
31	71	-----	20	6.5	-----	a520	-----	1,440	-----	76	79	-----
Total	2,609	2,853	1,620	322.1	160.3	3,473.9	14,228	11,440	24,082	4,018	1,704	1,875
Mean	84.2	95.1	52.3	10.4	5.72	112	474	369	803	130	55.0	62.5
Ac-ft	5,170	5,660	3,210	639	318	6,890	28,220	22,690	47,770	7,970	3,380	3,720

Calendar year 1962: Max 3,630 Min 19 Mean 397 Ac-ft 287,600
 Water year 1962-63: Max 1,610 Min 4.7 Mean 187 Ac-ft 135,600

* Discharge measurement made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Nov. 6, 7, 10, 19-28, Dec. 5 to Apr. 4. Shifting-control method used Oct. 1 to Nov. 5, Nov. 8, 9, 11-17, Nov. 29 to Dec. 4, May 3-30, Sept. 8-30.

RED RIVER OF THE NORTH BASIN

31

5-645. Red River of the North at Halstad, Minn.

Location.--Lat 47°21'10", long 96°50'50", on line between secs. 24 and 25, T.145 N., R.49 W., on left bank on upstream side of highway bridge, half a mile west of Halstad, 2½ miles downstream from Wild Rice River, and at mile 375.2.

Drainage area.--21,800 sq mi, approximately, (includes 3,800 sq mi in closed basins).

Records available.--April 1936 to June 1937 (no winter records), April 1942 to September 1960 (spring and summer months only), May 1961 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 826.65 ft above mean sea level, datum of 1929. Prior to July 17, 1961, wire-weight gage at same site and datum.

Extremes.--Maximum discharge during year, 5,850 cfs June 16 (gage height, 13.14 ft); minimum daily, 266 cfs Sept. 18-19 (gage height, 2.62 ft).

1936-37, 1942-63: Maximum discharge, 24,500 cfs Apr. 16, 1947; maximum gage height, 34.00 ft Apr. 17, 1947; minimum discharge observed, 5.4 cfs Oct. 8, 9, 12-14, 1936.

Flood in 1897 reached a stage of about 38.5 ft.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair. Some regulation by many controlled lakes and reservoirs on tributaries.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.6	246	8.0	2,460
3.0	344	14.0	6,450
5.0	1,020		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	997	664	751	430	270	270	*3,060	1,270	2,950	al,850	471	516
2	997	679	744	420	270	270	2,600	1,270	3,120	al,750	546	546
3	982	a685	729	440	270	270	2,430	1,260	3,690	1,690	606	537
4	952	a695	729	470	280	270	1,870	1,240	4,290	al,600	573	534
5	914	704	726	490	280	270	1,820	1,240	4,870	al,600	537	500
6	887	708	637	500	280	270	2,230	1,240	5,270	al,500	489	477
7	876	751	630	510	290	280	2,420	1,230	5,370	al,400	438	477
8	887	a760	620	520	310	280	3,330	1,200	5,110	al,300	390	471
9	902	a770	600	510	330	290	*4,320	1,180	4,890	al,200	358	453
10	914	a780	520	500	330	290	4,310	1,170	4,840	1,120	369	429
11	921	a790	500	470	330	290	3,810	1,130	4,780	986	396	402
12	929	a800	580	460	330	290	3,210	1,110	4,710	936	435	378
13	917	a820	620	460	320	300	2,730	1,110	4,920	898	623	341
14	914	830	580	430	320	310	2,330	1,100	5,370	845	672	307
15	906	834	550	400	320	320	2,080	1,100	5,740	812	555	292
16	898	834	530	380	320	320	1,950	1,110	5,820	808	507	285
17	898	a830	530	370	330	310	1,800	1,120	5,530	776	492	280
18	887	a820	520	390	330	310	1,720	1,170	4,890	758	438	266
19	876	a810	*520	400	330	320	1,640	1,260	4,140	747	381	266
20	868	a800	520	400	330	340	1,600	1,300	*3,510	726	350	292
21	826	794	510	380	320	350	1,570	1,310	3,060	718	325	310
22	751	a800	500	340	300	370	1,530	*1,320	2,780	661	*322	317
23	690	a800	490	320	300	390	*1,510	1,290	2,590	*592	339	336
24	654	a810	470	290	280	420	1,490	1,240	2,460	528	384	378
25	636	812	460	*280	280	580	1,460	1,160	2,380	462	366	399
26	*609	805	450	280	275	850	1,450	1,100	2,280	429	347	399
27	596	780	430	290	275	1,200	1,400	1,080	2,170	414	350	393
28	592	*715	420	300	*275	1,800	1,370	1,180	a2,100	423	381	396
29	592	754	420	290	-	2,600	1,340	1,980	a2,000	435	414	399
30	a610	758	430	280	-----	3,400	1,300	2,680	al,900	426	444	393
31	633	-----	430	270	-----	3,500	-----	2,870	-----	432	465	-----
Total	25,511	23,192	17,146	12,270	8,475	21,330	65,680	41,020	117,530	28,822	13,763	11,769
Mean	823	773	553	396	303	668	2,189	1,323	3,918	930	444	392
Ac-ft	50,600	46,000	34,010	24,340	16,810	42,310	130,300	81,360	233,100	57,170	27,300	23,340

Calendar year 1962: Max 15,800 Min 132 Mean 3,279 Ac-ft 2,374,000
 Water year 1962-63: Max 5,820 Min 266 Mean 1,059 Ac-ft 766,600

* Discharge measurement made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Dec. 7 to Mar. 31.

RED RIVER OF THE NORTH BASIN

5-675. Marsh River near Shelly, Minn.

Location.--Lat 47°24'45", long 96°45'50", in NE¼ sec. 3, T.14S N., R.48 W., near center of span on downstream truss of bridge, 3¼ miles southeast of Shelly and 10 miles upstream from mouth.

Drainage area.--151 sq mi.

Records available.--March 1944 to September 1963. Monthly discharge only for March 1944, published in WSP 1308.

Gage.--Chain gage read once or twice daily. Datum of gage is 844.14 ft above mean sea level, datum of 1929 (levels by Corps of Engineers).

Average discharge.--19 years, 93.3 cfs (67,550 acre-ft per year).

Extremes.--Maximum discharge during year, 274 cfs Apr. 8 (gage height, 4.60 ft); no flow for many days. 1944-63: Maximum discharge, 4,660 cfs May 11, 1950 (gage height, 18.96 ft, from floodmark); no flow for many days most years.

Remarks.--Records good except those for period of ice effect, which are poor. Large part of high flow of Wild Rice River diverted into Marsh River basin at overflow section 3¼ miles east of Ada. Another diversion from Wild Rice River formed 1 mile southeast of Ada supplemented flow at all stages 1947-51, after which it was closed except for small regulated flow diverted at same point for abatement of pollution from Ada sewage plant effluent.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Mar. 30 to Apr. 14, May 29 to June 9)

-0.2	0	0.2	2.9	1.5	46
-.1	.4	.4	6.6	2.0	74
0.0	1.0	.7	14	3.0	146
.1	1.8	1.0	24	5.0	376

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.4	0.6	2.8	0.2		0	34	11	109	2.2		
2	.4	.7	a2.6	a.2		0	*27	9.5	128	1.8		
3		a.8	2.4	.2		0	22	a9.0	131	1.5		
4	.4	1.0	2.6	.2		0	13	8.8	109	1.5		
5	.5	.9	2.1	.1		0	16	7.9	92	a1.2		
6	a.6	a.9	1.6	a.1		0	21	7.5	77	.9		
7	.8	.9	1.2	.1		0	a150	6.8	59	a.8		
8	a.8	1.2	a1.0	.1		0	233	a6.4	38	.7		
9	.7	1.1	.9	a.5		0	*137	6.2	26	.4		
10	.9	1.1	.6	1.0		0	a75	7.7	23	.2		
11	a.8	1.5	a.5	.8		.2	46	7.7	20	.2		
12	.7	2.1	.4	.6		.6	30	7.9	18	.4		
13	.6	2.6	.4	a.4		.2	23	7.7	16	.4		
14	.7	3.3	.4	.2		.5	17	8.4	14	.2		
15	.7	2.5	.2	a.1		3.0	15	a8.8	13	a.2		
16	.4	1.6	a.2	0		10	13	9.5	12	a.2		
17	.6	2.1	.2	0		a9.0	13	a10	10	.2		
18	.9	1.7	.1	0		6.0	13	12	8.6	.3		
19	.6	1.7	*.1	0		7.0	12	a12	*7.5	a.2		
20	.7	1.8	a.1	0		a15	11	a12	5.8	.1		
21	.9	1.0	.1	0		30	10	10	5.8	.1		
22	.8	.9	a.1	0		45	9.3	*11	5.8	.1		
23	.7	.7	.1	0		35	*8.4	9.0	4.8	*0		
24	.8	1.9	a.1	0		55	7.7	7.9	3.3	0		
25	.9	1.6	.2	*0		80	7.3	5.4	10	0		
26	*.9	1.5	a.2	0		*75	7.0	5.2	10	0		
27	.9	2.5	.2	0		60	8.1	8.6	a8.0	0		
28	.9	2.6	.3	0	(*)	60	a9.0	19	7.5	0		
29	.8	*2.5	a.2	0		55	10	23	6.0	0		
30	.6	a2.6	.1	0		51	12	32	3.5	0		
31	.5	-----	a.1	0		42	-----	51	-----	a0		
Total	21.3	47.9	22.1	4.8	0	639.5	1,009.8	358.9	981.6	13.8	0	0
Mean	0.69	1.60	0.71	0.15	0	20.6	33.7	11.6	32.7	0.45	0	0
Ac-ft	42	95	44	9.5	0	1,270	2,000	712	1,950	27	0	0

Calendar year 1962: Max 1,200 Min 0 Mean 77.0 Ac-ft 55,750
Water year 1962-63: Max 233 Min 0 Mean 8.49 Ac-ft 6,150

* Discharge measurement or observation of no flow made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Jan. 10 to Mar. 29.

5-690. Sandhill River at Climax, Minn.

Location.--Lat 47°36'10", long 96°47'40", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.148 N., R.48 W., near center of span on upstream side of highway bridge, 1 mile southeast of Climax and 4 miles upstream from mouth.

Drainage area.--405 sq mi, approximately.

Records available.--March 1943 to September 1963 (winter records incomplete in some years). Monthly discharge only for some periods, published in WSP 1308.

Gage.--Chain gage read once daily. Datum of gage is 833.69 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Average discharge.--17 years (1946-63), 57.6 cfs (41,700 acre-ft per year).

Extremes.--Maximum discharge during year, 300 cfs Apr. 7 (gage height, 6.34 ft, from floodmark); maximum gage-height, 7.26 ft Mar. 25, from floodmark (backwater from ice); minimum daily discharge, 3.0 cfs Mar. 3, 4. 1943-63: Maximum discharge, 3,040 cfs Apr. 22, 1950 (gage height, 16.31 ft, from floodmark); minimum not determined.

Remarks.--Records good except those for period of ice effect, which are poor.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 18 to Nov. 3)

0.9	8.7	2.0	43
1.1	13	3.0	94
1.3	19	6.0	354
1.6	28		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	44	25	26	16	4.8	3.4	*105	51	76	33	16	14
2	41	25	26	16	4.8	3.2	100	55	81	30	15	13
3	39	24	24	16	4.8	3.0	95	52	88	28	15	12
4	41	25	20	16	5.0	3.0	100	51	85	26	15	12
5	40	28	20	16	5.5	*8.0	110	46	79	26	14	12
6	39	32	14	17	6.0	10	155	46	72	25	13	11
7	38	33	26	*17	6.0	9.5	265	46	65	24	12	11
8	42	35	24	17	6.0	9.0	210	46	63	22	12	11
9	44	35	20	15	6.0	9.0	*180	47	56	20	12	11
10	40	37	16	15	5.5	8.5	125	45	88	22	12	10
11	38	38	14	12	5.5	12	108	46	81	40	11	10
12	38	42	12	8.0	5.5	18	98	45	72	137	12	11
13	38	45	14	8.0	5.5	16	90	44	61	102	11	11
14	37	38	14	7.5	5.0	22	84	46	57	69	11	12
15	38	24	15	7.5	5.0	26	82	46	53	51	11	11
16	37	30	15	7.0	5.0	32	80	47	52	37	11	10
17	37	38	16	7.0	5.5	30	75	46	49	54	11	*10
18	37	40	16	6.0	5.5	36	70	53	46	40	11	10
19	36	38	16	5.0	5.5	34	*63	52	*46	29	11	10
20	36	36	16	5.0	5.0	32	63	51	44	25	11	9.5
21	38	30	16	4.8	5.0	30	63	49	41	22	10	10
22	34	22	16	4.8	4.5	35	63	*49	38	20	*10	10
23	32	25	16	4.8	4.0	40	59	45	39	*19	9.5	9.5
24	32	36	16	4.8	3.5	75	56	43	40	18	10	9.5
25	*29	34	16	4.8	3.5	*94	57	42	42	16	9.5	10
26	30	36	16	4.8	3.5	82	57	43	42	15	10	9.1
27	29	*35	16	4.8	3.4	80	54	42	45	16	12	9.5
28	29	30	16	*4.8	3.4	*85	55	40	47	19	12	9.5
29	29	27	16	4.8	-	100	54	39	41	18	12	10
30	27	28	16	4.8	-----	105	55	40	36	16	17	9.5
31	27	-----	16	4.8	-----	110	-----	69	-----	16	15	-----
Total	1,116	971	540	286.8	138.2	1,160.6	2,831	1,462	1,725	1,035	374.0	318.1
Mean	36.0	32.4	17.4	9.25	4.94	37.4	94.4	47.2	57.5	33.4	12.1	10.6
Ac-ft	2,210	1,930	1,070	569	274	2,300	5,620	2,900	3,420	2,050	742	631

Calendar year 1962: Max 1,310 Min 1.0 Mean 107 Ac-ft 77,500

Water year 1962-63: Max 265 Min 3.0 Mean 32.8 Ac-ft 23,720

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 4 to Apr. 21.

5-740. Lower Red Lake near Red Lake, Minn.

Location.--Lat 47°57', long 95°17', in NW¼ sec.28, T.152 N., R.36 W., on left bank just upstream from dam at outlet, 13 miles northwest of village of Red Lake.

Drainage area.--1,950 sq mi, approximately.

Records available.--June 1930 to November 1932 (published as Red Lake at Redby), May 1933 to September 1963 (published as Red Lake near Red Lake 1933-40); records on Upper Red Lake published as Red Lake at Waskish, April 1930 to September 1933, all in reports of Geological Survey. October 1921 to September 1929 gage heights at Redby and on Upper Red Lake at Waskish in files of Minnesota Department of Conservation (fragmentary).

Gage.--Water-stage recorder. Datum of gage is 1,169.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). May 1933 to Sept. 6, 1934, staff gage at same site and datum. Staff gages at Waskish and Redby at datum 69.00 ft lower.

Extremes.--Maximum gage height during year, 6.70 ft Oct. 1; minimum, 4.69 ft Sept. 29 (affected by wind action). 1930-63: Maximum gage height, 9.53 ft June 25, 1950: minimum recorded, 0.80 ft Nov. 20, 1936.

Remarks.--Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

Month-end gage height, in feet, October 1962 to September 1963

Oct. 31	6.23	Jan. 31	5.74	Apr. 30	5.75	July 31	5.80
Nov. 30	6.05	Feb. 28	5.60	May 31	5.91	Aug. 31	5.36
Dec. 31	5.95	Mar. 31	5.62	June 30	5.99	Sept. 30	4.80

Note.--Mean daily gage heights are available.

5-745. Red Lake River near Red Lake, Minn.

Location.--Lat 47°57', long 95°17', in NW¼ sec.28, T.152 N., R.36 W., on left bank 50 ft downstream from dam at outlet of Lower Red Lake and 13 miles northwest of village of Red Lake.

Drainage area.--1,950 sq mi, approximately.

Records available.--May 1933 to September 1963. Monthly discharge only for May 1933, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,167.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 7, 1934, staff gage at site 50 ft upstream at datum 2.00 ft higher. Sept. 7, 1934, to Nov. 26, 1951, water-stage recorder at present site at datum 2.00 ft higher.

Average discharge.--30 years, 403 cfs (291,800 acre-ft per year).

Extremes.--Maximum daily discharge during year, 1,250 cfs Oct. 3-7, 10-12; maximum gage height, 7.24 ft Aug. 16 (affected by seiches and backwater from aquatic vegetation); no flow part of each day Sept. 11-12, 13, 17 (caused by regulation); minimum gage height, 3.03 ft Nov. 6.
1933-63: Maximum discharge, 3,600 cfs June 25, 1950 (gage height, 11.19 ft, affected by seiches and backwater from aquatic vegetation, present datum), from rating curve extended above 1,400 cfs; no flow at times.

Remarks.--Records fair. Flow completely regulated by outlet dam on Lower Red Lake.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,240	1,230	1,170	910	870	875	715	995	1,050	865	490	700
2	1,240	1,230	1,170	910	840	880	920	995	1,060	890	555	710
3	1,250	855	1,170	915	870	880	920	995	1,060	*890	650	720
4	1,250	40	1,160	925	880	875	920	995	1,070	860	650	720
5	1,250	39	1,160	935	870	875	920	995	1,070	810	620	700
6	1,250	730	1,030	950	880	875	920	995	1,080	790	630	700
7	1,250	1,220	635	960	890	870	920	995	1,080	785	640	690
8	1,240	1,220	635	965	900	865	920	990	1,080	780	620	690
9	1,240	1,220	635	975	885	870	920	*1,000	1,080	750	660	680
10	1,250	1,230	630	935	885	875	920	1,000	1,090	730	620	680
11	1,250	1,230	*625	920	885	875	*920	1,010	1,070	710	620	300
12	1,250	1,230	625	900	885	865	915	1,020	1,040	700	600	315
13	1,240	1,230	625	900	885	860	915	1,000	1,040	700	670	635
14	1,240	1,230	630	900	880	870	910	1,010	1,040	700	580	720
15	1,240	*1,230	630	900	880	875	910	1,010	1,040	710	630	710
16	*1,220	1,230	630	900	880	865	905	1,010	1,040	690	680	770
17	1,230	1,220	710	900	880	865	905	1,010	1,040	670	580	820
18	1,230	1,220	930	900	880	870	*900	1,010	1,040	*680	570	1,070
19	1,230	1,220	930	900	*875	865	905	1,010	*1,050	670	570	*1,060
20	1,230	1,210	930	895	860	*840	905	1,010	1,010	660	630	1,060
21	1,230	1,200	930	895	850	870	915	1,010	1,000	640	650	1,060
22	1,230	1,220	920	*890	865	865	925	1,020	990	660	660	1,050
23	1,230	1,220	900	890	870	860	935	1,020	970	560	*680	1,050
24	1,230	1,210	905	885	875	855	935	1,020	960	500	700	1,030
25	1,230	1,160	905	885	875	685	940	1,030	940	490	670	1,020
26	1,230	1,160	910	880	880	405	940	1,030	940	490	680	1,020
27	1,230	1,160	910	880	880	405	940	1,050	940	490	660	1,020
28	1,230	1,160	905	875	880	405	940	1,010	940	480	670	1,000
29	1,230	1,160	905	875	-	405	970	1,050	950	490	650	1,000
30	1,230	1,160	910	870	-----	405	995	1,040	900	490	680	1,000
31	1,230	-----	910	870	-----	405	-----	1,050	-----	*480	670	-----
Total	38,350	33,074	26,670	28,090	24,535	23,955	27,520	31,385	30,660	20,810	19,635	24,700
Mean	1,237	1,102	860	906	876	773	917	1,012	1,022	671	633	823
Ac-ft	76,070	65,600	52,900	55,720	48,660	47,510	54,590	62,250	60,810	41,280	38,950	48,990

Calendar year 1962: Max 1,260 Min 39 Mean 632 Ac-ft 457,800

Water year 1962-63: Max 1,250 Min 39 Mean 902 Ac-ft 653,300

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 25. Stage-discharge relation indefinite Oct. 1 to Dec. 9, Mar. 26 to Sept. 30.

RED RIVER OF THE NORTH BASIN

5-750. Red Lake River at High Landing, near Goodridge, Minn.

Location.--Lat 48°03', long 95°48', on line between secs. 28 and 29, T.153 N., R.40 W., on left bank at upstream side of highway bridge at High Landing, 7 miles south of Goodridge and 33 miles upstream from Thief River.

Drainage area.--2,300 sq mi, approximately.

Records available.--September 1929 to September 1963. Prior to October 1930, published as "at Kratka."

Gage.--Water-stage recorder. Datum of gage is 1,141.57 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Oct. 1, 1930, staff gage at site 10 miles downstream at different datum. Oct. 1, 1930, to Sept. 30, 1932, staff gage at datum 5.00 ft higher and Oct. 1, 1932, to Dec. 8, 1938, staff gage at datum 4.00 ft higher at site 50 ft downstream. Dec. 9, 1938, to Sept. 30, 1949, water-stage recorder at present site at datum 4.00 ft higher.

Average discharge.--34 years, 419 cfs (303,300 acre-ft per year).

Extremes.--Maximum discharge during year, 1,600 cfs Apr. 8 (gage height, 8.31 ft); maximum gage height recorded, 10.12 ft Mar. 22 (backwater from ice).

1929-63: Maximum discharge, 3,720 cfs May 11, 1950 (gage height, 13.42 ft); no flow during infrequent periods in 1931-34, 1936-37.

Remarks.--Records good except those for periods of ice effect, which are fair. Flow regulated by outlet dam on Lower Red Lake.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,340	1,360	1,230	920	880	880	646	1,030	1,040	860	537	739
2	1,330	1,360	1,210	920	860	880	*833	1,020	1,040	831	536	744
3	1,340	1,360	1,200	920	880	880	991	1,010	1,040	814	526	750
4	1,350	1,330	1,180	940	890	880	1,010	1,010	1,050	800	528	757
5	1,370	1,120	1,130	950	890	880	1,090	1,010	1,040	780	530	769
6	1,390	778	824	950	900	890	1,280	1,010	1,040	764	539	766
7	1,410	603	625	950	900	900	1,280	1,010	1,040	739	547	764
8	1,440	836	620	960	900	900	1,540	*1,000	1,040	720	556	766
9	1,450	1,010	620	970	900	890	1,250	1,000	1,040	700	562	769
10	1,450	1,110	630	920	900	890	1,110	1,020	1,040	683	570	771
11	1,460	1,190	640	910	900	900	1,060	1,030	1,040	696	577	778
12	1,460	1,240	640	910	900	900	1,020	1,030	1,040	855	587	785
13	1,470	1,270	650	910	900	900	1,010	1,030	1,040	792	595	739
14	1,470	*1,290	650	900	890	900	1,000	1,020	1,040	723	599	700
15	*1,480	1,290	660	900	900	910	1,000	1,020	1,020	683	603	700
16	1,440	1,300	660	900	890	910	1,030	1,020	1,010	*665	621	718
17	1,410	1,310	680	900	900	920	1,050	1,010	996	672	640	755
18	1,400	1,310	700	900	*900	940	1,050	998	*998	654	646	*766
19	1,390	1,310	880	860	890	*950	1,030	1,010	1,010	638	648	795
20	1,390	1,310	960	860	850	1,000	1,010	1,020	1,040	625	648	838
21	1,390	1,270	*970	*860	860	1,100	983	1,020	996	611	648	884
22	1,400	1,040	980	860	870	1,200	991	1,020	978	599	*648	919
23	1,400	1,000	950	860	880	1,250	985	1,020	957	595	657	952
24	1,390	1,180	940	860	880	1,200	983	1,010	936	585	659	978
25	1,380	1,370	940	870	880	*1,180	975	1,010	949	575	665	988
26	1,380	1,490	940	870	880	830	967	1,000	985	574	678	996
27	1,380	1,420	940	870	880	730	959	1,010	949	560	702	996
28	1,370	1,310	940	880	880	678	972	1,010	919	560	720	1,000
29	1,370	1,270	930	880	-	720	983	1,010	899	551	732	1,010
30	1,370	1,250	920	880	-----	741	998	1,000	879	547	737	1,010
31	1,360	-----	920	880	-----	650	-----	1,010	-----	537	737	-----
Total	43,430	36,287	26,759	27,920	24,830	28,379	31,086	31,428	30,091	20,988	19,178	24,902
Mean	1,401	1,210	863	901	887	915	1,036	1,013	1,003	677	619	830
Ac-ft	86,140	71,970	53,080	55,380	49,250	56,290	61,660	62,340	59,680	41,630	38,040	49,390

Calendar year 1962: Max 3,050 Min 46 Mean 767 Ac-ft 555,300
 Water year 1962-63: Max 1,540 Min 526 Mean 946 Ac-ft 684,800

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 8 to Mar. 26.

5-760. Thief River near Thief River Falls, Minn.

Location.--Lat 48°11', long 96°10', in sec.3, T.154 N., R.43 W., on right bank a quarter of a mile upstream from highway bridge, 5 miles north of city of Thief River Falls, 7 miles upstream from mouth, and 9 miles downstream from Mud Lake National Wild Life Refuge.

Drainage area.--959 sq mi.

Records available.--July 1909 to September 1917, April 1920 to September 1921, October 1922 to September 1924, October 1928 to September 1963. Monthly discharge only for some periods, annual maximums for water years 1919, 1922, 1925, 1926, published in WSP 1308.

Gage.--Water-stage recorder and control of grouted boulders. Datum of gage is 1,112.33 ft above mean sea level, datum of 1929 (levels by Minnesota Highway Department). Prior to May 4, 1939, staff or chain gage at same site and datum.

Average discharge.--46 years, 122 cfs (88,320 acre-ft per year).

Extremes.--Maximum discharge during year, 2,180 cfs Apr. 8 (gage height, 11.43 ft); no flow Jan. 16 to Feb. 16, Feb. 26 to Mar. 20.
1909-17, 1919-26, 1928-63: Maximum discharge, 5,610 cfs May 13, 1950 (gage height, 17.38 ft); no flow at times in some years.

Remarks.--Records good except those for period of ice effect, which are poor. Some regulation by Thief and Mud Lakes.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 26)

3.7	0	4.4	2.9	5.0	59
3.8	.1	4.5	5.6	6.0	304
4.0	.2	4.6	9.5	10.0	1,580
4.2	.6	4.7	17	12.0	2,460
4.3	1.2	4.8	29		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	21	19	0.4	0	0	220	636	516	255	37	3.6
2	20	12	18	.4	0	0	*420	612	552	247	34	3.9
3	19	7.2	14	.4	0	0	550	600	564	239	31	1.9
4	17	5.3	17	.4	0	0	530	597	549	223	30	1.8
5	18	4.4	10	.3	0	0	612	585	534	216	27	1.4
6	17	5.3	7.5	.3	0	0	1,470	570	522	210	26	1.2
7	17	4.7	6.5	.3	0	0	1,600	564	507	208	24	1.1
8	18	5.3	6.4	.3	0	0	2,080	*570	492	200	21	.9
9	19	6.8	5.5	.3	0	0	1,700	579	486	140	21	.8
10	18	7.9	*3.5	.2	0	0	*1,130	579	489	107	18	.6
11	18	8.3	1.6	.1	0	0	809	579	489	52	18	.6
12	18	8.7	1.0	.1	0	0	742	576	486	44	17	.6
13	19	9.1	1.0	.1	0	0	713	561	478	51	15	.6
14	19	*9.5	.9	.1	0	0	915	564	469	65	14	.6
15	*19	10	.8	.1	0	0	958	567	434	73	14	.6
16	18	11	.7	0	0	0	1,070	573	418	*75	15	.6
17	17	9.5	.8	0	1.0	0	1,240	579	409	71	15	.6
18	17	8.7	1.0	0	*1.6	0	*1,300	591	*452	63	14	*1.0
19	17	8.3	1.2	0	1.2	0	1,220	600	452	59	13	1.6
20	15	8.7	1.0	0	1.0	0	1,140	609	446	52	13	2.4
21	14	8.3	.9	*0	.8	.2	1,070	609	443	49	12	1.8
22	15	7.9	.8	0	.4	1.0	1,010	606	333	46	*12	1.5
23	14	7.2	.8	0	.2	20	928	606	309	41	11	1.2
24	14	7.2	.7	0	.1	200	915	579	283	41	7.9	1.0
25	12	6.8	.6	0	.1	*320	912	564	182	38	6.0	.9
26	12	6.4	.5	0	0	370	888	549	218	38	5.0	.8
27	13	7.9	.5	0	0	320	846	543	322	40	5.0	.5
28	13	14	.5	0	0	280	771	537	312	47	5.0	.4
29	13	17	.5	0	-	250	752	528	288	38	4.7	.4
30	12	18	.5	0	-----	200	723	516	270	40	5.0	.4
31	11	-----	.5	0	-----	150	-----	510	-----	38	4.4	-----
Total	503	272.4	124.2	3.8	6.4	2,111.2	29,234	17,838	12,704	3,106	495.0	35.3
Mean	16.2	9.08	4.01	0.12	0.23	68.1	974	575	423	100	16.0	1.18
Ac-ft	998	540	246	7.5	13	4,190	57,980	35,380	25,200	6,160	982	70

Calendar year 1962: Max 2,710 Min 0 Mean 391 Ac-ft 283,300
Water year 1962-63: Max 2,080 Min 0 Mean 182 Ac-ft 131,800

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Apr. 4.

RED RIVER OF THE NORTH BASIN

5-777. Ruffy Brook near Gonvick, Minn.

Location.--Lat 47°44'50", long 95°24'45", on line between sec.5 and 8, T.149 N., R.37 W., on downstream side of bridge on County Highway 17, 4 miles upstream from mouth, and 4½ miles east of Gonvick.

Drainage area.--45.2 sq mi.

Records available.--July 1960 to September 1963.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,227.93 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 9, 1960, reference point at same site and datum.

Extremes.--Maximum discharge during year, 225 cfs May 28 (gage height, 5.48 ft); minimum daily, 0.7 cfs Feb. 18-26; minimum gage height, 1.17 ft Sept. 15, 16.

1960-63: Maximum discharge, 364 cfs July 7, 1962 (gage height, 6.70 ft); minimum discharge, 0.6 cfs Sept. 5, 1961; minimum gage height, that of Sept. 15, 16, 1963.

Remarks.--Records good except those above 100 cfs, which are fair, and those for period of ice effect, which are poor.

Rating tables, water year 1962-63, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 4

Apr. 5 to Sept. 30

1.2	2.4	1.17	1.6	2.0	23
1.4	5.1	1.2	1.9	3.0	64
2.0	18	1.3	3.6	4.0	112
3.0	52	1.4	6.0	5.0	182
		1.7	14	6.0	278

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.4	4.1	6.8	2.2	1.6	0.8	37	17	84	9.4	15	2.9
2	4.5	3.9	7.0	2.2	1.4	.8	36	16	70	8.1	14	2.7
3	4.8	3.8	6.6	2.2	1.4	.8	*35	16	58	6.8	13	2.7
4	5.1	3.8	6.3	2.2	1.4	.8	40	15	55	5.3	12	2.2
5	4.4	3.4	4.6	2.2	1.4	.8	54	14	48	5.3	9.2	2.2
6	4.2	3.8	4.8	2.2	1.6	.8	46	14	42	5.3	8.9	2.2
7	3.6	3.9	4.0	2.2	1.6	1.0	46	18	37	4.8	8.7	2.2
8	6.0	3.8	4.0	2.2	1.4	1.2	67	18	39	4.3	8.7	2.2
9	4.5	4.1	3.0	2.2	1.4	1.2	54	*18	62	4.1	7.1	1.9
10	3.9	3.9	*3.2	2.0	1.2	1.2	*50	17	163	3.6	8.1	1.7
11	3.9	6.3	3.0	2.0	1.2	1.2	42	16	189	4.3	7.6	1.9
12	3.9	6.6	3.0	1.8	1.0	1.4	39	15	148	8.7	7.1	1.8
13	4.1	6.8	3.0	1.8	1.0	1.4	33	17	110	7.1	6.6	1.7
14	3.8	6.8	3.0	1.8	.8	1.4	29	18	80	6.3	6.8	1.7
15	3.9	*6.1	3.2	1.8	.8	1.4	28	18	97	5.8	6.8	1.6
16	*3.8	6.1	3.2	1.8	.8	1.4	29	16	52	5.8	7.4	1.6
17	4.2	5.8	4.0	1.8	.8	1.2	28	17	38	*6.0	6.8	3.1
18	3.9	5.8	4.4	1.8	.7	1.2	*28	18	33	6.0	6.3	3.1
19	3.9	5.6	4.4	1.8	*.7	2.2	23	18	*27	5.6	6.3	*2.7
20	3.9	6.0	4.0	1.7	.7	*3.0	20	19	22	5.6	4.8	2.4
21	4.1	6.6	4.0	1.7	.7	3.5	19	20	19	5.3	3.4	2.0
22	4.9	6.6	3.8	*1.7	.7	10	18	19	15	5.6	4.8	1.7
23	4.9	6.8	3.4	1.7	.7	20	16	19	13	5.8	*5.1	1.9
24	4.8	6.8	3.4	1.7	.7	25	18	18	12	6.0	3.6	2.1
25	4.8	6.8	3.4	1.6	.7	30	18	17	12	8.4	3.1	2.1
26	4.2	6.0	3.4	1.6	.7	35	24	20	20	14	3.6	2.1
27	4.2	6.6	3.0	1.6	.8	*38	19	111	16	17	3.6	2.2
28	3.8	6.6	3.0	1.6	.8	38	18	214	12	18	3.6	2.2
29	3.8	6.3	3.0	1.6	-	38	24	176	12	17	4.1	2.2
30	4.1	6.3	2.6	1.6	-----	37	20	136	10	15	4.1	2.2
31	3.8	---	2.2	1.6	-----	37	---	99	---	17	3.4	---
Total	132.1	165.8	120.7	57.9	28.7	336.7	958	1,184	1,595	247.3	213.6	65.2
Mean	4.26	5.53	3.89	1.87	1.02	10.9	31.9	38.2	53.2	7.98	6.89	2.17
Ac-ft	262	329	239	115	57	668	1,900	2,350	3,160	491	424	129

Calendar year 1962: Max 301 Min 1.1 Mean 25.7 Ac-ft 18,650
Water year 1962-63: Max 214 Min 0.7 Mean 14.0 Ac-ft 10,120

Peak discharge (base, 65 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-8	0600	3.21	73	6-11	1200	5.15	196
5-28	0715	5.48	225	6-15	1300	3.98	111

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 5 to Apr. 4.

5-780. Clearwater River at Plummer, Minn.

Location.--Lat 47°55', long 96°03', in SE¼SW¼ sec.4, T.151 N., R.42 W., on right bank 200 ft downstream from Soo Line Railroad bridge, 300 ft downstream from bridge on U. S. Highway 59, 0.9 mile northwest of railroad depot in Plummer, and 8 miles upstream from Hill River.

Drainage area.--512 sq mi.

Records available.--April 1939 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,099.12 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Nov. 10, 1939, staff gage at site 100 ft upstream at same datum.

Average discharge.--24 years, 168 cfs (121,600 acre-ft per year).

Extremes.--Maximum discharge during year, 966 cfs Apr. 4 (gage height, 7.54 ft, backwater from ice); minimum daily, 22 cfs Jan. 19 to Feb. 1.
1939-63: Maximum discharge, 3,640 cfs June 9, 1962 (gage height, 11.90 ft); minimum, 7.9 ft July 8, 1940

Remarks.--Records good except those for periods of ice effect, which are poor. Slight regulation by Clearwater Lake.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.3	20	4.0	257
2.6	42	5.0	472
3.0	86	7.0	1,030
3.5	160		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	74	68	98	46	22	26	480	225	649	127	89	59
2	72	68	110	44	24	26	*420	213	657	117	101	54
3	72	72	105	44	24	26	520	203	646	106	107	51
4	70	76	95	42	24	26	750	188	619	96	89	48
5	70	71	80	42	24	26	340	176	604	89	75	48
6	69	68	75	42	26	26	479	171	578	84	69	47
7	69	66	80	42	26	28	520	165	540	77	62	45
8	70	66	75	44	26	28	704	*160	486	72	60	43
9	71	85	80	46	26	28	654	158	444	69	53	41
10	72	100	*78	42	26	28	*508	157	438	67	45	40
11	71	94	76	38	26	30	433	160	466	84	53	40
12	69	92	74	36	25	32	394	152	525	303	53	38
13	69	*91	74	34	26	32	359	150	565	279	49	38
14	71	91	72	32	26	34	330	165	548	191	49	40
15	*71	91	70	30	26	34	303	167	479	*142	44	40
16	69	91	70	28	26	34	291	169	414	122	45	39
17	72	84	72	26	26	32	321	169	353	127	46	38
18	68	88	72	24	*26	34	*311	173	*309	117	54	*39
19	63	90	70	22	26	*40	289	178	277	100	53	43
20	64	100	68	22	26	40	275	182	249	87	52	51
21	65	90	64	*22	26	38	259	184	217	87	49	52
22	69	70	62	22	26	45	241	195	173	86	*46	50
23	70	75	58	22	26	90	223	193	152	58	46	49
24	74	85	56	22	26	250	211	184	138	54	52	48
25	71	90	54	22	26	*290	203	174	138	53	52	48
26	71	95	52	22	26	310	207	167	167	55	51	47
27	70	100	52	22	26	420	207	164	184	56	50	47
28	70	110	52	22	26	470	209	277	165	67	53	47
29	69	101	50	22	-	540	221	472	146	76	58	46
30	69	97	48	22	-----	550	233	596	137	87	65	47
31	68	-----	46	22	-----	520	-----	646	-----	80	63	-----
Total	2,162	2,565	2,188	968	715	4,133	10,895	6,733	11,463	3,215	1,833	1,363
Mean	69.7	85.5	70.6	31.2	25.5	133	363	217	382	104	59.1	45.4
Ac-ft	4,290	5,090	4,340	1,920	1,420	8,200	21,610	13,350	22,740	6,380	3,640	2,700

Calendar year 1962: Max 3,490 Min 26 Mean 338 Ac-ft 244,700
Water year 1962-63: Max 750 Min 22 Mean 132 Ac-ft 95,700

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-29	1430	6.73	580	6-2	1430	5.74	660
4-4	0500	7.54	966	6-13	1630	5.41	573

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Nov. 6-28, Dec. 1 to Apr. 5.

RED RIVER OF THE NORTH BASIN

5-782.3. Lost River at Oklee, Minn.

Location.--Lat 47°50'35", long 95°51'30", on west edge of sec.1, T.150 N., R.41 W., on upstream side of bridge on State Highway 222 at northwest edge of Oklee, 12 miles upstream from mouth.

Drainage area.--266 sq mi.

Records available.--July 1960 to September 1963.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,134.94 ft above mean sea level, adjustment of 1912. (levels by Corps of Engineers). Prior to Sept. 9, 1960, reference points at same site and datum.

Extremes.--Maximum discharge during year, 355 cfs June 4 (gage height, 5.13 ft); no flow Feb. 16 to Mar. 21, 1960-63: Maximum discharge, 1,490 cfs May 24, 1962 (gage height, 8.72 ft); no flow Feb. 16 to Mar. 21, 1963.

Maximum stage known since at least 1897, 10.39 ft Apr. 21, 1950, from floodmarks (discharge, 2,790 cfs).

Remarks.--Records good except those for period of ice effect, which are poor.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	23	20	28	5.5	0.4	0	124	114	229	43	16	12
2	23	19	31	5.5	.4	0	*89	99	252	38	16	11
3	21	19	29	5.0	.4	0	77	93	271	32	12	11
4	22	19	25	5.0	.2	0	79	81	335	29	11	9.3
5	22	17	22	4.5	.2	0	123	74	318	23	6.6	9.3
6	22	16	20	4.5	.2	0	161	69	200	19	3.1	7.9
7	22	15	18	4.0	.2	0	202	68	134	17	2.2	4.1
8	18	18	16	4.0	.2	0	277	*65	119	18	1.5	3.1
9	20	20	14	3.5	.1	0	305	63	113	16	1.5	2.6
10	20	23	*13	3.5	.1	0	*296	64	133	14	1.5	2.6
11	18	24	12	3.0	.1	0	272	65	155	19	1.5	2.2
12	16	33	11	2.5	.1	0	216	65	171	225	.9	.9
13	15	32	10	2.5	.1	0	160	68	182	237	.9	1.1
14	15	*30	9.5	2.0	.1	0	132	77	192	163	.9	1.5
15	*21	30	9.5	2.0	.1	0	120	77	198	99	.4	1.5
16	16	29	9.5	2.0	0	0	134	77	199	*62	.4	1.5
17	16	28	9.0	1.6	0	0	173	77	170	50	1.8	1.5
18	16	26	9.0	1.4	*0	0	177	75	*100	40	.9	*1.5
19	16	27	9.0	1.2	0	*0	155	74	70	28	.9	1.8
20	16	26	8.5	1.2	0	0	138	75	60	24	1.1	1.8
21	16	28	8.5	*1.1	0	0	124	81	50	21	1.1	1.8
22	15	28	8.5	1.0	0	2.0	101	86	44	18	1.1	7.9
23	17	22	8.0	1.0	0	30	93	79	39	11	1.1	10
24	20	21	8.0	1.0	0	80	89	73	33	9.3	1.5	12
25	20	20	7.5	.8	0	90	90	66	47	6.0	1.8	8.6
26	20	22	7.5	.8	0	*110	90	66	94	2.2	*2.2	14
27	19	27	7.0	.8	0	115	88	68	116	2.2	1.8	16
28	19	27	7.0	.8	0	130	94	112	97	3.6	1.8	16
29	20	27	6.5	.6	-	140	122	158	66	4.7	16	18
30	20	27	6.5	.6	-----	150	131	186	48	6.6	14	20
31	20	-----	6.0	.6	-----	145	-----	208	-----	16	14	-----
Total	584	720	394.0	73.5	2.9	992.0	4,432	2,703	4,235	1,296.6	137.5	212.5
Mean	18.8	24.0	12.7	2.37	0.10	32.0	148	87.2	141	41.8	4.44	7.08
Ac-ft	1,160	1,430	781	146	5.8	1,970	8,790	5,360	8,400	2,570	273	421

Calendar year 1962 Max 1,460 Min 1.8 Mean 179 Ac-ft 129,600

Water year 1962-63: Max 335 Min 0 Mean 43.2 Ac-ft 31,310

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Dec. 4 to Mar. 30 (no gage-height record Jan. 14 to Feb. 3).

5-785. Clearwater River at Red Lake Falls, Minn.

Location.--Lat 47°53'15", long 96°16'25", in NW¼NE¼ sec.22, T.151 N., R.44 W., on left bank 40 ft downstream from Great Northern Railroad Bridge in Red Lake Falls, 1.4 miles upstream from mouth, and 3 miles downstream from Badger Creek.

Drainage area.--1,370 sq mi, approximately.

Records available.--June 1909 to September 1917, October 1934 to September 1963. Monthly discharge only for October, November 1934, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 949.49 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 12, 1911, staff gage at site half a mile upstream and Sept. 12, 1911, to Sept. 30, 1917, staff gage at site 40 ft upstream at different datum.

Average discharge.--37 years, 284 cfs (205,600 acre-ft per year).

Extremes.--Maximum discharge during year, 2,300 cfs July 13 (gage height, 6.15 ft, from floodmark); maximum gage height, 6.35 ft Mar. 30, from floodmarks (backwater from ice); minimum daily discharge, 29 cfs Feb. 21, 22.

1909-17, 1934-63: Maximum discharge, 9,310 cfs May 6, 1950 (gage height, 11.28 ft); maximum gage height observed, 17.5 ft Apr. 5, 1913, site and datum then in use (backwater from ice); no flow Sept. 15, 1936, Sept. 14, 1939, Aug. 19-22, 1940.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are poor. Slight regulation by Clearwater Lake and several smaller lakes.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 18 to Nov. 1, May 31 to June 7, June 13-15)

1.6	19	3.0	351
1.7	30	4.0	826
2.0	78	5.0	1,500
2.5	188		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	141	119	176	78	30	30	600	468	896	300	134	80
2	139	121	178	78	30	30	600	451	926	280	141	80
3	139	121	196	78	30	32	556	413	950	260	141	76
4	139	126	186	76	30	32	363	396	938	240	148	74
5	134	117	146	76	30	*32	542	363	908	210	128	71
6	132	128	145	76	32	35	962	343	861	190	113	67
7	132	143	145	78	30	35	1,160	332	820	170	100	65
8	139	130	140	*78	30	35	1,340	324	769	160	90	57
9	137	141	135	78	30	35	1,320	324	735	140	84	54
10	134	146	130	76	30	36	*1,120	335	713	125	78	49
11	134	196	130	70	30	40	974	308	758	400	69	47
12	134	164	125	65	30	40	861	320	803	900	62	44
13	132	164	120	60	30	40	747	308	861	1,500	64	43
14	132	181	115	50	30	45	645	312	878	1,300	58	41
15	132	171	110	48	30	50	579	332	832	900	57	41
16	132	171	105	45	30	55	547	351	763	550	58	40
17	128	152	102	42	30	60	542	355	*702	580	57	*38
18	130	137	100	40	30	70	611	367	631	500	57	40
19	123	169	100	38	30	80	*583	363	538	350	64	40
20	119	176	98	38	30	100	547	359	476	250	64	40
21	119	146	96	36	29	150	511	359	417	230	60	44
22	121	126	96	36	29	200	480	*367	355	210	*58	49
23	121	130	90	34	30	250	438	380	294	*164	57	49
24	121	159	96	34	30	300	413	363	260	132	52	49
25	*123	191	95	32	30	350	392	343	290	123	52	47
26	121	176	85	32	30	430	392	324	343	123	57	47
27	121	*176	90	30	30	450	392	316	451	119	60	47
28	121	194	90	*30	30	500	400	328	451	115	62	47
29	121	199	85	30		*530	417	565	376	119	62	47
30	119	181	85	30	-----	850	447	758	350	137	67	47
31	119	-----	80	30	-----	700	-----	855	-----	141	76	-----
Total	3,989	4,651	3,670	1,622	840	5,622	19,481	12,082	19,345	10,918	2,430	1,560
Mean	129	155	113	52.3	30.0	181	649	390	645	352	78.4	52.0
Ac-ft	7,910	9,230	7,280	3,220	1,670	11,150	38,640	23,960	38,370	21,660	4,820	3,090

Calendar year 1962: Max 8,300 Min 40 Mean 779 Ac-ft 563,900
Water year 1962-63: Max 1,500 Min 29 Mean 236 Ac-ft 171,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 6 to Apr. 2 (no gage-height record Jan. 21-27, Jan. 29 to Mar. 4, Mar. 6-24). No gage-height record June 30 to July 22.

5-790. Red Lake River at Crookston, Minn.

Location.--Lat 47°46'32", long 96°36'33", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.150 N., R.46 W., on right bank at downstream side of highway bridge in Crookston, 0.3 mile downstream from Interstate Power Co.'s dam and 0.6 mile downstream from bridge on State Highway 81.

Drainage area.--5,280 sq mi, approximately.

Records available.--May 1901 to September 1963. Monthly discharge only for some periods, published in WSP 1308. Figures of daily discharge for Apr. 3-30, 1904, published in WSP 130, have been found unreliable and should not be used.

Gage.--Water-stage recorder. Datum of gage is 832.72 ft above mean sea level, datum of 1929. May 18, 1901, to June 30, 1909, chain gage at bridge 300 ft upstream at same datum. July 1, 1909, to Sept. 25, 1911, chain gage, Sept. 26, 1911, to Sept. 30, 1919, water-stage recorder, and Oct. 1, 1919, to Sept. 30, 1930, chain gage, at present site and datum.

Average discharge.--62 years, 987 cfs (714,600 acre-ft per year).

Extremes.--Maximum discharge during year, 6,820 cfs Apr. 9 (gage height, 13.25 ft); minimum, 334 cfs July 30 (gage height, 3.51 ft).

1901-63: Maximum discharge, 27,400 cfs May 7, 1950 (gage height, 25.70 ft); no flow for part of July 13, 1960 (caused by regulation of powerplant upstream).

Remarks.--Records good except those for period of ice effect, which are fair. Diurnal fluctuation caused by powerplant upstream.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

4.0	530	10.0	4,260
5.0	970	13.0	6,600
7.0	2,160	13.3	6,870

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,450	1,470	1,550	980	*890	870	*1,930	2,360	2,550	1,470	704	767
2	1,350	1,470	1,510	1,000	890	870	1,760	2,260	2,610	1,360	677	776
3	1,430	1,500	1,510	1,010	890	870	2,180	2,230	2,660	1,280	672	772
4	1,420	1,510	1,500	1,020	890	870	2,830	2,130	2,710	1,220	686	758
5	1,470	1,480	1,320	1,020	890	*870	2,910	2,120	2,680	1,170	654	772
6	1,450	1,450	898	1,040	890	880	4,120	2,060	2,640	1,100	622	767
7	1,480	1,300	610	1,060	890	900	5,840	2,040	2,550	1,080	610	762
8	1,540	1,000	610	*1,080	890	920	5,980	2,010	2,500	1,040	598	812
9	1,550	682	700	1,070	890	920	*6,640	1,990	2,450	1,000	598	704
10	1,560	1,040	680	1,080	880	910	5,380	1,990	2,400	950	594	744
11	1,580	1,230	710	1,080	880	910	4,060	2,010	2,380	1,340	590	754
12	1,580	1,330	740	1,050	880	920	3,360	1,990	2,450	2,500	582	758
13	1,570	1,380	760	1,040	880	920	2,990	2,020	2,520	3,570	586	754
14	1,590	1,450	780	1,020	880	920	2,740	2,010	2,560	2,640	590	762
15	1,600	1,480	780	1,010	880	920	2,770	2,010	2,540	1,950	594	731
16	1,600	1,500	800	1,000	890	920	2,780	2,030	2,420	1,540	618	700
17	1,580	1,520	800	990	880	920	2,870	2,060	2,300	1,350	626	*690
18	1,550	1,500	780	980	880	910	3,100	2,040	*2,200	1,200	630	713
19	1,530	1,500	770	970	880	920	3,220	2,030	2,150	1,140	654	762
20	1,510	1,560	750	960	880	920	3,080	2,040	2,040	1,020	672	776
21	1,500	1,530	780	950	880	930	2,920	2,080	1,970	945	664	790
22	1,530	1,120	900	940	880	950	2,730	*2,090	1,910	870	*668	839
23	1,520	906	1,000	930	880	1,050	2,650	2,080	1,700	*852	672	866
24	1,530	848	990	920	880	1,600	2,510	2,070	1,610	808	659	898
25	*1,530	857	980	910	880	2,300	2,460	2,020	1,580	776	664	935
26	1,510	1,190	970	900	870	*2,700	2,450	1,990	1,630	776	682	945
27	1,510	*1,710	990	900	870	2,600	2,410	1,960	1,680	785	713	965
28	1,510	2,090	990	900	870	2,400	2,400	1,920	1,880	740	713	740
29	1,510	1,880	990	890	-----	2,300	2,370	1,980	1,760	762	722	985
30	1,510	1,620	990	890	-----	2,200	2,330	2,230	1,590	614	744	980
31	1,470	-----	980	890	-----	2,050	-----	2,430	-----	749	758	-----
Total	47,020	41,103	29,118	30,480	24,700	39,140	95,770	64,280	66,620	38,597	20,216	23,977
Mean	1,517	1,370	939	983	882	1,263	3,192	2,074	2,221	1,245	652	799
Ac-ft	93,260	81,530	57,750	60,460	48,990	77,630	190,000	127,500	132,100	76,560	40,100	47,560

Calendar year 1962: Max 16,300 Min 72 Mean 2,197 Ac-ft 1,590,000
 Water year 1962-63: Max 6,640 Min 582 Mean 1,427 Ac-ft 1,033,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 7 to Mar. 31.

5-825. Red River of the North at Grand Forks, N. Dak.

Location.--Lat 47°56'26", long 97°02'47", in SE¼NE¼ sec.33, T.152 N., R.50 W., on left bank 500 ft downstream from dam at Riverside Park in Grand Forks, 2 miles downstream from Red Lake River, and at mile 296.0.

Drainage area.--30,100 sq mi, approximately (includes 3,800 sq mi in closed basins).

Records available.--April 1882 to September 1963. Monthly discharge only prior to May 1901, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 778.35 ft above mean sea level, datum of 1929. 1882-92, gages near site of Northern Pacific Railway bridge, 1½ miles upstream (history not available, datum apparently the same as following gage). 1892 to Oct. 15, 1926, staff and chain gages on Northern Pacific Railway bridge, at datum about 5½ ft higher, but published referred to datum only half a foot higher than present datum. Oct. 16, 1926, to Nov. 2, 1933, staff gages near present site, at datum 5 ft higher than present datum but published at present datum.

Average discharge.--81 years, 2,309 cfs (1,672,000 acre-ft per year).

Extremes.--Maximum discharge during year, 10,800 cfs Apr. 11 (gage height, 21.23 ft); minimum, 963 cfs Aug. 12 (gage height, 4.57 ft).

1882-1963: Maximum discharge, about 80,000 cfs Apr. 10, 1897 (gage height, 50.2 ft, site and datum then in use), from rating curve extended above 54,000 cfs; minimum, 2.4 cfs Feb. 3-5, 12, 14, 16-19, 1937 (caused by unusual regulation during repair of dam at Grand Forks).

Remarks.--Records good. Flow regulated by many lakes and reservoirs on tributaries.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,660	2,020	2,530	1,460	*1,040	1,200	*6,100	3,530	5,260	3,700	1,140	1,220
2	2,580	2,050	2,420	1,420	1,040	1,200	6,230	3,510	5,580	3,510	1,190	1,250
3	2,510	2,060	2,340	1,440	1,040	1,220	5,880	3,470	5,830	3,310	1,200	1,300
4	2,480	2,090	2,320	1,460	1,020	1,240	5,630	3,440	6,330	3,150	1,240	1,340
5	2,460	2,080	2,280	1,460	1,000	1,220	5,880	3,380	*6,930	3,020	1,290	1,330
6	2,440	2,080	1,790	1,480	1,000	1,200	5,650	3,350	7,430	2,870	1,280	1,300
7	2,410	2,120	1,240	1,520	1,040	1,200	6,420	3,320	7,740	2,740	1,210	1,300
8	2,420	2,030	1,220	1,540	1,060	1,240	8,620	3,280	7,800	2,620	1,130	1,270
9	2,420	1,860	1,220	1,560	1,080	1,240	*10,100	3,230	7,760	2,470	1,070	1,280
10	2,430	1,650	1,160	1,540	1,100	1,240	10,700	3,200	7,400	2,320	1,010	1,250
11	2,440	1,680	1,120	1,480	1,100	1,240	10,500	3,170	*7,210	2,300	975	1,230
12	2,440	1,960	1,000	1,460	1,100	1,240	*8,880	3,140	7,100	2,700	967	1,220
13	2,440	2,130	1,000	1,420	1,100	1,240	7,260	3,160	7,070	3,080	995	1,180
14	2,440	2,210	1,200	1,320	1,100	1,240	6,180	3,170	*7,240	4,200	1,020	1,140
15	2,420	2,300	1,440	1,260	1,080	1,240	5,440	3,140	7,640	4,140	1,130	1,100
16	2,420	2,370	1,560	1,260	1,080	1,340	5,050	3,150	7,900	3,560	1,220	1,090
17	2,410	2,380	1,620	1,240	1,080	1,380	4,870	3,170	8,010	3,060	1,220	1,020
18	2,390	2,380	1,660	1,200	1,120	1,320	4,750	3,230	7,960	2,670	1,180	1,010
19	2,360	2,340	1,640	1,220	1,140	1,320	*4,770	3,250	7,480	2,370	1,120	999
20	2,380	2,340	1,620	1,220	1,180	1,320	4,650	3,350	6,720	2,170	1,100	1,000
21	2,310	2,390	1,580	1,220	1,180	1,300	4,520	3,420	5,960	2,020	1,080	1,030
22	2,300	2,180	1,580	1,220	1,180	1,300	4,350	3,450	5,370	1,880	1,070	1,080
23	2,250	1,830	1,600	1,220	1,140	1,340	4,170	3,450	4,910	1,760	1,040	1,090
24	2,180	1,670	1,580	1,180	1,100	1,550	4,020	3,410	4,550	1,620	1,010	1,160
25	2,120	1,520	1,540	1,160	1,180	2,050	*3,870	3,360	4,270	1,480	1,020	1,220
26	2,080	1,520	1,500	1,120	1,220	*3,100	3,800	3,280	*4,100	1,380	1,040	1,260
27	2,060	1,900	1,440	1,080	*1,200	4,100	3,730	3,200	4,040	1,280	1,070	1,290
28	2,030	*2,540	1,440	1,060	1,200	4,800	3,690	3,110	3,940	1,260	1,090	1,300
29	2,020	2,890	1,480	1,080	-	5,300	3,680	*3,080	3,940	1,230	1,100	1,300
30	*2,020	2,820	1,480	1,080	-----	5,500	3,620	3,610	3,870	*1,200	*1,150	*1,300
31	2,020	-----	*1,480	1,060	-----	5,400	-----	4,630	-----	1,160	1,180	-----
Total	72,340	63,390	49,080	40,440	30,900	60,820	173,010	103,640	187,340	76,230	34,537	35,859
Mean	2,334	2,113	1,583	1,305	1,104	1,962	5,767	3,343	6,245	2,459	1,114	1,195
Ac-ft	143,500	125,700	97,350	80,210	61,290	120,600	343,200	205,600	371,600	151,200	68,500	71,130
Calendar year 1962:	Max 26,500	Min 175	Mean 5,811	Ac-ft 4,207,000								
Water year 1962-63:	Max 10,700	Min 967	Mean 2,541	Ac-ft 1,840,000								

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 8 to Apr. 2.

RED RIVER OF THE NORTH BASIN

5-875. Middle River at Argyle, Minn.

Location.--Lat 48°20'27", long 96°49'02", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.10, T.156 N., R.48 W., on left bank 20 ft upstream from bridge on U. S. Highway 75 in Argyle and 14 miles upstream from mouth.

Drainage area.--265 sq mi.

Records available.--March to September 1945, November 1950 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 828.53 ft above mean sea level, datum of 1929. Prior to Nov. 8, 1951, chain or wire-weight gage at bridge 20 ft upstream at datum 1.0 ft higher. Nov. 8, 1951, to Sept. 18, 1952, water-stage recorder at present site at datum 1.0 ft higher.

Average discharge.--13 years (1950-63), 30.8 cfs (22,300 acre-ft per year).

Extremes.--Maximum discharge during year, 825 cfs Apr. 11 (gage height, 11.28 ft); no flow Jan. 15 to Mar. 21, Sept. 15-30.
1945, 1950-63: Maximum discharge, 1,620 cfs June 12, 1962 (gage height, 14.12 ft); no flow at times most years.

Maximum stage known, 15.25 ft in April 1950, present datum, from floodmarks (discharge, 2,790 cfs).

Remarks.--Records good except those for period of doubtful gage-height record, which are fair, and those for period of ice effect, which are poor.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 4 to Nov. 17, Apr. 22 to May 30, June 6, 7, 21-24)

0.8	0	1.5	6.0	4.0	106
.9	.1	1.7	9.5	6.0	238
1.0	.4	2.0	18	9.0	504
1.1	1.1	3.0	59	11.0	775
1.2	2.1				

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.7	2.4	5.2	1.8		0	110	48	27	20	15	0.6
2	2.0	2.6	5.2	1.6		0	80	56	27	16	16	.4
3	2.4	2.6	5.2	1.4		0	40	52	25	13	16	.4
4	3.0	2.8	5.0	1.2		0	30	46	27	11	14	.4
5	2.9	2.7	4.8	1.2		0	*55	45	28	9.3	12	.4
6	3.6	3.4	4.6	1.2		0	60	42	29	8.3	9.1	.3
7	2.7	4.6	4.4	1.0		0	150	40	29	7.2	7.2	.4
8	2.9	4.5	4.4	1.0		0	*410	38	24	6.4	5.8	.4
9	3.6	4.3	4.2	.8		0	550	37	40	5.7	5.0	.1
10	2.6	4.3	4.0	.6		0	727	39	26	5.1	4.1	.1
11	3.2	4.3	3.9	.4		0	764	38	24	5.5	3.4	.2
12	4.0	4.3	3.8	.2		0	525	37	34	5.4	3.0	.4
13	4.0	4.2	3.7	.1		0	348	39	36	5.8	3.0	.1
14	4.1	4.2	3.6	.1		0	256	40	32	6.3	2.8	.1
15	2.3	4.2	3.5	0		0	193	39	28	5.5	2.4	0
16	2.2	4.2	3.4	0		0	155	39	24	6.3	2.2	0
17	2.0	4.2	*3.3	0		0	131	39	21	5.7	2.0	0
18	1.9	4.2	3.2	0		0	*128	36	21	4.9	1.8	0
19	1.9	4.2	3.1	0		0	140	38	20	4.7	3.0	0
20	1.9	4.2	3.0	0		0	128	38	19	4.7	2.9	0
21	2.0	5.2	2.9	0		0	112	42	45	4.3	2.6	0
22	2.3	5.2	2.8	0		1	92	41	61	4.0	2.2	0
23	2.4	5.0	2.7	0		2	*72	47	54	3.8	1.8	0
24	2.4	4.8	2.6	0		6	65	52	43	3.7	1.5	0
25	2.3	4.8	2.5	0	(*)	*10	60	53	*36	3.3	1.2	*0
26	2.3	*4.6	2.4	0		40	61	49	32	5.0	.9	0
27	2.3	4.8	2.3	0		70	59	44	27	4.3	.8	0
28	2.4	5.0	2.2	0		110	56	*42	27	4.6	*.8	0
29	2.4	5.0	2.1	*0	-	*140	54	36	27	4.6	.8	0
30	*2.4	5.0	2.0	0	-----	110	47	32	24	*6.9	.8	0
31	2.4	-----	1.9	0	-----	90	-----	29	-----	12	.6	-----
Total	81.5	125.8	107.9	12.6	0	579	5,658	1,293	917	213.3	144.7	4.3
Mean	2.63	4.19	3.48	0.41	0	18.7	189	41.7	30.6	6.88	4.67	0.14
Ac-ft	162	250	214	25	0	1,150	11,220	2,570	1,820	423	287	8.5

Calendar year 1962 Max 1,440 Min 0 Mean 91.0 Ac-ft 65,890
Water year 1962-63: Max 764 Min 0 Mean 25.0 Ac-ft 18,120

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 18 to Apr. 9 (no gage-height record Jan. 25 to Apr. 7. Discharge computed from once-daily wire-weight gage readings Mar. 25 to Apr. 9).

5-920. Red River of the North at Drayton, N. Dak.

Location.--Lat 48°34'20", long 97°08'50", on line between secs. 24 and 25, T.159 N., R.51 W., on downstream end of east pier on interstate highway bridge, 1½ miles northeast of Drayton and at mile 207.

Drainage area.--34,800 sq mi, approximately (includes 3,800 sq mi in closed basins).

Records available.--April 1936 to June 1937, April 1941 to September 1963 (fragmentary prior to April 1949).

Gage.--Water-stage recorder. Datum of gage is 755.00 ft above mean sea level, datum of 1929 (Minnesota highway bench mark). Prior to Nov. 30, 1954, wire-weight gage at site 1½ miles upstream at datum 1.59 ft higher.

Average discharge.--14 years (1949-63), 3,222 cfs (2,333,000 acre-ft per year); median of yearly mean discharges, 2,450 cfs (1,770,000 acre-ft per year).

Extremes.--Maximum discharge during year, 12,900 cfs Apr. 12 (gage height, 20.42 ft); minimum discharge, 977 cfs Aug. 14 (gage height, 4.71 ft).

1936-37, 1941-63: Maximum discharge, 86,500 cfs May 12, 1950 (gage height, 41.58 ft, former site and datum); minimum observed, 7.7 cfs Oct. 16, 1936 (gage height 1.75 ft, former site and datum).

Maximum discharge known since 1860, that of May 12, 1950. Flood of April 1897 reached a stage of about 41 ft, at site and datum in use prior to Nov. 30, 1954.

Remarks.--Records good except those for period of ice effect, which are fair. Some regulation by reservoirs on tributaries.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,720	2,100	2,750	1,480	1,040	1,260	5,250	3,950	4,100	4,050	1,330	1,130
2	2,690	2,110	2,600	1,500	1,060	1,260	*5,600	3,900	4,850	3,920	1,310	1,180
3	2,590	2,110	2,450	1,480	1,060	1,280	5,900	3,850	5,350	*3,700	1,320	1,230
4	2,520	2,140	2,350	1,480	1,020	1,300	5,700	3,800	5,830	3,580	1,350	1,270
5	2,440	2,140	2,300	1,480	1,020	1,300	*5,350	3,700	*6,300	3,400	1,380	1,300
6	2,410	2,180	2,200	1,500	1,020	1,300	5,650	3,650	6,800	3,280	1,420	1,330
7	2,390	2,220	2,000	1,520	1,040	1,300	5,850	3,600	7,300	3,150	1,440	1,330
8	2,380	2,190	1,700	1,540	1,040	1,310	5,700	3,550	7,800	3,000	*1,420	1,310
9	2,360	2,180	1,320	1,560	1,060	1,310	6,650	3,500	8,200	2,890	1,340	1,300
10	2,360	2,120	1,040	1,560	1,080	1,310	8,700	3,450	8,150	2,750	1,250	1,270
11	2,380	1,960	1,160	1,560	1,100	1,320	11,200	3,400	*8,060	2,640	1,140	*1,270
12	2,400	1,780	1,120	1,520	1,100	1,320	*12,800	3,380	7,940	2,550	1,060	1,250
13	2,410	1,760	1,170	1,480	1,100	1,320	11,800	3,350	7,750	2,620	1,010	1,220
14	2,440	1,910	1,100	1,440	1,100	1,320	10,200	3,330	*7,620	3,080	990	1,190
15	2,460	2,080	1,020	1,380	*1,100	1,320	8,750	3,300	7,550	3,970	1,000	1,180
16	2,460	2,190	1,040	*1,300	1,120	1,340	*7,650	3,300	7,700	4,500	1,060	1,140
17	2,440	2,270	*1,180	1,260	1,140	1,340	6,800	3,300	7,950	4,300	1,180	1,110
18	2,430	2,320	1,320	1,260	1,160	*1,360	6,150	3,320	8,100	3,830	1,180	1,090
19	2,440	2,360	1,440	1,240	1,180	1,380	5,700	3,350	7,900	3,340	1,190	1,060
20	2,430	*2,330	1,540	1,240	1,180	1,400	5,450	3,370	7,780	2,950	1,190	1,020
21	2,400	2,380	1,600	1,220	1,180	1,420	5,300	3,450	*7,250	2,650	1,140	1,010
22	2,390	2,350	1,620	1,220	1,180	1,440	*5,200	3,520	6,550	2,430	1,110	1,010
23	*2,360	2,200	1,600	1,220	1,200	1,480	5,000	3,600	5,950	2,240	1,080	1,030
24	2,340	2,000	1,580	1,220	1,200	1,520	4,800	3,620	5,450	2,070	1,050	1,080
25	2,290	1,800	1,520	1,200	1,200	1,580	4,650	3,620	5,080	1,910	1,030	1,120
26	2,220	1,700	1,540	1,200	1,180	1,700	4,450	3,600	4,750	1,840	1,020	1,180
27	2,170	1,700	1,520	1,180	1,240	2,200	4,300	3,550	4,500	1,800	1,030	1,250
28	2,140	1,750	1,500	1,140	1,260	3,000	4,200	3,480	4,400	1,650	1,060	1,320
29	2,100	2,400	1,480	1,100	-----	3,900	4,150	3,350	4,240	1,500	1,080	1,350
30	2,100	2,700	1,440	1,080	-----	4,500	*4,000	3,280	4,120	1,410	1,080	1,380
31	2,100	-----	1,460	1,080	-----	4,950	-----	3,420	-----	1,360	1,100	-----
Total	73,760	63,430	49,660	41,640	31,360	54,040	192,900	108,840	195,320	88,360	36,340	35,910
Mean	2,379	2,114	1,602	1,343	1,120	1,743	6,430	3,511	6,511	2,850	1,172	1,197
Ac-ft	146,300	125,800	98,500	82,590	62,200	107,200	382,600	215,900	387,400	175,300	72,080	71,230

Calendar year 1962: Max 32,200 Min 190 Mean 6,637 Ac-ft 4,806,000
 Water year 1962-63: Max 12,800 Min 990 Mean 2,662 Ac-ft 1,927,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 18 to Mar. 31.

5-940. South Branch Two Rivers at Lake Bronson, Minn.

Location.--Lat 48°43'50", long 96°39'50", in SW¼SW¼ sec.30, T.161 N., R.46 W., on left bank 100 ft upstream from bridge on U. S. Highway 59 at town of Lake Bronson and 2 miles downstream from dam at outlet of Bronson Lake.

Drainage area.--444 sq mi.

Records available.--September 1928 to November 1936, April to September 1937, April 1941 to October 1943, April to December 1944, April 1945 to September 1947, October 1953 to September 1963. Monthly discharge only for some periods, published in WSP 1308. Published as South Fork Two Rivers at Bronson prior to 1941.

Gage.--Water-stage recorder. Datum of gage is 930.46 ft above mean sea level, adjustment of 1928 (levels by Geodetic Survey of Canada). Prior to Nov. 23, 1953, chain gage at bridge 100 ft downstream at same datum.

Average discharge.--22 years (1928-36, 1941-43, 1945-47, 1953-63), 67.2 cfs (48,650 acre-ft per year).

Extremes.--Maximum discharge during year, 1,570 cfs April 8 (gage height, 7.56 ft); minimum daily, 0.8 cfs Jan. 19 to Feb. 5.
1928-37, 1941-47, 1953-63: Maximum discharge, 2,960 cfs June 13, 1962 (gage height, 10.82 ft); no flow at times during 1937, 1941, 1960.

Remarks.--Records good above 400 cfs, fair below except those for periods of ice effect, no gage-height record, or indefinite stage-discharge relation, which are poor. Flow partly regulated since 1937 by Bronson Lake (usable capacity, 3,700 acre-ft).

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.4	21	3.4	2.4	0.8	1.2	60	111	19	25	*4.5	3.2
2	4.6	21	3.4	2.4	.8	1.4	50	28	18	4.1	4.6	3.2
3	5.1	18	3.4	2.4	.8	1.4	40	9.0	*20	3.9	5.2	3.4
4	5.1	18	3.4	2.2	.8	1.4	30	8.5	18	3.9	5.4	3.4
5	4.6	17	3.4	2.2	.8	1.6	*22	9.5	18	3.8	5.4	3.5
6	4.6	17	3.4	2.0	1.0	1.8	50	11	18	3.8	5.3	4.1
7	4.8	17	3.4	2.0	1.0	1.8	400	13	16	3.4	4.2	4.5
8	5.1	16	3.4	2.0	1.0	2.0	*1,090	15	15	3.3	3.8	4.7
9	5.1	16	3.5	2.0	1.0	2.0	1,440	17	17	3.3	3.6	4.6
10	4.8	15	4.0	1.6	1.0	2.2	1,230	82	16	3.2	3.2	4.5
11	5.1	15	5.0	1.4	1.0	2.4	968	122	36	3.5	3.2	4.9
12	5.4	14	6.0	1.4	1.0	3.0	482	7.2	29	3.6	3.2	3.7
13	5.4	13	4.5	1.4	1.0	3.2	497	6.9	*12	3.6	2.9	1.7
14	6.4	13	4.5	1.2	1.0	4.0	449	7.5	12	3.6	2.9	1.7
15	5.8	11	4.2	1.0	1.0	5.0	378	5.2	9.4	3.8	2.9	2.0
16	5.4	3.9	4.0	1.0	1.0	10	331	5.0	9.9	4.5	2.9	2.0
17	5.1	3.9	3.6	1.0	1.1	10	153	4.8	11	4.0	2.9	4.0
18	5.4	3.7	3.4	1.0	1.1	8	20	4.8	12	3.8	2.9	6.0
19	4.8	3.7	3.1	.8	1.1	10	99	4.8	13	4.4	2.7	4.0
20	4.8	3.7	*3.1	.8	1.1	15	126	5.2	15	3.9	2.8	3.5
21	5.1	3.7	2.8	.8	1.1	20	120	12	19	4.0	3.3	3.0
22	5.8	3.5	2.8	.8	1.1	30	106	22	19	3.7	2.7	3.0
23	5.4	3.5	2.8	.8	1.1	40	*92	33	19	3.7	2.7	2.8
24	5.4	3.5	2.8	.8	1.1	50	80	38	20	3.7	2.7	2.6
25	5.4	3.5	2.8	.8	*1.1	70	71	32	*26	3.8	2.7	*2.4
26	6.1	*3.4	2.8	.8	1.1	100	61	26	32	4.7	*2.7	2.0
27	5.1	3.4	2.6	.8	1.2	120	50	25	63	3.9	2.9	1.4
28	4.8	3.4	2.6	.8	1.2	110	45	*22	29	3.9	2.9	1.6
29	4.6	3.4	2.4	*.8	-	*103	40	19	33	3.8	3.0	1.8
30	*49	3.4	2.4	.8	-----	90	35	17	30	3.9	3.1	1.9
31	*23	-----	2.4	.8	-----	75	-----	17	-----	4.0	3.2	-----
Total	221.5	295.6	105.3	41.0	28.4	895.4	8,615	740.4	624.3	139.5	106.4	95.1
Mean	7.15	9.85	3.40	1.32	1.01	28.9	287	23.9	20.8	4.50	3.43	3.17
Ac-ft	439	586	209	81	56	1,780	17,090	1,470	1,240	277	211	189

Calendar year 1962: Max 2,910 Min 1.3 Mean 192 Ac-ft 139,300
Water year 1962-63: Max 1,440 Min 0.8 Mean 32.6 Ac-ft 23,630

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 9 to Mar. 28 (no gage-height record Jan. 17-28, Feb. 22-24, Feb. 26 to Mar. 27). No gage-height record Mar. 30 to Apr. 4, Apr. 6, 7, Sept. 19-24, 26, 28, 29. Stage-discharge relation indefinite May 13, 24, 25, Sept. 17, 18.

RED RIVER OF THE NORTH BASIN

5-1025. Red River of the North at Emerson, Manitoba

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(International gaging station)

Location.--Lat 49°00'30", long 97°13'00", in sec.2, T.1, R.2 E., on right bank 1,500 ft downstream from Canadian National Railway bridge in Emerson, three-quarters of a mile downstream from International Boundary, 3.6 miles downstream from Pembina River, and at mile 154.3.

Drainage area.--40,200 sq mi, approximately (includes 3,800 sq mi in closed basins).

Records available.--March to November 1902 (gage heights only), May 1912 to September 1929 (monthly discharge only, published in WSP 1308), October 1929 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 700.00 ft above mean sea level, datum of 1929, by Geodetic Survey of Canada. Prior to 1912, staff gage at different datum. May 3, 1912, to Apr. 10, 1953, chain gage and/or staff gage on Canadian National Railway bridge, 1,500 ft upstream. May 3, 1912, to Sept. 30, 1923, at datum 2.55 ft lower than present datum; Oct. 1, 1923, to Sept. 30, 1925, at datum 1.14 ft lower than present datum; Oct. 1, 1925, to Sept. 30, 1947, at datum 0.57 ft higher than present datum; and Oct. 1, 1947, to Sept. 30, 1948, at datum 0.21 ft higher than present datum.

Average discharge.--51 years (1912-63); 2,757 cfs (1,996,000 acre-ft per year); median of yearly mean discharges, 2,320 cfs (1,680,000 acre-ft per year).

Extremes.--Maximum discharge during year, 13,800 cfs Apr. 13 (gage height, 64.14 ft); minimum daily, 965 cfs Jan. 30, 31.

1912-63: Maximum discharge, 95,500 cfs May 13, 1950 (gage height, 90.89 ft); minimum observed, 0.9 cfs Feb. 6-8, 1937 (gage height, 44.00 ft).

Remarks.--Records good except those for periods of ice effect, which are fair.

Cooperation.--This station is one of the international gaging stations maintained by Canada under agreement with the United States.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,740	2,200	2,880	1,390	1,040	1,100	4,980	4,620	3,770	4,610	2,020	1,140
2	2,720	2,200	3,000	*1,380	1,090	1,120	5,280	4,500	4,380	4,450	1,800	1,160
3	2,680	2,220	2,850	1,380	1,090	1,140	5,630	4,400	5,320	4,260	1,600	*1,200
4	2,640	2,220	2,650	1,380	1,080	1,140	*5,720	4,330	6,480	4,050	1,530	1,230
5	2,580	2,220	2,280	1,370	1,060	1,140	5,830	4,220	7,610	*3,780	1,500	1,260
6	2,510	2,230	1,900	1,360	1,060	1,150	6,130	4,110	*8,090	3,580	1,480	1,300
7	2,460	2,260	1,840	1,370	1,040	1,150	7,610	4,000	8,500	3,370	1,500	1,330
8	2,450	2,300	1,890	1,390	1,030	1,160	*8,400	3,900	8,630	3,200	1,510	1,360
9	2,440	2,280	1,860	*1,400	1,020	1,150	11,600	3,810	8,710	3,040	1,500	1,340
10	2,420	2,260	1,640	1,400	1,030	1,150	*11,700	*3,710	9,250	2,910	1,460	1,330
11	2,410	2,240	1,430	1,400	1,030	1,150	*12,600	3,610	9,970	2,850	1,380	1,300
12	2,420	2,110	1,250	1,400	1,040	1,160	13,400	3,530	10,100	2,650	1,290	1,300
13	2,460	*1,970	1,180	1,400	1,050	*1,170	13,700	3,530	9,750	2,530	1,220	*1,300
14	2,480	1,710	1,170	1,400	1,060	1,180	13,300	3,500	9,300	2,520	*1,160	1,280
15	*2,490	1,800	1,190	1,390	*1,070	1,190	12,200	3,440	8,910	2,830	1,110	1,230
16	2,490	1,920	1,140	1,360	1,080	1,210	10,800	*3,410	8,610	3,460	1,090	1,210
17	2,500	2,110	1,130	1,310	1,090	1,230	9,370	3,420	8,510	3,910	1,120	1,200
18	2,470	2,180	1,100	1,260	1,090	1,250	8,190	3,420	8,510	3,830	1,190	1,190
19	2,460	2,310	1,150	1,210	1,090	1,280	*7,330	3,430	8,510	3,590	1,260	1,160
20	2,460	2,370	*1,200	1,160	1,100	1,310	6,720	3,450	8,420	3,210	1,280	1,120
21	2,450	2,420	1,290	1,120	1,090	1,340	6,370	3,470	*8,100	2,920	1,280	1,090
22	2,440	2,400	1,430	1,090	1,100	1,360	6,180	3,520	7,540	2,650	1,240	1,070
23	2,420	2,390	1,480	1,080	1,110	1,380	6,000	3,580	6,950	2,410	1,210	1,050
24	2,400	2,250	1,510	1,080	1,120	1,400	5,790	3,640	6,280	2,280	1,190	1,050
25	2,380	2,180	1,490	1,080	1,120	*1,470	5,570	3,680	6,100	2,110	1,150	*1,080
26	2,360	2,040	1,470	1,070	1,110	1,640	*5,350	3,700	6,430	2,100	1,120	1,120
27	2,310	1,970	1,480	1,050	1,090	1,780	5,140	3,700	6,180	2,170	1,100	1,160
28	2,270	1,890	1,470	1,030	*1,080	2,110	4,960	3,680	5,680	2,280	1,100	1,220
29	2,240	2,100	1,490	1,000	965	2,890	4,830	3,600	5,240	2,650	1,100	1,280
30	2,210	2,550	1,450	965	-----	3,650	4,740	3,500	4,860	*2,310	1,120	1,320
31	2,200	-----	1,420	965	-----	4,420	-----	3,510	-----	2,020	1,140	-----
Total	75,960	65,300	50,710	38,640	30,060	46,970	235,420	115,920	224,690	94,530	40,750	36,380
Mean	2,450	2,180	1,640	1,250	1,070	1,520	7,850	3,740	7,490	3,050	1,310	1,210
Ac-ft	150,700	129,500	100,600	76,640	59,620	93,160	466,900	229,900	445,700	187,500	80,830	72,160

Calendar year 1962: Max 33,300 Min 158 Mean 7,154 Ac-ft 5,189,000

Water year 1962-63: Max 13,700 Min 965 Mean 2,890 Ac-ft 2,093,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 12 to Apr. 8. Discharge computed from once daily readings of wire-weight gage May 9-16, June 14 to Sept. 30.

RED RIVER OF THE NORTH BASIN

5-1045. Roseau River below South Fork near Malung, Minn.

Location.--Lat 48°47'30", long 95°44'40", in SW¼ sec.6, T.161 N., R.39 W., on left bank a quarter of a mile downstream from South Fork and 1½ miles northwest of Malung.

Drainage area.--573 sq mi.

Records available.--October 1946 to September 1963.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,029.67 ft above mean sea level, adjustment of 1912.

Average discharge.--17 years, 127 cfs (91,940 acre-ft per year).

Extremes.--Maximum discharge during year, 1,470 cfs Apr. 9 (gage height, 11.86 ft); minimum, 1.0 cfs Sept. 23. 1946-63: Maximum discharge, 3,650 cfs Apr. 24, 1950 (gage height, 22.51 ft); no flow for part of Jan. 15, 1952 (caused by construction of concrete control) and July 23 to Sept. 8, 1961.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

4.4	1.1	5.2	20	6.5	263
4.5	1.9	5.5	42	7.0	453
4.6	3.1	5.7	69	8.0	700
4.7	4.7	6.0	124	12.0	1,500
4.9	9.0				

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	44	29	96	9.5	3.0	3.0	160	195	184	176	78	4.0
2	43	29	96	9.5	3.0	3.0	180	187	328	137	87	3.8
3	40	29	100	9.5	2.8	2.8	400	171	453	111	87	4.0
4	38	27	98	9.5	2.7	3.0	600	161	456	94	69	3.7
5	36	26	58	9.0	2.7	3.0	800	142	425	81	51	3.0
6	35	29	48	9.0	2.7	3.0	1,100	131	364	67	40	2.4
7	33	30	45	9.0	2.7	3.0	1,120	124	297	61	32	1.9
8	34	25	42	9.0	2.7	3.1	1,300	120	245	55	28	1.8
9	36	35	39	8.0	2.7	3.1	1,450	120	212	46	24	1.8
10	37	37	37	7.0	2.7	3.1	1,440	114	252	39	20	4.2
11	36	37	35	6.5	2.7	3.1	*1,290	116	324	36	19	4.0
12	35	37	30	6.0	2.8	3.2	1,060	128	340	39	17	4.0
13	34	40	28	6.0	2.8	3.2	808	142	340	45	17	1.5
14	36	46	25	5.5	2.7	3.2	600	164	320	49	15	1.4
15	35	49	22	5.5	2.7	3.4	463	198	286	42	12	1.5
16	34	46	20	5.0	2.8	3.4	395	215	241	39	11	1.4
17	33	34	20	4.6	2.8	3.4	453	224	204	37	14	1.3
18	32	41	20	4.5	2.8	3.4	527	293	179	40	15	1.4
19	32	46	19	4.2	3.0	3.5	527	364	171	41	15	1.3
20	32	62	*17	4.0	3.0	3.5	500	432	238	39	12	1.2
21	32	51	17	4.0	3.0	3.7	422	485	249	43	13	1.2
22	33	32	17	4.0	3.0	5.0	340	500	238	46	8.5	1.1
23	33	42	16	3.6	3.0	20	297	488	207	50	9.0	3.0
24	34	56	16	3.5	3.0	50	*259	450	166	52	9.3	6.0
25	34	52	15	3.4	3.0	100	234	391	161	50	6.6	4.5
26	33	*44	14	3.2	*3.0	250	221	332	*193	46	5.6	*3.7
27	33	44	13	3.2	2.8	*300	212	290	324	44	*5.3	2.8
28	32	50	12	3.0	2.8	300	210	252	320	45	4.9	2.6
29	30	66	11	3.0	-	280	201	*227	278	45	4.5	2.2
30	30	85	10	3.0	-----	180	201	207	224	42	4.7	2.0
31	*30	-----	10	*3.0	-----	160	-----	187	-----	*55	4.3	-----
Total	1,069	1,256	1,046	177.7	79.4	1,712.1	17,770	7,550	8,219	1,792	738.7	78.7
Mean	34.5	41.9	33.7	5.73	2.84	55.2	592	244	274	57.8	23.8	2.62
Ac-ft	2,120	2,490	2,070	352	157	3,400	35,250	14,980	16,300	3,550	1,470	156

Calendar year 1962: Max 2,460 Min 5.1 Mean 256 Ac-ft 185,500
 Water year 1962-63: Max 1,450 Min 1.1 Mean 114 Ac-ft 82,300

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 6 to Jan. 30, Feb. 1-3, 28, Mar. 1, Mar. 22 to Apr. 7 (no gage-height record Jan. 22-30, Mar. 25, 26).

5-1060. Sprague Creek near Sprague, Manitoba

(International gaging station)

Location.--Lat 48°59'33", long 95°39'43", in NE¼ sec.34, T.164 N., R.39 W., on left bank half a mile south of international boundary, 3½ miles south of Sprague, Manitoba, 8 miles upstream from mouth, and 14 miles north-east of Roseau, Minn.

Drainage area.--169 sq mi. Prior to October 1958, 151 sq mi; change due to construction of drainage ditch within basin.

Records available.--September 1928 to September 1963 (winter records incomplete prior to 1941). Prior to September 1951, published as Mud Creek near Sprague.

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,038.4 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Prior to Mar. 15, 1929, staff gage at same site and datum.

Average discharge.--24 years (1928-29, 1940-63), 57.0 cfs (41,270 acre-ft per year).

Extremes.--Maximum discharge during year, 705 cfs Apr. 10 (gage height, 10.60 ft); minimum daily, 0.1 cfs Jan. 31 to Feb. 2.

1928-63: Maximum discharge, 2,070 cfs Sept. 1, 1942 (gage height, 15.31 ft), from rating curve extended above 960 cfs; no flow at times in some years.

Remarks.--Records good except those for period of ice effect, which are poor.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20	16	35	1.2	0.1	1.2	70	124	166	77	8.2	1.5
2	19	16	32	1.2	.1	1.2	80	116	238	65	9.1	.7
3	18	16	32	1.2	.2	1.2	80	106	245	54	6.9	1.0
4	18	15	28	1.0	.2	1.2	*76	97	256	46	5.0	.7
5	17	16	20	1.0	.3	1.2	100	90	264	40	4.5	.5
6	17	16	18	1.0	.3	1.4	200	87	247	34	4.0	.6
7	18	19	12	1.0	.4	1.4	300	94	210	30	3.2	.6
8	18	21	10	1.0	.4	1.4	496	121	174	25	2.6	.5
9	20	23	9.0	.8	.4	1.6	592	124	153	22	2.7	.5
10	21	23	8.0	.8	.4	1.6	690	117	153	*17	2.8	.5
11	21	25	7.0	.8	.6	*1.6	*606	109	157	17	2.7	.6
12	20	25	6.0	.8	.6	1.6	462	103	146	16	2.1	.9
13	20	27	6.0	.8	.6	1.6	356	166	156	14	1.8	.6
14	23	27	5.0	.8	.6	1.8	290	249	160	12	1.6	.7
15	20	26	5.0	.8	.8	1.8	257	245	151	9.7	1.5	.9
16	20	24	5.0	.6	.8	2.0	278	232	136	18	2.1	2.2
17	19	21	4.5	.6	.8	2.0	376	222	120	40	2.5	.7
18	19	21	4.5	.6	.8	2.0	357	216	109	31	2.4	.6
19	20	20	4.0	.6	.8	3.0	340	215	105	26	2.0	.6
20	24	21	4.0	.4	1.0	4.0	316	218	97	21	1.7	.6
21	17	22	*3.4	.4	1.0	4.0	278	218	87	22	1.7	1.2
22	16	20	3.4	.4	1.0	10	245	202	80	17	1.7	.9
23	17	17	3.2	.3	1.0	30	210	184	73	12	1.7	.5
24	15	14	3.0	.3	1.0	50	*189	164	174	6.4	1.7	.6
25	15	13	2.5	.3	1.2	60	177	148	261	6.6	1.7	.7
26	16	13	2.2	.3	*1.2	70	165	133	*319	9.1	1.4	*.7
27	16	*15	2.0	.2	1.2	80	154	127	255	12	*2.0	.7
28	16	22	1.8	.2	1.2	*60	143	123	182	12	1.3	1.2
29	16	34	1.6	.2	-	60	141	*113	128	12	1.4	1.3
30	16	35	1.4	.2	-----	60	133	101	97	9.4	1.2	1.2
31	*16	-----	1.2	*.1	-----	70	-----	100	-----	*8.8	2.2	-----
Total	568	623	280.7	19.9	19.0	588.8	8,157	4,664	5,099	742.0	87.4	24.5
Mean	18.3	20.8	9.05	0.64	0.68	19.0	272	150	170	23.9	2.82	0.82
Ac-ft	1,130	1,240	557	39	38	1,170	16,180	9,250	10,110	1,470	173	49

Calendar year 1962: Max 843 Min 0 Mean 73.4 Ac-ft 53,160

Water year 1962-63: Max 690 Min 0.1 Mean 57.2 Ac-ft 41,410

* Discharge measurement made on this day.

Note.---Stage-discharge relation affected by ice Nov. 21 to Apr. 7 (no gage-height record Jan. 26-30, Feb. 3-25, Feb. 27 to Mar. 10, Mar. 12-23, Apr. 23).

RED RIVER OF THE NORTH BASIN

5-1065. Roseau River at Roseau Lake, Minn.

Location.--Lat 48°54'22", long 95°49'55"; in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.28, T.163 N., R.40 W., on upstream bridge piling on left bank at Roseau Lake, $3\frac{1}{4}$ miles upstream from Pine Creek, $3\frac{1}{4}$ miles downstream from Sprague Creek, and 7 miles northwest of Roseau.

Records available.--November 1939 to September 1963 (incomplete).

Gage.--Staff gage read once daily. Datum of gage is 1,018.59 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,030.99 ft Apr. 12, 13; minimum observed, 1,020.28 ft Sept. 21. 1939-63: Maximum elevation observed, 1,036.86 ft May 13, 1950: minimum observed, 1,019.75 ft Aug. 16, 1941.

Elevation, in feet, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	21.74						25.46	26.87	25.22	27.31	22.01	20.44
2	21.72						25.09	26.47	25.93	26.90	22.13	20.44
3	21.70						25.01	26.13	26.74	26.36	22.13	20.42
4	21.66						25.12	25.75	26.98	25.80	22.00	20.40
5	21.64						26.38	25.40	26.94	25.28	21.83	20.36
6	21.62						28.72	25.06	26.74	24.76	21.63	20.34
7	21.56						29.62	24.86	26.43	24.26	21.50	20.32
8	21.52						29.90	24.81	26.20	23.87	21.32	20.32
9	21.54						30.00	24.76	26.03	23.51	21.17	20.30
10	21.56						30.62	24.68	26.26	23.17	21.07	20.30
11	21.62						30.89	24.55	26.40	22.84	20.97	20.30
12	21.64						30.97	24.43	26.48	22.56	20.92	20.30
13	21.60						30.95	24.61	26.50	22.27	20.86	20.32
14	21.60						30.82	25.26	26.51	22.15	20.82	20.32
15	21.62						30.67	25.72	26.44	21.94	20.79	20.32
16	21.66						30.53	25.83	26.26	21.82	20.78	20.32
17	21.68						30.51	25.91	26.00	21.85	20.74	20.30
18	21.76						30.42	26.03	25.72	21.93	20.80	20.30
19	21.66						30.31	26.33	25.53	21.98	20.80	20.30
20	21.56						30.20	26.63	25.47	21.90	20.80	20.30
21	21.58						30.03	26.89	25.39	21.99	20.78	20.28
22	21.60						29.81	27.01	25.22	21.97	20.74	20.30
23	21.62						29.60	26.99	25.11	21.87	20.72	20.30
24	21.66					24.08	29.29	26.74	25.88	21.78	20.70	20.32
25	21.66					25.64	29.00	26.53	27.31	21.73	20.66	20.36
26	21.64					27.63	28.60	26.32	28.10	21.71	20.57	20.42
27	21.62					27.51	28.31	26.10	28.23	21.81	20.56	20.46
28	21.65					27.22	27.92	25.84	28.05	21.83	20.52	20.60
29	21.65					27.07	27.61	25.59	27.80	21.82	20.50	20.62
30	21.61				-----	26.41	27.26	25.31	27.57	21.80	20.46	20.64
31	21.60	-----			-----	25.75	-----	25.07	-----	21.81	20.44	-----

Note.--Add 1,000 ft to obtain elevation above mean sea level.

5-1075. Roseau River at Ross, Minn.

Location.--Lat 48°54'37", long 95°55'18", in SE¼ sec.27, T.163 N., R.41 W., on left bank 300 ft downstream from highway bridge, a quarter of a mile north of Ross, and 2.3 miles downstream from Pine Creek.

Drainage area.--1,220 sq mi, approximately.

Records available.--July 1928 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,018.44 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Prior to Mar. 13, 1929, staff gage at same site and datum.

Average discharge.--35 years, 229 cfs (165,800 acre-ft per year).

Extremes.--Maximum discharge during year, 1,550 cfs Apr. 13 (gage height, 11.51 ft); minimum, 2.0 cfs Sept. 27. 1928-63: Maximum discharge, 6,560 cfs May 12, 1950 (gage height, 18.25 ft); no flow Aug. 29, 30, 1961. Maximum stage known, about 19 ft in 1896. Other outstanding floods reached the following stages (from information by local residents); flood of July 1919, 17.5 ft; flood of 1927, about 16 ft.

Remarks.--Records good except those below 100 cfs, which are fair, and those for period of ice effect, which are poor. High flow regulated by natural storage in Roseau Lake.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 15,
June 24 to Aug. 27, Sept. 30)

0.2	1.4	3.0	111
0.4	4.2	4.0	195
0.7	9.5	6.0	438
1.0	17	9.0	963
1.5	32	12.0	1,675
2.0	53		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	74	63	120	16	4.0	4.0	360	700	431	734	86	8.0
2	73	64	130	16	4.0	4.0	350	630	526	667	90	7.8
3	70	64	130	16	4.0	4.0	360	574	648	587	91	7.6
4	66	64	125	15	4.0	4.0	*440	522	690	504	87	7.2
5	67	62	130	15	4.0	4.0	580	468	690	430	76	6.9
6	63	62	125	15	4.0	4.0	937	424	664	363	65	6.7
7	59	68	110	14	4.0	4.0	1,130	390	622	308	61	5.8
8	56	69	90	14	4.0	4.0	1,220	379	579	257	46	5.2
9	56	72	85	14	4.0	4.0	1,280	376	568	218	40	4.9
10	60	77	75	14	4.0	4.2	1,370	367	589	183	34	4.4
11	62	82	60	12	4.0	4.4	1,460	347	616	153	29	4.4
12	62	84	45	10	4.0	4.6	*1,520	330	624	136	26	4.4
13	61	89	35	9.0	4.0	5.0	1,550	348	630	110	24	4.5
14	60	92	30	8.0	4.0	5.2	1,540	437	635	96	22	4.5
15	61	92	28	7.0	4.0	5.4	1,500	502	629	89	20	4.7
16	64	92	26	6.0	4.0	5.6	1,470	523	600	80	20	4.2
17	64	90	26	5.5	4.0	5.6	1,450	530	562	84	19	4.4
18	67	85	26	5.5	4.0	5.6	1,440	547	510	88	19	4.5
19	66	85	28	5.5	4.0	5.8	1,410	589	473	86	20	4.4
20	62	85	*28	5.0	4.0	6.0	1,370	632	455	87	20	4.4
21	62	90	26	5.0	4.0	6.5	1,340	674	464	91	19	3.8
22	60	85	24	5.0	4.0	8.0	1,300	692	445	89	18	3.4
23	65	85	24	4.5	4.0	15	*1,240	683	403	86	17	2.8
24	64	80	24	4.5	4.0	100	1,180	659	550	81	14	2.8
25	64	80	22	4.5	*4.0	200	1,120	632	*743	75	13	3.0
26	63	80	22	4.5	4.0	300	1,050	602	836	76	*13	*2.7
27	62	*75	20	4.0	4.0	350	971	565	871	81	*14	2.2
28	63	85	20	4.0	4.0	*380	899	*525	848	80	*10	2.8
29	64	95	20	*4.0	-	400	840	485	808	80	8.4	2.8
30	*64	110	18	4.0	-----	380	772	448	778	*76	7.8	3.2
31	64	-----	18	4.0	-----	370	-----	420	-----	74	8.2	-----
Total	1,968	2,406	1,690	270.5	112.0	2,602.9	33,449	16,000	18,487	6,149	1,037.4	138.4
Mean	63.5	80.2	54.5	8.73	4.00	84.0	1,115	516	616	198	33.5	4.61
Ac-ft	3,900	4,770	3,350	537	222	5,160	66,350	31,740	36,670	12,200	2,060	275

Calendar year 1962: Max 2,110 Min 5.4 Mean 457 Ac-ft 330,900
Water year 1962-63: Max 1,550 Min 2.2 Mean 231 Ac-ft 167,200

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 16 to Apr. 5.

RED RIVER OF THE NORTH BASIN

5-1080. Roseau River near Badger, Minn.

Location.--Lat 48°54'42", long 96°00'24", in SW¼ sec.30, T.163 N., R.41 W., on right bank 100 ft upstream from highway bridge and 9 miles north of Badger.

Records available.--August 1928 to September 1963 (incomplete).

Gage.--Water-stage recorder. Datum of gage is 1,016.90 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,027.80 ft Apr. 13; minimum recorded, 1,017.56 ft Sept. 27.
1928-63: Maximum elevation, 1,032.65 ft May 13, 1950; minimum recorded, 1,017.42 ft Aug. 30, 1961.

Mean elevation, in feet, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	19.73						23.40	24.64	22.96	24.94	19.67	17.92
2	19.68						23.02	24.31	23.46	24.65	19.99	17.90
3	19.65						23.15	24.01	24.12	24.23	20.10	17.87
4	19.60						23.56	23.70	24.40	23.75	20.07	17.86
5	19.58						24.19	23.38	24.42	23.27	19.88	17.82
6	19.53						25.54	23.06	24.33	22.80	19.63	17.80
7	19.48						26.51	22.83	24.14	22.37	19.38	17.77
8	19.44						27.01	22.70	23.95	21.97	19.17	17.72
9	19.42						27.12	22.68	23.87	21.61	18.98	17.70
10	19.44						27.29	22.61	23.97	21.25	18.83	17.68
11	19.51						27.52	22.48	24.11	20.93	18.71	17.66
12	19.52						27.71	22.35	24.18	20.70	18.63	17.65
13	19.48						27.79	22.42	24.21	20.35	18.55	17.63
14	19.45						27.77	22.93	24.24	20.07	18.48	17.63
15	19.45						27.65	23.37	24.21	19.87	18.43	17.64
16	19.49						27.59	23.52	24.06	19.69	18.41	17.62
17	19.48						27.53	23.58	23.85	19.68	18.38	17.61
18	19.52						27.44	23.67	23.58	19.81	18.37	17.62
19	19.56						27.36	23.86	23.34	19.64	18.39	17.63
20	19.46						27.24	24.08	23.20	19.69	18.41	17.63
21	19.46						27.13	24.30	23.24	19.75	18.40	17.61
22	19.43						27.00	24.40	23.13	19.74	18.35	17.59
23	19.43						26.81	24.39	22.89	19.67	18.29	17.58
24	19.45						26.60	24.28	23.74	19.58	18.20	17.57
25	19.41						26.37	24.14	24.93	19.47	18.13	17.58
26	19.38						26.12	23.98	25.49	19.48	18.11	17.58
27	19.38						25.83	23.80	25.60	19.55	18.10	17.56
28	19.38					25.25	25.53	23.59	25.50	19.57	18.16	17.58
29	19.38					25.25	25.27	23.36	25.30	19.54	18.05	17.61
30	19.39					24.90	24.97	23.13	25.13	19.49	17.99	17.60
31						24.20		22.94		19.47	17.94	

Note.--Add 1,000 ft to obtain elevation above mean sea level.

5-1095. Roseau River near Haug, Minn.

Location.--Lat 48°55'28", long 96°12'26", in SE¼ sec.21, T.163 N., R.43 W., on left bank 250 ft downstream from abandoned highway bridge, 5 miles south of international boundary, and 8¼ miles northwest of Haug.

Records available.--April 1932 to September 1963 (incomplete).

Gage.--Water-stage recorder. Datum of gage is 1,014.02 ft above mean sea level, adjustment of 1928 by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,022.87 ft Apr. 21, 22; minimum recorded, 1,014.92 ft Sept. 27, 1932-63: Maximum elevation, 1,024.64 ft May 15, 1950; minimum recorded, 1,014.74 ft Aug. 8, 1933.

Mean elevation, in feet water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16.47						20.24	21.81		21.39	16.42	15.20
2	16.42						19.62	21.59		21.25	16.63	15.19
3	16.39						19.21	21.37		20.99	16.80	15.16
4	16.36							21.05		20.62	16.81	15.14
5	16.33						19.71	20.61		20.18	16.71	15.12
6	16.32						20.67	20.16		19.80	16.53	15.10
7	16.28						21.58	19.81		19.36	16.34	15.09
8	16.26						22.13	19.54		18.90	16.17	15.06
9	16.23						22.34	19.40		18.49	16.01	15.03
10	16.22						22.43	19.28		18.05	15.89	15.01
11	16.27						22.50	19.18		17.74	15.79	15.02
12	16.31						22.56	19.06	21.29	17.51	15.72	15.05
13	16.28						22.63	19.03	21.33	17.26	15.66	15.01
14	16.24						22.67		21.27	16.97	15.59	14.98
15	16.22						22.70		21.21	16.76	15.54	14.99
16	16.27						22.74		21.12	16.65	15.59	14.99
17	16.29						22.79		20.98	16.55	15.55	14.98
18	16.34						22.83		20.79	16.64	15.52	14.99
19	16.37						22.85		20.59	16.72	15.51	14.99
20	16.21						22.85		20.38	16.69	15.51	14.98
21	16.28						22.87		20.27	16.65	15.51	14.98
22	16.27						22.87		20.18	16.64	15.49	14.97
23	16.23						22.85		20.04	16.59	15.46	14.94
24	16.25						22.81		20.04	16.51	15.42	14.94
25	16.39						22.75		20.77	16.43	15.36	14.94
26	16.41						22.68		21.29	16.36	15.32	14.93
27	16.40						22.58		21.54	16.42	15.32	14.92
28	16.38					21.44	22.41		21.61	16.52	15.32	14.96
29	16.35				-	21.46	22.19		21.58	16.47	15.34	14.95
30	16.37				-----	21.29	21.96		21.50	16.42	15.32	14.94
31		-----			-----	20.75	-----		-----	16.40	15.24	-----

Note.--Add 1,000 ft to obtain elevation above mean sea level.

RED RIVER OF THE NORTH BASIN

5-1120. Roseau River below State ditch 51, near Caribou, Minn.

(International gaging station)

Location.--Lat 48°58'54", long 96°27'46", in SE¼SW¼ sec.34, T.164 N., R.45 W., on left bank 400 ft downstream from State ditch 51 (known locally as Caribou cutoff ditch) and 0.6 mile west of Caribou.

Drainage area.--1,570 sq mi, approximately.

Records available.--April to October 1917, April 1920 to September 1963 (some winter records incomplete). Published as "at Caribou", prior to April 1929; as "below Cutoff ditch, near Caribou" April 1929 to September 1936. Records published for both sites April 1929 to September 1930. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,002.14 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Prior to Apr. 1, 1929, chain gage at site at Caribou 0.6 mile upstream at datum 0.95 ft lower.

Average discharge.--15 years (1920-30, 1932-33, 1936-37, 1940-43), 298 cfs (215,700 acre-ft per year).

Extremes.--Maximum discharge during year, 1,510 cfs Apr. 25 (gage height, 7.46 ft); maximum gage height, 7.63 ft Mar. 31 (backwater from ice); minimum daily discharge recorded, 11 cfs Sept. 14-18, 24-29. 1917, 1920-63: Maximum discharge, 4,080 cfs May 19, 1950 (gage height, 11.81 ft); no flow Aug. 13, 1936. Flood of 1916 is reported to have reached a stage of about 15.5 ft at former site.

Remarks.--Records good except those below 20 cfs, which are fair, and those for periods of ice effect, which are poor. Occasionally, at high stages, there is some natural diversion of flow above station to headwaters of Two Rivers.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1962-63, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)

1.6	9.2	3.0	192
1.8	19	4.0	413
2.0	36	6.0	957
2.5	102	8.0	1,760

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	89					-	600	1,310	686	933	*104	20
2	82					-	550	1,240	670	912	110	19
3	79					-	500	1,170	*768	872	131	18
4	79					-	550	1,080	807	807	138	16
5	76					-	*594	976	819	721	134	14
6	78					-	760	855	816	637	116	12
7	73					-	1,010	751	813	559	97	12
8	72					-	1,270	662	821	460	79	12
9	70					-	1,250	602	841	389	70	12
10	68					-	1,250	567	889	319	59	12
11	70					-	1,260	541	924	*269	51	12
12	73					-	*1,270	528	957	231	46	12
13	75					-	1,290	528	979	200	42	12
14	72					-	1,320	525	969	165	38	11
15	70					-	1,350	549	954	138	36	11
16	70					-	1,390	602	930	129	36	11
17	72					-	1,420	640	902	115	38	11
18	78					-	1,430	662	858	113	36	11
19	79					-	1,450	678	816	132	35	12
20	79					-	1,470	707	771	132	34	12
21	73					-	1,480	737	723	122	33	12
22	76					-	1,500	763	710	116	34	12
23	72					-	*1,500	779	686	113	32	12
24	73					-	1,500	777	656	108	30	11
25	79					-	1,510	751	749	99	26	11
26	86					-	1,500	721	863	107	*25	11
27	88					-	1,480	691	*939	110	24	*11
28	86					250	1,450	656	960	116	24	11
29	85					300	1,420	618	963	115	23	11
30	*80					500	1,370	578	960	104	23	12
31	-					600		589		105	22	
Total							36,694	22,833	25,199	9,448	1,726	376
Mean							1,223	737	840	305	55.7	12.5
Ac-ft							72,780	45,290	49,980	18,740	3,420	746

Calendar year 1962: Max
Water year 1962-63: Max

Min
Min

Mean
Mean

Ac-ft
Ac-ft

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Mar. 28 to Apr. 4.

5-1125. Roseau River at international boundary, near Caribou, Minn.

Location.--Lat 48°59'57", long 96°30'20", near center of sec.29, T.164 N., R.45 W., on left bank 400 ft upstream from international boundary crossing and 3 miles northwest of Caribou.

Drainage area.--1,590 sq mi, approximately.

Records available.--May 1933 to September 1963 (incomplete).

Gage.--Water-stage recorder. Datum of gage is 1,002.59 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Gage readings have been reduced to elevations above mean sea level.

Extremes.--Maximum elevation during year, 1,006.69 ft Apr. 1; minimum recorded, 1,002.87 ft Sept. 27.
1933-63: Maximum elevation recorded, 1,007.43 ft Apr. 14, 1960; minimum recorded, 1,001.97 ft Aug. 14, 1933.

Mean elevation, in feet, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.53						6.56	6.20	4.94	5.63	3.58	3.07
2	3.50						6.12	6.16	4.90		3.61	3.04
3	3.49						5.58	6.00	5.14		3.67	3.04
4	3.49						5.27	5.85	5.24		3.70	3.02
5	3.49						5.19	5.60	5.29		3.69	2.99
6	3.49						5.13	5.29	5.27		3.64	2.97
7	3.48						5.33	5.02	5.26		3.58	2.94
8	3.45						5.80	4.80	5.30		3.52	2.95
9	3.43						6.00	4.66	5.34		3.45	2.94
10	3.41						6.05	4.59	5.46		3.39	2.94
11	3.42						6.07	4.52	5.54		3.35	2.94
12	3.47						6.08	4.44	5.63		3.32	2.96
13	3.47						6.09	4.43	5.71		3.28	2.96
14	3.43						6.12	4.44	5.66		3.25	2.95
15	3.42						6.17	4.54	5.64		3.24	2.95
16	3.41						6.30	4.67	5.57		3.24	2.95
17	3.45						6.38	4.75	5.49		3.24	2.94
18	3.45						6.30	4.81	5.39		3.24	2.95
19	3.44						6.30	4.88	5.27		3.23	2.95
20	3.46						6.28	4.95	5.16		3.21	2.95
21	3.43						6.27	5.00	5.07		3.22	2.95
22	3.43						6.27	5.08	5.01		3.21	2.95
23	3.41						6.28	5.12	4.97		3.21	2.95
24	3.41						6.30	5.11	4.90		3.19	2.96
25	3.43						6.31	5.07	5.11	3.60	3.16	2.94
26	3.48						6.33	4.99	5.43	3.63	3.13	2.91
27	3.49						6.32	4.92	5.60	3.62	3.12	2.88
28	3.48					5.61	6.31	4.84	5.68	3.64	3.11	2.95
29	3.48				-	5.68	6.30	4.74	5.69	3.63	3.12	2.96
30	3.47				-----	6.09	6.24	4.64	5.67	3.61	3.13	2.96
31		-----			-----	6.48	-----	4.67	-----	3.61	3.13	-----

Note.--Add 1,000 ft to obtain elevation above mean sea level.

LAKE OF THE WOODS BASIN

5-1255. Stony River near Isabella, Minn.

Location.--Lat 47°41'10", long 91°38'20", in NW¼ sec.17, T.60 N., R.10 W., on left bank 275 ft downstream from Slate Lake and bridge on State Highway 1, 11 miles upstream from Birch Lake, and 12¼ miles northwest of Isabella.

Drainage area.--180 sq mi.

Records available.--October 1952 to September 1963. Prior to October 1958, published as Stoney River near Isabella.

Gage.--Water-stage recorder. Datum of gage is 1,632.45 ft above mean sea level, datum of 1929.

Average discharge.--11 years, 126 cfs.

Extremes.--Maximum discharge during year, 330 cfs Apr. 6 (gage height, 8.48 ft); minimum daily, 9.1 cfs Feb. 28. 1952-63: Maximum discharge, 2,040 cfs Apr. 27, 1957 (gage height, 10.60 ft); minimum, 5.6 cfs Aug. 22, 1961 (gage height, 7.32 ft).

Remarks.--Records good except those for period of ice effect, which are fair.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Apr. 5				Apr. 6 to Sept. 30			
7.4	10	7.9	96	7.5	14	7.9	97
7.5	18	8.1	160	7.6	28	8.1	171
7.6	32	8.5	335	7.7	47	8.5	377
7.7	49						

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	96	40	29	24	10	9.2	55	147	292	139	*47	78
2	96	40	30	24	10	9.2	93	163	297	117	45	72
3	96	37	30	23	10	9.2	168	167	286	107	41	67
4	93	39	32	23	10	9.2	262	159	270	94	39	*60
5	93	39	32	*23	10	9.2	*305	151	*250	86	35	56
6	91	39	32	23	10	9.2	318	143	240	78	35	51
7	88	42	32	23	10	9.4	324	147	231	70	34	47
8	80	42	35	23	10	9.8	318	143	221	60	34	43
9	75	42	35	23	10	10	302	139	216	56	34	39
10	70	42	34	23	10	11	292	131	216	51	32	37
11	68	40	34	22	10	11	270	131	212	49	30	39
12	64	40	34	21	10	12	250	131	212	63	32	43
13	64	40	30	21	9.9	12	226	139	221	72	32	39
14	68	39	29	20	9.9	11	212	143	240	70	28	35
15	68	39	29	19	9.9	11	198	139	255	67	27	34
16	66	37	29	19	9.8	12	189	147	270	63	34	35
17	64	35	26	18	9.8	13	194	151	270	60	39	34
18	60	35	26	17	9.7	13	180	163	276	58	45	39
19	57	34	26	17	9.7	13	189	171	286	58	60	43
20	53	32	26	16	9.7	13	189	180	276	60	80	39
21	49	32	27	15	9.6	12	184	194	270	63	94	37
22	49	32	27	15	9.6	12	176	202	270	63	111	35
23	47	30	27	14	9.5	12	167	207	270	60	117	34
24	46	30	27	14	9.5	13	*159	202	260	58	117	34
25	44	29	26	13	9.4	16	151	198	240	51	117	35
26	42	29	26	12	9.3	18	143	189	*226	49	114	34
27	42	29	25	12	9.2	*18	139	189	202	51	111	32
28	42	*29	25	11	*9.1	18	135	198	180	54	107	32
29	42	29	24	11	-	23	139	207	163	54	97	30
30	*42	29	24	11	-----	35	139	236	147	51	92	30
31	40	-----	24	*10	-----	40	-----	265	-----	49	83	-----
Total	1,995	1,071	892	560	273.6	433.4	6,066	5,272	7,265	2,081	1,943	1,263
Mean	64.4	35.7	28.8	18.1	9.77	14.0	202	170	242	67.1	62.7	42.1
Cfsm	0.358	0.198	0.160	0.101	0.054	0.078	1.12	0.944	1.34	0.373	0.348	0.234
In.	0.41	0.22	0.18	0.12	0.06	0.09	1.25	1.09	1.50	0.43	0.40	0.26

Calendar year 1962 Max 793 Min 14 Mean 126 Cfsm 0.700 In. 9.50
 Water year 1962-63 Max 324 Min 9.1 Mean 79.8 Cfsm 0.443 In. 6.01

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 26 to Mar. 21.

5-1270. Kawishiwi River near Winton, Minn.

Location.--Lat 47°56'05", long 91°45'50", in NE 1/4 sec. 20, T.63 N., R.11 W., at powerplant of Minnesota Power & Light Co., just upstream from Fall Lake, and 1.8 miles east of Winton.

Drainage area.--1,200 sq mi, approximately.

Records available.--June 1905 to June 1907, October 1912 to September 1919 (fragmentary), September 1923 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Average discharge.--44 years (1905-6, 1915-17, 1918-19, 1923-63), 954 cfs (unadjusted).

Extremes.--Maximum daily discharge during year, 1,950 cfs June 20; minimum daily, 0 cfs Jan. 6.
1905-07, 1912-19, 1923-63: Maximum daily discharge, 16,000 cfs May 18, 1950; no flow at times.

Remarks.--Records good. Daily discharge computed from powerplant records. Flow regulated by powerplant and by Camp Six, Bald Eagle, Gabbro, Little Gabbro, Birch, White Iron, South Farm, Farm, and Garden Lakes.

Cooperation.--Records collected by Minnesota Power & Light Co., under general supervision of Geological Survey, in connection with a Federal Power Commission project.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	397	364	266	299	166	249	714	876	1,340	1,090	496	184
2	429	331	266	265	198	249	962	941	1,400	946	496	129
3	397	396	298	201	216	249	1,290	973	1,420	924	232	218
4	429	267	266	256	168	184	1,040	941	1,450	854	290	218
5	397	267	333	166	233	232	1,040	941	1,520	685	464	284
6	397	117	301	0	233	329	1,170	908	1,540	565	398	251
7	397	197	301	263	233	329	1,140	1,000	1,490	659	408	348
8	365	229	301	198	198	379	1,260	973	1,460	562	277	284
9	332	164	201	231	166	462	1,240	1,020	1,490	433	375	394
10	397	129	268	183	166	429	1,300	986	1,570	374	246	403
11	365	129	283	166	251	397	1,360	1,020	1,550	471	161	435
12	365	261	233	134	334	560	1,450	812	1,600	813	278	696
13	429	198	298	198	205	593	1,460	954	1,560	928	278	522
14	397	198	331	198	302	464	1,400	1,080	1,430	895	343	429
15	333	165	267	220	424	497	1,270	1,020	1,400	734	278	305
16	333	230	299	198	368	399	1,180	1,080	1,400	729	408	325
17	365	230	234	166	368	593	986	1,080	1,370	583	311	422
18	365	198	265	166	249	528	922	1,080	1,590	597	311	358
19	365	165	233	166	249	463	890	1,020	1,770	597	278	546
20	397	198	233	198	281	528	825	1,150	1,950	597	343	479
21	300	215	298	198	249	528	821	992	1,920	624	472	434
22	332	230	267	166	233	528	918	992	1,800	710	569	467
23	397	133	299	334	265	545	910	960	1,630	712	468	370
24	365	262	299	198	233	595	786	895	1,350	662	531	433
25	365	165	299	166	145	595	818	863	1,430	662	408	433
26	365	198	299	166	249	563	851	863	1,410	662	408	466
27	365	168	299	111	249	594	883	895	1,410	630	533	373
28	332	265	267	233	216	560	851	1,200	1,230	630	467	314
29	332	232	299	234	-	592	941	1,260	1,250	533	467	194
30	300	331	267	231	-----	641	876	1,460	1,120	579	499	342
31	331	-----	267	134	-----	691	-----	1,290	-----	496	366	-----
Total	11,435	6,632	8,637	6,043	6,847	14,545	31,554	31,525	44,850	20,936	11,859	11,056
Mean	369	221	279	195	245	469	1,052	1,017	1,495	675	383	369
(*)	-56	+16	-48	-36	-109	-303	+333	+217	-10	-17	-9	-33
Mean #	313	237	231	159	136	166	1,385	1,234	1,485	658	374	336
Cfsm #	0.261	0.198	0.192	0.132	0.113	0.138	1.15	1.03	1.24	0.548	0.312	0.280
In. #	0.30	0.22	0.22	0.15	0.12	0.16	1.28	1.19	1.38	0.63	0.36	0.31
Calendar year 1962:	Max 4,620	Min 32	Mean 951	Mean# 973	Cfsm# 0.811	In.# 10.98						
Water year 1962-63:	Max 1,950	Min 0	Mean 564	Mean# 559	Cfsm# 0.466	In.# 6.32						

* Change in contents, equivalent in cubic feet per second, in Camp Six, Bald Eagle, Gabbro, Little Gabbro, Birch, White Iron, South Farm, Farm, and Garden Lakes.

Adjusted for change in reservoir contents.

LAKE OF THE WOODS BASIN

5-1275. Basswood River near Winton, Minn.

(International gaging station)

Location.--Lat 48°04'55", long 91°39'10", in sec.30, T.65 N., R.10 W., on Jackfish Bay of Basswood Lake, used to determine discharge at outlet (lat 48°06', long 91°39', in sec.19, T.65 N., R.10 W., on international boundary 14 miles northeast of Winton).

Drainage area.--1,740 sq mi, approximately (above outlet of Basswood Lake).

Records available.--March to June 1924, September 1925 to March 1928, January 1930 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,299.80 ft above mean sea level, adjustment of 1928, by Geodetic Survey of Canada. Prior to June 2, 1938, staff gages at several sites on Jackfish Bay, at same datum. June 2 to Oct. 27, 1938, staff gage at Williams Island half a mile northeast of present gage at same datum.

Average discharge.--35 years (1925-27, 1930-63), 1,301 cfs.

Extremes.--Maximum discharge during year, 1,840 cfs June 22 (gage height, 1.16 ft); minimum, 264 cfs Dec. 15-16 (gage height, -0.57 ft).
1924, 1925-27, 1930-63: Maximum discharge, 15,600 cfs May 24, 1950 (gage height, 6.94 ft); minimum, 73 cfs Dec. 5, 1948.

Remarks.--Records excellent except those for periods of no gage-height record, which are fair. Flow affected by storage on Kawishiwi River.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1962-63 (gage height, in feet, and discharge, in cubic feet per second)

-0.60	254	-0.20	442	0.5	1,060
-0.50	287	-0.10	507	1.0	1,640
-0.40	328	0	580	1.5	2,330
-0.30	380	.2	760		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	960	448	312	338	295	344	580	1,080	1,280	1,640	1,060	631
2	930	442	308	338	299	344	640	1,080	1,320	1,590	*1,040	622
3	900	436	303	*338	299	338	732	1,080	1,340	1,560	1,000	622
4	880	423	295	333	303	344	800	1,070	1,360	1,520	980	597
5	860	417	291	328	303	338	870	1,060	*1,380	1,470	940	573
6	840	411	287	328	303	338	930	1,060	1,410	1,420	910	551
7	820	411	284	328	303	333	950	1,090	1,440	1,360	880	544
8	800	399	280	324	299	338	960	1,100	1,450	1,290	860	529
9	790	392	277	328	299	338	980	1,120	1,480	1,220	850	514
10	770	386	274	328	299	338	1,010	1,120	1,600	1,190	810	500
11	760	370	270	324	299	349	1,040	1,100	1,590	1,180	790	500
12	760	364	267	320	299	364	1,080	1,100	1,620	1,200	780	500
13	730	359	267	316	299	375	1,100	1,120	1,660	1,190	770	494
14	710	349	267	312	303	380	1,120	1,130	1,680	1,180	732	494
15	690	344	264	312	308	386	1,130	1,130	1,680	1,170	712	494
16	650	338	264	308	312	392	1,140	1,130	1,680	1,170	741	500
17	630	328	270	308	320	417	1,140	1,130	1,660	1,140	712	500
18	600	328	270	308	333	430	1,140	1,130	1,660	1,120	694	529
19	580	328	274	303	344	442	1,150	1,130	1,740	1,130	675	536
20	570	324	277	301	349	455	1,160	1,140	1,760	1,140	665	529
21	550	320	280	299	354	462	1,150	1,140	1,800	1,130	648	529
22	540	320	287	297	354	474	1,140	1,140	1,820	1,120	665	529
23	530	328	295	295	354	474	1,140	1,140	1,810	1,090	694	529
24	520	320	299	295	354	481	1,130	1,140	1,810	1,060	684	522
25	510	316	312	299	349	494	1,120	1,130	1,810	1,060	665	522
26	500	312	316	299	349	500	1,120	1,130	1,810	1,060	656	529
27	490	316	320	299	344	507	1,100	1,160	1,800	1,060	640	529
28	485	316	324	299	344	*522	1,100	1,170	1,790	1,080	656	536
29	*474	316	328	295	-	529	1,100	1,190	1,750	1,090	648	529
30	462	312	333	295	-----	536	1,080	1,210	1,710	1,080	648	522
31	455	-----	333	295	-----	544	-----	1,260	-----	1,060	640	-----
Total	20,736	10,773	9,028	9,690	8,970	12,906	30,832	34,910	48,700	37,770	23,845	16,035
Mean	669	359	291	313	320	416	1,028	1,126	1,623	1,218	769	534
Cfsm	0.384	0.206	0.167	0.180	0.184	0.239	0.591	0.647	0.933	0.700	0.442	0.307
In.	0.44	0.23	0.19	0.21	0.19	0.28	0.66	0.75	1.04	0.81	0.51	0.34

Calendar year 1962: Max 4,470 Min 264 Mean 1,261 Cfsm 0.725 In. 9.81
Water year 1962-63: Max 1,820 Min 264 Mean 724 Cfsm 0.416 In. 5.65

* Discharge measurement made on this day.

Note.--No gage-height record Oct. 1-28, Jan. 20-22.

5-1280. Namakan River at outlet of Lac la Croix, Ontario

(International gaging station)

Location.--Lat 48°21'20", long 92°12'50", at Campbell's Camp, 2½ miles west of outlet of Lac la Croix.Drainage area.--5,165 sq mi.Records available.--September 1921 to January 1922, April 1922 to September 1963, in reports of Geological Survey. Monthly discharge only for some periods, published in WSP 1308. August 1921 to September 1963 in reports of Water Resources Branch, Department of Northern Affairs and National Resources, Canada.Gage.--Water-stage recorder. Gage readings have been reduced to elevations above mean sea level, United States and Canada Boundary Survey datum. Prior to October 1933, staff gages at various sites on Lac la Croix. October 1933 to March 13, 1963, staff gage at present site and datum.Average discharge.--41 years (1922-63), 3,535 cfs.Extremes.--Maximum discharge during year, 6,590 cfs June 29 (elevation, 1,185.83 ft); minimum daily, 950 cfs

Mar. 14, 15 (elevation, 1,182.15 ft).

1921-63: Maximum discharge, 28,200 cfs May 31 to June 2, 1950 (elevation, 1,193.30 ft); minimum, 535 cfs at times in February, March and April 1924 (elevation, 1,181.50 ft).

Remarks.--Records good.Cooperation.--This station is maintained by Canada under agreement with the United States.

Rating table, water year 1962-63 (gage height, in feet, and discharge, in cubic feet per second)

1,182.1	910
1,183.0	1,820
1,184.0	3,130
1,186.0	6,980

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,190	1,840	1,410	1,220	1,060	982	1,040	2,860	4,410	6,430	4,620	3,030
2	3,130	1,840	1,400	1,210	1,060	982	1,100	2,890	4,570	6,390	4,550	2,990
3	3,100	1,830	1,390	1,210	1,050	982	1,260	2,890	4,700	6,370	4,480	2,950
4	3,070	1,830	1,380	1,200	1,050	974	1,340	2,920	4,810	6,300	4,460	2,910
5	3,060	1,830	1,370	1,200	1,040	974	1,410	2,930	4,850	6,260	4,370	2,850
6	3,050	1,830	1,360	1,190	1,040	974	1,470	2,950	4,910	6,190	4,280	2,810
7	3,030	1,820	1,350	1,190	1,040	966	1,540	3,020	4,930	6,120	4,230	2,780
8	3,020	1,820	1,340	1,190	1,040	966	1,600	3,050	4,930	6,010	4,190	2,720
9	3,000	1,820	1,320	1,180	1,040	966	1,640	3,090	5,050	5,900	4,120	2,700
10	2,990	1,820	1,310	1,180	1,030	958	1,700	3,130	5,230	5,820	4,030	2,650
11	2,990	1,800	1,300	1,170	1,030	958	1,740	3,140	5,290	5,820	3,950	2,630
12	2,930	1,780	1,300	1,160	1,030	958	1,790	3,200	5,400	5,800	3,910	2,600
13	2,820	1,750	1,290	1,160	1,020	958	1,840	3,220	5,520	5,690	3,860	2,540
14	2,770	1,730	1,290	1,150	1,020	950	1,910	3,280	5,610	5,590	3,780	2,500
15	2,680	1,710	1,290	1,150	1,010	950	1,960	3,310	5,670	5,460	3,760	2,440
16	2,630	1,690	1,280	1,140	1,010	958	2,040	3,360	5,780	5,360	3,780	2,390
17	2,540	1,670	1,280	1,140	999	966	2,100	3,390	5,840	5,170	3,660	2,350
18	2,490	1,640	1,280	1,130	999	974	2,160	3,380	5,930	5,070	3,620	2,440
19	2,430	1,620	1,270	1,130	990	974	2,260	3,340	6,040	5,010	3,520	2,410
20	2,360	1,600	1,270	1,120	990	974	2,310	3,460	6,120	4,930	3,470	2,340
21	2,280	1,580	1,260	1,120	990	974	2,350	3,500	6,210	4,870	3,420	2,270
22	2,230	1,560	1,260	1,110	990	982	2,400	3,500	6,300	4,790	3,420	2,220
23	2,210	1,530	1,250	1,110	990	982	2,470	3,520	6,320	4,700	3,420	2,210
24	2,180	1,510	1,250	1,100	982	982	2,530	3,520	6,370	4,570	3,380	2,180
25	2,130	1,490	1,240	1,100	982	982	2,570	3,520	6,450	4,500	3,340	2,140
26	2,100	1,470	1,240	1,090	982	990	2,630	3,500	6,500	4,440	3,280	*2,130
27	2,060	1,460	1,240	1,090	982	990	2,670	3,710	6,540	4,510	3,220	2,140
28	2,000	1,450	1,230	1,080	982	999	2,720	*3,950	6,540	4,680	3,220	2,070
29	1,960	1,440	1,230	1,080	-	1,010	2,790	4,030	6,570	4,720	3,160	2,020
30	1,900	1,420	1,220	1,070	-----	1,010	2,820	4,140	6,520	4,680	3,120	2,000
31	1,840	-----	1,220	1,070	-----	1,020	-----	4,260	-----	4,620	3,060	-----
Total	80,170	50,180	40,120	35,440	28,428	30,265	60,160	103,960	169,910	166,770	116,680	74,410
Mean	2,586	1,673	1,294	1,143	1,015	976	2,005	3,353	5,663	5,380	3,764	2,480
Cfsm	0.501	0.324	0.251	0.221	0.197	0.189	0.388	0.649	1.096	1.042	0.729	0.480
In.	0.58	0.36	0.29	0.26	0.20	0.22	0.43	0.75	1.22	1.20	0.84	0.54

Calendar year 1962: Max 11,000 Min 1,220 Mean 4,047 Cfsm 0.784 In. 10.63

Water year 1962-63: Max 6,570 Min 950 Mean 2,621 Cfsm 0.507 In. 6.89

* Discharge measurement made on this day.

LAKE OF THE WOODS BASIN

5-1282. Vermilion Lake near Soudan, Minn.

Location.--Lat 47°49'52", long 92°16'20", in SW¼SE¼ sec.20, T.62 N., R.15 W., on south shore of Vermilion Lake, at McKinley Park, 2 miles northwest of Soudan.

Records available.--October 1913 to July 1915, July 1941 to November 1942, June 1946 to September 1963 (fragmentary during 1947).

Gage.--Water-stage recorder. Datum of gage is 1,355.10 ft above mean sea level, datum of 1929. October 1913 to July 1915, staff gage 2 miles southwest of present gage at Tower, at datum about 0.5 ft lower. July 1941 to November 1942 and June 1946 to June 1951, staff gage approximately 13 miles northwest at Vermilion Dam near Tower, at same datum. All gage readings have been reduced to elevations above mean sea level, datum of 1929.

Extremes.--Maximum elevation during year, 1,358.02 ft June 19; minimum, 1,356.84 ft Nov. 20. 1913-15, 1941-42, 1946-63: Maximum elevation observed, 1,359.52 ft May 16, 1950; minimum observed, 1,356.02 ft Jan. 29, 1942. Elevation on June 6, 1913, was 1,359.94 ft (determined from reference point set by local observers).

Mean daily elevation, in feet, October 1962 to September 1963

Oct. 31.....1,356.95	Feb. 28.....1,356.91	June 30.....1,357.80
Nov. 30.....1,356.88	Mar. 31.....1,357.01	July 31.....1,357.57
Dec. 31.....1,356.92	Apr. 30.....1,357.57	Aug. 31.....1,357.34
Jan. 31.....1,356.89	May 31.....1,357.67	Sept.30.....1,357.03

Note.--Elevations other than those shown above are available.

LAKE OF THE WOODS BASIN

61

5-1285. Pike River near Embarrass, Minn.

Location.--Lat 47°39'36", long 92°18'54", in NE¼NW¼ sec.25, T.60 N., R.16 W., on left bank 75 ft below bridge on County Road 373, 5.4 miles west of Embarrass, and 8.5 miles downstream from Sandy River.

Drainage area.--115 sq mi.

Records available.--October 1953 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,410.27 ft above mean sea level, datum of 1929.

Average discharge.--10 years, 75.1 cfs.

Extremes.--Maximum discharge during year, 381 cfs Apr. 6 (gage height, 7.18 ft); minimum daily, 0.4 cfs Jan. 29 to Feb. 3; minimum gage height, 3.27 ft Nov. 9.

1953-63: Maximum discharge, 1,750 cfs Apr. 17, 1954 (gage height, 10.28 ft); minimum daily, that of Jan. 29 to Feb. 3, 1963; minimum gage height, 3.08 ft Aug. 25-28, 1961.

Flood in May 1950 reached a stage of approximately 11.3 ft, from information by local residents (discharge, 2,400 cfs).

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used July 22 to Sept. 30)

3.4	10	5.0	119
3.5	14	6.0	221
4.0	41	7.0	353
4.5	77	8.0	595

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	14	15	4.1	0.4	1.5	245	110	109	57	54	34
2	18	14	16	4.2	.4	1.5	269	106	117	50	48	30
3	17	14	16	4.2	.4	1.5	303	106	136	46	*42	27
4	16	14	16	*4.3	.5	1.6	337	102	143	42	35	*24
5	16	14	16	4.4	.5	1.6	365	95	140	36	30	21
6	15	13	15	4.4	.5	1.6	*378	90	*128	33	25	18
7	14	14	14	4.4	.5	1.6	364	87	115	29	21	17
8	14	14	12	4.2	.6	1.7	335	87	97	26	18	15
9	14	14	11	4.0	.6	1.7	287	87	102	24	15	13
10	15	14	10	3.6	.6	1.7	262	90	159	22	13	12
11	14	13	9.6	3.3	.6	1.7	223	95	214	22	10	11
12	14	14	9.0	3.0	.6	1.7	196	91	251	36	12	13
13	14	16	8.8	2.6	.7	1.7	164	97	275	51	13	12
14	14	16	8.8	2.4	.7	1.8	137	117	282	56	12	12
15	14	17	8.8	2.2	.8	1.8	124	132	270	59	11	11
16	14	17	8.8	1.9	.8	1.8	118	134	253	54	27	10
17	14	16	8.8	1.7	.9	1.9	129	137	234	52	60	10
18	13	16	8.7	1.6	.9	1.9	127	140	212	50	69	13
19	14	15	8.5	1.4	1.0	2.0	125	138	195	47	70	20
20	14	15	8.0	1.2	1.0	2.1	124	135	176	42	66	21
21	14	14	7.4	1.1	1.1	2.2	127	141	162	37	59	22
22	13	14	7.0	.9	1.1	2.4	121	141	149	33	60	22
23	14	13	6.5	.8	1.2	2.8	114	132	132	32	76	22
24	17	12	6.1	.7	1.2	4.4	105	122	111	33	71	22
25	16	11	5.7	.6	1.3	6.0	*102	110	93	32	66	23
26	14	11	5.4	.5	1.3	10	106	99	94	29	59	23
27	*15	12	5.1	.5	1.4	17	106	94	*91	32	53	22
28	16	*12	4.8	.5	*1.4	26	106	106	83	47	50	22
29	15	12	4.6	.4	-	*65	109	121	72	59	46	21
30	15	13	4.2	.4	-----	120	113	122	62	62	42	20
31	15	-----	4.2	*.4	-----	214	-----	114	-----	60	38	-----
Total	460	418	289.8	69.9	23.0	504.2	5,721	3,478	4,657	1,290	1,271	563
Mean	14.8	13.9	9.35	2.25	0.82	16.3	191	112	155	41.6	41.0	18.8
Cfsm	0.129	0.121	0.081	0.020	0.007	0.142	1.67	0.974	1.35	0.362	0.357	0.163
In.	0.15	0.14	0.09	0.02	0.007	0.16	1.85	1.12	1.51	0.42	0.41	0.18

Calendar year 1962: Max 578 Min 4.1 Mean 74.5 Cfsm 0.648 In. 8.79
Water year 1962-63: Max 378 Min 0.4 Mean 51.4 Cfsm 0.447 In. 6.06

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 20-22, Dec. 3 to Mar. 30.

LAKE OF THE WOODS BASIN

5-1290. Vermilion River below Vermilion Lake, near Tower, Minn.

Location.--Lat 47°57'41", long 92°28'33", in SE¼SW¼ sec.2, T.63 N., R.17 W., on left bank 200 ft downstream from dam at outlet of Vermilion Lake, 4.4 miles upstream from Twomile Creek, and 14.2 miles northwest of Tower.

Drainage area.--483 sq mi.

Records available.--May 1911 to September 1917, June 1928 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,350.36 ft above mean sea level, datum of 1929. May 17, 1911, to Sept. 30, 1917, and July 9, 1931, to Apr. 11, 1939, staff gage at same site and datum. June 26, 1928, to July 8, 1931, staff gage at datum 0.05 ft higher.

Average discharge.--41 years, 300 cfs.

Extremes.--Maximum discharge during year, 734 cfs June 18 (gage height, 2.40 ft); minimum, 18 cfs Nov. 21 (gage height, -0.33 ft, result of wind action).
1911-17, 1928-63: Maximum discharge, 2,710 cfs May 23, 1950 (gage height, 4.68 ft); no flow Oct. 25-29, 1955, caused by temporary storage behind new concrete dam at outlet of Vermilion Lake.

Remarks.--Records good except those for period of no gage-height record, which are fair.

Rating table, water year 1962-63 (gage height, in feet, and discharge, in cubic feet per second)

0.1	45	1.5	312
.5	88	2.0	534
1.0	176	3.0	1,100

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	174	71	66	64	60	67	103	381	470	484	339	212
2	174	67	60	64	63	67	134	368	494	457	332	208
3	170	73	71	64	64	67	176	343	509	457	294	203
4	166	50	*60	65	65	68	201	343	534	439	308	201
5	165	73	51	64	64	71	219	347	519	421	294	194
6	161	68	61	64	64	68	232	343	524	390	280	184
7	159	*55	62	63	66	68	241	351	519	385	271	178
8	153	73	64	*63	66	68	*262	343	514	355	271	170
9	149	70	63	62	68	68	271	347	544	347	258	166
10	155	64	61	61	70	70	280	351	584	347	246	161
11	*138	73	60	61	72	74	288	351	574	377	246	157
12	142	64	62	59	*74	82	294	360	594	385	235	159
13	144	64	62	58	74	87	298	351	609	368	224	161
14	140	66	63	58	72	84	302	351	614	347	214	161
15	148	60	63	58	70	82	305	360	604	347	212	142
16	103	59	64	59	71	85	324	*364	609	347	249	133
17	115	60	62	59	71	88	316	360	609	*316	246	134
18	113	60	63	59	71	91	324	343	*624	305	246	129
19	96	68	62	58	71	*91	335	347	624	294	230	133
20	102	73	62	60	68	91	332	377	619	288	227	129
21	96	46	63	59	68	94	324	360	619	284	230	118
22	91	47	63	59	68	96	332	372	619	280	*241	124
23	83	58	66	59	70	90	328	381	589	277	249	125
24	79	58	67	59	70	90	335	385	569	265	252	117
25	79	58	66	59	67	85	343	385	584	265	238	106
26	94	60	67	59	63	85	347	381	564	252	235	106
27	82	60	67	58	61	85	351	394	549	277	224	*100
28	79	60	68	58	65	88	355	426	544	320	230	100
29	79	58	65	58	-	84	339	426	534	347	224	98
30	65	58	65	57	-----	87	343	430	514	355	222	105
31	72	-----	65	57	-----	96	-----	444	-----	335	214	-----
Total	3,766	1,874	1,964	1,865	1,896	2,517	8,634	11,465	16,976	10,713	7,781	4,414
Mean	121	62.5	63.4	60.2	67.7	81.2	288	370	566	346	251	147
Cfsm	0.251	0.129	0.131	0.125	0.140	0.168	0.596	0.766	1.17	0.716	0.520	0.304
In.	0.29	0.14	0.15	0.14	0.15	0.19	0.66	0.88	1.31	0.82	0.60	0.34

Calendar year 1962: Max 1,350 Min 46 Mean 352 Cfsm 0.729 In. 9.87
Water year 1962-63: Max 624 Min 46 Mean 202 Cfsm 0.418 In. 5.67

* Discharge measurement made on this day.

Note.--No gage-height record Jan. 13 to Feb. 11.

5-1294. Rainy Lake at Fort Frances, Ontario

(International gaging station)

Location.--Lat $48^{\circ}37'15''$, long $93^{\circ}21'20''$, on Government dock at Pither's Point in town of Fort Frances.

Records available.--January 1910 to September 1917 and October 1934 to September 1963 in reports of Geological Survey. August 1911 to September 1963 in reports of Water Resources Branch, Department of Northern Affairs and National Resources, Canada. Prior to October 1949, published as "at Ranier, Minn."

Gage.--Water-stage recorder. Auxiliary staff gages read once daily. Datum of gage is at mean sea level (United States and Canadian Boundary Survey). Prior to Jan. 1, 1950, staff gage 3 miles northeast of Ranier, Minn., at same datum. Supplementary gage in town pumping station, half a mile south, used during winter months.

Extremes.--Maximum elevation during year, 1,108.35 ft July 28; minimum, 1,105.15 ft Mar. 29.
1910-17, 1934-63: Maximum elevation observed, 1,112.97 ft July 5, 1950; minimum observed, 1,101.26 ft Apr. 17, 1923, Apr. 2, 1930.

Cooperation.--This station is maintained by Canada under agreement with the United States.

Month-end elevation, in feet, water year October 1962 to September 1963

Oct. 31.....	7.45	Apr. 30.....	5.51
Nov. 30.....	7.10	May 31.....	6.38
Dec. 31.....	7.25	June 30.....	8.13
Jan. 31.....	6.77	July 31.....	8.27
Feb. 28.....	6.22	Aug. 31.....	8.10
Mar. 31.....	5.24	Sept. 30.....	7.61

Note.--Add 1,100 ft to obtain elevation above mean sea level.

LAKE OF THE WOODS BASIN

5-1305. Sturgeon River near Chisholm, Minn.

Location.--Lat 47°40'25", long 92°54'00", in NE¼ sec.20, T.60 N., R.20 W., on left bank 1,000 ft upstream from highway bridge, 0.6 mile downstream from East Branch Sturgeon River, and 11½ miles north of Chisholm.

Drainage area.--187 sq mi.

Records available.--August 1942 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,306.7 ft above mean sea level, datum of 1929. Prior to Aug. 24, 1944, staff gage at site 1,000 ft downstream at different datum.

Average discharge.--21 years, 117 cfs.

Extremes.--Maximum discharge during year, 668 cfs Apr. 3 (gage height, 3.23 ft); minimum daily, 7.2 cfs Feb. 1-2; minimum gage height, 0.08 ft Jan. 28 to Feb. 1.

1942-63: Maximum discharge, 3,630 cfs May 7, 1950 (gage height, 6.41 ft) from rating curve extended above 1,600 cfs on basis of slope-area measurement of peak flow; minimum daily, 6.0 cfs Feb. 18-27, 1944; minimum gage height, that of Jan. 28 to Feb. 1, 1963.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

0.0	7.5	0.6	26	2.0	225
.1	8.8	.9	44	2.5	383
.2	11	1.2	72	3.0	585
.3	14	1.6	134	4.0	1,120

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	60	53	54	28	7.2	9.4	562	146	218	69	80	60
2	59	51	54	28	7.2	9.3	590	138	290	66	70	56
3	57	52	55	28	7.3	9.2	643	140	352	61	64	55
4	56	51	*61	28	7.4	9.1	628	136	345	56	57	51
5	56	49	59	28	7.5	9.0	623	128	307	51	51	50
6	54	*42	51	28	7.8	8.8	535	123	257	51	47	49
7	53	40	48	28	8.0	8.7	442	121	218	52	45	48
8	54	40	41	*28	8.3	8.6	*369	121	193	50	43	46
9	55	39	37	28	8.7	8.5	314	115	260	48	41	43
10	*55	39	33	27	9.1	8.4	260	123	408	45	37	42
11	55	40	30	25	*9.1	8.3	228	130	427	46	36	42
12	54	42	28	21	9.2	8.2	205	124	397	63	50	43
13	54	46	27	19	9.4	8.1	186	142	348	80	70	42
14	55	50	27	18	9.4	8.0	174	174	283	84	67	42
15	57	53	28	14	9.7	8.0	163	*190	238	76	59	41
16	59	55	29	12	10	7.9	167	190	208	*70	90	40
17	57	57	31	11	10	7.9	176	186	*183	67	113	40
18	57	57	32	10	10	*8.0	176	181	163	65	104	43
19	56	54	34	9.5	10	8.2	176	176	154	61	89	46
20	55	51	32	9.1	10	8.4	178	169	148	58	76	44
21	56	45	30	8.7	10	8.8	174	172	138	54	*66	44
22	57	41	30	8.5	10	9.2	163	181	124	50	71	44
23	58	42	29	8.3	10	10	152	176	112	46	86	43
24	59	44	29	8.1	10	12	142	161	101	42	82	43
25	57	46	28	7.9	9.8	15	136	146	97	41	71	45
26	56	47	28	7.8	9.7	21	136	132	103	43	65	46
27	55	51	29	7.7	9.6	43	138	172	98	62	62	*43
28	57	53	29	7.6	9.5	82	134	268	88	100	63	43
29	57	53	29	7.5	-	183	136	287	79	110	65	44
30	55	53	28	7.4	-----	317	144	266	70	103	65	44
31	54	-----	28	7.3	-----	427	-----	235	-----	91	64	-----
Total	1,739	1,436	1,108	514.4	253.9	1,298.0	8,250	5,149	6,407	1,961	2,049	1,362
Mean	56.1	47.9	35.7	16.6	9.07	41.9	275	166	214	63.3	66.1	45.4
Cfsm	0.300	0.256	0.191	0.089	0.049	0.224	1.47	0.888	1.14	0.339	0.353	0.243
In.	0.35	0.29	0.22	0.10	0.05	0.26	1.64	1.02	1.27	0.39	0.41	0.27

Calendar year 1962: Max 793 Min 14 Mean 121 Cfsm 0.647 In. 8.79
 Water year 1962-63: Max 643 Min 7.2 Mean 86.4 Cfsm 0.462 In. 6.27

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-3	1900	3.23	668				

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 6-14, 19-21, 23, 24, Dec. 7-11, 13, 15, 16, Dec. 22 to Jan. 5, Jan. 12, 13, Jan. 19 to Mar. 26.

5-1315. Little Fork River at Little Fork, Minn.

Location.--Lat $48^{\circ}24'$, long $93^{\circ}34'$, in NW $\frac{1}{4}$ sec. 9, T. 68 N., R. 25 W., on left bank 100 ft downstream from bridge on State Highway 65 at town of Little Fork and $1\frac{1}{2}$ miles upstream from Beaver Creek, and 18 miles upstream from mouth.

Drainage area.--1,730 sq mi, approximately.

Records available.--June to November 1909, April to November 1910, April 1911 to June 1917, September 1917, October 1917 to March 1919 (gage heights only), June 1928 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,073.06 ft above mean sea level, datum of 1929. June 23, 1909, to Mar. 4, 1917, staff gage at same site and datum. Mar. 5 to Sept. 30, 1917, June 22, 1928, to June 21, 1936, chain gage and June 22, 1936, to July 20, 1937, wire-weight gage, at site 100 ft upstream at same datum.

Average discharge.--40 years (1911-16, 1928-63), 965 cfs.

Extremes.--Maximum discharge during year, 8,790 cfs Apr. 4 (gage height, 24.94 ft, backwater from ice); minimum daily, 15 cfs Feb. 9-22; minimum gage height, 5.54 ft Feb. 3.

1909-17, 1928-63: Maximum discharge, 25,000 cfs Apr. 18, 1916, May 11, 1950 (gage height, 37.00 ft); minimum observed, 21 cfs Aug. 26, 27, 1936.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect or backwater from Rainy River (gage height, in feet, and discharge, in cubic feet per second)

5.5	170	9.0	1,200
6.0	265	12.0	2,600
7.0	528	16.0	4,820
		22.0	9,120

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	537	339	305	118	24	20	600	1,290	3,890	855	1,780	628
2	510	336	312	115	22	21	1,700	1,270	4,470	782	1,450	573
3	484	329	320	113	20	21	3,450	1,240	4,460	754	1,170	525
4	463	329	310	112	19	22	7,600	1,200	4,780	696	957	478
5	449	290	285	111	18	22	6,700	1,150	4,610	619	784	434
6	415	275	*263	111	17	23	5,300	1,100	4,000	585	684	401
7	396	*315	252	111	16	24	4,580	1,050	3,270	561	555	364
8	390	310	235	111	16	25	*3,610	1,040	2,710	498	481	336
9	380	310	220	*109	15	27	3,000	1,040	2,300	454	423	310
10	377	315	210	107	15	28	2,550	1,040	2,110	423	385	289
11	*369	320	208	105	15	30	2,150	1,020	3,220	537	352	276
12	364	320	205	99	15	32	1,840	971	4,650	858	327	269
13	354	317	200	93	*15	35	1,630	975	4,560	894	327	265
14	352	327	200	89	15	39	1,470	1,160	4,000	854	354	285
15	352	327	200	85	15	43	1,360	1,620	3,360	822	349	296
16	352	320	200	80	15	47	1,290	*1,890	2,800	780	384	312
17	354	311	200	76	15	52	1,370	1,900	2,340	749	538	305
18	352	300	200	70	15	57	1,470	1,800	*2,000	*650	714	*317
19	352	285	195	68	15	*62	1,480	1,630	1,770	693	1,030	298
20	352	272	188	63	15	67	1,520	1,490	1,720	752	1,050	283
21	346	263	180	59	15	70	1,530	1,440	1,710	527	920	294
22	350	254	175	55	15	72	1,500	1,460	1,650	515	*784	329
23	346	250	170	50	16	76	1,430	1,490	1,520	446	740	327
24	352	270	160	46	16	81	1,330	1,430	1,370	406	743	310
25	344	300	155	44	16	88	1,220	1,310	1,200	375	784	301
26	342	340	150	40	17	100	1,190	1,180	1,110	350	774	289
27	336	367	145	37	18	115	1,170	1,230	1,100	350	706	274
28	354	329	138	34	19	135	1,150	3,460	1,050	483	672	269
29	354	312	130	32	-	160	1,190	4,300	1,000	1,070	659	265
30	352	308	125	30	-----	195	1,280	4,120	930	1,720	641	257
31	344	-----	122	27	-----	275	-----	3,740	-----	1,960	644	-----
Total	11,774	9,240	6,358	2,400	464	2,064	67,660	51,036	79,660	22,018	22,161	10,159
Mean	380	308	205	77.4	16.6	66.6	2,255	1,646	2,655	710	715	339
Cfsm	0.220	0.178	0.118	0.045	0.0096	0.039	1.30	0.951	1.53	0.410	0.413	0.196
In.	0.25	0.20	0.14	0.05	0.01	0.04	1.45	1.10	1.71	0.47	0.48	0.22

Calendar year 1962: Max 13,400 Min 57 Mean 1,524 Cfsm 0.881 In. 11.95
 Water year 1962-63: Max 7,600 Min 15 Mean 781 Cfsm 0.451 In. 6.12

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 5, 6, 8-11, 16-26, Dec. 4 to Apr. 3. Backwater from Rainy River June 19 to July 3, July 21-30, Aug. 16-18.

5-1320. Big Fork River at Big Falls, Minn.

Location.--Lat 48°12', long 93°48', in sec.35, T.155 N., R.25 W., on left bank at village of Big Falls, 700 ft downstream from falls, 0.3 mile downstream from bridge on U.S. Highway 71, and 4¼ miles upstream from Sturgeon River.

Drainage area.--1,460 sq mi, approximately.

Records available.--August to November 1909, April to November 1910, April 1911 to September 1912 (gage heights and discharge measurements only), June 1928 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,144.71 ft above mean sea level, datum of 1929. Prior to June 10, 1911, staff gage at railroad bridge about 0.4 mile upstream at different datum. June 10, 1911, to Dec. 17, 1937, staff gage or chain gage at site 200 ft upstream at same datum.

Average discharge.--35 years (1928-1963), 638 cfs.

Extremes.--Maximum discharge during year, 3,840 cfs June 3 (gage height, 7.61 ft); maximum gage height, 8.06 ft Apr. 4 (backwater from ice); minimum daily, 45 cfs Feb. 18-24; minimum gage height, 2.81 ft Sept. 26. 1909-12, 1928-63: Maximum discharge, 14,800 cfs May 8, 9, 1950; maximum gage height, 17.08 ft May 8, 1950; minimum discharge recorded, 7 cfs Aug. 7, 1939.

Remarks.--Records good except those for periods of ice effect, which are fair. Some diurnal fluctuation at low flow caused by powerplant a quarter of a mile upstream.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.0	134	5.0	1,340
3.5	349	6.0	2,190
4.0	635	8.0	4,270

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	596	558	503	178	70	47	190	1,170	3,410	515	394	364
2	590	552	469	173	67	48	380	1,130	3,680	475	344	340
3	583	527	469	173	62	48	750	1,100	3,810	452	307	311
4	576	521	469	173	60	49	1,740	1,080	3,590	415	270	297
5	576	460	452	172	58	50	3,200	1,030	3,110	374	243	274
6	576	450	*425	172	56	50	3,000	963	2,560	349	218	256
7	570	470	390	171	55	51	*2,690	907	2,120	326	197	235
8	570	460	290	170	55	51	2,200	921	1,800	311	185	227
9	576	440	268	*168	54	52	1,890	942	1,580	311	172	206
10	596	455	252	163	51	52	1,760	914	1,560	297	164	218
11	602	510	240	155	50	52	1,650	872	1,680	316	157	201
12	*609	527	238	148	49	53	1,530	844	1,690	364	157	248
13	609	503	235	140	49	54	1,400	851	1,580	431	185	311
14	602	*498	234	130	48	55	1,300	956	1,440	452	214	284
15	602	498	232	122	*47	56	1,200	1,090	1,310	480	201	270
16	602	498	232	118	46	56	1,160	1,170	1,200	447	206	265
17	602	490	235	112	46	57	1,220	*1,170	1,090	404	279	252
18	609	460	232	107	45	58	1,320	1,110	998	*354	302	252
19	622	470	230	104	45	59	1,390	1,050	*1,100	344	284	*248
20	616	440	225	101	45	*61	1,330	1,000	1,250	311	252	239
21	609	400	220	97	45	62	1,250	977	1,150	288	235	239
22	602	320	215	94	45	65	1,190	970	1,020	265	*218	231
23	602	260	210	92	45	67	1,120	956	900	243	261	231
24	602	245	208	88	45	70	1,030	907	798	222	307	222
25	602	300	200	86	46	72	998	851	720	210	293	218
26	596	360	198	84	46	74	1,030	804	746	185	265	210
27	583	465	192	80	46	85	1,050	1,120	746	218	256	210
28	564	515	188	78	47	93	1,050	2,820	674	458	265	210
29	558	527	183	76	-	105	1,080	3,570	622	515	344	210
30	558	533	180	74	-----	130	1,140	3,760	564	458	364	210
31	558	-----	179	73	-----	165	-----	3,440	-----	404	369	-----
Total	18,318	13,712	8,493	3,872	1,423	2,047	42,238	40,445	48,498	11,194	7,908	7,489
Mean	591	457	274	125	50.8	66.0	1,408	1,305	1,617	361	255	250
Cfsm	0.405	0.313	0.188	0.086	0.035	0.045	0.964	0.894	1.11	0.247	0.175	0.171
In.	0.47	0.35	0.22	0.10	0.04	0.05	1.08	1.03	1.24	0.29	0.20	0.19

Calendar year 1962: Max 9,410 Min 60 Mean 1,124 Cfsm 0.770 In. 10.45

Water year 1962-63: Max 3,810 Min 45 Mean 563 Cfsm 0.386 In. 5.26

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 5-11.17-27, Dec. 5 to Apr. 6.

LAKE OF THE WOODS BASIN

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5-1335. Rainy River at Manitou Rapids, Minn.

(International gaging station)

Location.-- Lat 48°38'04", long 93°54'47", in sec.36, T.160 N., R.26 W., on left bank at Manitou Rapids, 3½ miles east of Manitou Post Office and 4 miles west of Indus.

Drainage area.--19,400 sq mi, approximately.

Records available.--July 1928 to September 1963. Monthly discharge only for some periods, published in WSP 1308. October 1911 to October 1924 (gage heights only) at site near Birchdale in files of Corps of Engineers. Published as "near Birchdale" 1932-34.

Gage.--Water-stage recorder. Datum of gage is 1,062.48 ft above mean sea level, datum of 1929. Prior to Nov. 10, 1934, chain gage at site near Birchdale 7 miles downstream at different datum.

Average discharge.--35 years, 11,810 cfs.

Extremes.--Maximum discharge during year, 29,500 cfs June 28 (gage height, 11.88 ft); minimum daily discharge, 4,100 cfs Dec. 26; minimum gage height, 2.13 ft Dec. 26.
1928-63: Maximum discharge, 71,600 cfs May 12, 1950 (gage height, 21.04 ft); minimum daily, 928 cfs Dec. 26, 1929.

Remarks.--Records good. Diurnal fluctuation caused by powerplant at International Falls. Some regulation at low and medium flows by Rainy and Namakan Lakes.

Cooperation.--This station is maintained by the United States under agreement with Canada.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

2.5	4,830	5.0	9,660
3.0	5,620	7.0	14,700
4.0	7,500	10.0	23,300

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11,300	9,960	8,900	6,800	8,500	8,700	6,800	10,500	17,800	28,700	25,100	12,000
2	11,800	10,100	8,230	7,200	8,850	8,600	8,800	11,000	17,800	28,300	24,900	10,400
3	11,800	9,730	5,540	8,000	8,800	8,600	12,000	11,200	16,200	27,600	24,500	9,660
4	11,700	9,150	7,440	9,000	7,950	8,600	16,000	10,400	18,500	24,400	23,900	11,000
5	11,700	5,490	8,640	9,000	8,100	8,600	21,000	9,410	19,900	23,500	22,600	11,600
6	11,600	7,760	8,770	7,600	8,450	9,200	20,600	7,120	19,900	22,600	22,500	11,600
7	11,300	9,110	8,790	7,000	8,550	9,500	*18,300	8,100	18,800	22,300	20,600	11,600
8	9,910	*9,340	8,710	8,400	8,700	9,600	12,500	8,770	17,800	21,600	17,800	11,300
9	10,600	9,180	8,060	8,800	8,750	9,500	13,600	9,150	16,300	20,800	17,800	8,380
10	11,300	9,080	6,750	*9,000	8,650	9,300	13,400	9,430	13,700	16,600	17,800	9,820
11	11,100	6,900	5,200	9,000	7,500	9,000	12,900	9,040	15,600	14,800	17,500	10,900
12	11,000	4,830	8,500	9,000	8,050	9,500	12,300	8,950	21,400	15,900	16,700	13,800
13	10,700	5,620	8,600	8,800	8,600	9,600	11,900	6,840	24,200	19,000	17,200	11,100
14	10,400	7,980	8,600	7,600	8,600	9,600	9,890	8,860	25,000	20,200	17,500	11,000
15	8,820	9,410	8,500	8,200	8,600	9,600	7,640	10,000	24,800	19,600	17,500	10,900
16	9,130	9,540	8,350	8,700	8,300	9,700	7,560	10,400	23,900	19,800	17,800	9,960
17	10,300	9,730	4,800	8,700	8,000	9,700	10,000	10,900	21,800	19,700	18,300	10,400
18	10,300	9,040	6,900	8,700	5,500	9,500	11,400	11,100	21,300	19,400	18,400	11,400
19	10,100	5,320	8,290	8,700	6,500	9,400	11,400	10,400	*22,200	19,200	17,400	11,600
20	10,000	7,200	8,350	8,200	8,000	9,500	10,800	7,880	23,200	19,400	17,100	11,600
21	9,840	9,360	8,200	7,600	8,400	9,400	10,300	9,410	27,400	19,300	13,700	11,300
22	6,160	9,200	8,100	7,150	8,600	9,400	7,700	10,200	29,100	18,100	12,300	10,200
23	7,700	7,160	6,400	8,000	8,600	9,500	8,380	10,200	28,800	18,600	*11,900	7,440
24	9,150	8,200	4,600	8,500	8,500	9,400	9,940	10,200	28,200	18,500	12,100	8,510
25	9,800	8,460	4,200	8,700	7,800	7,600	10,000	9,820	27,900	18,300	12,000	10,100
26	9,980	5,220	4,100	8,800	8,300	7,900	9,890	9,340	28,100	18,300	10,200	10,600
27	9,840	7,160	6,600	8,450	8,700	7,800	10,200	6,880	29,100	18,100	10,700	10,600
28	9,450	8,770	8,350	7,000	8,700	7,400	10,400	9,380	29,400	18,500	11,800	10,500
29	6,010	9,110	8,550	7,800	-	7,400	7,340	13,600	29,300	19,200	12,100	9,800
30	7,820	9,110	8,500	8,400	-----	7,400	8,970	15,800	29,100	23,100	12,300	6,450
31	9,500	-----	7,400	8,400	-----	7,500	-----	16,500	-----	24,900	12,300	-----
Total	310,110	246,220	230,920	255,200	230,550	276,000	341,910	310,780	686,500	638,300	524,300	315,520
Mean	10,000	8,207	7,449	8,232	8,234	8,903	11,400	10,030	22,880	20,590	16,910	10,520
Cfsm	0.515	0.423	0.384	0.424	0.424	0.459	0.588	0.517	1.18	1.06	0.872	0.542
In.	0.59	0.47	0.44	0.49	0.44	0.53	0.66	0.60	1.32	1.22	1.01	0.60

Calendar year 1962: Max 54,800 Min 4,100 Mean 17,240 Cfsm 0.889 In. 12.05
Water year 1962-63: Max 21,000 Min 4,100 Mean 11,960 Cfsm 0.616 In. 8.37

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 30. No gage-height record Mar. 31 to Apr. 5.

LAKE OF THE WOODS BASIN

5-1342. Rapid River near Baudette, Minn.

Location.--Lat 48°32'10", long 94°33'45", in NE¼ sec.1, T.158 N., R.31 W., on left bank 75 ft upstream from bridge on State Highway 72, 1.2 miles downstream from North Branch Rapid River, and 12 miles south of Baudette.

Drainage area.--543 sq mi.

Records available.--October 1956 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,093.92 ft above mean sea level, datum of 1929 (Minnesota Highway Department bench mark).

Average discharge.--7 years, 251 cfs.

Extremes.--Maximum discharge during year, 1,740 cfs June 5 (gage height, 8.49 ft); minimum daily, 3.4 cfs Feb. 8-12, Feb. 27 to Mar. 3; minimum gage height, 1.62 ft Sept. 16.

1956-63: Maximum discharge, 5,750 cfs May 24, 1962 (gage height, 17.13 ft); minimum, 0.1 cfs Aug. 13, 1961 (gage height, 1.18 ft).

Remarks.--Records good except those for period of ice effect, which are fair.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.6	7.2	3.5	240
1.8	14	4.0	368
2.0	23	5.0	648
2.3	47	6.0	944
2.6	80	8.0	1,580
3.0	139	9.0	1,920

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	299	174	264	25	6.1	3.4	540	561	1,070	596	155	30
2	284	172	276	24	5.8	3.4	640	516	1,380	467	141	28
3	269	172	279	24	5.5	3.4	732	477	1,340	368	125	24
4	257	159	282	23	5.2	3.5	767	436	1,600	305	108	21
5	245	137	213	23	5.0	3.5	1,080	392	1,730	252	91	20
6	240	160	146	23	4.9	3.5	1,100	354	1,610	222	77	19
7	233	161	155	23	4.7	3.5	*974	336	1,410	192	70	17
8	233	*190	155	22	4.6	3.4	1,010	344	1,180	170	62	16
9	247	200	142	22	4.5	3.4	1,140	336	1,000	150	56	15
10	264	188	112	*21	4.3	3.4	1,080	382	1,160	125	51	15
11	262	209	95	19	4.2	3.4	962	414	1,190	176	42	12
12	252	204	85	18	4.1	3.4	872	395	1,090	1,060	38	10
13	*240	222	74	16	4.1	3.5	785	449	971	1,290	40	9.7
14	235	235	67	15	*4.0	3.6	706	587	878	1,110	40	8.6
15	235	242	64	14	4.0	3.6	648	576	776	923	38	8.3
16	233	247	64	13	3.9	3.7	830	573	689	752	51	8.0
17	222	213	60	12	3.9	3.7	1,200	*779	604	602	53	8.3
18	217	204	59	11	3.8	3.7	1,140	848	567	499	55	*22
19	204	222	58	10	3.7	3.7	1,040	896	*905	*441	52	29
20	204	217	55	9.6	3.7	3.8	959	887	1,030	480	44	33
21	190	206	52	9.1	3.7	*3.8	857	899	848	455	37	26
22	200	143	47	8.6	3.6	3.9	764	893	694	382	33	24
23	217	162	43	8.3	3.6	4.0	686	818	584	305	*30	22
24	217	175	40	8.0	3.5	4.4	622	738	488	247	29	21
25	202	185	37	7.6	3.5	5.0	584	677	527	213	28	20
26	192	188	35	7.3	3.5	6.0	561	610	1,040	182	27	20
27	188	190	32	7.0	3.4	15	547	590	1,110	172	25	19
28	188	196	30	6.7	3.4	35	530	614	965	165	25	19
29	188	226	28	6.5	-	80	564	581	839	170	25	19
30	184	252	27	6.3	-----	220	590	539	718	157	33	19
31	178	-----	26	6.2	-----	400	-----	519	-----	165	33	-----
Total	7,019	5,851	3,102	449.2	118.2	847.6	24,510	18,016	29,993	12,793	1,714	562.9
Mean	226	195	100	14.5	4.22	27.3	817	581	1,000	413	55.3	18.8
Cfsm	0.416	0.359	0.184	0.027	0.0078	0.050	1.50	1.07	1.84	0.761	0.102	0.035
In.	0.48	0.40	0.21	0.03	0.008	0.06	1.68	1.23	2.05	0.88	0.12	0.04

Calendar year 1962: Max 5,630 Min 6.0 Mean 632 Cfsm 1.16 In. 15.79
 Water year 1962-63: Max 1,730 Min 3.4 Mean 288 Cfsm 0.530 In. 7.26

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 5, 23-27, Dec. 7 to Apr. 2.

5-1395. Warroad River near Warroad, Minn.

Location.--Lat 48°52'00", long 95°21'20", in SE¼NE¼ sec.12, T.162 N., R.37 W., on upstream handrail of bridge near center of span, half a mile upstream from Bulldog Run and 2½ miles south of Warroad.

Drainage area.--110 sq mi, approximately.

Records available.--March 1946 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Chain gage read once daily. Datum of gage is 1,070.74 ft above mean sea level, datum of 1929 (levels by Stanley Johnson, consulting engineer and instructor at University of North Dakota).

Average discharge.--17 years, 35.1 cfs.

Extremes.--Maximum discharge during year, 507 cfs Apr. 10 (gage height, 7.58 ft); maximum gage height, 7.74 ft Apr. 5 (backwater from ice); minimum daily discharge, 0.1 cfs Sept. 11.
1946-63: Maximum discharge, 1,460 cfs Aug. 7, 1962 (gage height, 9.61 ft, from flood mark); no flow Mar. 28, 1947, Aug. 20-29, 1953, Sept. 11-16, 19-22, 1960, June 25 to Sept. 2, 1961.

Remarks.--Records good except those for periods of shifting control, which are fair, and those for period of ice effect, which are poor.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.7	0.1	2.4	5.4	5.0	132
1.8	.3	2.7	12	6.0	211
1.9	.7	3.0	21	7.0	348
2.0	1.2	3.5	43	8.0	670
2.2	2.9	4.0	72		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	11	40	1.6	0.8	0.9	65	57	121	92	59	1.3
2	16	11	38	1.4	.8	.9	70	53	148	65	81	1.4
3	15	11	38	1.4	.8	.9	75	48	202	48	68	1.5
4	17	11	34	1.6	.8	.9	*130	42	281	33	43	1.8
5	15	9.9	32	1.6	.8	.9	350	36	270	28	25	1.5
6	14	9.5	28	1.4	.8	.9	323	32	214	23	20	1.0
7	15	9.9	26	1.6	.8	.9	380	31	156	19	17	1.1
8	14	11	25	1.4	.8	.9	494	31	113	16	13	1.2
9	13	13	18	1.2	.8	1.0	497	30	95	13	12	1.4
10	13	13	12	1.2	.8	1.2	487	29	100	12	10	.3
11	13	13	11	1.0	.8	1.4	*375	34	125	11	7.3	.1
12	13	14	10	.8	.8	1.2	305	33	146	11	6.5	.3
13	12	13	8.0	.8	.8	1.4	254	42	150	12	6.4	.5
14	14	12	8.0	.8	.8	1.4	207	52	143	11	6.5	.5
15	13	11	7.5	.8	.8	1.4	165	80	127	13	6.7	.5
16	12	11	7.0	.8	.9	1.2	153	79	115	12	8.1	.6
17	12	11	6.5	.8	.9	1.4	148	81	97	13	6.7	.5
18	12	11	5.0	.8	.9	1.2	168	105	80	15	5.4	.5
19	12	11	4.8	.8	.9	1.5	164	116	78	18	6.7	.4
20	12	12	*4.8	.8	.9	1.5	142	135	95	20	6.5	.4
21	11	12	4.0	.8	.9	2.0	124	143	89	18	4.3	.4
22	12	13	3.6	.8	.9	3.0	107	143	77	17	3.1	.5
23	10	14	3.6	.8	.9	5.0	87	139	67	16	2.8	.5
24	11	14	3.0	.6	.9	25	*79	124	67	17	2.7	.5
25	13	14	2.5	.6	.9	20	73	107	101	16	2.4	.5
26	12	*14	2.5	.6	*.9	*60	70	90	*187	13	1.8	*.5
27	11	16	2.0	.6	.9	100	64	79	263	12	1.8	.6
28	12	20	2.0	.6	.9	90	58	73	280	12	*2.0	.6
29	12	28	1.8	.8	-	85	60	*69	163	12	1.2	.5
30	11	40	1.6	.8	-----	70	63	58	122	14	1.3	.5
31	*11	-----	1.4	*.8	-----	70	-----	56	-----	*17	1.2	-----
Total	401	414.3	391.6	30.4	23.7	553.0	5,737	2,227	4,272	649	439.4	21.9
Mean	12.9	13.8	12.6	0.98	0.85	17.8	191	71.8	142	20.9	14.2	0.73
Cfsm	0.117	0.125	0.115	0.009	0.008	0.162	1.74	0.653	1.29	0.190	0.129	0.007
In.	0.14	0.14	0.13	0.01	0.01	0.19	1.94	0.75	1.44	0.22	0.15	0.01

Calendar year 1962: Max 1,270 Min 1.4 Mean 76.6 Cfsm 0.696 In. 9.45
Water year 1962-63: Max 497 Min 0.1 Mean 41.5 Cfsm 0.379 In. 5.13

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 14 to Apr. 5. Shifting-control method used Oct. 1 to Nov.13, July 6 to Sept. 30.

UPPER MISSISSIPPI RIVER BASIN

MISSISSIPPI RIVER MAIN STEM

5-2010: Winnibigoshish Lake near Deer River, Minn.

Location.--Lat 47°25'42", long 94°03'00", in sec.25, T.146 N., R.27 W., at dam on Mississippi River, 1 mile northwest of Little Winnibigoshish Lake and 14 miles northwest of town of Deer River.

Drainage area.--1,442 sq mi.

Records available.--April 1884 to September 1963. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,289.47 ft above mean sea level, adjustment of 1912. Prior to July 8, 1949, staff gage at same site and datum.

Extremes.--Maximum contents during year, 578,010 acre-ft July 28 (gage height, 10.18 ft); minimum, 422,960 acre-ft Feb. 28 to Mar. 3 (gage height, 7.83 ft).

1884-1963: Maximum contents observed, 996,500 acre-ft July 30, 1905 (gage height, 14.45 ft); minimum observed, 33,680 acre-ft below zero of capacity table Oct. 20, 1931 (gage height, -0.69 ft).

Remarks.--Reservoir is formed by Winnibigoshish Lake and several other natural lakes controlled by a concrete and timber dam, completed in 1884; storage began in 1884. Capacity (revised) between gage heights 6.00 ft and 14.2 ft (maximum allowable range) is 653,570 acre-ft, of which 416,270 acre-ft is controlled storage between gage heights 6.00 ft and 12.0 ft (normal operating range). Contents shown herein are contents above gage height 0.00 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents. water year October 1962 to September 1963

	Gage height (feet)†	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	10.04	568,200	-
Oct. 31.....	9.46	529,610	-38,590
Nov. 30.....	8.99	498,740	-30,870
Dec. 31.....	8.46	463,950	-34,790
Calendar year 1962.....	-	-	-45,290
Jan. 31.....	7.93	429,160	-34,790
Feb. 28.....	7.83	422,960	- 6,200
Mar. 31.....	8.02	435,070	+12,110
Apr. 30.....	8.60	473,140	+38,070
May 31.....	9.24	515,150	+42,010
June 30.....	10.00	565,390	+50,240
July 31.....	10.02	566,800	+ 1,410
Aug. 31.....	9.41	526,310	-40,490
Sept. 30.....	9.19	511,870	-14,440
Water year 1962-63.....	-	-	-56,330

† Gage height at 2400

5-2015. Mississippi River at Winnibigoshish Dam near Deer River, Minn.

Location.--Lat. 47°25'42", long 94°03'00", in SW¼ sec. 25, T.146 N., R.27 W., at dam 1 mile northwest of Little Winnibigoshish Lake and 14 miles northwest of town of Deer River.

Drainage area.--1,442 sq mi.

Records available.--May 1884 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder on headwater and staff gage on tailwater, read twice daily. Datum of gage is 1,289.47 ft above mean sea level, adjustment of 1912. Prior to July 8, 1949, staff headwater gage at same site and datum.

Average discharge.--79 years, 501 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,300 cfs Oct. 4; minimum daily, 46 cfs Sept. 14.
1884-63: Maximum daily discharge, 4,370 cfs Aug. 6, 1905; no flow at times in several years.

Remarks.--Daily discharge is computed on the basis of modified weir formula and corrected to conform with discharge measurements, the head being determined from readings of headwater and tailwater gages. Flow completely regulated by Winnibigoshish Lake (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; four discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	492	949	863	839	623	481	111	98	124	196	431	260
2	769	950	871	836	518	481	139	99	133	208	508	254
3	1,030	976	847	824	513	481	129	106	136	192	642	244
4	1,300	992	909	868	506	484	133	106	106	192	701	189
5	1,110	992	931	899	504	484	112	104	116	192	853	112
6	988	937	864	880	504	484	127	106	117	191	801	71
7	981	1,010	853	875	501	484	127	107	107	189	794	50
8	984	971	857	868	499	487	134	113	117	189	772	49
9	1,030	949	848	865	496	487	*116	113	122	190	760	49
10	1,000	937	836	854	499	487	118	113	129	190	784	49
11	1,000	917	831	847	502	489	121	114	135	185	767	49
12	992	928	837	803	499	493	112	92	138	195	762	49
13	976	920	873	792	499	496	115	122	144	199	750	47
14	969	912	867	786	499	493	115	134	144	206	728	46
15	976	912	921	770	493	493	117	107	150	191	713	47
16	1,090	912	909	765	496	493	120	109	155	185	692	47
17	979	903	902	759	496	496	148	114	153	189	701	47
18	*960	900	893	*770	496	496	129	142	153	194	689	48
19	965	888	891	780	496	496	119	139	166	191	680	48
20	931	874	879	774	502	502	131	125	*164	190	668	51
21	943	949	870	765	496	496	137	107	162	189	591	105
22	943	931	898	761	493	493	122	108	157	187	561	145
23	965	860	905	758	489	493	117	99	160	183	541	186
24	958	851	890	748	489	493	113	99	164	181	471	223
25	956	843	883	740	489	496	118	100	164	178	466	259
26	971	835	866	727	487	260	120	100	185	181	415	253
27	982	845	863	722	487	104	118	114	184	194	410	255
28	990	881	851	716	484	104	118	123	184	235	399	255
29	979	885	880	740	-	107	132	129	184	224	357	257
30	990	875	859	730	-----	108	121	120	191	247	279	251
31	966	-----	851	721	-----	108	-----	122	-----	337	264	-----
Total	30,165	27,484	27,098	24,582	14,055	13,049	3,689	3,484	4,444	6,190	18,950	3,995
Mean	973	916	874	793	502	421	123	112	148	200	611	133
(Δ)	-628	-519	-566	-566	-112	+197	+640	+683	+844	+22.9	-658	-243
Mean Δ	345	397	308	227	390	618	763	795	992	223	-47.0	-110
Cfsm Δ	0.239	0.275	0.214	0.157	0.270	0.429	0.529	0.551	0.688	0.155	0.033	0.076
Ins. Δ	0.28	0.31	0.25	0.18	0.28	0.49	0.59	0.64	0.77	0.18	0.04	0.08

Calendar year 1962: Max 2,250 Min 101 Mean 930 Mean Δ 868 Cfsm Δ 0.602 In. Δ 8.18
Water year 1962-63: Max 1,300 Min 46 Mean 485 Mean Δ 407 Cfsm Δ 0.282 In. Δ 4.09

* Discharge measurement made on this day.

Δ Change in contents, equivalent in cubic feet per second, in Winnibigoshish Lake.

Δ Adjusted for change in contents.

LEECH LAKE RIVER BASIN

5-2060. Leech Lake at Federal Dam, Minn.

Location.--Lat 47°12'23", long 94°18'31", in lot 2, sec.14, T.143 N., R.29 W., at head of Leech Lake River on Waboose Bay, 5 miles southwest of town of Federal Dam.

Drainage area.--1,163 sq mi.

Records available.--April 1884 to September 1963. Month-end contents only for some periods, published in WSP 1308. Prior to October 1956, published as "Leech Lake Reservoir."

Gage.--Water-stage recorder. Datum of gage is 1,293.23 ft above mean sea level, adjustment of 1912. Prior to Dec. 31, 1884, staff gage half a mile north of outlet to Leech Lake River at datum 5.76 ft lower. Dec. 31, 1884, to May 24, 1931, staff gage half a mile north of outlet to Leech Lake River at present datum.

Extremes.--Maximum contents during year, 398,760 acre-ft Oct. 15 (gage height, 2.91 ft); minimum, 124,500 acre-ft Mar. 26 (gage height, 0.66 ft).

1884-1963: Maximum contents observed, 734,300 acre-ft June 30, 1916 (gage height, 5.18 ft); minimum observed, 72,830 acre-ft below zero of capacity table Sept. 30, Nov. 19, 1934, Jan. 9, 1935 (gage height, -1.18 ft).

Remarks.--Reservoir is formed by Leech Lake and several other natural lakes controlled by concrete and timber dam; storage began in 1884; original timber structure completed in 1884, replaced by present dam in 1902. Capacity (revised) between gage heights 0.00 ft and 5.24 ft (maximum allowable range) is 689,780 acre-ft, of which 356,570 acre-ft is controlled storage between gage heights 0.00 ft and 3.00 ft (normal operating range). Contents shown herein are contents above gage height -0.50 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1962 to September 1963

	Gage height (feet) [/]	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	2.79	383,580	-
Oct. 31.....	2.32	324,160	-59,420
Nov. 30.....	1.90	271,060	-53,100
Dec. 31.....	1.50	220,500	-50,560
Calendar year 1962.....	-	-	+24,020
Jan. 31.....	1.12	174,570	-45,930
Feb. 28.....	0.79	138,660	-35,910
Mar. 31.....	0.72	131,050	- 7,610
Apr. 30.....	1.13	175,660	+44,610
May 31.....	1.35	201,520	+25,860
June 30.....	1.66	240,710	+39,190
July 31.....	1.64	238,200	- 2,510
Aug. 31.....	1.58	230,620	- 7,580
Sept. 30.....	1.43	211,640	-18,980
Water year 1962-63.....	-	-	-171,940

[/] Gage height at 2400.

5-2065. Leech Lake River at Federal Dam, Minn.

Location.--Lat 47°14'45", long 94°13'12", in sec.29, T.144 N., R.28 W., on right bank at dam on Leech Lake River at town of Federal Dam, 2 miles downstream from natural outlet of Leech Lake.

Drainage area.--1,163 sq mi.

Records available.--May 1884 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder, headwater gage, and staff tailwater gage, read twice daily. Datum of gage is 1,293.23 ft above mean sea level, adjustment of 1912. Prior to July 3, 1948, staff headwater gage at same datum. May 27 to Nov. 30, 1929, staff gage at site 600 ft downstream at different datum.

Average discharge.--79 years (1884-1963), 339 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,150 cfs Oct. 16; minimum daily, 51 cfs Sept. 12, 16. 1884-1963: Maximum daily discharge, 2,520 cfs June 7, 1957 (result of dam failure); no flow at times.

Remarks.--Discharge computed on basis of modified weir formula, the head being obtained from readings on tailwater gage and mean gage height from recording headwater gage. Flow completely regulated by Leech Lake (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; seven discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	683	994	968	983	827	723	129	114	98	117	98	87
2	683	975	976	977	838	723	116	116	102	117	96	83
3	679	994	955	983	820	715	139	101	100	108	103	88
4	698	994	1,000	977	814	723	99	95	84	107	94	58
5	834	954	968	983	827	715	114	95	90	106	97	62
6	999	968	906	968	867	723	118	95	90	108	92	64
7	954	994	1,040	968	833	715	111	99	96	103	86	58
8	999	951	1,060	968	795	723	126	95	81	104	85	59
9	1,010	975	1,040	1,020	827	700	134	90	83	103	83	58
10	987	910	1,030	996	820	700	*116	81	96	103	85	60
11	984	958	1,030	950	833	681	99	92	99	104	83	58
12	965	971	*1,020	889	814	693	103	76	104	109	91	51
13	965	942	996	877	833	704	105	104	109	109	85	56
14	951	970	978	870	833	693	102	105	110	106	85	57
15	992	970	978	846	795	655	100	100	107	98	*84	55
16	1,150	951	969	823	795	662	103	100	109	96	79	51
17	*1,040	958	978	867	795	710	137	108	107	96	79	52
18	989	970	969	879	788	693	110	115	108	98	86	54
19	955	970	978	848	801	693	108	*111	104	96	85	54
20	928	1,000	959	842	710	761	123	103	*100	96	79	119
21	928	1,060	1,010	823	728	710	122	103	100	96	80	154
22	930	893	1,030	858	756	674	106	108	96	92	83	207
23	1,010	907	1,020	840	*756	667	114	100	94	87	85	201
24	1,010	996	993	857	756	674	111	99	94	87	83	204
25	996	996	993	839	748	687	114	99	96	85	80	207
26	954	1,010	954	884	723	405	115	97	108	88	79	207
27	975	996	954	890	728	215	99	101	104	92	79	206
28	965	989	993	871	728	115	96	103	104	107	88	194
29	975	989	993	884	132	101	100	99	99	102	94	204
30	956	976	955	871	-----	126	101	98	104	97	88	201
31	943	-----	952	857	-----	118	-----	100	-----	98	91	-----
Total	29,087	29,181	30,645	27,988	22,188	18,628	3,371	3,103	2,976	3,115	2,685	3,269
Mean	938	973	989	903	792	601	112	100	99.2	100	86.6	109
(\times)	-966	-892	-822	-747	-646	-124	750	421	659	-41.0	-123	-319
Mean \neq	-28	81	167	156	146	477	862	521	758	59.0	-36.4	-210
Cfsm \neq	-0.024	0.070	0.144	0.134	0.126	0.410	0.741	0.448	0.652	0.051	-0.031	-0.181
In. \neq	-0.03	0.08	0.17	0.15	0.13	0.47	0.83	0.52	0.73	0.06	-0.04	-0.20

Calendar year 1962: Max 1,150 Min. 91 Mean 610 Mean \neq 643 Cfsm \neq 0.553 In. \neq 7.71
 Water year 1962-63: Max 1,150 Min. 51 Mean 483 Mean \neq 245 Cfsm \neq 0.211 In. \neq 3.41

* Discharge measurement made on this day.

\neq Change in contents, equivalent in cubic feet per second, in Leech Lake.

\neq Adjusted for change in contents.

Note.--Negative figures of adjusted discharge and runoff indicate that evaporation and seepage from lake exceeded inflow.

MISSISSIPPI RIVER MAIN STEM

5-2105. Pokegama Lake near Grand Rapids, Minn.

Location.--Lat 47°10'00", long 93°33'20", in NW¼ sec.17, T.54 N., R.25 W., at narrows on State Highway 169, 4 miles south of Grand Rapids.

Drainage area.--3,265 sq mi.

Records available.--April 1884 to September 1963. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Pokegama Reservoir near Grand Rapids October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,264.89 ft above mean sea level, adjustment of 1912. Prior to May 30, 1949, staff gage at Pooles Arm of Pokegama Lake, 5 miles northwest at same datum.

Extremes.--Maximum contents during year, 62,400 acre-ft Aug. 1 (gage height, 9.37 ft); minimum, 26,240 acre-ft Mar. 22 (gage height, 6.63 ft).

1884-1963: Maximum contents, 121,400 acre-ft (revised) May 8, 1897 (gage height, 13.50 ft); minimum observed, 4,520 acre-ft below zero of capacity table Sept. 30, 1934 (gage height, 4.12 ft).

Remarks.--Reservoir is formed by Pokegama Lake and several other natural lakes controlled by concrete dam; storage began in 1884; original timber dam completed in 1884, replaced by present structure in 1888-89. Capacity (revised) between gage heights 6.00 ft and 12.0 ft (maximum allowable range) is 81,720 acre-ft, of which 53,150 acre-ft is controlled storage between gage heights 6.00 ft and 10.00 ft (normal operating range). Contents shown herein are contents above gage height 4.50 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1962 to September 1963

	Gage height (feet)*	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	9.00	57,120	-
Oct. 31.....	9.04	57,700	+580
Nov. 30.....	8.34	48,280	-9,420
Dec. 31.....	7.43	36,400	-11,880
Calendar year 1962.....			-10,050
Jan. 31.....	7.24	34,000	-2,400
Feb. 28.....	6.83	28,780	-5,220
Mar. 31.....	7.14	32,730	+3,950
Apr. 30.....	8.80	54,430	+21,700
May 31.....	8.94	56,310	+1,880
June 30.....	8.80	54,430	-1,880
July 31.....	9.36	62,260	+7,830
Aug. 31.....	9.25	60,690	-1,570
Sept. 30.....	8.92	56,050	-4,640
Water year 1962-63.....	-	-	+19,650

* Gage height at 2400.

5-2110. Mississippi River at Grand Rapids, Minn.

Location.--Lat 47°13'56", long 93°31'48", in SW¼NW¼ sec.21, T.55 N., R.24 W., in machine room of Blandin Paper Mill in Grand Rapids, 400 ft upstream from bridge on State Highway 169, 2.5 miles upstream from Prairie River, and at mile 1.182 upstream from Ohio River.

Drainage area.--3,370 sq mi, approximately.

Records available.--October 1883 to September 1963. Monthly discharge only for some periods, published in WSP 1308. Published as "at Pokegama Dam near Grand Rapids" 1942-44.

Gage.--Water-stage recorder. Datum of gage is 1,242.00 ft above mean sea level, adjustment of 1912. Prior to Feb. 17, 1945, staff gages operated by Corps of Engineers at Pokegama Dam 3½ miles upstream at datum 22.89 ft higher. Feb. 17, 1945, to Sept. 3, 1948, water-stage recorder at site 300 ft upstream, within 0.10 ft of present datum. Sept. 9, 1948, to Jan. 6, 1949, staff gage at site 400 ft downstream at present datum. Jan. 7, 1949, to Jan. 16, 1951, tape float and inside staff gages at present site and datum.

Average discharge.--80 years, 1,109 cfs.

Extremes.--Maximum discharge during year, 2,290 cfs Dec. 8, computation of peak flow through Pokegama Dam (furnished by Corps of Engineers); minimum daily, 386 cfs July 25, 26.

1883-63: Maximum discharge, 12,500 cfs Sept. 3, 1948 (gage height, 15.2 ft, from floodmark), caused by dam failure at gage, from rating curve extended above 4,500 cfs by logarithmic plotting; maximum daily, 5,250 cfs Sept. 5, 8, 1905; no flow at times in several years.

Remarks.--Daily discharge is computed flow through Pokegama Dam and corrected to conform with discharge measurements. Flow completely regulated by Pokegama Lake (see preceding page). Backwater from Prairie River occurs at times in most years.

Cooperation.--Records furnished by Corps of Engineers, 1883-1944, 1959-63.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,620	2,160	2,160	1,800	1,550	1,240	1,990	604	1,020	654	857	942
2	1,620	2,130	2,150	1,820	1,560	1,240	2,220	604	1,020	647	1,000	731
3	*1,620	2,130	2,130	1,820	1,520	1,230	2,060	612	1,020	654	982	738
4	1,620	2,080	2,130	1,810	1,520	1,220	1,910	777	1,010	658	973	738
5	1,620	2,090	1,410	1,810	1,520	1,220	1,650	767	1,000	658	963	634
6	1,600	2,140	400	1,810	1,520	1,220	1,420	756	987	658	947	630
7	1,600	2,100	686	1,800	1,500	1,220	1,330	746	981	650	937	495
8	1,600	2,100	2,290	1,800	1,490	1,230	1,370	736	987	647	932	497
9	1,620	2,100	2,070	1,800	1,490	1,220	1,350	671	987	588	937	495
10	1,620	2,160	2,020	1,750	1,480	1,220	*1,310	556	1,030	480	932	492
11	1,640	2,150	*1,900	1,730	1,470	1,220	1,280	556	1,210	480	932	485
12	1,640	2,130	1,800	1,730	1,460	1,230	984	549	1,230	483	947	480
13	1,660	*2,130	1,780	1,710	1,460	1,230	989	586	1,250	496	952	475
14	1,680	2,110	1,800	1,680	1,400	1,220	999	773	1,250	486	957	468
15	1,710	2,210	1,920	1,730	1,400	1,210	962	777	1,250	483	*957	461
16	1,710	2,180	1,850	1,730	1,410	1,210	914	786	1,240	483	963	453
17	1,710	2,160	1,830	1,730	1,400	1,230	942	790	1,220	493	973	*447
18	1,730	2,150	1,940	*1,740	1,390	1,260	938	795	1,200	490	978	447
19	1,790	2,140	1,900	1,690	1,390	1,270	942	800	1,430	486	978	451
20	1,930	2,120	1,880	1,630	*1,360	1,290	699	*813	1,350	477	968	449
21	1,930	2,090	1,880	1,620	1,250	1,300	703	790	1,180	474	968	443
22	1,940	2,010	1,870	1,620	1,290	*1,310	711	777	1,060	469	973	436
23	1,940	1,900	1,770	1,570	1,290	1,320	715	773	879	*466	978	426
24	1,940	1,910	1,770	1,570	1,290	1,330	715	762	745	441	978	421
25	1,930	1,960	1,800	1,560	1,290	1,330	715	751	*615	386	973	424
26	1,930	2,000	1,730	1,580	1,260	1,330	630	738	628	386	963	424
27	1,930	2,020	1,740	1,590	1,260	1,310	630	654	636	401	963	424
28	1,930	2,010	1,770	1,580	1,250	1,360	634	786	632	452	963	424
29	1,930	2,060	1,810	1,580	-	1,450	637	805	647	492	968	427
30	2,080	2,190	1,770	1,550	-----	1,570	590	816	647	578	957	431
31	2,120	-----	1,770	1,550	-----	1,700	-----	816	-----	687	952	-----
Total	54,940	62,820	55,726	52,490	39,470	39,940	32,939	22,522	30,341	16,383	29,701	15,288
Mean	1,772	2,094	1,798	1,693	1,410	1,288	1,098	727	1,011	528	958	510
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1962: Max 3,600 Min 400 Mean 1,890 Ac-ft
 Water year 1962-63: Max 2,290 Min 386 Mean 1,240 Ac-ft

* Discharge measurement made on this day.

SWAN RIVER BASIN

5-2168. O'Brien Creek near Pengilly, Minn.

Location.--Lat 47°18'56", long 93°09'26", in SE¼ sec.20, T.56 N., R.22 W., on right bank 200 ft upstream from Duluth, Missabe and Iron Range Railroad bridge; 1.0 mile upstream from mouth and 2 miles southeast of Pengilly.

Records available.--April to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,338.44 ft above mean sea level, datum of 1929 (Lake Survey reference mark). Prior to July 24, 1963, reference point at same site and datum.

Extremes.--Maximum daily discharge during period, 134 cfs April 3; maximum gage height, 3.25 ft April 3 (affected by frost action); minimum discharge, 7.4 cfs Sept. 27-30.

Remarks.--Records good except those for periods of doubtful or no gage-height record, which are fair. Flow affected by natural storage in lakes above station.

Cooperation.--Additional discharge measurements and gage readings furnished by M. A. Hanna Mining Co.

Rating table, April-September 1963 (gage height, in feet, and discharge, in cubic feet per second)

2.0	7.4
2.1	11
2.2	16
2.4	30
2.7	60
3.0	97

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							a20	a20	a35	16	19	14
2							a40	*19	a48	*16	*17	*14
3							a134	20	57	15	16	14
4							a75	a20	*49	a13	15	13
5							a47	a19	37	*12	15	12
6							a42	*17	*32	a12	*13	*12
7							a38	*14	*34	a11	12	12
8							a34	13	a34	11	12	11
9							a*31	*25	a55	*9.3	*12	11
10							a*28	25	71	8.5	13	*11
11							a*24	a25	*77	8.5	13	11
12							a23	a26	58	*11	17	*11
13							a22	28	*44	a14	*29	11
14							a20	*52	30	a15	28	11
15							*17	66	a27	15	21	11
16							*20	*35	a24	13	*19	11
17							*35	39	20	17	29	*12
18							a32	a34	*19	23	30	12
19							*29	a30	38	*17	23	*15
20							a25	*28	49	a17	*19	*15
21							a22	29	*36	a17	*16	12
22							*20	26	a30	a17	16	10
23							*17	*22	a24	*16	*18	9.3
24							*17	19	17	13	17	*8.5
25							*17	a19	*17	13	16	8.2
26							*19	a18	23	*13	13	8.2
27							a20	*18	22	17	*12	*8.2
28							a22	*76	*19	32	13	7.8
29					-		23	81	a18	41	16	7.8
30					-----		*22	a60	a17	*27	*16	7.4
31		-----			-----		-----	*40	-----	21	15	-----
Total							935	963	1,061	501.3	540	331.4
Mean							31.2	31.1	35.4	16.2	17.7	11.0
Ac-ft							-	-	-	-	-	-
Calendar year	: Max		Min		Mean		Ac-ft					
Water year	: Max		Min		Mean		Ac-ft					

* Discharge measurement made on this day.
a Doubtful or no gage-height record.

SWAN RIVER BASIN

77

5-2170. Swan River near Warba, Minn.

Location.--Lat 47°06'40", long 93°15'50", in SE¼ sec.33, T.54 N., R.23 W., on left bank 75 ft upstream from highway bridge, 1¼ miles south of Warba, 3¼ miles northwest of Swan River, and 22 miles upstream from mouth.

Drainage area.--254 sq mi.

Records available.--October 1953 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,259.80 ft above mean sea level (Minnesota State Highway Department bench mark).

Average discharge.--10 years, 121 cfs.

Extremes.--Maximum discharge during year, 540 cfs Apr. 1 (gage height, 7.19 ft); minimum daily, 26 cfs Jan. 19-27; minimum gage height, 2.17 ft Nov. 9.

1953-63: Maximum discharge, 1,000 cfs Apr. 13, 1954 (gage height, 9.00 ft); maximum gage height, 9.02 ft Apr. 13, 1954 (backwater from ice); minimum discharge, 15 cfs Sept. 4, 5, 1961 (gage height, 1.65 ft). Flood of May 1950 reached a stage of about 11.5 ft from information by local residents.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 4, Nov. 12-20,
June 16 to Sept. 30)

2.0	31	4.0	175
2.4	54	6.0	378
3.0	95	7.0	510

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	85	75	61	34	27	31	498	151	219	136	126	61
2	80	75	62	34	27	32	446	142	222	137	112	58
3	77	73	62	34	28	32	444	141	215	123	96	59
4	74	71	61	35	28	32	442	140	204	112	85	58
5	73	59	56	35	28	33	430	134	199	103	67	55
6	73	57	52	35	29	33	*412	129	201	95	56	52
7	71	58	*48	35	29	34	399	122	198	88	50	49
8	70	59	46	36	30	35	395	121	204	81	42	46
9	71	60	43	36	30	35	389	120	222	75	41	44
10	68	62	41	35	31	35	372	122	262	63	45	43
11	68	64	39	33	31	35	344	136	291	58	41	38
12	74	64	38	31	31	35	313	147	283	73	44	46
13	75	64	38	29	31	35	286	188	255	81	52	46
14	68	62	39	27	31	36	261	231	224	69	*61	44
15	64	*63	41	27	30	36	243	220	202	61	62	37
16	64	63	42	27	30	36	244	205	180	61	61	38
17	*60	61	44	*27	30	37	266	217	160	63	58	38
18	56	61	45	26	30	38	258	226	144	63	58	44
19	55	60	45	26	30	39	243	*212	164	65	63	79
20	55	60	43	26	*30	41	231	206	202	64	61	*82
21	54	58	42	26	31	*45	218	207	197	59	52	71
22	60	56	40	26	31	65	202	200	188	*58	47	57
23	66	57	38	26	30	80	190	187	162	58	46	64
24	64	58	36	26	30	100	179	173	147	57	46	63
25	60	61	34	26	30	155	169	163	*138	52	43	56
26	58	67	33	26	30	205	163	152	147	46	49	55
27	58	68	32	26	30	287	160	144	152	66	46	52
28	58	69	32	27	31	350	153	234	142	94	62	52
29	58	65	32	27	-	410	158	299	131	122	76	51
30	59	61	33	27	-----	455	160	281	130	125	72	51
31	64	-----	34	27	-----	490	-----	242	-----	119	67	-----
Total	2,040	1,891	1,332	918	834	3,342	8,668	5,592	5,785	2,527	1,887	1,589
Mean	65.8	63.0	43.0	29.6	29.8	108	289	180	193	81.5	60.9	53.0
Cfsm	0.259	0.248	0.169	0.116	0.117	0.425	1.14	0.709	0.760	0.321	0.240	0.209
In.	0.30	0.28	0.20	0.13	0.12	0.49	1.27	0.82	0.85	0.37	0.27	0.23

Calendar year 1962 Max 707 Min 32 Mean 107 Cfsm 0.421 In. 5.73
Water year 1962-63 Max 498 Min 26 Mean 99.7 Cfsm 0.393 In. 5.33

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 5-11, 21-25, Dec. 4 to Mar. 31.

SANDY RIVER BASIN

5-2185. Sandy Lake at Libby, Minn.

Location.--Lat 46°46'40", long 93°19'20", in sec.36, T.50 N., R.24 W., on dam on Sandy River, at Libby, 2.2 miles upstream from mouth, and 14 miles north of McGregor.

Drainage area.--421 sq mi.

Records available.--July to December 1893, October to December 1894, July 1895 to September 1963. Month-end contents only for some periods, published in WSP 1308. Published as Sandy Lake Reservoir at Libby October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,207.71 ft above mean sea level, adjustment of 1912. Prior to Sept. 23, 1949, float gage at same site and datum.

Extremes.--Maximum contents during year, 54,510 acre-ft July 28 (gage height, 9.21 ft); minimum, 36,280 acre-ft Mar. 26 (gage height, 7.16 ft).

1895-1963: Maximum contents, 167,200 acre-ft May 19, 1950 (gage height, 17.51 ft); minimum observed, 5,950 acre-ft below zero of capacity table Jan. 20, 1921 (gage height, 0.65 ft).

Remarks.--Reservoir is formed by Sandy, Flowage, Snake, and Aitkin Lakes controlled by concrete dam. Storage began in 1893; original timber crib dam completed in 1895, replaced by present structure in 1911. Capacity (revised) between gage heights 7.00 ft and 14.00 ft (minimum allowable limit to top of structure) is 73,330 acre-ft, of which 37,550 acre-ft is controlled storage between gage heights 7.00 ft and 11.00 ft (normal operating range). Contents shown herein are contents above gage height 1.72 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1962 to September 1963

	Gage height (feet)†	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	8.95	52,040	-
Oct. 31.....	8.93	51,850	-190
Nov. 30.....	8.55	48,360	-3,490
Dec. 31.....	8.19	45,100	-3,260
Calendar year 1962.....	-	-	-2,870
Jan. 31.....	7.79	41,610	-3,490
Feb. 28.....	7.43	38,540	-3,070
Mar. 31.....	7.59	39,910	+1,370
Apr. 30.....	8.49	47,790	+7,880
May 31.....	9.02	52,700	+4,910
June 30.....	9.07	53,170	+470
July 31.....	9.10	53,450	+280
Aug. 31.....	9.11	53,550	+100
Sept. 30.....	9.06	53,080	-470
Water year 1962-63.....	-	-	+1,040

† Gage height at 2400.

5-2190. Sandy River at Sandy Lake Dam, at Libby, Minn.

Location.--Lat 46°47'18", long 93°19'06", in sec.25, T.50 N., R.24 W., at dam at outlet of Sandy Lake, a quarter of a mile north of Libby and 1.2 miles above mouth.

Drainage area.--421 sq mi.

Records available.--July 1893 to March 1894, July 1894, November 1894 to March 1895, August 1895 to September 1963. Monthly discharge only for some periods, published in WSP 1308. Published as "below Sandy Lake Reservoir" 1893-1916.

Gage.--Water-stage recorders on headwater and tailwater. Datum of gages is 1,207.71 ft above mean sea level, adjustment of 1912. Prior to June 20, 1949, staff gages at same site and datum.

Average discharge.--68 years (1895-1963), 199 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 910 cfs June 13; minimum daily, 3 cfs many days in October, July, August and September.
1893-1963: Maximum daily discharge, 3,740 cfs July 12, 1897; no flow at times.

Remarks.--Discharge computed on basis of head over dam, using modified weir formula, head being obtained from headwater and tailwater recorder records. Flow completely regulated by Sandy Lake (see preceding page).

Cooperation.--Two discharge measurements made and records reviewed by Geological Survey. Computations of daily discharge furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3	74	70	60	58	58	141	48	737	129	220	88
2	3	72	68	60	58	58	125	50	700	129	215	88
3	3	72	68	60	58	58	115	50	480	132	129	215
4	3	70	68	60	58	56	350	50	490	132	3	220
5	3	70	68	60	58	56	500	50	485	115	3	215
6	3	72	68	58	58	56	575	50	330	3	3	220
7	3	72	76	58	56	54	415	50	330	3	3	3
8	3	72	86	58	56	54	470	50	335	3	3	3
9	3	70	80	58	56	54	490	50	330	3	3	3
10	3	70	78	58	56	54	500	50	350	3	3	3
11	3	70	76	60	56	56	370	52	670	3	3	3
12	3	70	76	60	56	56	294	52	785	3	3	3
13	3	70	74	60	56	54	270	142	910	3	3	3
14	3	70	70	62	56	52	285	541	885	3	44	3
15	3	70	66	60	56	50	295	790	885	3	44	3
16	3	70	64	60	56	50	225	760	450	3	44	3
17	3	70	62	60	56	52	230	817	291	3	88	3
18	3	70	60	60	56	52	235	850	303	3	88	94
19	3	70	60	60	56	78	240	845	303	3	88	178
20	3	70	60	60	56	75	240	850	259	3	88	174
21	3	70	60	58	56	75	250	726	198	3	88	174
22	3	70	58	58	56	96	231	530	201	3	88	174
23	3	70	58	58	56	96	76	535	134	3	172	3
24	3	70	58	58	56	115	76	424	32	3	172	* 6
25	3	70	60	58	56	105	65	295	40	3	172	6
26	3	70	60	60	56	150	46	305	41	3	3	6
27	3	70	60	60	56	185	46	315	123	3	3	6
28	3	72	62	60	56	185	48	378	126	112	3	6
29	3	70	62	58	-	130	48	568	126	140	3	6
30	3	70	60	58	-----	130	48	765	129	135	88	6
31	3	-----	60	58	-----	115	-----	760	-----	220	88	-----
Total	93	2,116	2,056	1,836	1,580	2,515	7,299	11,798	11,465	1,310	1,958	1,918
Mean	3.0	70.5	66.3	59.2	56.4	81.1	243	381	382	42.3	63.2	63.9
(%)	-3.06	-58.7	-52.9	-56.8	-55.4	+22.3	+132	+79.8	+7.8	+4.7	+1.6	-8.0
Mean*	-0.06	11.8	13.4	2.4	1.0	103	375	461	390	47.0	64.8	55.9
Cfsm*	-0.00014	0.028	0.032	0.0057	0.0024	0.245	0.891	1.10	0.926	0.112	0.154	0.133
In.*	-0.0002	0.03	0.04	0.007	0.002	0.28	1.00	1.27	1.03	0.13	0.18	0.15

Calendar year 1962: Max 936 Min 3 Mean 140 Mean* 136 Cfsm* 0.323 In.* 4.36
Water year 1962-63: Max 910 Min 3 Mean 126 Mean* 127 Cfsm* 0.302 In.* 4.12

* Discharge measurement made on this day.

* Change in contents, equivalent in cubic feet per second, in Sandy Lake.

* Adjusted for change in contents.

MISSISSIPPI RIVER MAIN STEM

5-2205. Mississippi River below Sandy River, near Libby, Minn.

Location.--Lat 46°47', long 93°20', in sec.25, T.50 N., R.24 W., on right bank 600 ft downstream from Sandy River and three-quarters of a mile northwest of Libby, and at mile 1,106 upstream from Ohio River.

Drainage area.--5,060 sq mi, approximately.

Records available.--April 1930 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,204.55 ft above mean sea level, adjustment of 1912. Prior to July 28, 1931, staff gage at site 600 ft upstream at datum 3.16 ft higher.

Average discharge.--33 years, 1,843 cfs.

Extremes.--Maximum discharge during year, 4,520 cfs Apr. 2 (gage height, 11.12 ft, backwater from ice); minimum, 568 cfs Dec. 8 (gage height, 2.66 ft).
1930-63: Maximum discharge, 16,000 cfs May 17, 1950 (gage height, 20.02 ft); minimum, 83 cfs Nov. 16, 1936 (gage height, 1.44 ft).

Remarks.--Records good except those for periods of ice effect, which are fair. Flow regulated by powerplants and Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 70, 72, 74, 78).

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

3.0	718	7.0	2,780
4.0	1,190	9.0	3,880
5.0	1,710	11.0	5,020

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,110	2,440	2,480	2,110	1,790	1,700	3,900	1,640	2,910	1,590	1,360	1,410
2	2,080	2,510	2,540	2,100	1,790	1,700	4,300	1,540	2,910	1,480	1,490	1,430
3	2,060	2,560	2,550	2,090	1,790	1,700	4,500	1,460	2,860	1,410	1,560	1,440
4	2,030	2,570	2,520	2,090	1,790	1,700	4,400	1,440	2,890	1,360	1,500	1,370
5	2,050	2,570	2,490	2,080	1,790	1,700	4,340	1,450	2,870	1,290	1,510	1,340
6	2,070	2,520	2,450	2,070	1,780	1,700	*4,190	1,520	2,700	1,220	1,530	1,170
7	2,030	2,490	1,740	2,060	1,780	1,700	3,920	1,540	2,690	1,040	1,550	911
8	2,030	2,500	772	2,050	1,780	1,700	3,780	1,540	2,720	987	1,540	978
9	2,010	*2,560	1,050	2,040	1,780	1,710	3,690	1,540	2,760	1,030	1,470	846
10	2,000	2,550	*1,440	2,020	1,780	1,720	3,640	1,430	2,920	1,070	1,400	809
11	1,990	2,550	1,840	2,000	1,770	1,750	3,530	1,360	3,240	883	1,320	777
12	1,990	2,580	1,900	1,960	1,760	1,750	3,380	1,290	3,430	758	1,350	809
13	2,020	2,590	1,980	1,940	1,760	1,760	3,180	1,690	3,590	745	1,380	809
14	2,040	2,550	2,020	1,930	1,750	1,800	2,960	2,240	3,620	763	*1,510	781
15	2,070	2,540	2,100	1,920	1,740	1,800	2,800	2,480	3,560	814	1,520	768
16	*2,050	2,550	2,110	1,910	1,730	1,850	2,710	2,540	3,170	855	1,460	758
17	2,020	2,570	2,140	*1,900	1,720	1,850	2,650	2,760	2,880	864	1,440	736
18	2,040	2,580	2,160	1,900	1,710	1,900	2,580	2,950	2,780	804	1,390	869
19	2,060	2,570	2,180	1,890	*1,700	1,900	2,530	2,930	2,780	758	1,400	1,080
20	2,070	2,540	2,190	1,880	1,700	1,950	2,480	*2,870	2,840	883	1,390	1,120
21	2,150	2,510	2,190	1,870	1,690	2,000	2,380	2,560	2,850	992	1,390	1,110
22	2,280	2,500	2,180	1,860	1,690	2,000	2,080	2,340	2,730	*888	1,420	1,010
23	2,310	2,420	2,170	1,850	1,690	2,050	1,870	2,380	2,430	772	1,510	818
24	2,300	2,400	2,160	1,840	1,680	2,100	1,840	2,240	*2,090	768	1,520	*768
25	2,330	2,380	2,140	1,830	1,680	2,200	1,770	1,980	1,930	768	1,470	754
26	2,290	2,370	2,140	1,820	1,690	2,300	1,750	1,840	1,840	727	1,330	745
27	2,220	2,360	2,140	1,810	1,690	2,500	1,720	1,810	1,820	855	1,330	758
28	2,230	2,360	2,130	1,810	1,690	*2,650	1,590	2,140	1,690	1,040	1,330	791
29	2,270	2,410	2,120	1,800	-	2,800	1,510	2,650	1,630	1,180	1,350	791
30	2,280	2,440	2,110	1,800	-----	3,100	1,650	2,980	1,600	1,330	1,430	777
31	2,300	-----	2,110	1,790	-----	3,300	-----	2,980	-----	1,350	1,440	-----
Total	65,780	75,040	64,242	60,020	48,690	62,340	87,620	64,110	80,730	31,274	44,590	28,533
Mean	2,122	2,501	2,072	1,936	1,739	2,011	2,921	2,068	2,691	1,009	1,438	951
Cfsm	0.419	0.494	0.409	0.383	0.344	0.397	0.577	0.409	0.532	0.199	0.284	0.188
In.	0.48	0.55	0.47	0.44	0.36	0.46	0.64	0.47	0.59	0.23	0.33	0.21

Calendar year 1962: Max 6,210 Min 772 Mean 2,623 Cfsm 0.518 In. 7.03
Water year 1962-63: Max 4,500 Min 727 Mean 1,953 Cfsm 0.386 In. 5.23

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 24-26, Dec. 9 to Apr. 4.

MISSISSIPPI RIVER MAIN STEM

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5-2275. Mississippi River at Aitkin, Minn.

Location.--Lat 46°32'26", long 93°42'26", in W½ sec.24, T.47 N., R.27 W., at upstream side of highway bridge at north edge of Aitkin, 1 mile downstream from Mud River and at mile 1,055.9 upstream from Ohio River.

Drainage area.--6,140 sq mi, approximately.

Records available.--March 1945 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,185.41 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Mar. 1, 1945, to July 12, 1954, staff gage, July 13, 1954, to June 23, 1955, chain gage, June 24, 1955, to Mar. 14, 1961, wire-weight gage, at same site and datum.

Average discharge.--18 years, 2,758 cfs.

Extremes.--Maximum discharge during year, 6,860 cfs Apr. 5 (gage height, 9.37 ft, backwater from ice); minimum, 884 cfs July 26 (gage height, -0.19 ft).
1945-63: Maximum discharge, 20,000 cfs May 20, 1950 (gage height, 19.49 ft); minimum, 151 cfs Sept. 1, 1961 (gage height, -2.40 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Slight regulation by powerplants and by Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 70, 72, 74, 78). Water diverted at medium and high stages into Aitkin diversion channel 6½ miles above station, bypasses station and returns to river 15½ miles below station. Diversion began Apr. 2, 1955. These records include flow in diversion channel.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,400	2,400	2,570	2,230	1,910	1,800	4,150	2,300	4,150	2,110	1,770	1,640
2	2,340	2,510	2,600	2,230	1,910	1,800	4,600	2,340	4,140	2,050	1,740	1,660
3	2,280	2,600	2,650	2,230	1,910	1,800	5,430	2,300	4,160	1,960	1,790	1,660
4	2,250	2,680	2,680	2,230	1,910	1,800	6,190	2,210	4,140	1,830	1,830	1,680
5	2,220	2,670	2,670	2,230	1,910	1,800	*6,710	2,140	4,150	1,740	1,790	1,630
6	2,210	2,650	2,630	2,180	1,910	1,800	6,290	2,110	4,180	1,650	1,750	1,580
7	2,210	2,630	2,510	2,180	1,860	1,800	5,680	2,130	3,960	1,550	1,740	1,460
8	2,190	2,620	2,120	2,180	1,860	1,800	5,310	2,160	3,950	1,430	1,740	1,240
9	2,170	2,630	1,620	2,130	1,860	1,800	5,100	2,160	3,990	1,320	1,740	1,170
10	2,160	2,670	1,180	2,130	1,860	1,800	4,950	2,210	4,070	1,230	1,670	1,080
11	2,150	2,670	1,300	2,080	1,810	1,800	4,860	2,170	4,340	1,280	1,610	1,010
12	2,140	2,670	1,550	2,080	1,810	1,850	*4,740	2,110	4,720	1,150	1,650	985
13	2,130	2,630	*1,680	2,080	1,800	1,850	4,510	2,270	4,900	1,070	1,720	982
14	2,140	2,710	2,000	2,070	1,800	1,900	4,240	2,880	5,090	929	1,740	1,000
15	2,150	2,680	2,100	2,020	1,800	1,900	3,980	3,450	5,190	929	1,800	1,000
16	2,170	*2,680	2,200	2,020	1,800	1,950	3,800	3,750	5,220	929	*1,820	*988
17	2,170	2,660	2,300	1,970	1,800	2,000	3,730	3,880	4,820	929	1,770	974
18	2,140	2,660	2,360	1,970	1,750	2,000	3,510	4,110	4,360	929	1,720	968
19	*2,160	2,670	2,360	1,970	1,750	2,060	3,550	4,220	4,070	985	1,680	1,070
20	2,160	2,660	2,420	1,920	1,700	2,060	3,480	4,220	3,900	943	1,670	1,290
21	2,170	2,650	2,430	*1,920	1,700	2,110	3,400	4,160	3,820	940	1,650	1,470
22	2,250	2,600	2,430	1,920	*1,650	2,110	3,250	*3,910	3,710	1,030	1,640	1,500
23	2,350	2,570	2,430	1,920	1,700	2,110	3,000	3,670	3,460	1,010	1,660	1,420
24	2,380	2,440	2,440	1,920	1,750	2,160	2,710	3,590	3,200	*957	1,700	1,240
25	2,400	2,380	2,380	1,920	1,750	2,170	2,600	3,430	2,780	915	1,720	1,120
26	2,410	2,430	2,330	1,920	1,750	2,180	2,480	3,160	*2,560	904	1,690	1,060
27	2,400	2,610	2,280	1,910	1,750	*2,470	2,410	2,930	2,440	1,460	1,610	1,040
28	2,360	2,530	2,230	1,910	1,750	2,800	2,370	2,980	2,350	1,680	1,580	1,040
29	2,340	2,510	2,180	1,910	-	3,040	2,300	3,350	2,290	1,730	1,560	1,050
30	2,380	2,540	2,180	1,910	-----	3,360	2,230	3,820	2,150	1,750	1,580	1,040
31	2,380	-----	2,230	1,910	-----	3,740	-----	4,080	-----	1,780	1,620	-----
Total	69,760	78,010	69,040	63,200	50,520	65,620	121,660	94,200	116,260	41,099	52,750	37,047
Mean	2,250	2,600	2,227	2,039	1,804	2,117	4,055	3,039	3,875	1,326	1,702	1,235
Cfsm	0.366	0.423	0.363	0.332	0.294	0.345	0.660	0.495	0.631	0.216	0.277	0.201
In.	0.42	0.47	0.42	0.38	0.31	0.40	0.74	0.57	0.70	0.25	0.32	0.22

Calendar year 1962: Max 9,300 Min 1,000 Mean 3,079 Cfsm 0.501 In. 6.81

Water year 1962-63: Max 6,710 Min 904 Mean 2,354 Cfsm 0.383 In. 5.20

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10 to Apr. 6. Computed from once-daily wire-weight gage readings by Corps of Engineers Oct. 1-18, June 8 to July 23.

PINE RIVER BASIN

5-2305. Pine River Reservoir at Cross Lake, Minn.

Location.--Lat 46°40'09", long 94°06'44", in SW¼NW¼ sec.21, T.137 N., R.27 W., at dam on Pine River, at outlet of Cross Lake at village of Cross Lake.

Drainage area.--562 sq mi.

Records available.--March 1886 to September 1963. Month-end contents only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,216.32 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to May 3, 1949, staff gage at same site and datum.

Extremes.--Maximum contents during year, 100,110 acre-ft June 10 (gage height, 13.13 ft); minimum, 74,720 acre-ft Mar. 11 (gage height, 11.23 ft).
1886-1963: Maximum contents observed, 173,600 acre-ft July 10, 1916 (gage height, 18.24 ft); minimum observed, 1,310 acre-ft below zero of capacity table Aug. 20, 1918 (gage height, 1.35 ft).

Remarks.--Reservoir is formed by Trout, Whitefish, Rush, and Cross Lakes and several other natural lakes controlled by timber crib dams; storage began in 1886; dam completed in 1886. Capacity (revised) between gage heights 10.00 ft and 18.5 ft (maximum allowable range) is 118,710 acre-feet of which 53,280 acre-feet is controlled storage between gage heights 10.00 ft and 14.00 ft (normal operating range). Contents shown herein are contents above a gage height of 2.35 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1962 to September 1963

	Gage height (feet)*	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	12.69	94,140	-
Oct. 31.....	12.51	91,700	-2,440
Nov. 30.....	12.14	86,740	-4,960
Dec. 31.....	11.87	83,150	-3,590
Calendar year 1962.....	-	-	-9,090
Jan. 31.....	11.58	79,320	-3,830
Feb. 28.....	11.32	75,890	-3,430
Mar. 31.....	11.69	80,770	+4,880
Apr. 30.....	12.74	94,810	+14,040
May 31.....	13.00	98,340	+3,530
June 30.....	12.94	97,510	-830
July 31.....	12.76	95,090	-2,420
Aug. 31.....	12.78	95,350	+260
Sept. 30.....	12.85	96,300	+950
Water year 1962-63.....	-	-	+2,160

* Gage height at 2400.

5-2310. Pine River at Cross Lake Dam, at Cross Lake, Minn.

Location.--Lat 46°40'09", long 94°06'44", in SW¼NW¼ sec.21, T.137 N., R.27 W., at dam at outlet of Cross Lake at village of Cross Lake.

Drainage area.--562 sq mi.

Records available.--April 1886 to September 1963. Monthly discharge only for some periods, published in WSP 1308. Published as "below Pine River Reservoir" 1895-1916, 1929, and as "at Pine River Dam, at Cross Lake" 1941-56.

Gage.--Water-stage recorder, headwater gage, and tape float tailwater gage, read twice daily. Datum of gages is 1,216.32 ft above mean sea level, datum of 1929. Mar. 26, 1886, to May 31, 1929, staff gages on headwater and tailwater at same sites and datum. June 1 to Nov. 30, 1929, staff gage in tailwater at datum 1.60 ft lower. Dec. 1, 1929, to May 2, 1949, staff gage on headwater and Dec. 1, 1929, to August 1949, staff gage on tailwater at present sites and datum.

Average discharge.--77 years, 205 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 725 cfs June 11, 12; minimum daily, 50 cfs Sept. 14-16, 18, 19, 26-30.

1886-1963: Maximum daily discharge, 2,246 cfs in June 1896 (does not include flow bypassing dam through crevasse); no flow at times.

Remarks.--Discharge computed principally on basis of modified weir formula, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Pine River Reservoir (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; three discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	120	200	145	140	145	140	55	55	340	150	60	60
2	120	200	145	140	145	140	68	55	340	150	60	60
3	120	200	145	140	145	140	100	55	340	150	60	60
4	120	200	145	140	140	140	100	55	340	150	60	60
5	120	195	145	140	140	140	100	55	340	150	60	60
6	120	195	145	140	140	140	100	66	340	150	60	65
7	120	195	145	140	140	140	100	100	340	138	60	65
8	120	195	145	140	140	140	111	100	340	95	60	65
9	120	195	145	140	140	140	145	100	340	95	60	65
10	120	190	145	140	140	140	150	100	452	95	60	60
11	120	190	150	140	140	140	*159	100	725	95	60	65
12	111	190	150	140	140	140	159	100	725	95	60	65
13	90	190	150	140	140	140	159	133	720	95	60	65
14	90	190	150	140	140	140	159	200	720	85	55	50
15	90	190	150	140	140	140	160	200	720	55	55	50
16	90	190	145	140	140	140	160	212	720	55	55	50
17	85	185	145	140	140	140	160	240	656	55	55	60
18	*85	185	145	140	140	140	160	240	500	55	55	50
19	85	162	145	140	140	140	119	240	500	55	60	50
20	85	105	140	140	140	140	55	253	450	55	60	60
21	85	105	140	145	145	140	55	285	300	55	60	60
22	85	105	140	*145	145	140	55	285	300	55	60	55
23	85	100	140	145	145	140	55	285	300	55	60	55
24	80	100	140	140	145	140	55	251	213	55	60	55
25	80	100	140	140	145	140	55	150	150	55	60	55
26	80	100	140	140	145	140	55	150	150	55	65	50
27	80	109	140	140	145	140	55	197	150	55	65	50
28	80	145	140	140	145	119	55	313	150	55	65	50
29	105	145	140	145	-	55	55	340	150	55	65	50
30	200	145	140	145	-----	55	55	340	150	55	60	50
31	200	-----	140	145	-----	55	-----	340	-----	55	55	-----
Total	3,291	4,896	4,460	4,370	3,975	4,064	3,029	5,595	11,961	2,628	1,850	1,715
Mean	106	163	144	141	142	131	101	180	399	84.4	59.7	57.2
(Δ)	-39.7	-83.3	-58.4	-62.3	-61.8	+79.4	+236	+57.4	-14.0	-39.4	+4.19	+16.0
Mean Δ	66.3	79.7	85.6	78.7	80.2	210	337	237	385	45.4	63.9	73.2
Cfs Δ	0.118	0.142	0.152	0.140	0.143	0.374	0.600	0.422	0.685	0.081	0.114	0.130
In. Δ	0.14	0.16	0.18	0.16	0.15	0.43	0.67	0.49	0.76	0.09	0.13	0.14

Calendar year 1962: Max 1,980 Min 40 Mean 233 Mean Δ 220 Cfs Δ 0.391 In. Δ 5.33
 Water year 1962-63: Max 725 Min 50 Mean 142 Mean Δ 145 Cfs Δ 0.258 In. Δ 3.50

* Discharge measurement made on this day.

Δ Change in contents, equivalent in cubic feet per second, in Pine River Reservoir.

Δ Adjusted for change in contents.

PINE RIVER BASIN

5-2315. Pelican Lake near Pequot Lakes, Minn.

Location.--Lat 46°37', long 94°11', in NE¼NE¼ sec.10, T.136 N., R.28 W., on downstream side of right abutment of dam and bridge on channel between Ossawinnamakee and Pelican Lakes, 0.5 miles upstream from Pelican Lake and 6 miles east of town of Pequot Lakes.

Records available.--April 1938 to September 1963 (fragmentary). Prior to October 1956, published as Pelican Lake diversion near Pequot Lakes.

Gage.--Staff gage read about three times weekly during open-water period. Datum of gage is 1,203.69 ft above mean sea level, datum of 1929 (levels by Minnesota Department of Conservation).

Extremes.--Maximum gage height observed during year, 2.74 ft June 10; minimum observed, 2.05 ft Sept. 28. 1938-63: Maximum gage height observed, 4.12 ft May 23, 25, 27, 1950; minimum observed, 1.36 ft May 2, 1938.

Remarks.--Crest of stoplogs on dam is normally fixed at 1,207.19 ft, but may be lowered to 1,203.69 ft (elevation of sill and apron) by removal of stoplogs.

Gage height, in feet, October 1962 to September 1963

Oct. 1.....	2.30	June 29.....	2.62	Sept. 28.....	2.05
Apr. 11.....	2.39	July 29.....	2.40		
May 30.....	2.52	Aug. 31.....	2.18		

Note.--Gage readings other than those shown are available.

5-2415. Rabbit River near Crosby, Minn.

Location.--Lat 46°30'55", long 93°57'35", in NE¼ sec.35, T.47 N., R.29 W., on right bank a third of a mile downstream from Clinker Lake control dam and 2 miles north of Crosby.

Drainage area.--8.38 sq mi.

Records available.--August 1945 to July 1963 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 1,190.00 ft above mean sea level, adjustment of 1912.

Average discharge.--17 years (1945-62), 5.78 cfs.

Extremes.--Maximum discharge during period October to July, 12 cfs June 10 (gage height, 5.93 ft); no flow many days during November and December.

1945-62: Maximum discharge, 94 cfs June 27, 1946 (gage height, 7.54 ft) from rating curve extended above 30 cfs (release from log jam); no flow at times.

Remarks.--Records fair. Some regulation by Clinker Lake. Flow affected by pumping from Rabbit Lake and underground mine.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.8	0.4	0	0.7	1.3	1.6	5.3	5.6	9.9	5.4		
2	2.0	.3	0	.7	1.3	1.7	5.7	5.6	9.9	5.2		
3	2.2	.3	0	.7	1.3	1.7	6.0	5.7	9.8	4.7		
4	2.2	.2	0	.7	1.3	1.8	5.7	5.5	10	4.3		
5	2.1	.2	0	.7	1.3	1.8	5.9	5.3	10	3.9		
6	1.1	.2	0	.7	1.4	1.8	5.5	5.4	10	3.8		
7	.8	.2	0	.7	1.4	1.9	5.5	5.6	9.9	3.6		
8	.7	.2	0	.7	1.4	1.9	6.1	5.6	10	3.4		
9	.5	.1	0	.8	1.4	2.0	5.7	5.6	10	3.3		
10	.5	.1	0	.8	1.4	2.0	5.2	6.4	12	3.2		
11	.5	.1	.1	.8	1.4	2.0	*4.7	6.0	11	3.2		
12	.5	.1	.4	.8	1.4	2.1	4.6	6.2	11	3.3		
13	.6	.1	*.6	.9	1.4	2.2	4.7	9.1	9.9	3.2		
14	.5	.1	.6	.9	1.4	2.3	4.9	8.6	9.2	3.2		
15	.5	.1	.6	.9	1.4	2.3	5.2	8.4	9.1	3.2		
16	.5	*0	.6	1.0	1.4	2.4	6.5	8.4	8.6	3.0		
17	.5	0	.6	1.0	1.4	2.5	6.5	8.6	8.2	2.8		
18	*.5	0	.6	1.0	1.4	2.5	6.2	8.6	8.0	2.5		
19	.4	0	.6	1.1	1.4	2.6	6.4	8.7	7.8	2.2		
20	.4	0	.6	1.1	1.4	2.7	6.1	9.1	7.5	1.8		
21	.4	0	.6	1.2	*1.5	2.8	5.9	*9.2	*7.2	1.5		
22	.6	0	.6	*1.2	1.5	*2.8	5.6	9.2	6.8	1.2		
23	.7	0	.6	1.2	1.5	3.0	5.5	9.2	6.6	*.9		
24	.8	0	.6	1.2	1.5	3.4	5.4	9.2	6.2	.7		
25	.7	0	.6	1.3	1.5	4.0	5.6	9.1	6.1	.7		
26	.7	0	.6	1.3	1.5	4.5	5.9	8.7	6.5	.8		
27	.5	0	.6	1.3	1.6	4.9	5.7	9.8	6.2	.8		
28	.5	0	.7	1.3	1.6	4.9	5.9	12	5.6	.7		
29	.5	0	.7	1.3	-	4.9	6.1	11	5.2	.7		
30	.5	0	.7	1.3	-----	4.5	5.9	11	4.9	.5		
31	.4	-----	.7	1.3	-----	4.3	-----	10	-----	.5		
Total	25.1	2.7	12.3	30.6	39.7	85.8	169.9	246.4	253.1	78.2		
Mean	0.81	0.09	0.40	0.99	1.42	2.77	5.66	7.95	8.44	2.52		
Cfsm	0.097	0.011	0.048	0.118	0.169	0.331	0.675	0.949	1.01	0.301		
In.	0.11	0.01	0.05	0.14	0.18	0.38	0.75	1.09	1.12	0.35		

Calendar year 1962: Max 22 Min 0 Mean 3.48 Cfsm 0.415 In. 5.63

Water year 1962-63: Max - Min - Mean - Cfsm - In. -

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Dec. 8 to Mar. 26. No gage-height record Jan. 11-21, Jan. 23 to Feb. 20, Feb. 22 to Mar. 21, Mar. 23, 24, July 24-31.

CROW WING RIVER BASIN

5-2440. Crow Wing River at Nimrod, Minn.

Location.--Lat 46°39', long 94°53', in sec.32, T.137 N., R.33 W., on right bank 200 ft upstream from highway bridge, 0.2 mile north of Nimrod, and 0.7 mile upstream from Cat River.

Drainage area.--1,010 sq mi, approximately.

Records available.--April 1910 to September 1914, July 1930 to September 1963 (winter records incomplete prior to 1940).

Gage.--Water-stage recorder. Datum of gage is 1,313.27 ft above mean sea level, datum of 1929 (levels by Wadena County Highway Department from Minnesota Highway Department bench mark). Apr. 15, 1910, to Sept. 30, 1914, chain gage at bridge 10 ft downstream at datum 2.2 ft lower. July 28, 1930, to Aug. 19, 1948, chain gage and Aug. 20, 1948, to Nov. 4, 1949, wire-weight gage, at bridge 10 ft downstream at same datum.

Average discharge.--24 years (1939-63), 449 cfs.

Extremes.--Maximum discharge during year, 1,140 cfs June 11 (gage height, 4.12 ft); maximum gage height, 6.29 ft Apr. 1 (backwater from ice); minimum discharge, 164 cfs July 23, 24.
1910-14, 1930-63: Maximum discharge, 2,750 cfs May 23, 1962 (gage height, 6.04 ft); maximum gage height, 7.64 ft Apr. 20, 1950 (backwater from ice); minimum discharge observed, 45 cfs Aug. 7, 1936.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Flow affected by natural storage in many lakes.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	454	404	394	245	186	198	820	520	610	426	350	454
2	448	399	394	245	186	200	722	509	621	404	388	487
3	454	*399	390	240	186	202	711	509	632	404	377	504
4	*454	399	388	240	186	206	666	504	796	404	355	498
5	454	394	340	240	186	210	655	487	833	394	355	487
6	454	399	262	240	186	216	655	476	796	377	333	*476
7	448	402	360	240	186	219	644	470	778	377	316	465
8	454	402	400	240	*186	222	677	465	827	355	*300	454
9	454	402	410	239	186	228	655	460	933	344	306	454
10	454	400	410	235	186	230	*632	476	1,090	328	306	438
11	448	399	400	*233	186	230	616	470	1,130	306	338	438
12	443	399	380	230	186	233	610	470	1,090	*300	487	432
13	460	399	360	230	186	238	593	492	1,030	278	465	426
14	470	400	350	220	185	242	576	498	*968	262	432	416
15	470	400	330	220	185	*250	565	*498	940	252	410	388
16	460	402	325	215	184	255	571	498	898	242	394	372
17	448	402	320	210	183	260	571	520	865	231	394	355
18	443	395	320	208	182	268	560	515	833	217	394	366
19	426	380	318	204	180	276	554	509	796	217	388	382
20	416	370	315	200	181	282	554	504	761	208	372	382
21	416	330	310	198	180	290	548	498	722	194	355	377
22	432	273	305	196	180	300	537	492	677	185	388	372
23	438	315	300	192	182	316	515	476	638	168	394	*372
24	438	335	290	190	184	330	470	460	604	185	394	372
25	438	350	280	190	186	360	460	443	576	221	388	372
26	421	365	275	188	188	380	443	426	571	217	382	366
27	404	375	265	188	190	440	448	448	543	421	404	350
28	404	382	260	187	194	520	476	482	498	537	438	366
29	399	*382	255	187	-	640	509	470	465	465	426	394
30	399	382	250	187	-----	780	520	443	448	394	426	404
31	399	-----	245	187	-----	860	-----	470	-----	372	438	-----
Total	13,600	11,435	10,201	6,664	5,182	9,881	17,533	14,958	22,969	9,685	11,893	12,419
Mean	439	381	329	215	185	319	584	483	766	312	384	414
Cfsm	0.435	0.377	0.326	0.213	0.183	0.316	0.578	0.478	0.758	0.309	0.380	0.410
In.	0.50	0.42	0.38	0.25	0.19	0.36	0.65	0.55	0.85	0.36	0.44	0.46

Calendar year 1962: Max 2,560 Min 218 Mean 507 Cfsm 0.502 In. 6.81
Water year 1962-63: Max 1,130 Min 168 Mean 401 Cfsm 0.397 In. 5.41

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 7-21, 23-27, Dec. 3-5, Dec. 7 to Apr. 1 (no gage-height record Jan. 6-10, Feb. 1-7, Feb. 19 to Mar. 14).

5-2465. Gull Lake near Brainerd, Minn.

Location.--Lat 46°24'40", long 94°21'26", in N½ sec.20, T.134 N., R.29 W., in pool of dam on Gull River, 800 ft south of outlet of Gull Lake, a quarter of a mile upstream from Gull Lake Dam, and 8 miles northwest of Brainerd.

Drainage area.--287 sq mi.

Records available.--August 1911 to September 1963. Prior to October 1941 month-end contents only, published in WSP 1308. Published as Gull Lake Reservoir October 1941 to September 1956.

Gage.--Water-stage recorder. Datum of gage is 1,188.14 ft above mean sea level, adjustment of 1912. Prior to Aug. 10, 1949, staff gage 800 ft north of present site at same datum.

Extremes.--Maximum contents during year, 60,620 acre-ft June 9 (gage height, 6.22 ft); minimum, 48,570 acre-ft Feb. 26 (gage height, 5.29 ft).
1911-63: Maximum contents, 74,800 acre-ft June 30, 1914 (gage height, 7.30 ft); minimum observed, 22,250 acre-ft Mar. 20, 1924 (gage height, 3.00 ft).

Remarks.--Reservoir is formed by Gull Lake and several other natural lakes controlled by concrete dam completed in 1913; storage began in 1912. Capacity (revised) between gage heights 5.00 ft and 7.00 ft (maximum allowable range and normal operating range) is 26,020 acre-ft. Contents shown herein are contents above gage height 1.00 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

Cooperation.--Records furnished by Corps of Engineers, in terms of cfs-days and converted to acre-feet by Geological Survey.

Month-end gage height and contents, water year October 1962 to September 1963

	Gage height (feet)†	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	5.86	55,930	-
Oct. 31.....	5.78	54,900	-1,030
Nov. 30.....	5.49	51,150	-3,750
Dec. 31.....	5.38	49,730	-1,420
Calendar year 1962.....	-	-	-5,690
Jan. 31.....	5.32	48,950	-780
Feb. 28.....	5.31	48,830	-120
Mar. 31.....	5.73	54,270	+5,440
Apr. 30.....	5.95	57,100	+2,830
May 31.....	6.06	58,550	+1,450
June 30.....	6.02	58,020	-530
July 31.....	6.05	58,410	+390
Aug. 31.....	5.97	57,360	-1,050
Sept. 30.....	5.98	57,500	+140
Water year 1962-63.....	-	-	+1,570

† Gage height at 2400.

CROW WING RIVER BASIN

5-2470. Gull River at Gull Lake Dam, near Brainerd, Minn.

Location.--Lat 46°24'40", long 94°21'12", in sec.20, T.134 N., R.29 W., in headwater and tailwater of dam at outlet of Gull Lake, 8 miles northwest of Brainerd.

Drainage area.--287 sq mi.

Records available.--August 1911 to September 1963. Monthly discharge only for some periods, published in WSP 1308. Published as "at Gull Lake Reservoir" 1929.

Gage.--Water-stage recorder on headwater and staff gage on tailwater. Datum of gages is 1,188.14 ft above mean sea level, adjustment of 1912. August 1911 to May 23, 1929, and Dec. 1, 1929, to Aug. 1, 1949, both gages were staff gages at same site and datum. May 24 to Nov. 30, 1929, staff gage 500 ft downstream at different datum.

Average discharge.--52 years, 99.8 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 445 cfs June 11; minimum daily, 15 cfs many days. 1911-63: Maximum daily discharge, 1,123 cfs May 15, 1938; no flow at times.

Remarks.--Discharge computed at dam on basis of modified weir formulas, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Gull Lake (see preceding page).

Cooperation.--Computations of daily discharge furnished by Corps of Engineers; two discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	15	86	59	47	43	42	85	21	125	25	63	22
2	15	85	59	47	43	42	159	21	129	25	57	30
3	15	84	58	47	42	42	242	23	127	24	56	64
4	15	85	60	47	42	42	324	24	129	22	54	63
5	15	80	61	47	41	42	319	23	201	22	52	23
6	15	78	57	47	40	42	399	23	198	21	34	24
7	15	78	56	47	39	42	393	24	225	21	15	24
8	15	76	56	47	37	42	397	27	262	21	15	24
9	15	72	54	47	35	42	393	28	264	20	15	23
10	15	72	52	46	36	42	307	30	387	20	15	23
11	15	71	51	46	44	43	*309	77	445	15	15	23
12	15	70	49	46	44	46	309	77	437	15	26	23
13	15	70	48	46	44	47	305	171	350	15	119	21
14	15	69	*48	45	44	47	303	214	350	15	111	19
15	15	69	48	45	44	47	300	211	265	15	62	19
16	15	69	48	44	43	46	225	211	263	15	23	22
17	15	67	48	44	43	50	233	238	185	15	25	24
18	15	66	48	44	43	50	156	287	118	15	23	25
19	15	65	48	44	43	53	93	277	120	15	15	25
20	15	65	48	44	43	55	97	195	118	15	15	25
21	15	67	48	44	43	55	49	123	114	15	15	25
22	15	65	49	43	43	55	49	123	70	15	18	24
23	15	62	48	43	43	55	49	68	21	15	23	24
24	15	60	48	44	42	55	16	25	21	15	23	22
25	15	59	48	44	42	56	17	25	22	15	23	23
26	15	58	47	44	41	59	18	26	25	15	22	23
27	15	58	48	44	42	63	18	28	26	15	22	23
28	15	58	48	44	42	66	19	148	25	26	24	24
29	15	59	47	43	-	70	22	279	23	28	23	23
30	15	59	47	43	-----	73	63	195	23	68	23	23
31	87	-----	47	43	-----	77	-----	108	-----	65	22	-----
Total	537	2,082	1,581	1,396	1,171	1,588	5,668	3,350	5,068	663	1,048	780
Mean	17.3	69.4	51.0	45.0	41.8	51.2	189	108	169	21.4	33.8	26.0
(∇)	-16.8	-63.0	-23.2	-12.6	-2.14	+88.4	+47.7	+23.5	-9.00	+6.45	-17.1	+2.33
Mean ∇	0.50	6.40	27.8	32.4	39.7	140	237	132	160	27.8	16.7	28.3
Cfsm ∇	0.0017	0.022	0.097	0.113	0.138	0.488	0.826	0.460	0.557	0.097	0.058	0.099
In. ∇	0.001	0.02	0.11	0.13	0.14	0.56	0.92	0.53	0.62	0.11	0.07	0.11

Calendar year 1962: Max 660 Min 15 Mean 102 Mean ∇ 94.1 Cfsm ∇ 0.328 In. ∇ 4.46
 Water year 1962-63: Max 445 Min 15 Mean 68.3 Mean ∇ 70.5 Cfsm ∇ 0.246 In. ∇ 3.32

* Discharge measurement made on this day.

∇ Change in contents, equivalent in cubic feet per second, in Gull Lake.

∇ Adjusted for change in contents.

5-2670. Mississippi River near Royalton, Minn.

Location.--Lat 45°51'40", long 94°21'30", in lot 2, sec.20, T.39 N., R.32 W., at plant of Minnesota Power & Light Co., 4 miles northwest of Royalton, and 4.5 miles downstream from Swan River, and at mile 956 upstream from Ohio River.

Drainage area.--11,600 sq mi, approximately.

Records available.--March 1924 to September 1963.

Average discharge.--39 years, 3,866 cfs.

Extremes.--Maximum daily discharge during year, 11,300 cfs Apr. 6; minimum daily, 1,060 cfs Dec. 11.
1924-63: Maximum daily discharge, 29,400 cfs Apr. 13, 1952; minimum daily, 254 cfs Nov. 25, 1936.

Remarks.--Records fair. Discharge computed on basis of powerplant records. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see p. 70, 72, 74, 78, 87, 82).

Cooperation.--Records collected by Minnesota Power & Light Co. under general supervision of Geological Survey, in connection with a Federal Power Commission project.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4,120	3,350	3,700	2,940	2,250	2,230	9,680	4,080	6,960	3,630	4,520	2,910
2	3,620	3,560	3,720	2,870	2,280	2,240	8,370	4,280	7,120	3,060	4,280	2,980
3	3,840	3,530	3,880	3,130	2,250	2,190	8,260	4,600	7,480	2,790	4,360	3,330
4	3,620	3,820	3,680	2,860	2,340	2,230	8,960	4,500	8,200	3,010	3,720	3,180
5	*3,620	4,030	3,990	2,930	2,330	2,250	9,700	4,280	8,020	2,910	3,420	3,160
6	3,480	3,690	3,480	2,960	2,260	2,220	11,300	3,860	8,130	2,740	3,930	3,180
7	3,590	3,850	3,210	3,020	2,190	2,190	10,700	3,820	8,580	2,780	3,350	3,160
8	3,540	3,980	2,820	3,050	2,300	2,270	9,780	3,890	8,690	2,640	3,110	2,920
9	3,560	3,880	2,240	3,060	2,370	2,290	9,220	4,220	8,960	2,350	2,980	2,750
10	3,500	3,810	1,640	3,000	2,340	2,220	9,140	4,220	9,200	2,120	2,880	2,400
11	3,420	3,890	1,060	2,780	2,410	2,300	*8,540	4,090	9,440	2,120	2,850	2,320
12	3,350	3,820	1,480	2,860	2,290	2,340	8,940	4,440	9,740	2,120	4,040	2,220
13	3,280	4,020	1,670	2,840	2,420	2,340	7,400	5,290	10,500	2,170	5,090	2,150
14	3,420	3,820	2,280	2,700	2,390	2,300	7,080	5,550	10,800	2,060	5,420	1,980
15	3,420	3,820	2,370	2,730	2,320	2,260	6,970	5,880	10,800	1,690	5,200	1,980
16	3,280	3,900	2,510	2,540	2,380	2,320	7,190	6,690	10,800	1,590	4,770	2,240
17	3,220	3,820	2,580	2,490	2,420	2,470	6,680	7,100	10,200	1,690	5,060	2,370
18	3,240	3,630	2,940	2,480	2,360	2,580	6,660	7,390	9,300	1,760	5,080	2,370
19	3,420	3,860	3,050	2,500	2,390	2,540	6,420	7,430	8,790	1,650	4,620	2,270
20	3,380	3,780	3,020	2,420	2,320	2,620	6,180	7,560	8,130	1,670	4,460	2,260
21	3,220	3,910	3,220	2,460	2,270	2,570	5,740	7,560	7,270	1,600	3,950	2,350
22	3,220	3,540	3,270	2,430	2,230	2,570	5,680	6,930	6,580	1,460	3,780	2,470
23	3,220	3,420	2,880	2,400	2,290	3,160	5,180	6,690	6,200	1,680	3,230	2,870
24	3,360	3,420	2,990	2,420	2,440	3,730	5,020	6,370	5,760	1,720	3,370	2,530
25	3,290	3,350	3,220	2,400	2,320	3,820	4,840	6,100	5,380	2,260	2,720	2,490
26	3,540	3,300	3,050	2,340	2,200	4,390	4,700	5,730	4,900	2,160	3,000	2,460
27	3,560	3,830	3,110	2,310	2,190	5,450	4,120	5,660	*4,400	2,910	*3,190	2,300
28	3,470	3,860	2,970	2,370	2,230	5,860	4,340	6,630	4,930	4,640	3,260	2,340
29	3,420	3,740	2,930	2,320	-	6,700	4,580	6,430	3,720	5,120	2,960	2,020
30	3,480	*3,550	2,960	2,210	-----	*7,680	4,460	6,640	3,870	5,400	2,700	1,900
31	3,360	-----	2,800	2,250	-----	8,440	-----	6,740	-----	4,830	3,000	-----
Total	107,060	111,780	88,720	82,070	64,780	100,770	215,830	174,650	232,850	80,330	118,300	75,860
Mean	3,454	3,726	2,862	2,647	2,314	3,251	7,194	5,634	7,762	2,591	3,816	2,529
Cfsm	0.298	0.321	0.247	0.228	0.199	0.280	0.620	0.486	0.669	0.223	0.329	0.218
In.	0.34	0.36	0.28	0.26	0.21	0.32	0.69	0.56	0.75	0.26	0.38	0.24

Calendar year 1962: Max 25,700 Min 1,060 Mean 5,154 Cfsm 0.444 In. 6.01
Water year 1962-63: Max 11,300 Min 1,060 Mean 3,981 Cfsm 0.343 In. 4.65

* Discharge measurement made on this day.

SAUK RIVER BASIN

5-2705. Sauk River near St. Cloud, Minn.

Location.--Lat 45°33'35", long 94°14'00", in SE¼SW¼ sec.8, T.124 N., R.28 W., on right bank half a mile north-west of Waite Park, 3 miles west of St. Cloud, and 5 miles upstream from mouth.

Drainage area.--925 sq mi.

Records available.--July 1909 to December 1912, April to December 1913, May to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 1,034.95 ft above mean sea level, adjustment of 1912. Prior to Nov. 22, 1934, chain gage on highway bridge 1 mile downstream at datum 6.77 ft lower.

Average discharge.--33 years (1909-12, 1930-31, 1934-63) 243 cfs.

Extremes.--Maximum discharge during year, 910 cfs June 1 (gage height, 3.30 ft); minimum daily, 48 cfs

Feb. 11-15, 25; minimum gage height, 0.86 ft Sept. 15, 16.

1909-13, 1929-63: Maximum discharge, 5,580 cfs Apr. 13, 1951 (gage height, 7.89 ft); minimum, 0.3 cfs Nov. 25, 1936.

Remarks.--Records good except those for periods of ice effect, which are fair. Flow regulated by powerplants and reservoirs above station.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 6,
July 24 to Sept. 30)

0.7	44	2.0	346
1.0	89	3.0	748
1.5	199	4.0	1,320

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	280	188	172	94	55	52	340	300	882	162	67	64
2	274	186	172	94	53	55	386	303	860	*157	99	67
3	274	180	172	93	51	55	444	303	806	140	87	67
4	272	180	186	*93	52	56	410	286	753	134	83	68
5	*269	172	180	93	52	56	382	274	753	127	78	68
6	269	*175	155	94	52	58	372	272	728	127	81	70
7	269	188	160	96	51	58	366	280	676	121	83	68
8	283	172	165	96	50	60	382	266	427	110	83	66
9	289	170	160	93	49	62	393	254	444	110	94	61
10	283	170	150	92	49	60	*386	237	480	108	84	61
11	280	167	145	89	*48	65	382	245	487	101	83	60
12	274	172	140	86	48	70	386	245	483	108	94	60
13	266	175	142	93	48	74	376	312	480	110	86	55
14	263	175	145	79	48	80	356	330	455	103	81	54
15	269	180	150	78	48	85	343	324	434	94	78	52
16	292	180	150	78	50	*90	330	327	410	91	76	55
17	254	177	151	79	51	93	334	362	382	89	73	62
18	245	177	151	74	51	98	289	362	366	89	70	83
19	234	175	150	70	50	103	298	343	343	84	67	96
20	234	183	145	68	49	106	309	334	309	83	68	86
21	231	182	140	64	49	107	292	337	283	78	70	92
22	222	180	130	63	49	120	269	312	266	70	75	89
23	225	175	120	62	50	121	283	*292	242	68	79	91
24	219	172	117	60	50	124	280	303	228	70	78	101
25	216	164	112	58	48	125	274	298	216	*72	72	110
26	211	162	108	56	50	*126	263	280	214	67	70	103
27	208	170	105	56	50	148	251	318	194	67	75	99
28	205	172	104	55	50	172	245	483	191	70	*75	92
29	199	172	100	55	-	220	274	507	175	62	73	86
30	199	*172	98	54	-----	277	283	499	164	61	73	84
31	194	-----	97	54	-----	306	-----	551	-----	60	68	-----
Total	7,702	5,263	4,372	2,359	1,401	9,282	9,978	10,139	13,131	2,993	2,423	2,270
Mean	248	175	141	76.1	50.0	106	333	327	438	96.5	78.2	75.7
Cfsm	0.268	0.189	0.152	0.082	0.054	0.115	0.360	0.354	0.474	0.104	0.085	0.082
In.	0.31	0.21	0.18	0.09	0.06	0.13	0.40	0.41	0.53	0.12	0.10	0.09

Calendar year 1962: Max 1,780 Min 37 Mean 362 Cfsm 0.391 In. 5.32
Water year 1962-63: Max 882 Min 48 Mean 179 Cfsm 0.194 In. 2.63

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 21, 22, Dec. 6 to Mar. 29.

5-2750. Elk River near Big Lake, Minn.

Location.--Lat 45°20', long 93°40', in sec.23, T.33 N., R.27 W., on right bank at upstream side of highway bridge, 4 miles east of Big Lake and 4 miles downstream from St. Francis River.

Drainage area.--615 sq mi.

Records available.--April 1911 to September 1917, April to September 1931, April to November 1932, March to November 1933, March 1934 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 899.60 ft above mean sea level, datum of 1929. April 1911 to Sept. 30, 1917, staff gage and Apr. 1, 1931, to July 26, 1934, chain gage, at same site and datum.

Average discharge.--35 years (1911-17, 1934-63), 242 cfs.

Extremes.--Maximum discharge during year, 982 cfs June 11 (gage height, 3.25 ft); maximum gage height, 4.61 ft Mar. 27 (backwater from ice); minimum discharge, 43 cfs Dec. 7 (gage height, 0.66 ft, result of freezeup). 1911-17, 1931-63: Maximum discharge, 5,330 cfs Apr. 10, 1952 (gage height, 10.36 ft), from rating curve extended above 3,800 cfs; minimum, 3.6 cfs July 31, 1934.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 27

Mar. 28 to Sept. 30

1.0	110	0.8	66	2.0	482
1.4	242	1.1	142	3.0	882
2.0	456	1.5	285	4.0	1,280

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	246	160	153	97	74	71	482	311	614	156	81	124
2	238	156	156	96	73	72	462	311	694	152	104	136
3	228	160	*156	*96	72	74	458	338	754	142	127	156
4	224	166	153	96	72	75	426	346	786	136	112	149
5	*218	*163	150	98	74	76	398	342	802	130	107	139
6	214	160	110	100	72	78	366	322	810	124	102	133
7	224	156	105	102	72	80	358	322	842	118	94	130
8	238	156	130	102	71	82	*354	315	890	112	90	124
9	235	156	127	102	71	84	330	289	914	107	118	121
10	221	153	120	100	70	86	318	304	954	104	110	115
11	207	156	112	97	*70	86	315	300	974	100	104	110
12	204	156	108	92	70	87	304	311	966	100	130	107
13	197	156	106	89	69	90	292	366	962	102	188	104
14	190	156	105	88	69	95	278	366	910	100	212	97
15	193	156	105	87	68	105	266	350	842	97	248	102
16	190	156	105	85	68	*112	259	354	758	97	292	121
17	197	156	106	84	68	120	244	370	678	100	292	133
18	193	156	108	83	68	130	241	370	598	97	270	130
19	183	156	108	82	68	145	248	362	530	100	252	160
20	176	156	110	82	68	165	248	370	470	94	237	177
21	173	156	110	82	67	175	244	382	422	90	219	177
22	173	131	107	82	67	220	241	366	370	85	205	184
23	170	125	104	80	66	255	263	330	322	83	202	188
24	170	119	100	80	66	280	270	*330	274	81	191	194
25	166	139	100	80	66	370	270	318	237	*90	177	208
26	163	166	100	79	67	*475	270	311	212	87	160	205
27	163	156	102	78	68	610	266	354	198	87	152	188
28	163	156	104	78	69	662	266	498	*188	102	*146	177
29	163	153	102	77	-	614	289	574	184	100	142	174
30	160	153	100	76	-----	558	307	578	170	92	133	163
31	160	-----	98	75	-----	518	-----	570	-----	87	133	-----
Total	6,040	4,600	3,560	2,725	1,943	6,650	9,333	11,330	18,325	3,252	5,130	4,426
Mean	195	153	115	87.9	69.4	215	311	365	611	105	165	148
Cfs/m	0.317	0.249	0.187	0.143	0.113	0.350	0.506	0.593	0.993	0.171	0.268	0.241
In.	0.37	0.28	0.22	0.16	0.12	0.40	0.56	0.69	1.11	0.20	0.31	0.27

Calendar year 1962: Max 2,000 Min 66 Mean 292 Cfs/m 0.475 In. 6.46
 Water year 1962-63: Max 974 Min 66 Mean 212 Cfs/m 0.345 In. 4.69

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 22-25, Dec. 6 to Mar. 27.

CROW RIVER BASIN

92

5-2780. Middle Fork Crow River near Spicer, Minn.

Location.--Lat 45°15'45", long 94°48'10", in NE¼ sec.27, T.121 N., R.33 W., on right bank 75 ft upstream from highway bridge, 1½ miles downstream from Lake Calhoun, 3 miles downstream from Green Lake, and 6.8 miles northeast of Spicer.

Drainage area.--179 sq mi.

Records available.--March 1949 to September 1963.

Gage.--Water-stage recorder and concrete and steel V-notch sharp-crested weir. Datum of gage is 1,147.93 ft above mean sea level, datum of 1929 (Kandiyohi County Highway Department bench mark). Prior to July 20, 1950, chain gage at bridge 75 ft downstream at same datum.

Average discharge.--14 years, 48.4 cfs.

Extremes.--Maximum discharge during year, 196 cfs June 8 (gage height, 5.00 ft); minimum daily, 1.3 cfs Jan. 30 to Feb. 25.

1949-63: Maximum discharge, 408 cfs June 29, 1953; maximum gage height, 6.67 ft June 25, 1957; no flow Mar. 15-24, 1949, Feb. 26 to Mar. 26, 1960.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Flow affected by natural storage and some regulation from lakes above station.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 3-14, July 30, 31)

Oct. 1 to Mar. 20

Mar. 21 to Sept. 30

2.0	5.6	1.9	2.3	2.5	26
2.1	8.8	2.0	4.7	3.0	51
2.2	13	2.1	8.1	4.0	120
2.5	30	2.3	17	5.0	210

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	21	12	8.8	9.1	1.3	1.5	41	92	126	75	35	15
2	19	12	9.7	9.3	1.3	1.5	44	86	114	*75	37	15
3	19	12	9.7	*9.6	1.3	1.5	52	82	105	76	36	6.4
4	19	16	9.4	9.8	*1.3	1.6	50	86	120	66	33	6.1
5	18	11	9.2	10	1.3	1.6	43	85	149	64	31	6.4
6	18	*12	9.0	10	1.3	1.6	39	82	*173	61	29	6.4
7	21	15	9.0	10	1.3	1.7	37	86	185	56	27	*6.7
8	*26	11	9.1	9.8	1.3	1.7	41	82	195	52	26	6.4
9	27	9.7	9.3	9.5	1.3	1.8	42	80	189	49	26	5.7
10	27	9.2	9.3	9.1	1.3	1.8	43	*88	178	46	24	5.4
11	29	8.4	9.3	8.5	1.3	1.9	*43	89	165	42	24	5.4
12	27	8.8	9.1	7.7	1.3	2.0	48	98	156	50	25	4.7
13	24	8.8	9.1	6.5	1.3	2.0	46	113	154	54	24	2.8
14	24	7.7	9.3	5.6	1.3	2.9	44	98	152	51	23	2.3
15	26	8.8	9.5	4.8	1.3	4.5	38	76	154	47	21	6.1
16	23	8.4	9.7	4.2	1.3	7.0	40	72	156	46	21	8.9
17	15	7.7	9.8	3.7	1.3	11	44	72	149	49	21	9.4
18	16	8.0	9.6	3.3	1.3	19	31	62	140	47	19	11
19	18	7.7	9.5	2.9	1.3	*24	29	66	133	47	19	11
20	17	9.2	9.3	2.6	1.3	25	25	78	124	44	18	9.8
21	18	12	9.2	2.3	1.3	25	22	86	116	41	18	8.9
22	20	9.4	9.1	2.1	1.3	24	22	93	110	38	18	7.4
23	17	8.4	9.0	2.0	1.3	26	26	100	102	35	17	7.4
24	17	8.8	8.9	1.9	1.3	33	39	112	93	35	17	8.1
25	17	8.4	8.7	1.8	1.3	35	49	106	89	39	16	9.8
26	14	8.4	8.5	1.6	1.4	*37	57	102	89	40	15	9.4
27	14	8.4	8.4	1.5	1.4	37	62	102	79	42	16	*9.8
28	15	8.4	8.4	1.4	1.5	38	64	124	73	44	16	8.5
29	14	8.8	8.6	1.4	-	42	93	140	78	41	15	6.7
30	16	*8.8	8.8	1.3	-----	41	101	145	76	39	15	6.4
31	13	-----	9.0	1.3	-----	41	-----	140	-----	38	15	-----
Total	609	293.2	283.3	164.6	36.8	494.6	1,355	2,923	3,922	1,529	697	233.3
Mean	19.6	9.77	9.14	5.31	1.31	16.0	45.2	94.3	131	49.3	22.5	7.78
Cfsm	0.109	0.055	0.051	0.030	0.0073	0.089	0.253	0.527	0.732	0.275	0.126	0.043
In.	0.13	0.06	0.06	0.03	0.008	0.10	0.28	0.61	0.81	0.32	0.14	0.05

Calendar year 1962: Max 176 Min 0.3 Mean 33.9 Cfsm 0.189 In. 2.58
Water year 1962-63: Max 195 Min 1.3 Mean 34.4 Cfsm 0.192 In. 2.60

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 22, Dec. 4 to Mar. 20 (no gage-height record Jan. 20 to Feb. 3, Feb. 25 to Mar. 17).

5-2785. South Fork Crow River at Cosmos, Minn.

Location.--Lat 44°56'05", long 94°40'20", in SW¼ sec.14, T.117 N., R.32 W., on downstream side of bridge on State Highway 7, 1 mile east of Cosmos, 2¼ miles upstream from small tributary, and 3¼ miles west of Corvuso.

Drainage area.--221 sq mi.

Records available.--March 1945 to September 1963.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 1,079.09 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Mar. 1 to Sept. 3, 1945, chain gage and Sept. 4, 1945, to June 12, 1959, wire-weight gage, at same site at datum 3.00 ft higher.

Average discharge.--18 years, 42.8 cfs.

Extremes.--Maximum discharge during year, 1,260 cfs June 5 (gage height, 10.89 ft, from graph based on gage readings); no flow on many days.

1945-63: Maximum discharge, 1,890 cfs June 17, 1957 (gage height, 12.62 ft, present datum, from graph based on gage readings); no flow on many days.

Remarks.--Records good except those for period of ice effect, which are fair.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*7.5	*5.4	5.5	0.3		0	24	31	49	48	32	22
2	6.5	5.1	5.8	.3		0	22	28	54	45	34	23
3	6.5	4.8	5.9	*.3		0	*20	30	76	*45	33	*22
4	6.5	5.1	5.6	.3	(*)	0	18	32	*256	44	31	28
5	6.5	4.1	5.3	.3		0	16	28	970	43	29	33
6	6.5	3.7	5.0	.3		0	16	*26	886	42	28	26
7	11	3.9	4.7	.3		0	17	25	636	41	27	25
8	11	4.1	4.4	.3		0	17	26	501	38	26	24
9	9.9	4.3	4.0	.3		0	16	25	388	36	28	22
10	8.5	4.5	3.6	.3		0	14	61	*661	34	27	21
11	7.9	4.6	3.2	.2		(*)0	13	49	526	32	27	21
12	7.1	4.6	3.0	.2		0	14	123	401	33	30	21
13	7.1	4.6	2.7	.2		0	14	114	359	34	28	20
14	7.3	4.5	2.6	.2		0.1	13	65	318	32	26	20
15	7.9	4.5	2.5	.2		.6	12	51	278	31	26	20
16	8.1	4.3	2.5	.2		.9	11	45	227	32	25	27
17	7.5	4.0	2.5	.2		2.3	13	53	176	32	25	24
18	7.1	3.7	2.5	.1		6.0	12	49	125	36	25	23
19	7.1	3.4	2.4	.1		*9.3	13	40	98	52	24	22
20	6.7	3.2	2.3	.1		15	13	34	86	39	24	22
21	6.7	3.3	2.1	.1		22	13	32	74	35	23	22
22	7.3	3.4	1.9	.1		35	13	28	66	33	23	21
23	7.1	3.5	1.6	.1		100	14	26	60	30	24	22
24	6.9	3.7	1.3	.1		260	12	25	51	30	24	22
25	6.9	3.9	1.0	.1		234	17	24	49	38	24	24
26	6.9	*4.0	.7	0		140	18	23	51	38	23	24
27	6.5	4.3	.5	0		*60	17	27	48	37	23	*23
28	6.3	4.6	.4	0		54	17	71	50	37	24	22
29	6.0	4.9	.4	0		48	27	88	61	*34	24	21
30	5.8	5.2	.3	0		34	36	67	50	36	23	20
31	5.6	-----	.3	0	-----	27	-----	56	-----	36	22	-----
Total	226.2	127.2	86.5	5.2	0	1,048.2	492	1,402	7,631	1,153	812	687
Mean	7.30	4.24	2.79	0.17	0	33.8	16.4	45.2	254	37.2	26.2	22.9
Cfsm	0.033	0.019	0.013	0.00077	0	0.153	0.074	0.20	1.15	0.17	0.12	0.10
In.	0.04	0.02	0.01	0.0009	0	0.18	0.08	0.24	1.28	0.19	0.14	0.12

Calendar year 1962: Max 385 Min 0 Mean 21.8 Cfsm 0.0986 In. 1.33
 Water year 1962-63: Max 970 Min 0 Mean 37.4 Cfsm 0.17 In. 2.30

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 7 to Mar. 24.

CROW RIVER BASIN

5-2790. South Fork Crow River near Mayer, Minn.

Location.--Lat 44°54'20", long 93°53'05", in SW¼SW¼ sec.30, T.117 N., R.25 W., near center of span on down-stream side of bridge on State Highway 7, 1.3 miles north of Mayer, 4.3 miles southwest of Watertown, and 16 miles upstream from confluence with North Fork.

Drainage area.--1,170 sq mi, approximately.

Records available.--April 1934 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 926.00 ft above mean sea level (levels by Hennepin County Park Board Survey). Prior to June 14, 1940, chain gage at same site and datum.

Average discharge.--29 years, 217 cfs.

Extremes.--Maximum discharge during year, 3,750 cfs June 12 (gage height, 10.84 ft); no flow for many days. 1934-63: Maximum discharge, 11,000 cfs Apr. 10, 1952 (gage height, 15.70 ft); no flow at times.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 28

Mar. 29 to Sept. 30

1.2	24	1.1	20	4.0	512
1.3	36	1.2	28	5.0	780
1.5	63	1.4	53	7.0	1,580
2.0	137	1.6	81	9.0	2,520
		2.0	148	11.0	3,890
		3.0	321		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	42	39	42	3.8	0.5	0	425	272	642	325	86	28
2	49	40	46	3.8	.5	0	368	258	653	312	84	28
3	52	37	39	*3.6	.5	0	*326	245	659	296	86	*35
4	52	39	38	3.6	*.4	0	294	238	659	267	84	39
5	53	35	37	3.5	.4	0	269	224	*717	253	81	66
6	50	39	20	3.4	.4	0	221	*211	913	230	72	66
7	53	37	20	3.4	.4	0	208	202	1,070	219	65	55
8	73	35	19	3.3	.4	0	214	185	1,170	*202	62	55
9	112	40	18	3.2	.4	0	213	187	1,760	184	61	55
10	113	35	16	3.2	.3	0	204	.255	*2,650	172	58	54
11	118	35	14	3.1	.3	*0	187	480	3,550	153	54	47
12	108	32	13	2.9	.3	0	177	578	3,610	140	54	43
13	108	32	12	2.7	.3	.1	172	720	3,490	134	49	38
14	108	34	11	2.5	.2	.2	162	843	3,490	145	53	32
15	90	34	10	2.4	.2	.7	151	892	3,400	138	46	28
16	84	32	9.8	2.2	.2	2.0	143	896	2,880	122	54	26
17	74	31	9.6	2.1	.2	23	131	913	2,110	107	53	28
18	73	30	9.4	1.9	.1	*133	153	913	1,740	118	49	28
19	69	30	9.4	1.8	.1	200	122	832	1,530	131	42	39
20	66	32	8.9	1.6	.1	250	112	704	1,380	131	39	45
21	56	29	8.2	1.5	.1	285	107	589	1,180	145	38	42
22	56	18	7.4	1.3	0	310	104	519	910	133	38	38
23	49	31	6.8	1.2	0	340	109	442	674	131	37	38
24	48	30	6.4	1.1	0	390	122	380	556	111	37	37
25	41	33	5.9	1.0	0	450	143	330	416	102	37	49
26	40	*37	5.5	.9	0	530	143	294	370	89	35	75
27	40	52	5.1	.8	0	*650	151	258	344	81	35	64
28	40	49	4.6	.7	0	880	146	289	317	131	34	69
29	*39	46	4.2	.7	-	868	155	456	321	*138	36	62
30	44	46	4.1	.6	-----	668	216	571	348	111	36	*57
31	39	-----	3.9	.6	-----	519	-----	625	-----	95	36	-----
Total	2,039	1,069	464.2	68.4	6.3	6,499.0	5,648	14,801	43,509	5,046	1,631	1,366
Mean	65.8	35.6	15.0	2.21	0.225	210	188	477	1,450	163	52.6	45.5
Cfs/m	0.056	0.030	0.013	0.0019	0.00019	0.179	0.161	0.408	1.24	0.139	0.045	0.039
In.	0.06	0.03	0.01	0.002	0.00002	0.21	0.18	0.47	1.38	0.16	0.05	0.04

Calendar year 1962 Max 2,950 Min 1.0 Mean 312 Cfs/m 0.268 In. 3.26
 Water year 1962-63 Max 3,610 Min 0 Mean 225 Cfs/m 0.192 In. 2.59

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 21, 23-25, Dec. 4 to Mar. 28.

5-2800. Crow River at Rockford, Minn.

Location.--Lat 45°05'15", long 93°44'00", in sec.29, T.119 N., R.24 W., on right bank at Rockford, 150 ft downstream from bridge on State Highway 55 and 1 mile downstream from confluence of North and South Forks.

Drainage area.--2,520 sq mi, approximately.

Records available.--April to July 1906 (published as "near Dayton"), June 1909 to September 1917, April to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 893.65 ft above mean sea level, adjustment of 1912. Apr. 13 to July 21, 1906, staff gage at Berning Mill 14 miles downstream at different datum. June 4, 1909, to Sept. 30, 1917, staff gage at site 600 ft downstream at different datum. Apr. 23, 1929, to Aug. 21, 1934, chain gage at site 600 ft downstream at present datum.

Average discharge.--38 years (1909-17, 1930-31, 1934-63), 558 cfs.

Extremes.--Maximum discharge during year, 4,630 cfs June 15 (gage height, 8.58 ft); minimum daily, 28 cfs Feb. 1-3.

1909-17, 1929-63: Maximum discharge, 13,900 cfs Apr. 13, 1952 (gage height, 16.24 ft); minimum, 1.8 cfs Nov. 15, 1936 (gage height, 1.05 ft), caused by ice jam upstream.

Remarks.--Records good.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.8	57	2.5	220	4.0	1,010
2.0	89	3.0	401	6.0	2,540
2.2	136	3.5	662	9.0	4,980

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	226	170	196	64	28	35	*1,230	*793	1,550	877	269	103
2	229	159	196	63	28	35	1,080	800	1,660	828	263	105
3	241	157	199	62	28	35	972	821	1,770	780	253	105
4	250	154	196	61	29	36	885	835	1,800	720	253	107
5	247	152	187	60	29	36	835	821	1,930	662	250	122
6	241	149	149	59	29	37	753	793	2,070	614	235	152
7	256	146	119	58	30	38	720	780	2,190	574	223	141
8	300	152	110	57	31	38	746	753	2,310	536	211	131
9	342	149	100	56	32	40	793	739	2,430	499	208	126
10	384	152	95	54	33	41	800	950	2,830	465	202	122
11	384	146	90	53	34	43	766	1,130	3,380	432	190	119
12	371	146	85	52	35	45	675	1,320	3,980	428	196	112
13	358	144	81	50	36	47	608	1,510	4,390	419	184	105
14	350	144	*74	48	37	*50	568	1,630	4,530	410	173	96
15	338	144	72	47	38	53	536	1,720	4,610	410	168	89
16	304	144	72	45	38	57	520	1,760	4,560	397	157	94
17	289	144	72	*44	39	62	484	1,800	4,290	380	157	91
18	282	141	71	42	*39	70	494	1,820	3,910	362	154	96
19	266	139	71	41	39	85	499	1,790	3,510	367	146	105
20	247	139	72	39	38	110	494	1,730	3,130	367	136	114
21	232	139	73	38	38	150	484	1,620	2,740	362	129	122
22	223	134	73	37	38	215	480	1,480	2,420	350	126	117
23	214	119	72	36	37	300	484	1,340	2,050	338	126	112
24	205	114	72	35	37	500	504	1,220	1,780	314	126	117
25	196	122	71	33	36	*1,160	530	1,110	1,530	293	126	129
26	196	*154	70	32	36	1,410	541	1,020	1,310	282	124	129
27	190	182	69	31	35	1,560	557	965	1,150	282	126	149
28	187	196	68	31	*34	1,700	552	972	*1,020	311	124	144
29	*184	199	67	30	-	1,840	591	1,110	942	334	*119	141
30	176	196	66	29	-----	1,720	688	1,320	921	*311	112	*134
31	176	-----	*66	*29	-----	1,490	-----	*1,440	-----	286	107	-----
Total	8,084	4,526	3,074	1,416	961	13,038	19,869	37,892	76,693	13,990	5,373	3,529
Mean	261	151	99.2	45.7	34.3	421	662	1,222	2,556	451	173	118
Cfsm	0.104	0.060	0.039	0.018	0.014	0.167	0.263	0.485	1.01	0.179	0.069	0.047
In.	0.12	0.07	0.05	0.02	0.01	0.19	0.29	0.56	1.13	0.21	0.08	0.05

Calendar year 1962: Max 4,960 Min 26 Mean 789 Cfsm 0.313 In. 4.27
 Water year 1962-63: Max 4,610 Min 28 Mean 516 Cfsm 0.205 In. 2.78

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 25, Dec. 8-11, Dec. 17 to Mar. 28 (no gage-height record Jan. 15, 16).

RUM RIVER BASIN

5-2840. Mille Lacs Lake at Garrison, Minn.

Location.--Lat 46°18'05", long 93°49'05", in SW¼SE¼ sec.12, T.44 N., R.28 W., at pumphouse of Minnesota Division of Game and Fish, a quarter of a mile southwest of Borden Lake Outlet and three-quarters mile north-east of Garrison.

Records available.--June 1931 to September 1963. Prior to October 1939, published as "at Wealthwood."

Gage.--Water-stage recorder. Datum of gage is 1,240.40 ft above mean sea level, datum of 1929. Prior to Oct. 1, 1941, staff gage at Wealthwood at various datums; gage readings have been reduced to elevations above mean sea level, adjustment of 1912. Oct. 1, 1941, to Sept. 30, 1958, water-stage recorder at datum 1,240.50 ft above mean sea level, adjustment of 1912. To convert these records to datum of 1929, subtract 0.10 ft.

Extremes.--Maximum elevation during year, 1,251.65 ft June 8 (affected by wind action); minimum, 1,249.38 ft Nov. 21 (affected by wind action).
1931-63: Maximum elevation, 1,253.51 ft July 25, 1952: minimum observed, 1,245.74 ft Oct. 16-19, 1936.

Remarks.--Water level affected by fixed-crest spillway at outlet of Ogechie Lake with crest at elevation 1,250.50 ft. Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

Mean daily elevation, in feet, October 1962 to September 1963

Oct. 31..... 1,249.91	Jan. 31..... 1,249.76	Apr. 30..... 1,250.27	July 31..... 1,250.51
Nov. 30..... 1,249.72	Feb. 28..... 1,249.81	May 31..... 1,250.48	Aug. 31..... 1,250.31
Dec. 31..... 1,249.72	Mar. 31..... 1,249.95	June 30..... 1,250.68	Sept.30..... 1,250.32

Note.--Elevations other than those shown are available.

RUM RIVER BASIN

97

5-2847.5. Rum River at Spencer Brook, Minn.

Location.--Lat 45°31'45", long 93°26'21", in NW¼NE¼ sec.15, T.35 N., R.25 W., near center of right span on downstream side of county highway bridge, 200 ft downstream from Spencer Brook, ¼ mile north of Spencer Brook store, and 7½ miles southeast of Princeton.

Records available.--July 1960 to September 1963.

Gage.--Wire-weight gage read once daily. Datum of gage is 925.65 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Extremes.--Maximum discharge during year, 5,380 cfs June 10 (gage height, 12.44 ft); minimum daily, 30 cfs Feb. 22-24; minimum gage height, 0.64 ft Sept. 11.

1960-63: Maximum discharge, 7,350 cfs May 25, 1962 (gage height, 13.12 ft); minimum daily, 14 cfs Jan. 27 to Feb. 3, 1961; minimum gage height, 0.50 ft Sept. 2, 3, 1961.

Remarks.--Records good except those for period of ice effect, which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 16 to July 10)

Oct. 1 to Mar. 26

Mar. 27 to Sept. 30

0.9	60	0.6	42	5.0	787
1.1	81	0.8	58	7.0	1,270
1.3	104	1.0	77	9.0	1,930
		1.4	119	10.0	2,450
		2.0	195	11.0	3,260
		3.0	362	12.2	4,860

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	90	73	88	35	33	31	445	601	2,050	123	51	46
2	91	70	89	35	32	32	425	612	1,910	*123	54	55
3	92	70	92	35	32	33	413	636	1,930	111	57	56
4	93	72	92	35	32	33	399	565	2,410	101	60	56
5	93	72	68	36	32	34	364	502	2,510	98	*58	61
6	94	*72	47	36	33	34	333	475	2,560	96	53	*60
7	96	70	*37	35	32	36	312	409	2,200	95	52	56
8	98	70	39	35	32	36	298	358	2,100	90	52	54
9	98	70	38	35	*32	36	349	319	2,400	86	51	51
10	96	72	37	35	32	37	419	317	*4,860	80	50	49
11	92	72	37	35	31	38	377	319	4,290	79	50	45
12	90	74	36	35	31	39	328	326	*3,240	78	82	48
13	88	75	36	35	31	41	305	333	2,350	77	219	55
14	86	75	36	*35	31	43	274	597	*1,830	77	381	57
15	85	74	36	35	31	45	271	817	1,500	76	303	60
16	*84	75	36	35	31	47	266	828	1,200	76	236	61
17	82	75	37	35	31	50	260	851	884	76	171	62
18	80	74	37	34	32	54	257	599	713	73	132	80
19	78	74	36	34	31	58	277	738	580	72	117	88
20	77	74	36	34	31	63	291	847	419	71	105	97
21	76	72	36	33	31	77	339	789	407	70	92	106
22	75	73	36	33	30	95	391	654	370	69	85	111
23	73	75	36	33	30	155	*375	597	312	65	82	92
24	73	76	36	33	30	320	348	514	274	62	76	91
25	73	77	36	33	31	*742	330	580	238	60	72	94
26	72	77	36	32	31	970	317	738	210	60	64	89
27	72	76	36	32	31	1,040	305	890	195	60	58	85
28	72	76	35	32	31	879	298	1,060	180	60	56	82
29	73	80	35	32	-	663	288	1,240	160	59	53	76
30	73	88	35	32	-	578	460	1,540	141	55	50	74
31	72	-----	35	33	-----	498	-----	2,010	-----	53	48	-----
Total	2,587	2,223	1,382	1,057	878	6,837	10,114	21,661	44,423	2,431	3,070	2,097
Mean	83.5	74.1	44.6	34.1	31.4	221	337	699	1,481	78.4	99.0	69.9
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1962: Max 7,240 Min 27 Mean 324 Ac-ft -
Water year 1962-63: Max 4,860 Min 30 Mean 271 Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Mar. 26.

RUM RIVER BASIN

5-2860. Rum River near St. Francis, Minn.

Location.--Lat 45°19'40", long 93°22'20", in SE¼ sec.19, T.33 N., R.24 W., on left bank at upstream side of highway bridge, 4 miles south of St. Francis and 15½ miles upstream from mouth.

Drainage area.--1,360 sq mi, approximately.

Records available.--May to November 1929, March 1930 to September 1931, April to November 1932, March 1933 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 861.12 ft above mean sea level, adjustment of 1912. Prior to Nov. 9, 1933, chain gage at site 50 ft downstream at same datum.

Average discharge.--31 years (1930-31, 1933-63), 534 cfs.

Extremes.--Maximum discharge during year, 4,160 cfs June 14 (gage height, 7.07 ft); minimum, 154 cfs Aug. 11 (gage height, 2.35 ft).
1929-63: Maximum discharge, 9,260 cfs Apr. 13, 1952 (gage height, 11.03 ft); minimum, 29 cfs Aug. 18, 1934 (gage height, 1.91 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 27

Mar. 28 to Sept. 30

2.2	100	2.3	139	4.0	1,060
2.5	192	2.5	202	5.0	1,940
3.0	390	3.0	400	6.0	2,940
		3.5	690	7.0	4,080

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	256	230	248	119	113	129	956	722	1,410	*391	167	161
2	259	223	252	119	116	130	855	790	1,670	378	212	176
3	263	219	252	119	118	131	783	892	1,940	364	216	183
4	271	223	256	119	120	132	748	940	2,100	347	212	186
5	271	219	256	119	123	133	690	932	2,240	338	*196	186
6	271	*219	237	118	126	134	658	878	2,330	330	186	*183
7	271	216	*172	117	129	135	613	825	2,480	330	176	186
8	275	219	166	116	130	136	595	755	2,640	313	170	183
9	286	216	180	114	130	138	607	703	2,790	281	170	176
10	286	216	155	112	130	139	607	677	*2,860	273	161	170
11	286	216	149	110	129	140	625	644	2,910	258	158	164
12	275	216	140	109	129	143	670	658	*3,140	251	226	209
13	259	216	138	109	129	146	601	690	3,680	251	309	209
14	252	216	139	*109	*129	148	547	790	*4,080	243	342	192
15	248	216	140	108	129	150	505	848	4,060	240	461	186
16	*244	219	140	107	128	154	488	940	3,740	240	500	205
17	244	219	140	107	128	156	500	1,040	3,300	240	450	254
18	237	219	138	106	130	160	488	1,110	2,810	229	378	240
19	230	219	137	106	131	165	488	1,080	2,270	222	326	266
20	226	219	136	106	130	175	517	1,050	1,730	222	289	289
21	219	219	133	106	128	225	535	1,060	1,330	209	262	285
22	216	216	130	106	127	290	559	1,080	1,050	192	247	273
23	212	195	128	106	126	370	*595	1,040	878	180	243	262
24	212	206	124	107	125	490	625	980	755	170	233	258
25	212	216	122	107	126	*630	625	908	651	176	216	273
26	209	223	121	107	127	760	613	855	589	170	205	305
27	209	226	120	108	127	1,050	513	878	535	176	199	301
28	212	230	119	108	128	1,450	607	996	478	212	192	273
29	226	241	118	108	-	1,580	613	1,120	450	196	180	258
30	233	241	118	109	-----	1,360	664	1,190	410	186	173	251
31	233	-----	119	110	-----	1,120	-----	1,280	-----	173	167	-----
Total	7,603	6,588	4,923	3,431	3,541	12,199	18,590	28,351	61,306	7,781	7,622	6,743
Mean	245	220	159	111	126	394	620	915	2,044	251	246	225
Cfsm	0.180	0.162	0.117	0.082	0.093	0.290	0.456	0.673	1.50	0.185	0.181	0.165
In.	0.21	0.18	0.13	0.09	0.10	0.33	0.51	0.78	1.68	0.21	0.21	0.18

Calendar year 1962 Max 4,820 Min 104 Mean 523 Cfsm 0.385 In. 5.20
Water year 1962-63 Max 4,080 Min 106 Mean 462 Cfsm 0.340 In. 4.61

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 7 to Mar. 27.

MISSISSIPPI RIVER MAIN STEM

99

5-2885. Mississippi River near Anoka, Minn.

Location.--Lat 45°07'36", long 93°17'48", in SW¼ sec.12, T.119 N., R.21 W., on right bank half a mile downstream from Coon Creek, 1½ miles downstream from hydroelectric plant of Northern States Power Co. at Coon Rapids, 6½ miles downstream from Anoka, and at mile 864.8 upstream from Ohio River.

Drainage area.--19,100 sq mi, approximately.

Records available.--June 1931 to September 1963. Prior to October 1931 published as "at Coon Rapids, near Anoka."

Gage.--Water-stage recorder. Datum of gage is 805.02 ft above mean sea level, adjustment of 1912. Prior to June 14, 1932, at site 1¼ miles upstream at different datum.

Average discharge.--32 years, 6,750 cfs.

Extremes.--Maximum discharge during year, 22,600 cfs June 15 (gage height, 7.84 ft); minimum daily, 1,700 cfs Dec. 11; minimum gage height, 1.20 ft Oct. 8.

1931-63: Maximum discharge, 75,900 cfs Apr. 14, 1952 (gage height, 17.51 ft); minimum, 586 cfs Sept. 13, 1934 (gage height, 0.37 ft).

Remarks.--Records excellent except those for period of ice effect, which are good. Flow slightly regulated by six reservoirs on headwaters; total usable capacity, 1,640,600 acre-ft. Diurnal regulation caused by power-plant above station.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.5	2,320	4.0	8,250
2.0	3,300	6.0	15,100
3.0	5,600	8.0	23,300

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6,050	5,000	5,530	4,050	3,100	3,090	14,000	8,050	13,600	*6,780	6,390	3,700
2	6,750	5,380	5,360	4,250	3,000	3,020	14,500	7,850	14,300	6,440	6,020	4,190
3	5,880	5,190	*5,500	4,200	3,050	3,100	12,700	8,190	15,400	5,500	6,050	4,030
4	5,950	5,220	5,120	4,150	3,080	3,100	12,000	8,790	15,800	4,810	5,480	4,900
5	5,850	*5,600	5,700	4,200	3,200	3,160	12,300	8,460	16,100	5,310	5,480	4,980
6	5,580	5,530	5,430	4,200	3,200	3,180	12,800	8,130	16,400	5,100	4,700	5,170
7	5,920	5,480	5,190	4,200	3,250	3,200	14,200	7,760	17,200	4,830	5,380	4,580
8	5,440	5,700	4,420	4,200	3,000	3,300	*14,700	7,440	17,900	4,580	4,880	4,810
9	*6,460	5,340	4,600	4,300	3,080	3,160	13,400	7,460	17,800	5,050	4,740	4,440
10	5,850	5,600	2,500	4,300	3,000	3,300	12,300	7,960	18,900	4,300	4,490	3,920
11	6,000	5,600	1,700	3,850	3,300	3,200	12,200	7,880	19,000	3,890	4,470	3,610
12	5,780	5,980	1,900	3,700	3,100	3,250	12,100	8,310	19,800	3,650	4,400	3,630
13	5,650	5,170	2,080	3,200	3,250	3,280	11,600	9,410	20,800	3,740	6,050	3,740
14	5,500	5,550	2,200	3,900	3,350	3,500	10,400	9,790	22,000	3,740	6,570	2,690
15	5,580	5,600	3,000	3,800	3,300	3,500	9,690	10,400	22,100	3,780	6,780	3,170
16	5,600	5,620	3,800	3,600	3,300	3,700	9,960	10,800	21,500	3,590	6,910	3,340
17	5,620	5,530	3,900	3,750	3,230	3,750	9,820	12,200	20,300	3,090	7,010	3,450
18	5,360	5,340	4,200	3,400	3,290	4,050	9,860	12,700	19,300	2,630	6,540	3,520
19	5,410	5,260	4,350	3,250	3,380	4,550	8,940	12,400	17,400	2,930	6,620	4,170
20	5,430	5,500	4,400	3,200	3,250	4,650	9,600	12,500	15,400	3,200	6,280	4,260
21	5,340	5,500	4,100	3,200	3,200	4,200	8,970	12,300	14,000	3,170	5,530	4,010
22	5,100	5,720	4,550	3,230	3,150	5,050	8,490	12,200	12,500	3,050	5,780	3,650
23	5,050	5,260	4,400	3,300	3,120	4,800	8,520	12,800	11,200	2,540	5,480	3,870
24	5,170	5,140	4,000	3,260	3,120	5,800	8,490	*11,000	10,500	2,600	5,480	3,870
25	5,480	5,120	3,800	3,230	3,500	8,500	8,080	10,900	9,570	3,200	4,700	4,700
26	5,050	5,120	4,250	3,200	3,150	10,200	7,790	10,000	8,880	*3,260	4,700	4,350
27	5,190	5,380	4,300	3,150	3,130	9,500	7,630	9,990	8,160	3,540	4,720	4,100
28	5,410	5,100	4,100	3,200	3,100	11,800	7,600	10,700	7,440	3,890	4,400	4,140
29	5,500	5,750	4,300	3,350	-	14,300	7,540	12,300	7,440	5,920	*4,420	3,810
30	5,190	5,430	4,000	3,300	-----	14,700	8,310	12,400	6,850	6,360	4,510	3,390
31	5,380	-----	3,700	3,100	-----	14,200	-----	12,800	-----	6,440	4,280	-----
Total	173,520	162,710	126,380	113,220	89,180	172,090	318,490	313,870	457,540	130,910	169,240	120,190
Mean	5,597	5,424	4,077	3,652	3,185	5,551	10,620	10,120	15,250	4,223	5,459	4,006
Cfsm	0.293	0.284	0.213	0.191	0.167	0.291	0.556	0.530	0.798	0.221	0.286	0.210
In.	0.34	0.32	0.25	0.22	0.17	0.34	0.62	0.61	0.89	0.25	0.33	0.23

Calendar year 1962: Max 39,400 Min 1,700 Mean 8,232 Cfsm 0.431 In. 5.85
 Water year 1962-63: Max 22,100 Min 1,700 Mean 6,431 Cfsm 0.337 In. 4.57

* Discharge measurement made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 28.

MINNEHAHA CREEK BASIN

5-2890. Minnetonka Lake near Wayzata, Minn.

Location.--Lat 44°57'00", long 93°29'55", in SW¼SW¼ sec.8, T.117 N., R.22 W., on east side of Wayzata Bay, 150 ft north of bridge over channel connecting Grays Bay and Wayzata Bay on State Highway 101.

Records available.--June 1938 to September 1963 (fragmentary prior to October 1941). Lake elevations collected in this vicinity since 1881, are contained in files of Hennepin County Highway Department. Published as "at Excelsior" prior to June 1947.

Gage.--Water-stage recorder. Datum of gage is 922.30 ft above mean sea level, datum of 1929. Prior to Sept. 10, 1939, staff gage and Sept. 10, 1939, to July 28, 1952, water-stage recorder, at Excelsior, at elevation 920.00 ft, above mean sea level, 1903 adjustment, which is 0.96 higher than present datum. Gage readings have been reduced to elevations above mean sea level, datum of 1929, subsequent to June 30, 1947.

Extremes.--Maximum elevation during year, 929.84 ft June 13; minimum, 928.61 ft Sept. 28.
1939-63: Maximum elevation, 930.42 ft Sept. 17, 1951; minimum, 922.72 ft Dec. 21, 1938, to Jan. 3, 1939 (datum of 1929).

Remarks.--Water level subject to fluctuation caused by wind action.

Mean daily elevation, in feet, October 1962 to September 1963

Oct. 31.....929.00	Feb. 28.....928.86	June 30.....929.51
Nov. 30.....928.91	Mar. 31.....929.22	July 31.....929.11
Dec. 31.....928.83	Apr. 30.....929.37	Aug. 31.....928.74
Jan. 31.....928.85	May 31.....929.47	Sept.30.....928.63

Note.--Elevations other than those shown are available.

5-2895. Minnehaha Creek at Minnetonka Mills, Minn.

Location.--Lat 44°56'30", long 93°26'45", near center of E½ sec.15, T.117 N., R.22 W., on left bank 40 ft upstream from bridge on county highway at Minnetonka Mills, 2.2 miles downstream from outlet of Minnetonka Lake, and 2.9 miles northwest of Hopkins.

Drainage area.--130 sq mi.

Records available.--August 1953 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 916.11 ft above mean sea level, datum of 1929.

Average discharge.--10 years, 14.1 cfs.

Extremes.--Maximum discharge during year, 141 cfs June 6 (gage height, 6.15 ft); maximum gage height, 6.97 ft Mar. 23 (backwater from ice); no flow on many days.

1953-63: Maximum discharge, 235 cfs May 23, 1962 (gage height, 6.66 ft); maximum gage height, that of Mar. 23, 1963 (backwater from ice); no flow for many days each year.

Remarks.--Records good except those for periods of ice effect, which are fair. Discharge affected by storage in Minnetonka Lake controlled by fixed-crest dam.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

4.35	0	4.7	1.7	5.2	20
4.4	.1	4.8	3.7	5.5	45
4.5	.3	4.9	6.4	6.0	114
4.6	.7	5.0	9.8	6.5	205

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	4.0	1.9	0.3		0	15	42	79	43	5.0	0.3
2	18	3.7	1.7	.3		0	16	44	104	43	4.5	.7
3	18	3.7	*1.7	.3		0	29	43	114	38	3.7	.9
4	18	4.2	1.7	.3		0	23	42	123	36	3.0	.7
5	18	*3.3	1.8	.3		*0	22	42	132	35	2.6	.7
6	18	3.3	1.7	.2		0	21	43	139	35	2.1	.7
7	18	6.7	1.7	.2		0	21	50	128	34	1.7	.6
8	22	5.0	1.6	.2		0	25	52	119	29	1.6	.6
9	25	4.2	1.5	.2		0	26	44	121	28	1.5	.5
10	25	3.3	1.4	.2		0	25	70	127	25	1.5	.4
11	25	2.8	1.3	.2		0	26	77	123	24	1.2	.5
12	25	2.8	1.2	.2		0	28	84	112	23	1.5	1.0
13	23	2.4	1.2	.2		0	28	116	96	20	1.3	.6
14	22	2.1	1.1	.1		0	25	130	83	19	1.2	.5
15	25	2.1	1.0	.1		.1	26	125	77	16	1.1	.4
16	38	2.1	.9	.1		.1	28	119	72	14	*1.0	.4
17	31	1.9	.9	.1		.2	36	123	69	13	.9	.5
18	25	1.7	.8	.1		.2	23	132	65	13	.7	.6
19	20	1.6	.7	.1		.2	25	128	60	12	.6	1.9
20	16	1.5	.7	.1		.3	30	*123	55	12	.6	*.9
21	14	1.9	.6	.1		.3	26	121	51	11	.5	.6
22	14	2.2	.6	.1		*.4	20	106	51	10	.5	.4
23	14	2.4	.5	.1		3.6	28	95	50	*8.7	.6	.4
24	11	2.2	.5	0		20	30	82	51	7.3	.6	.4
25	9.8	2.0	.4	0		18	30	76	53	6.4	.5	.5
26	7.0	1.9	.4	0		16	28	72	56	5.5	.5	.4
27	5.8	2.2	.4	0		15	27	70	54	6.1	.5	.3
28	5.5	2.1	*.3	*0		15	25	76	51	8.3	.5	.3
29	4.7	2.2	.3	0	-	*15	34	82	46	7.7	.4	.3
30	5.0	2.1	.3	0	-----	15	40	76	44	6.4	.4	.2
31	4.5	-----	.3	0	-----	15	-----	77	-----	5.5	.3	-----
Total	543.3	83.6	31.1	4.1	0	134.4	786	2,562	2,505	594.9	42.6	17.2
Mean	17.5	2.79	1.00	0.13	0	4.34	26.2	82.6	83.5	19.2	1.37	0.57
Cfsm	0.135	0.021	0.0077	0.0010	0	0.033	0.202	0.635	0.642	0.148	0.011	0.0044
In.	0.16	0.02	0.009	0.001	0	0.04	0.22	0.73	0.72	0.17	0.01	0.005

Calendar year 1962: Max 224 Min 0 Mean 39.8 Cfsm 0.306 In. 4.17

Water year 1962-63: Max 139 Min 0 Mean 20.8 Cfsm 0.154 In. 2.08

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 21-25, Dec. 4 to Mar. 30.

MINNESOTA RIVER BASIN

5-2900. Little Minnesota River near Peever, S. Dak.

Location.--Lat 45°36'05", long 96°52'18", in SW¼ sec.13, T.125 N., R.50 W., on right bank, 2 miles northwest of town of Browns Valley, Minn., 3¼ miles upstream from proposed Lake Traverse diversion, 5.3 miles northeast of Peever, 7¼ miles downstream from Jorgenson River, and 8 miles upstream from Big Stone Lake.

Drainage area.--447 sq mi.

Records available.--October 1939 to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 1,000 ft (from topographic map). Oct. 1, 1939, to Mar. 20, 1940, staff gage at site 4¼ miles downstream at different datum. Mar. 21 to Apr. 12, 1940, staff gage at site 100 ft downstream at present datum. Apr. 13 to Aug. 27, 1940, staff gage at present site and datum.

Average discharge.--24 years, 48.6 cfs (35,180 acre-ft per year).

Extremes.--Maximum discharge during year, 183 cfs June 10 (gage height, 3.68 ft); no flow, Mar. 12-15. 1939-63: Maximum discharge, 4,730 cfs Apr. 8, 1952 (gage height, 12.16 ft); maximum gage height, 13.35 ft Mar. 25, 1943, from floodmark (backwater from ice); no flow at times in 1940, 1942, 1950, 1954, 1957, 1959, 1963.

Remarks.--Records good except those for periods of ice effect or no gage height record, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 29

Mar. 30 to Sept. 30

2.3	4.4	2.0	0.2	2.5	9.9
2.4	7.0	2.1	.9	2.6	16
2.5	11	2.2	2.1	2.9	42
2.6	17	2.3	3.9	3.2	80
3.0	50	2.4	6.3	3.6	163

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6.4	5.9	10	2.4	0.2	0.2	68	36	10	3.9	11	2.2
2	*5.6	6.2	9.8	2.4	.3	.2	66	32	9.9	3.3	*14	2.2
3	5.6	6.2	9.8	2.2	.3	.1	62	28	18	3.1	17	1.8
4	5.6	7.3	9.8	2.2	.3	.1	56	25	59	3.1	13	*1.8
5	7.0	8.3	8.7	2.2	.3	.1	*52	21	56	3.3	9.5	1.5
6	6.4	7.6	8.3	2.3	*.3	.1	55	21	51	3.1	6.9	1.3
7	7.0	7.6	8.3	2.5	.3	.1	46	21	51	3.1	5.3	1.2
8	8.3	7.3	7.3	2.6	.3	.1	42	20	54	3.1	4.3	1.1
9	11	7.6	7.0	*2.5	.3	.1	41	20	54	5.3	3.3	1.0
10	12	7.6	6.6	2.4	.3	.1	38	*17	100	*6.3	2.7	1.0
11	9.8	7.6	5.8	2.4	.3	.1	36	15	142	5.3	2.4	1.0
12	8.7	7.6	4.0	1.4	.3	.0	33	20	*129	4.1	2.2	1.1
13	8.3	7.3	3.6	.8	.3	*0	31	37	125	3.3	1.8	.7
14	8.3	7.3	3.6	.8	.3	0	28	49	102	2.7	1.5	.7
15	7.6	7.3	3.6	.7	.3	0	26	37	78	2.1	1.2	.6
16	6.2	7.3	3.8	.7	.3	.1	27	36	64	1.6	1.0	.6
17	6.2	7.3	3.9	.7	.2	.2	21	32	52	1.6	.8	.6
18	8.3	7.6	4.0	.6	.2	.3	20	26	42	1.4	.6	.7
19	7.0	7.6	4.1	.6	.2	.5	19	21	34	1.4	.6	.6
20	5.6	8.0	4.2	.5	.2	3.0	18	17	27	1.3	1.0	.6
21	5.4	7.6	4.1	.4	2	*38	18	14	21	1.1	1.6	.5
22	5.6	7.3	4.1	.4	.2	*96	17	11	18	.8	1.6	.4
23	5.4	8.0	3.8	.3	.2	110	19	9.9	15	.6	1.4	.5
24	5.4	8.3	3.5	.2	.2	110	20	8.3	13	.6	1.4	*.6
25	5.6	7.6	3.0	.2	.2	108	21	9.1	10	.4	1.3	.6
26	5.6	8.7	2.6	.1	.2	100	25	9.5	8.3	.7	1.2	.5
27	5.4	9.4	2.6	.1	.2	91	23	14	6.6	2.7	1.2	.4
28	5.4	*9.4	2.6	.1	.2	*85	25	14	5.8	13	1.2	.6
29	5.4	9.8	2.6	.1		88	30	14	5.3	26	1.1	.6
30	5.9	11	2.4	.1		93	37	14	4.8	15	2.9	.6
31	*5.6	-----	2.4	.2	-----	74	-----	12	-----	11	2.9	-----
Total	211.6	233.6	159.9	35.1	7.1	998.4	1,020	660.8	1,365.7	134.3	117.9	27.6
Mean	6.83	7.79	5.16	1.13	0.25	32.2	34.0	21.3	45.5	4.33	3.80	0.92
Cfsm	0.015	0.017	0.012	0.0025	0.00056	0.072	0.076	0.048	0.102	0.0097	0.0085	0.0021
In.	0.02	0.02	0.01	0.003	0.0006	0.08	0.08	0.05	0.11	0.01	0.01	0.002
Ac-ft	420	463	317	70	14	1,980	2,020	1,310	2,710	266	234	55

Calendar year 1962 Max 2,440 Min 0.8 Mean 154 Cfsm 0.345 In. 4.68 Ac-ft 111,600
 Water year 1962-63 Max 142 Min 0 Mean 13.6 Cfsm 0.0304 In. 0.40 Ac-ft 9,860

Peak discharge (base, 450 cfs).--No peak above base.

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Dec. 9 to Jan. 26, Jan. 30 to Mar. 29 (no gage-height record Feb. 16 to Mar. 12, Mar. 15-20).

5-2910. Whetstone River near Big Stone City, S. Dak.

Location.--Lat 45°17'32", long 96°29'14", in SE¼NW¼ sec.18, T.121 N., R.46 W., on right bank 20 ft downstream from highway bridge, 1½ miles west of Big Stone City, and 4½ miles upstream from Big Stone Lake.

Drainage area.--389 sq mi.

Records available.--March 1910 to November 1912 (no winter records) and March 1931 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 996.96 ft above mean sea level, adjustment of 1912. Mar. 8, 1910, to Nov. 30, 1912, staff gage 2 miles downstream at different datum. Mar. 18, 1931, to Aug. 27, 1938, chain gage and Aug. 28, 1938, to May 3, 1939, wire-weight gage, at site 20 ft upstream at present datum. May 4, 1939, to Nov. 8, 1952, water-stage recorder at site 80 ft downstream at present datum.

Average discharge.--32 years (1931-63), 46.3 cfs (33,520 acre-ft per year).

Extremes.--Maximum discharge during year, 1,600 cfs July 28 (gage height, 7.85 ft); minimum daily discharge, 2.6 cfs Jan. 28 to Feb. 2.

1910-12, 1931-63: Maximum discharge, 5,710 cfs Apr. 8, 1952 (gage height, 13.64 ft, from floodmark); maximum gage height, 13.95 ft Apr. 11, 1947; no flow at times in most years.

Maximum stage known, about 26 ft in June 1919, present site and datum, from information by local resident.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 7-29, June 9-12)

Oct. 1 to Mar. 29

Mar. 30 to Sept. 30

1.9	6.1	1.8	4.3	3.5	127
2.1	11	1.9	6.6	4.0	227
2.3	18	2.1	13	5.0	514
		2.5	32	6.0	835
		3.0	70	8.0	1,680

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11	10	18	5.1	2.6	3.7	63	73	21	10	*202	10
2	*11	11	17	5.0	2.6	3.7	61	71	32	8.8	124	11
3	12	12	17	4.9	2.7	3.8	60	56	255	9.4	90	12
4	12	13	16	4.9	2.7	3.9	*57	45	180	9.7	73	*12
5	12	13	16	5.0	*2.8	4.0	48	37	115	10	58	11
6	13	13	15	5.0	2.8	4.2	43	34	89	9.7	46	11
7	14	14	14	5.0	2.8	4.4	41	33	81	9.7	38	10
8	13	13	14	5.0	2.8	4.6	39	31	83	9.1	31	8.8
9	14	13	13	*4.8	2.9	4.9	39	*29	136	8.5	26	8.2
10	13	14	13	4.8	2.9	5.2	39	26	206	*8.2	24	7.5
11	12	14	12	4.7	3.0	5.6	37	25	242	8.2	23	6.9
12	10	13	12	4.6	3.0	*6.2	36	35	*152	7.5	21	6.6
13	10	14	11	4.5	3.1	6.5	33	48	97	6.4	19	6.4
14	10	14	10	4.3	3.1	6.8	31	82	73	5.8	17	6.4
15	9.7	14	10	4.1	3.1	7.3	30	81	59	5.4	15	6.6
16	8.7	14	10	4.0	3.1	7.9	29	62	47	5.4	14	6.4
17	8.4	14	9.6	4.0	3.2	8.5	27	54	40	5.6	13	6.1
18	8.7	14	9.1	3.9	3.2	9.1	25	58	34	5.8	12	26
19	8.2	15	8.7	3.9	3.2	9.8	24	56	30	7.2	11	28
20	7.8	14	8.1	3.8	3.3	*11	23	44	26	7.2	10	16
21	7.6	14	7.4	3.6	3.3	12	23	37	24	7.5	9.4	28
22	7.6	14	6.9	3.4	3.4	14	23	30	22	8.2	10	23
23	7.4	16	6.5	3.2	3.4	*23	24	27	21	7.8	10	22
24	7.4	16	6.3	3.1	3.4	62	24	26	21	10	10	20
25	7.6	16	6.2	3.0	*3.5	230	25	24	19	194	10	18
26	8.0	16	6.1	2.8	3.5	190	26	23	17	256	10	*18
27	8.0	*16	6.0	2.7	3.6	144	27	23	15	740	16	15
28	8.0	17	5.8	2.6	3.6	*109	29	24	13	1,290	19	13
29	8.0	17	5.6	2.6	-	90	39	24	12	779	15	12
30	*9.0	18	5.4	2.6	-----	84	54	23	10	580	14	10
31	9.4	-----	5.2	2.6	-----	73	-----	22	-----	460	12	-----
Total	306.5	426	320.9	123.5	86.6	1,152.1	1,079	1,263	2,172	4,490.1	1,002.4	395.9
Mean	9.89	14.2	10.4	3.98	3.09	37.2	36.0	40.7	72.4	145	32.3	13.2
Cfsm	0.025	0.037	0.027	0.010	0.0079	0.096	0.093	0.105	0.186	0.373	0.083	0.034
In.	0.03	0.04	0.03	0.01	0.008	0.11	0.10	0.12	0.21	0.43	0.10	0.04
Ac-ft	608	845	636	245	172	2,290	2,140	2,510	4,310	8,910	1,990	785

Calendar year 1962: Max 2,750 Min 2.7 Mean 160 Cfsm 0.411 In. 5.60 Ac-ft 116,000
Water year 1962-63: Max 1,290 Min 2.6 Mean 35.1 Cfsm 0.090 In. 1.23 Ac-ft 25,440

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-25	0530	6.99	398	6-11	0400	4.25	263
6-3	1000	4.51	367	7-28	0600	7.85	1,600

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 5 to Mar. 29 (no gage-height record Jan. 27, Jan. 29 to Feb. 3, Feb. 6-8, 10-17, 19-24, Feb. 26 to Mar. 2, Mar. 4-9, 11, 13, 17).

MINNESOTA RIVER BASIN

5-2915. Big Stone Lake at Ortonville, Minn.

Location.--Lat 45°18'18", long 96°26'57", in NW¼SW¼ sec. 9, T.121 N., R.46 W., at power plant intake at west edge of Ortonville, half mile north of concrete dam at outlet, half a mile southwest of Ortonville.

Records available.--March 1937 to September 1963.

Gage.--Wire-weight gage read once a day. Datum of gage is 957.69 ft above mean sea level, datum of 1929. Sept. 17, 1947, staff gage at site ¼ mile south at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site ¼ mile south at same datum. Sept. 21, 1959 to June 30, 1963, supplementary wire-weight gage read once daily, at present site and datum.

Extremes.--Maximum gage height during year, 8.27 ft July 26; minimum, 5.90 ft Dec. 3. 1937-63: Maximum gage height, 12.73 ft Apr. 17, 1952; minimum observed, 2.20 ft Nov. 20, 1940.

Remarks.--Reservoir is formed by natural lake with concrete dam at outlet. Fixed crest of dam is at elevation 963.64 ft, with one 5-foot gate and two 2½-foot gates with lowest sill at elevation 958.40 ft (all elevations are referred to datum of 1929). Ordinarily changes in gate openings are not made.

Silt barrier dam 700 ft upstream in outlet channel of lake completed July 7, 1958; crest elevation, 963.6 ft. Supplementary wire-weight gage readings used for stages below crest of silt barrier to June 30, 1963. Water level subject to fluctuation caused by wind action.

Gage height, in feet, October 1962 to September 1963

Oct. 31.....6.20	Feb. 28.....6.05	June 30.....7.29
Nov. 30.....6.20	Mar. 31.....6.80	July 31.....7.65
Dec. 31.....6.09	Apr. 30.....6.73	Aug. 31.....7.10
Jan. 31.....6.09	May 31.....6.64	Sept. 30.....6.05

Note.--Gage-height record other than shown above is available.

5-2920. Minnesota River at Ortonville, Minn.

Location.--Lat 45°17'44", long 96°26'38", in NE¼NW¼ sec.16, T.121 N., R.46 W., on left bank 400 ft downstream from bridge on U. S. Highway 12 and 1,300 ft downstream from dam at outlet of Big Stone Lake, at Ortonville.

Drainage area.--1,160 sq mi, approximately.

Records available.--February 1938 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 956.38 ft above mean sea level, datum of 1929. Prior to Mar. 31, 1939, staff gage on downstream side of dam 1,300 ft upstream at datum 1.31 ft higher.

Average discharge.--25 years, 116 cfs (83,980 acre-ft per year).

Extremes.--Maximum discharge during year, 753 cfs Apr. 3 (gage height, 8.81 ft); minimum discharge, 8.5 cfs

Jan. 30, Feb. 1, 3, 4, 5.

1938-63: Maximum discharge, 3,060 cfs Apr. 13, 1952 (gage height, 12.92 ft); no flow Dec. 13, 1940.

Remarks.--Records good except those for periods of ice effect, which are fair. Some regulation by Big Stone Lake (see preceding page).

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-13, Mar. 19-21
June 30 to July 18, Sept. 24-30)

1.3	9.4	4.0	148
1.5	19	5.0	221
2.0	43	6.0	330
3.0	98	7.0	458

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	111	52	32	16	b15	14	205	30	33	87	*95	100
2	*112	71	45	16	b22	14	212	44	30	84	169	106
3	112	55	35	17	12	b15	448	41	33	78	154	104
4	113	98	b70	18	10	b17	*192	46	38	79	134	*103
5	108	35	b78	19	*11	15	180	66	44	83	135	100
6	108	54	41	19	b17	19	149	50	50	85	140	109
7	116	91	36	19	13	b19	132	52	60	82	134	109
8	115	37	b42	20	13	b20	164	51	52	67	126	107
9	114	34	b45	*22	b14	b19	164	*96	58	56	131	107
10	112	31	b35	b25	b18	17	140	92	102	*52	120	103
11	122	48	b29	22	b17	19	139	56	80	53	111	108
12	100	40	23	b24	b16	*28	164	53	*62	53	153	106
13	98	35	24	22	b17	25	130	110	84	53	132	80
14	97	42	20	19	b17	22	122	76	77	48	107	69
15	121	60	21	16	13	25	70	97	85	44	104	77
16	131	60	20	15	13	b35	163	90	97	42	131	69
17	103	50	22	b14	b13	b43	140	108	90	43	102	71
18	138	30	22	b14	b14	37	44	103	84	41	81	100
19	91	29	27	14	b15	48	58	99	90	42	85	94
20	80	48	25	b19	b16	*58	39	103	72	41	82	91
21	76	71	21	17	b14	54	26	104	65	40	75	90
22	108	50	b30	18	b14	62	28	60	68	36	81	76
23	84	42	b29	16	b12	84	30	43	70	33	82	64
24	82	35	21	19	b12	244	24	36	66	31	98	84
25	68	33	b20	17	b12	330	25	32	84	29	92	85
26	42	26	19	16	11	175	23	33	79	40	84	*80
27	54	*24	b19	14	14	153	22	38	85	86	93	87
28	69	36	b18	13	14	*146	26	35	77	161	114	95
29	54	37	b17	b11	-	199	75	35	78	105	118	80
30	*78	41	16	9.9	-----	195	43	35	84	104	112	75
31	53	-----	14	9.9	-----	189	-----	31	-----	112	107	-----
Total	2,970	1,395	916	530.8	399	2,340	3,377	1,945	2,077	1,990	3,482	2,729
Mean	95.8	46.5	29.5	17.1	14.2	75.5	113	62.7	69.2	64.2	112	91.0
Ac-ft	5,890	2,770	1,820	1,050	791	4,640	6,700	3,860	4,120	3,970	6,910	5,410

Calendar year 1962: Max 1,290 Min 0.6 Mean 359 Ac-ft 260,200
Water year 1962-63: Max 448 Min 9.9 Mean 66.2 Ac-ft 47,930

* Discharge measurement made on this day.

b Stage-discharge relation affected by ice.

MINNESOTA RIVER BASIN

5-2925. Minnesota River near Odessa, Minn.

Location.--Lat 45°15'22", long 96°20'20", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.29, T.121 N., R.45 W., near center of span on upstream side of highway bridge, 0.6 mile southwest of Odessa and 5.0 miles upstream from Yellow Bank River.

Drainage area.--1,340 sq mi, approximately.

Records available.--July 1909 to December 1912 (no winter records), May 1944 to June 1963 (discontinued).
Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read once daily. Datum of gage is 940.76 ft above mean sea level, datum of 1929.

July 4, 1909, to Dec. 31, 1912, chain gage at site 250 ft upstream at datum 0.45 ft lower. May 5, 1944, to July 18, 1948, chain gage at site 250 ft upstream at present datum.

Average discharge.--18 years (1944-62), 129 cfs (93,390 acre-ft per year).

Extremes.--Maximum discharge during period Oct. 1, 1962, to June 30, 1963, 335 cfs April 4 (gage height, 8.00 ft); minimum, 8.6 cfs Dec. 9.

1909-12, 1944-63: Maximum discharge, 3,070 cfs Apr. 13, 1952 (gage height, 14.06 ft, from graph based on gage readings); no flow at times during 1950, 1951, 1954, 1959, 1960.

Remarks.--Records fair. Some regulation by Big Stone Lake (see p. 104).

Discharge, in cubic feet per second, water year October 1962 to June 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	110	59	42	25	9.2	9.7	221	75	52			
2	*109	59	34	25	9.2	10	220	63	55			
3	110	63	39	24	9.2	10	238	32	59			
4	108	65	45	23	9.2	10	*290	64	62			
5	109	66	76	23	*9.2	11	216	85	68			
6	106	35	60	22	9.2	11	204	78	69			
7	108	73	40	22	9.2	11	168	78	85			
8	108	65	8.9	*22	9.2	12	177	78	88			
9	110	35	8.6	22	9.2	12	173	*94	104			
10	109	43	9.8	21	9.2	13	164	104	120	(*)		
11	107	31	11	21	9.2	13	153	93	*144			
12	107	45	14	20	9.2	*14	148	107	124			
13	101	43	16	19	9.2	15	145	120	117			
14	96	78	18	18	9.2	16	134	125	126			
15	86	50	21	17	9.4	18	124	113	120			
16	117	57	22	16	9.6	20	100	112	124			
17	100	55	24	15	9.6	23	138	73	122			
18	90	40	26	14	9.5	25	119	119	115			
19	79	37	27	13	9.3	29	70	112	110			
20	77	31	28	13	9.1	*34	75	104	106			
21	72	59	28	12	9.0	40	50	119	95			
22	71	66	28	11	8.9	50	49	99	89			
23	84	58	29	11	8.8	61	54	72	86			
24	67	48	29	11	8.9	76	55	64	85			
25	66	39	28	10	9.0	94	50	60	82			
26	58	40	28	10	9.2	116	51	55	91			
27	60	*32	28	9.8	9.3	150	51	58	89			
28	60	30	28	9.6	9.4	*184	51	63	86			
29	56	48	28	9.5	-	248	53	59	82			
30	*60	46	27	9.4	-----	241	105	60	80			
31	58	-----	26	9.2	-----	229	-----	58	-----			
Total	2,759	1,496	877.3	507.5	257.8	1,805.7	3,846	2,596	2,835			
Mean	89.0	49.9	28.3	16.4	9.21	58.2	128	83.7	94.5			
Ac-ft	5,470	2,970	1,740	1,010	511	3,580	7,630	5,150	5,620			

Calendar year 1962: Max 1,390 Min 0.7 Mean 388 Ac-ft 280,800
Water year : Max Min Mean Ac-ft

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 30.

5-2930. Yellow Bank River near Odessa, Minn.

Location.--Lat 45°13'35", long 96°21'12", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.1, T.120 N., R.46 W., on left bank 150 ft downstream from highway bridge, 2 $\frac{1}{2}$ miles southwest of Odessa, and 4 $\frac{1}{2}$ miles upstream from mouth.

Drainage area.--398 sq mi.

Records available.--October 1939 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 953.34 ft above mean sea level, datum of 1929 (Corps of Engineers bench mark). Prior to Aug. 28, 1940, wire-weight gage at site 150 ft upstream at same datum.

Average discharge.--24 years, 57.2 cfs (41,410 acre-ft per year).

Extremes.--Maximum discharge during year, 1,350 cfs May 14 (gage height, 8.18 ft); minimum daily discharge, 1.8 cfs Jan. 30 to Feb. 5; minimum gage height, 1.90 ft Sept. 14, 15.
1939-63: Maximum discharge, 6,260 cfs Apr. 4, 1952 (gage height, 17.06 ft); maximum gage height, 17.98 ft Mar. 25, 1943, from floodmark (backwater from ice); no flow Jan. 26 to Feb. 8, 1940, Jan. 8, 9, 1942, Jan. 25 to Feb. 25, 1959.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Dec. 6, Mar. 28 to Apr. 19)

Oct. 1 to Mar. 27

Mar. 28 to Sept. 30

1.9	4.6	1.9	4.7	3.0	94
2.0	7.3	2.0	7.8	4.0	250
2.1	11	2.1	12	5.0	455
2.2	14	2.3	23	6.0	705
2.3	19	2.5	39	8.0	1,300

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5.9	9.8	17	5.3	1.8	2.2	107	89	45	34	75	7.4
2	*6.2	9.9	17	5.2	1.8	2.2	97	110	45	31	*70	9.0
3	7.3	11	16	5.1	1.8	2.2	98	97	130	29	69	9.4
4	5.9	11	16	5.1	1.8	2.3	87	80	122	29	63	*8.6
5	5.6	11	16	5.0	*1.8	2.3	*78	68	177	28	56	7.8
6	6.4	11	13	5.0	1.9	2.4	68	63	169	28	48	8.2
7	8.2	11	12	5.0	1.9	2.4	63	59	172	28	41	8.6
8	7.3	11	10	*5.0	1.9	2.5	58	52	327	28	35	8.2
9	8.6	10	9.6	5.0	1.9	2.6	54	*48	568	26	31	7.4
10	8.0	11	9.0	5.0	1.9	2.8	49	44	848	*23	29	6.5
11	14	11	8.5	4.9	2.0	2.9	45	41	899	21	28	6.8
12	11	13	8.1	4.7	2.0	*3.0	42	358	*785	19	25	5.8
13	8.6	12	7.8	4.6	2.0	3.2	39	692	535	17	21	5.3
14	8.9	11	7.5	4.5	2.0	3.6	37	1,040	380	15	18	5.0
15	8.2	11	7.3	4.2	2.0	4.0	35	458	296	13	16	4.7
16	8.6	11	7.2	4.0	2.0	4.8	32	291	234	12	14	5.0
17	7.3	11	7.2	3.7	2.0	5.6	29	221	181	12	12	5.0
18	7.0	11	7.2	3.4	2.1	7.1	28	207	161	12	10	16
19	7.3	11	7.1	3.2	2.1	10	27	182	137	12	9.4	21
20	8.0	11	7.0	3.0	2.1	*20	28	148	116	11	8.2	30
21	7.6	11	6.8	2.7	2.1	28	25	121	102	9.8	7.4	42
22	8.9	10	6.6	2.5	2.1	42	26	104	89	9.4	7.8	27
23	8.6	12	6.5	2.3	2.1	*77	26	92	81	8.6	7.4	24
24	8.9	12	6.2	2.2	2.1	179	26	83	75	9.0	9.8	23
25	8.9	11	5.9	2.1	2.1	368	27	77	68	12	10	22
26	9.2	12	5.8	2.1	2.1	330	29	71	61	15	11	*22
27	9.2	*12	5.2	2.0	2.1	270	32	64	56	26	33	21
28	9.8	15	5.6	1.9	2.1	*227	34	60	50	79	16	28
29	12	16	5.5	1.9	-	182	45	55	45	115	12	25
30	*9.2	16	5.4	1.8	-----	154	63	51	39	115	9.4	22
31	9.2	-----	5.4	1.8	-----	127	-----	47	-----	90	8.2	-----
Total	259.8	346.7	275.4	114.2	55.6	2,072.1	1,434	5,173	6,993	916.8	810.6	441.7
Mean	8.38	11.6	8.88	3.68	1.99	66.8	47.8	167	233	29.6	26.1	14.7
Cfsm	0.021	0.029	0.022	0.0092	0.0050	0.168	0.120	0.420	0.585	0.074	0.066	0.037
In.	0.02	0.03	0.03	0.01	0.005	0.19	0.13	0.48	0.65	0.09	0.08	0.04
Ac-ft	515	688	546	227	110	4,110	2,840	10,260	13,870	1,820	1,610	876

Calendar year 1962: Max 1,620 Min 0.5 Mean 100 Cfsm 0.251 In. 3.42 Ac-ft 72,530
Water year 1962-63: Max 1,040 Min 1.8 Mean 51.8 Cfsm 0.130 In. 1.76 Ac-ft 37,470

Peak discharge (base, 300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-25	0400	9.43	431	6-11	2230	6.71	908
5-14	0200	8.18	1,350				

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 7 to Mar. 27.

MINNESOTA RIVER BASIN

5-2940. Pomme de Terre River at Appleton, Minn.

Location.--Lat 45°12'10", long 96°01'20", in SW¼NW¼ sec.14, T.120 N., R.43 W., on left bank at Appleton, 60 ft upstream from bridge on U.S. Highway 59 and State Highway 119 and 8 miles upstream from mouth.

Drainage area.--905 sq mi, approximately.

Records available.--March 1931 to September 1935 (no winter records), October 1935 to September 1963. Prior to October 1953, published as "near Appleton."

Gage.--Water-stage recorder and concrete control. Datum of gage is 978.00 ft above mean sea level, datum of 1929. Prior to Dec. 22, 1952, staff gage at site 4 miles upstream at datum 25.17 ft higher.

Average discharge.--28 years (1935-63), 92.6 cfs (67,040 acre-ft per year).

Extremes.--Maximum discharge during year, 595 cfs Mar. 27 (gage height, 6.30 ft); minimum, 1.8 cfs Dec. 5 (gage height, 3.48 ft).
1931-63: Maximum discharge, 5,050 cfs Apr. 8, 1952 (gage height, 10.13 ft, site and datum then in use); no flow for several periods.

Remarks.--Records good except those for period of ice effect, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 24

Mar. 25 to Sept. 30

4.6	44	4.6	34	5.5	237
4.9	92	4.8	59	6.0	475
5.2	162	5.0	98	6.5	725
5.5	258				

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	171	107	88	37	15	24	231	187	124	126	116	44
2	174	104	90	37	15	24	215	158	137	121	112	45
3	168	104	88	37	16	24	202	153	184	119	126	44
4	162	104	88	38	16	25	196	150	330	116	126	*49
5	157	102	49	38	17	25	190	150	430	114	100	49
6	154	98	57	38	17	26	181	134	322	107	92	56
7	171	98	70	39	18	27	169	137	272	103	81	56
8	174	98	60	38	18	28	164	*131	306	98	77	55
9	174	102	53	38	18	28	164	129	400	*92	79	52
10	168	96	52	37	18	29	161	124	*450	85	75	50
11	159	94	57	35	18	30	155	119	455	81	73	48
12	157	96	53	33	19	31	153	142	405	81	72	46
13	154	96	54	31	19	33	147	150	346	75	68	45
14	149	94	53	29	20	36	142	161	322	73	64	43
15	141	94	53	27	20	40	134	153	302	73	63	41
16	144	92	54	25	21	70	124	155	291	73	56	41
17	139	94	57	23	22	100	116	181	272	70	52	37
18	136	92	60	22	22	110	116	254	254	66	50	53
19	131	88	63	20	23	110	119	211	244	68	48	72
20	129	84	*62	19	23	102	119	181	231	72	46	68
21	127	86	60	18	23	97	119	164	215	72	43	56
22	124	86	58	18	23	110	119	161	199	72	49	53
23	122	86	58	17	23	130	119	153	181	66	49	56
24	120	90	45	*17	23	220	124	150	169	68	46	55
25	118	92	43	16	23	415	126	144	155	72	46	52
26	*113	92	43	16	23	450	126	134	147	70	46	*46
27	111	94	42	16	24	*515	131	134	142	88	49	46
28	109	94	41	16	*24	364	131	142	142	158	48	50
29	107	*90	40	15	-	295	153	153	139	178	45	45
30	107	88	39	15	-----	268	184	139	137	144	43	45
31	107	-----	38	15	-----	244	-----	131	-----	*129	43	-----
Total	4,377	2,835	1,768	820	561	4,030	4,530	4,765	7,703	2,930	2,083	1,498
Mean	141	94.5	57.0	26.5	20.0	130	151	154	257	94.5	67.2	49.9
Cfsm	0.156	0.104	0.063	0.029	0.022	0.144	0.167	0.170	0.284	0.104	0.074	0.055
In.	0.18	0.12	0.07	0.03	0.02	0.17	0.19	0.20	0.32	0.12	0.09	0.06
Ac-ft	8,680	5,620	3,510	1,630	1,110	7,990	8,990	9,450	15,280	5,810	4,130	2,970

Calendar year 1962: Max 1,300 Min 2.6 Mean 245 Cfsm 0.271 In. 3.67 Ac-ft 177,700
Water year 1962-63: Max 515 Min 15 Mean 104 Cfsm 0.115 In. 1.57 Ac-ft 75,270

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-27	1830	6.30	595	6-5	1145	6.02	455
4-30	2400	5.39	204	6-11	0800	6.06	475
5-18	0115	5.60	272				

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 25 to Mar. 24.

5-3000. Lac qui Parle River near Lac qui Parle, Minn.

Location.--Lat 45°00', long 95°55', in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.27, T.118 N., R.42 W., on right bank 40 ft downstream from highway bridge and half a mile southwest of village of Lac qui Parle.

Drainage area.--983 sq mi.

Records available.--April 1910 to November 1914; March 1931 to September 1963 (winter records incomplete prior to 1934). Published as "at Lac qui Parle", 1910-14.

Gage.--Water-stage recorder. Datum of gage is 951.98 ft above mean sea level (Minnesota Highway Department Bench mark). Apr. 27, 1910, to Nov. 15, 1914, staff gage at site 2 miles downstream at different datum. Mar. 17, 1931, to Mar. 9, 1937, staff gage at site 40 ft upstream at present datum.

Average discharge.--32 years (1912-13, 1931-32, 1933-63), 115 cfs (83,260 acre-ft per year).

Extremes.--Maximum discharge during year, 825 cfs Aug. 1 (gage height, 4.13 ft); minimum daily, 0.3 cfs Jan. 26 to Feb. 1. 1910-14, 1931-63: Maximum discharge, 11,100 cfs Apr. 6, 1952 (gage height, 18.18 ft); maximum gage height, 18.52 ft Mar. 24, 1948 (backwater from ice); No flow at times in several years.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 21, Nov. 27 to Dec. 3, April 15-19, Sept. 27-30)

0.7	8.9	1.5	96
.8	16	2.0	192
.9	24	3.0	460
1.2	54	5.0	1,160

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	25	17	22	6.6	0.3	1.6	197	204	59	36	814	46
2	27	19	24	6.7	.4	1.7	188	251	57	29	783	42
3	28	22	23	6.8	.4	1.8	166	237	*183	27	668	*39
4	29	22	22	6.9	.4	1.9	157	201	292	27	502	38
5	32	24	20	6.9	.4	2.0	150	172	144	27	378	36
6	38	24	19	7.0	.5	2.2	129	*152	114	27	305	38
7	45	22	18	7.1	.6	2.4	98	138	127	25	249	47
8	47	19	18	7.1	.8	2.7	112	126	138	24	213	40
9	32	18	17	6.9	.9	3.0	102	119	135	44	215	37
10	28	18	15	6.5	.9	4.2	98	112	239	*47	179	36
11	31	18	14	6.0	.8	8.0	84	106	319	38	161	34
12	31	18	13	5.5	.8	11	74	155	261	32	152	30
13	31	21	12	4.8	.8	12	68	170	232	28	137	27
14	33	22	12	4.1	.7	13	52	201	389	22	126	24
15	24	19	11	3.5	.7	14	55	249	401	20	115	22
16	22	18	11	3.0	.7	16	55	239	350	16	106	21
17	21	17	10	2.6	.8	20	*54	227	294	15	96	21
18	21	16	9.1	2.0	.8	40	52	206	249	13	88	22
19	19	15	8.3	1.6	.9	80	50	177	213	17	81	24
20	22	15	*7.6	1.2	1.0	140	49	166	181	15	75	24
21	17	16	7.3	1.0	1.0	*180	48	148	155	14	70	27
22	17	20	7.0	.6	1.0	250	52	135	131	35	63	25
23	10	17	6.7	.5	1.0	310	54	122	114	54	64	25
24	7.9	15	6.6	*.4	1.1	400	55	115	104	41	62	25
25	*8.4	14	6.5	.4	1.2	480	55	106	93	33	58	22
26	11	15	6.5	.3	1.3	520	59	96	81	28	58	22
27	14	17	6.5	.3	1.4	460	66	88	73	86	62	25
28	18	18	6.5	.3	*1.4	*410	68	84	63	150	59	46
29	19	*27	6.5	.3	-	330	88	77	53	*333	52	62
30	19	24	6.5	.3	-----	266	127	71	44	562	50	*51
31	18	-----	6.5	.3	-----	208	-----	64	-----	719	54	-----
Total	745.3	567	379.1	107.5	23.0	4,191.5	2,662	4,714	5,288	2,584	6,095	978
Mean	24.0	18.9	12.2	3.47	0.82	135	88.7	152	176	83.4	197	32.6
Cfsm	0.024	0.019	0.013	0.0035	0.00083	0.137	0.090	0.155	0.179	0.085	0.200	0.033
In.	0.03	0.02	0.01	0.004	0.0009	0.16	0.10	0.18	0.20	0.10	0.23	0.04
Ac-ft	1,480	1,120	752	213	46	8,310	5,280	9,350	10,490	5,130	12,090	1,940

Calendar year 1962: Max 3,400 Min 0.2 Mean 233 Cfsm 0.237 In. 3.21 Ac-ft 168,800
Water year 1962-63: Max 814 Min 0.3 Mean 77.6 Cfsm 0.079 In. 1.07 Ac-ft 56,200

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 22-26, Dec. 4 to Mar. 29 (no gage-height record Feb. 10 to Mar. 20, Mar. 22-26).

MINNESOTA RIVER BASIN

5-3010. Minnesota River near Lac qui Parle, Minn.

Location.--Lat 45°01'17", long 95°52'05", in NW¼ sec.24, T.118 N., R.42 W., on left bank 200 ft downstream from dam at Lac qui Parle Outlet, 2.4 miles northeast of village of Lac qui Parle, and 3.5 miles west of Watson.

Drainage area.--4,050 sq mi, approximately.

Records available.--October 1942 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 900.00 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Nov. 10, 1944, at datum 0.20 ft lower.

Average discharge.--21 years, 648 cfs (469,100 acre-ft per year).

Extremes.--Maximum discharge during year, 1,480 cfs June 16 (gage height, 26.88 ft); minimum, 26 cfs Nov. 13 (gage height, 20.32 ft).

1942-63: Maximum discharge, 19,700 cfs Apr. 10, 1952 (gage height, 37.98 ft, from floodmark); no flow Nov. 17, 1942, Sept. 29, 1947, Oct. 19 to Nov. 18, 1951, Nov. 24, 1952.

Remarks.--Records good except those for periods of ice effect, which are fair. Part of flow from 2,050 square miles of Chippewa River basin at times diverted into Minnesota River above station. Some regulation by Big Stone Lake since Apr. 17, 1927, Lac qui Parle Lake since January 1938, and Marsh Lake since Nov. 1, 1939.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1-24, May 21 to June 8)

Oct. 1 to Mar. 18				Mar. 19 to Sept. 30			
20.8	70	22.0	228	20.8	76	23.0	510
21.0	96	23.0	368	21.0	103	24.0	745
21.5	161	24.0	534	21.5	195	25.0	995
				22.0	300	27.0	1,520

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	224	*131	125	122	121	52	1,150	478	612	447	1,110	128
2	224	128	125	121	122	52	1,150	530	616	443	1,280	128
3	222	128	125	120	122	52	1,180	586	*730	363	1,420	*128
4	221	128	125	119	121	52	1,160	591	1,180	296	1,390	128
5	221	128	126	118	120	52	1,140	595	1,320	296	1,140	129
6	221	128	130	118	120	52	1,130	*666	1,310	292	965	131
7	227	128	127	117	120	52	1,100	888	1,200	290	752	131
8	228	128	125	114	121	52	1,100	888	998	195	570	131
9	228	128	125	112	121	52	1,080	880	998	126	566	129
10	227	128	125	113	121	52	1,050	795	1,270	*126	563	129
11	228	128	125	117	120	54	895	683	1,460	126	561	129
12	229	128	125	118	119	55	595	690	1,460	128	376	129
13	229	110	125	120	117	56	586	905	*1,470	128	250	131
14	229	119	124	122	115	57	584	1,080	1,470	128	250	131
15	232	121	124	123	112	58	575	1,090	1,470	128	252	133
16	236	121	124	125	108	61	575	1,250	1,480	128	254	133
17	235	121	123	127	94	67	575	1,450	1,480	128	254	268
18	234	121	123	128	79	75	523	1,460	1,470	128	256	481
19	234	122	123	128	74	85	392	1,460	1,460	129	180	586
20	232	122	123	129	72	266	294	1,460	1,400	128	126	584
21	232	122	*122	130	69	390	290	1,460	1,170	128	126	579
22	234	123	130	130	66	491	290	1,340	898	128	126	582
23	262	122	132	130	64	500	290	975	880	128	128	420
24	372	122	132	*125	61	504	294	625	748	128	129	256
25	375	123	131	111	58	519	292	618	579	128	129	254
26	*372	123	130	114	56	586	290	614	575	129	129	254
27	369	125	128	118	54	880	292	614	570	131	129	254
28	369	125	126	120	*52	*1,130	292	614	506	131	128	254
29	291	*123	125	120	-	1,150	352	614	453	*131	128	254
30	142	122	124	120	-----	1,150	474	614	451	322	128	*254
31	134	-----	123	120	-----	1,160	-----	612	-----	755	128	-----
Total	7,713	3,726	3,900	3,749	2,699	9,814	19,990	27,125	31,684	6,392	13,923	7,358
Mean	249	124	126	121	96.4	317	66.6	875	1,056	206	449	245
Ac-ft	15,300	7,390	7,740	7,440	5,350	19,470	39,650	53,800	62,840	12,680	27,620	14,590

Calendar year 1962: Max 4,570 Min 25 Mean 1,139 Ac-ft 824,300
Water year 1962-63: Max 1,480 Min 52 Mean 378 Ac-ft 273,900

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 6, 9-18, Dec. 22 to Mar. 18.

5-3045. Chippewa River near Milan, Minn.

Location.--Lat 45°06'39", long 95°47'57", in SE¼SE¼ sec.16, T.119 N., R.41 W., on right bank 800 ft upstream from bridge on State Highway 40, 2.0 miles upstream from small tributary, and 5½ miles east of Milan.

Drainage area.--1,870 sq mi, approximately.

Records available.--March 1937 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 959.69 ft above mean sea level, datum of 1929. Prior to Mar. 23, 1940, chain gage and Mar. 23, 1940, to June 14, 1942, wire-weight gage, on bridge 800 ft downstream at same datum.

Average discharge.--26 years, 235 cfs (170,100 acre-ft per year).

Extremes.--Maximum discharge during year, 852 cfs June 3 (gage height, 3.70 ft); maximum gage height, 6.47 ft Mar. 28 (backwater from ice); minimum daily, 25 cfs Jan. 24-26.
1937-63: Maximum discharge, 6,930 cfs Apr. 9, 1952 (gage height, 12.12 ft); maximum gage height, 12.29 ft Apr. 7, 1952 (backwater from ice); no flow at times during 1940.

Remarks.--Records good except those for periods of ice effect, which are fair. Flow regulated by several small lakes above gage.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 28

Mar. 29 to Sept. 30

1.9 109
2.2 187
2.5 277
3.0 479

1.7 73
2.0 138
2.5 283
3.0 479
3.5 744
3.7 852

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	261	193	168	59	27	27	489	464	373	261	228	168
2	264	193	168	58	27	27	465	428	406	246	216	165
3	264	193	165	56	27	27	451	414	771	240	210	*160
4	261	187	165	55	27	27	432	410	755	237	219	187
5	261	184	150	53	28	27	432	401	685	231	199	179
6	258	182	80	52	27	28	410	393	578	225	199	179
7	277	182	93	52	27	29	389	381	679	219	182	165
8	297	182	97	52	27	30	373	*373	717	205	171	152
9	304	176	95	51	26	31	354	362	749	*173	165	138
10	297	174	93	50	26	32	340	358	825	179	160	131
11	294	174	91	48	26	33	326	346	*798	173	154	119
12	291	171	90	43	26	35	318	525	733	187	143	110
13	287	174	89	39	26	37	305	674	690	168	136	104
14	284	174	89	36	26	39	296	701	647	168	130	95
15	277	171	89	33	26	41	286	658	604	162	121	93
16	267	168	92	32	26	44	*274	620	567	171	116	95
17	261	165	94	30	27	48	264	706	520	168	108	99
18	255	163	94	29	26	53	258	695	479	162	104	110
19	248	163	92	28	26	59	252	625	451	168	99	136
20	242	157	*85	27	26	64	252	562	419	165	95	152
21	239	160	88	26	26	100	252	510	389	162	91	157
22	233	147	88	26	26	150	249	464	362	157	89	141
23	224	129	87	26	26	210	252	436	336	133	99	143
24	218	190	84	*25	26	310	258	414	322	124	95	146
25	212	207	81	25	26	500	268	397	302	128	95	157
26	*212	204	80	25	26	700	274	377	289	128	93	*157
27	209	176	78	26	27	790	280	362	277	182	110	152
28	207	182	75	26	*27	740	289	428	264	182	152	138
29	204	*176	71	26	-----	562	332	460	274	225	182	131
30	198	168	66	26	-----	562	446	410	277	246	190	119
31	198	-----	62	26	-----	515	-----	389	-----	*234	179	-----
Total	7,804	5,265	3,039	1,166	740	5,967	9,866	14,743	15,538	5,809	4,530	4,178
Mean	252	176	98.0	37.6	26.4	192	329	476	518	187	146	139
Cfsm	0.135	0.094	0.052	0.020	0.014	0.103	0.176	0.255	0.277	0.100	0.078	0.074
In.	0.16	0.10	0.06	0.02	0.01	0.12	0.20	0.29	0.31	0.12	0.09	0.08
Ac-ft	15,480	10,440	6,030	2,310	1,470	11,840	19,570	29,240	30,820	11,520	8,990	8,290

Calendar year 1962: Max 1,600 Min 5.0 Mean 376 Cfsm 0.201 In. 2.74 Ac-ft 272,300
Water year 1962-63: Max 825 Min 25 Mean 215 Cfsm 0.115 In. 1.56 Ac-ft 156,000

Peak discharge (base, 400 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-27	2100	6.26	803	6-3	0300	3.70	852
5-1	0100	3.03	494	6-10	1910	3.66	830
5-14	0130	3.48	733				

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 7 to Mar. 28.

MINNESOTA RIVER BASIN

5-3110. Minnesota River at Montevideo, Minn.

Location.--Lat 44°56'00", long 95°44'00", in NW¼NW¼ sec.19, T.117 N., R.40 W., on right bank 100 ft upstream from bridge on U. S. Highway 212, at Montevideo, and 400 ft downstream from Chippewa River.

Drainage area.--6,180 sq mi, approximately.

Records available.--July 1909 to September 1917, October 1917 to September 1929 (no winter records), October 1929 to September 1963. Prior to October 1939, published as "near Montevideo." Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 910.87 ft above mean sea level, adjustment of 1912. July 22, 1909, to Feb. 4, 1932, chain gage at bridge 600 ft downstream at present datum. Feb. 5, 1932, to Nov. 26, 1934, chain gage at bridge 100 ft downstream at present datum.

Average discharge.--42 years (1909-17, 1929-63), 623 cfs (451,000 acre-ft per year).

Extremes.--Maximum discharge during year, 2,340 cfs June 11 (gage height, 9.12 ft); minimum daily, 86 cfs Feb. 26, 27; minimum gage height, 2.94 ft Aug. 23.

1909-63: Maximum discharge, 24,500 cfs, Apr. 10, 1952 (gage height, 20.02 ft, from floodmark); no flow for several days in 1933-34, 1936.

Remarks.--Records good except those for period of ice effect or no gage-height record, which are fair. Flow regulated by Big Stone Lake since Apr. 17, 1937, Lac qui Parle since January 1938 and Marsh Lake since Nov. 1, 1939.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used July 9-11)

Oct. 1 to Mar. 15

Mar. 16 to Sept. 30

3.0	208	2.8	189	5.0	685
4.0	379	3.0	225	7.0	1,370
5.0	596	3.5	334	10.0	2,740
		4.0	449		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	532	*325	300	172	150	*88	1,770	979	990	701	1,210	346
2	530	319	295	172	150	89	1,750	985	1,030	685	1,400	341
3	527	319	296	172	150	91	1,760	1,040	1,510	660	1,640	322
4	523	316	291	172	149	93	1,750	1,040	*1,650	552	1,640	*311
5	516	316	290	171	148	95	1,690	1,030	*1,990	527	1,500	315
6	516	310	237	170	147	99	1,660	1,030	1,990	513	1,160	318
7	536	305	234	170	144	102	1,620	*1,240	1,980	502	1,040	305
8	553	309	302	169	142	106	1,580	1,280	1,790	479	758	290
9	560	307	338	167	139	108	1,550	1,270	1,760	313	716	283
10	565	302	335	163	138	111	1,490	1,240	2,020	*290	701	*277
11	558	302	305	162	137	118	1,410	1,080	2,330	290	693	262
12	555	300	297	160	136	123	1,020	1,260	2,310	290	641	245
13	550	295	270	158	135	130	922	1,600	2,280	295	435	239
14	546	281	265	157	134	141	897	1,790	2,260	275	405	233
15	536	288	260	153	136	160	881	1,760	2,230	266	398	249
16	532	288	253	150	137	180	851	1,890	2,220	279	389	243
17	525	295	250	148	138	205	842	2,170	2,210	275	385	262
18	518	290	248	147	138	245	824	2,170	2,170	270	380	484
19	509	286	246	145	135	300	741	2,090	2,140	279	357	662
20	504	285	245	143	128	500	600	2,030	2,090	270	235	695
21	495	280	*244	141	118	600	586	1,980	1,860	262	219	708
22	495	281	240	141	106	640	586	1,810	1,410	256	216	711
23	491	278	234	141	96	660	590	1,420	1,280	247	229	695
24	548	255	224	141	90	680	588	1,050	1,200	243	233	488
25	579	276	212	*142	87	750	595	1,020	942	247	225	454
26	570	307	208	143	86	1,000	595	1,000	884	247	223	458
27	559	314	200	144	86	1,180	617	990	857	357	366	451
28	560	310	185	147	87	*1,500	617	1,050	818	350	316	440
29	548	309	178	148	-----	1,940	688	1,080	724	329	318	428
30	408	*302	174	148	-----	1,850	863	1,030	708	*401	357	419
31	332	-----	172	149	-----	1,800	-----	1,010	-----	733	362	-----
Total	16,276	8,950	7,828	4,806	3,567	15,684	31,933	42,414	49,633	11,683	19,147	11,934
Mean	525	298	253	155	127	506	1,064	1,368	1,654	377	618	398
Ac-ft	32,280	17,750	15,530	9,530	7,080	31,110	63,340	84,130	98,450	23,170	37,980	23,670

Calendar year 1962: Max 5,790 Min 37 Mean 1,456 Ac-ft 1,054,000
 Water year 1962-63: Max 2,330 Min 86 Mean 613 Ac-ft 444,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 9 to Mar. 28. No gage-height record May 14 to June 3, Sept. 5-9.

5-3114. South Branch Yellow Medicine River at Minneota, Minn.

Location.--Lat 44°33'50", long 95°59'50", in SE¼ sec.26, T.113 N., R.43 W., on left upstream wingwall of bridge on State Highway 68, 0.5 mile northwest of Minneota, and 6 miles upstream from confluence with North Branch Yellow Medicine River.

Records available.--July 1960 to September 1963.

Gage.--Staff gage read once daily. Datum of gage is 1,150.00 ft above mean sea level, datum of 1929.

Extremes.--Maximum discharge during year, 1,660 cfs July 27 (gage height, 10.66 ft); no flow at times. 1959-63: Maximum discharge, that of July 27, 1963; no flow at times.

Remarks.--Records good except those for period of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second (Shifting-control method used Oct. 5-26)

Oct. 1-26

Oct. 27 to Sept. 30

3.4	1.0	2.9	1.9	7.0	254
3.5	1.8	3.1	5.4	8.0	445
3.6	2.9	3.5	14	9.0	730
3.8	5.4	4.0	28	10.0	1,220
4.0	12	5.0	71	10.5	1,540
		6.0	138		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.3	2.4	2.6	0.4		0	16	23	4.3	0.2	588	8.6
2	2.3	2.6	2.7	.4		0	15	20	3.9	1.0	425	10
3	1.8	2.9	2.1	.4		0	17	16	4.5	1.8	302	9.8
4	1.3	3.1	2.2	.4		0	*14	13	3.7	5.3	182	8.9
5	1.2	2.7	2.8	.3		0	14	11	3.6	13	121	*8.4
6	1.1	2.7	2.2	.3		0	13	9.3	*3.2	10	92	9.3
7	1.4	2.9	1.8	.3		.1	11	10	2.7	5.4	87	9.3
8	1.2	2.6	1.7	.2		.2	10	*7.6	3.9	3.2	42	8.6
9	1.1	2.4	1.6	.2		.4	9.3	6.5	42	*3.2	43	8.2
10	2.8	3.1	1.5	.2		.5	8.9	14	38	1.9	60	7.3
11	2.9	2.9	1.4	.2		.6	8.2	16	12	1.6	42	6.9
12	2.9	2.4	1.3	.2		.7	8.2	53	8.6	1.1	34	6.3
13	2.9	2.4	1.2	.2		.8	7.6	40	6.9	.5	30	5.9
14	3.0	2.4	1.2	.2		.9	7.1	31	6.3	.1	26	5.7
15	3.1	2.6	1.1	.2		1.0	6.9	26	5.4	.1	22	5.7
16	2.8	2.6	1.1	.2		1.1	6.3	20	4.5	.9	20	6.9
17	2.4	2.4	1.0	.1		1.2	5.7	18	3.7	3.7	19	5.9
18	2.4	2.7	.9	.1		1.3	4.7	16	2.9	3.4	17	9.1
19	2.3	2.4	.9	.1		1.5	5.4	14	3.2	13	17	12
20	2.4	3.1	*.8	.1		2.5	5.9	11	2.7	13	16	16
21	2.4	2.6	.8	.1		4.0	5.3	11	2.2	30	15	16
22	2.8	9.5	.7	.1		9.0	5.3	9.5	1.9	25	14	14
23	2.3	3.2	.7	.1		14	8.6	8.0	1.5	22	13	18
24	2.4	2.7	.7	.1		63	8.0	7.3	1.2	18	14	35
25	*2.6	2.7	.6	0		105	6.3	6.7	1.2	12	14	158
26	2.1	2.9	.6	0		92	5.7	6.3	1.1	27	13	53
27	4.5	2.7	.6	0	(*)	39	5.4	5.7	1.0	1,420	13	32
28	2.4	*2.7	.5	0		29	6.5	5.7	1.0	1,210	13	25
29	2.6	2.4	.5	0		32	14	5.3	.9	909	12	22
30	2.6	2.4	.5	0		22	23	5.1	.6	684	11	18
31	2.2	-----	.4	0	-----	18	-----	4.5	-----	*882	9.5	-----
Total	82.4	87.1	38.7	5.1	0	439.8	282.3	450.5	178.6	5,321.4	2,326.5	559.8
Mean	2.66	2.90	1.25	0.16	0	14.2	9.41	14.5	5.95	172	75.0	18.7
Ac-ft	163	173	77	10	0	872	560	894	354	10,550	4,610	1,110

Calendar year 1962: Max 1,240 Min 0 Mean 50.0 Ac-ft 36,170
 Water year 1962-63: Max 1,420 Min 0 Mean 26.6 Ac-ft 19,240

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Mar. 29 (no gage-height record Mar. 7-11, 14, 15).

5-3135. Yellow Medicine River near Granite Falls, Minn.

Location.--Lat 44°43', long 95°31', in sec.35, T.115 N., R.39 W., on right bank 50 ft downstream from highway bridge, 6 miles upstream from mouth, and 8 miles south of town of Granite Falls.

Drainage area.--653 sq mi.

Records available.--March 1931 to September 1935 (no winter records), October 1935 to September 1938, October 1939 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 971.59 ft above mean sea level, datum of 1929. Mar. 16, 1931, to June 10, 1936, chain gage and June 11, 1936, to June 13, 1938, wire-weight gage, on bridge 50 ft upstream at same datum. Oct. 12, 1939, to Nov. 30, 1952, staff gage 500 ft downstream at same datum.

Average discharge.--27 years (1935-38, 1939-63), 101 cfs (73,120 acre-ft per year).

Extremes.--Maximum discharge during year, 1,590 cfs Aug. 1 (gage height, 5.60 ft); maximum gage height, 5.98 ft Mar. 26 (backwater from ice); minimum daily discharge, 3.4 cfs Jan. 21-31.

1931-38, 1939-63: Maximum discharge, 11,800 cfs June 18, 1957 (gage height, 12.41 ft); no flow at times in 1931, 1933, 1948, 1959.

Flood in June 1919 reached a stage of 17.5 ft, from information by local residents.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 28

Mar. 29 to Sept. 30

2.3	11	2.3	13	3.3	247
2.4	19	2.5	35	4.0	560
2.5	31	2.7	65	5.0	1,180
2.7	65	2.9	114	6.0	1,880

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14	17	19	10	3.5	*4.8	133	168	48	16	1,580	60
2	18	*21	18	10	3.5	4.8	120	219	46	13	1,560	60
3	17	24	18	10	3.5	4.8	111	188	45	15	1,560	55
4	25	30	17	10	3.5	5.0	*92	155	*43	16	1,460	*55
5	26	26	18	10	3.7	5.1	120	126	46	16	1,180	54
6	23	21	15	10	3.8	5.2	117	109	42	16	889	55
7	31	20	16	*10	3.7	5.4	103	*95	41	57	682	55
8	32	19	15	9.8	3.6	5.5	90	83	36	133	560	57
9	34	19	15	9.1	3.6	5.6	80	74	38	92	505	55
10	36	19	15	8.8	3.6	5.8	74	72	76	67	447	49
11	63	18	15	7.2	3.6	6.0	69	74	230	*49	387	48
12	54	18	14	6.0	3.6	6.4	67	126	188	35	348	42
13	44	18	14	5.4	3.6	6.8	62	285	165	29	297	36
14	40	18	14	5.2	3.6	7.4	60	442	136	27	262	35
15	36	18	14	4.5	3.6	8.8	57	438	114	22	236	35
16	27	18	14	3.8	3.6	10	54	378	95	22	209	32
17	24	18	14	3.8	3.7	13	49	297	74	22	188	30
18	23	18	14	3.8	3.8	16	48	230	63	49	162	34
19	21	18	15	3.6	3.9	21	46	188	57	181	145	38
20	20	17	16	3.5	4.0	26	45	155	49	233	130	39
21	21	17	16	3.4	4.0	35	41	123	42	266	114	36
22	20	17	15	3.4	4.1	45	42	109	36	247	103	46
23	17	18	15	3.4	4.2	60	45	92	32	233	98	55
24	18	18	14	3.4	4.3	80	43	83	28	195	100	63
25	18	19	14	*3.4	4.4	130	42	72	27	165	114	100
26	16	19	13	3.4	4.4	360	46	65	26	152	95	212
27	19	21	13	3.4	4.6	486	48	63	22	339	95	356
28	16	20	12	3.4	4.7	289	49	59	21	575	92	266
29	17	20	12	3.4	-	236	55	55	19	915	83	202
30	17	*20	12	3.4	-----	188	67	52	16	*1,250	72	168
31	17	-----	11	3.4	-----	162	-----	49	-----	1,520	63	-----
Total	804	584	457	181.9	107.7	2,244.4	2,075	4,724	1,901	6,967	13,816	2,428
Mean	25.9	19.5	14.7	5.87	3.85	72.4	69.2	152	63.4	225	446	80.9
Cfsm	0.040	0.030	0.023	0.0090	0.0059	0.111	0.106	0.233	0.097	0.345	0.683	0.124
In.	0.05	0.03	0.03	0.01	0.006	0.13	0.12	0.27	0.11	0.40	0.79	0.14
Ac-ft	1,590	1,160	906	361	214	4,450	4,120	9,370	3,770	13,820	27,400	4,820

Calendar year 1962: Max 2,910 Min 3.6 Mean 206 Cfsm 0.315 In. 4.28 Ac-ft 149,400
 Water year 1962-63: Max 1,580 Min 3.4 Mean 99.4 Cfsm 0.152 In. 2.09 Ac-ft 71,980

Peak discharge (base, 100 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-27	0330	4.91	575	7-8	0200	3.05	162
5-2	0100	3.24	226	7-21	1300	3.34	262
5-14	1600	3.83	476	8-1	0600	5.60	1,590
6-11	1000	3.31	251	9-27	1200	3.64	387

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice
 Dec. 7-12, Dec. 18 to Mar. 28.

5-3150. Redwood River at Marshall, Minn.

Location.--Lat 44°27', long 95°47', in NW¼ sec.4, T.111 N., R.41 W., on upstream side of highway bridge on Fourth Street in Marshall and 10 miles upstream from Threemile Creek.

Drainage area.--307 sq mi.

Records available.--March 1940 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Chain gage read twice daily. Datum of gage is 1,144.88 ft above mean sea level, datum of 1929.

Average discharge.--23 years, 49.1 cfs (35,550 acre-ft per year).

Extremes.--Maximum discharge during year, 677 cfs July 31 (gage height, 3.93 ft); minimum daily, 1.2 cfs Jan. 22 to Feb. 1.

1940-63: Maximum discharge, 5,370 cfs June 17, 1957 (gage height, 10.14 ft); maximum gage height, 11.05 ft Apr. 6, 1951 (from floodmark); no flow at times.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Unknown amount of natural diversion into Cottonwood River basin at extremely high stages.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 1 to Nov. 12)

0.7	2.3	1.1	26	2.0	184
.8	5.2	1.3	55	2.5	299
.9	9.8	1.5	87	3.0	414
1.0	17	1.7	123	4.0	699

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.4	7.4	7.9	a4.7	1.2	2.9	44	63	22	11	504	32
2	7.4	8.8	7.9	4.6	a1.3	2.9	42	53	17	8.8	451	33
3	6.5	7.0	8.3	4.5	1.3	3.0	38	42	15	17	402	38
4	6.1	9.3	8.3	a4.3	1.4	3.1	*49	41	12	15	382	34
5	5.6	16	8.3	4.2	1.4	3.2	24	a36	*11	57	336	*30
6	6.1	10	7.2	4.0	1.5	3.4	28	36	10	33	322	30
7	a6.8	9.8	7.0	3.8	1.5	3.5	22	33	10	33	290	36
8	7.4	7.0	5.1	3.7	1.5	3.6	19	*25	13	29	278	25
9	7.4	7.4	4.6	a3.5	a1.5	3.7	a21	25	153	25	278	24
10	7.9	a8.0	4.5	3.3	a1.5	a3.8	24	22	79	*22	251	22
11	7.9	7.9	4.5	3.2	1.5	3.9	19	37	61	22	253	20
12	5.2	7.0	a4.5	3.0	1.5	4.1	20	a47	52	22	212	20
13	5.2	8.3	4.5	a2.8	1.5	a4.4	18	60	52	22	191	19
14	6.5	8.8	4.5	2.6	1.6	4.9	a16	68	49	17	a170	a18
15	10	10	4.5	2.3	1.6	5.5	13	60	46	16	155	18
16	6.5	9.8	4.6	2.0	1.7	6.7	12	52	38	14	a135	22
17	4.4	3.8	5.0	1.8	a1.7	8.6	11	50	39	20	125	a24
18	5.2	a11	5.2	1.6	1.8	15	17	42	41	68	119	26
19	4.4	12	5.4	1.4	1.8	20	18	a38	38	267	104	32
20	5.2	12	*6.0	a1.3	a1.9	*53	15	36	25	267	96	46
21	a5.3	12	5.9	1.3	2.0	100	a15	33	22	232	87	39
22	5.2	10	a5.8	1.2	2.1	155	16	30	20	207	79	36
23	4.4	14	a5.7	*1.2	a2.2	205	17	28	a18	167	76	44
24	5.2	15	a5.7	1.2	2.4	a230	16	25	16	131	71	55
25	*5.6	a10	5.7	1.2	a2.5	270	15	25	17	127	a70	102
26	4.8	6.5	5.4	1.2	2.6	240	17	a24	14	115	a58	71
27	7.0	7.9	5.3	a1.2	*2.7	220	14	22	13	176	53	65
28	a7.0	*7.9	5.2	1.2	2.8	130	a20	24	12	320	47	58
29	7.0	8.3	5.1	1.2	-	77	33	30	10	315	41	50
30	7.0	7.0	4.9	1.2	-----	68	-----	25	9.3	532	38	42
31	7.0	-----	a4.8	1.2	-----	55	-----	22	-----	*597	37	-----
Total	194.6	285.9	177.3	75.9	50.0	1,909.2	699	1,154	934.3	3,904.8	5,711	1,111
Mean	6.28	9.53	5.72	2.45	1.79	61.6	23.3	37.2	31.1	126	184	37.0
Cfs/m	0.020	0.031	0.019	0.0080	0.0058	0.201	0.076	0.121	0.101	0.410	0.599	0.121
In.	0.02	0.03	0.02	0.009	0.006	0.23	0.08	0.14	0.11	0.47	0.69	0.13
Ac-ft	386	567	352	151	99	3,790	1,390	2,290	1,850	7,740	11,330	2,200

Calendar year 1962: Max 1,250 Min 1.5 Mean 113 Cfs/m 0.368 In. 5.00 Ac-ft 81,700
Water year 1962-63: Max 597 Min 1.2 Mean 44.4 Cfs/m 0.145 In. 1.94 Ac-ft 32,140

* Discharge measurement made on this day.

a No gage-height record.

Note.--Stage-discharge relation affected by ice Dec. 6 to Mar. 28.

MINNESOTA RIVER BASIN

5-3152. Prairie Ravine near Marshall, Minn.

Location.--Lat 44°29'45", long 95°47'55", NE¼ sec.20, T.112 N., R.41 W., on right bank just upstream from culvert on U. S. Highway 59 and 2.7 miles north of Marshall.

Drainage area.--5.0 sq mi.

Records available.--November 1958 to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 1,130 ft (from topographic map).

Extremes.--1959: Maximum discharge during period November to September, 2.0 cfs June 17 (gage height, 4.89 ft); no flow most of year.
 1959-60: Maximum discharge during year, 65 cfs Apr. 4 (gage height, 7.11 ft); maximum gage height, 7.73 ft Mar. 27 (backwater from ice); no flow most of year.
 1960-61: Maximum discharge during year, 8.3 cfs May 17 (gage height, 5.27 ft); maximum gage height, 5.37 ft Mar. 16 (backwater from ice); no flow most of year.
 1961-62: Maximum discharge during the year, 75 cfs Mar. 28 (gage height, 7.62 ft); maximum gage height, 8.78 ft Mar. 27 (backwater from ice); no flow most of year.
 1962-63: Maximum discharge during the year, 67 cfs July 18 (gage height, 7.30 ft); no flow most of year.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year March to September 1959

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1									0			
2									*0			
3									0			
4									0			
5									0			
6									0			
7									0			
8									0			
9									*0			
10									0			(*)
11						(*)			0	(*)		
12									0		(*)	
13									0			
14							(*)		0			
15								(*)	0			
16									0			
17									.2			
18						(*)			.5			
19									.1			
20									0			
21									0			
22									0			
23									0			
24									0			
25									0			
26									0			
27									0			
28									0			
29									0			
30									0			
31									0			
Total						0	0	0	0.8	0	0	0
Mean						0	0	0	0.03	0	0	0
Cfsm						0	0	0	0.006	0	0	0
In.						0	0	0	0.006	0	0	0
Calendar year	: Max	Min	Mean	Cfsm	In.							
Water year	: Max	Min	Mean	Cfsm	In.							

* Observation of no flow made on this day.

5-3152. Prairie Ravine near Marshall, Minn.--continued

Discharge, in cubic feet per second, water year October 1959 to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1			(*)			0	3.1	0.1	0	0.8	0	0.1
2						0	2.8	.1	0	1.1	0	0
3						0	4.5	.1	0	1.3	0	0
4		(*)				0	33	.1	0	.7	*0	0
5						0	43	.1	0	.4	0	0
6						0	*21	.1	0	.2	0	*0
7	(*)					0	8.3	.1	0	.1	0	0
8						0	3.1	.1	0	*.1	0	.2
9						0	1.8	.1	0	0	0	.1
10						0	1.2	.1	*0	0	0	.1
11						0	.8	0	0	10	0	0
12						0	.9	0	0	12	0	0
13						0	1.1	0	0	19	0	0
14						0	1.0	0	0	11	0	0
15						0	.9	0	0	2.2	*0	0
16						0	.5	0	.1	.9	0	0
17						0	.5	0	.2	2.7	0	0
18						0	.3	0	.2	1.5	0	0
19						0	.2	0	.1	.8	0	0
20						0	.1	0	0	.5	0	0
21						0	.1	0	.1	.3	0	0
22						0	.1	0	.2	.2	0	0
23						*0	.1	0	.1	.2	0	0
24						0	.1	0	.1	.1	0	0
25						0	.1	0	0	.1	0	0
26						0	.1	0	0	0	0	0
27						8.9	.1	0	0	0	0	0
28						38	*.1	0	.2	0	2.0	0
29						35	.1	0	1.0	0	.9	*0
30						*31	.1	0	.8	0	.3	0
31						12		0		0	.2	
Total	0	0	0	0	0	124.9	129.1	1.0	3.1	66.2	3.4	0.5
Mean	0	0	0	0	0	4.03	4.30	0.03	0.10	2.14	0.11	0.02
Cfsm	0	0	0	0	0	0.806	0.860	0.0060	0.020	0.428	0.022	0.004
In.	0	0	0	0	0	0.93	0.96	0.007	0.02	0.49	0.03	0.004

Calendar year : Max - Min - Mean - Cfsm - In. -
 Water year 1959-60 Max 43 Min 0 Mean 0.897 Cfsm 0.179 In. 2.44

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Mar. 26-28.

5-3152. Prairie Ravine near Marshall, Minn.---continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1			*0			0	0	0	0.2	2.0	0.2	
2			0			0	0	0	.2	1.2	.1	
3			0			0	0	0	.2	.8	.1	
4			0.2			0	0	0	.2	.5	*0	
5			.5	(*)		0	0.1	0.1	.2	.3	0	
6			.2			0	0	.2	.2	.2	0	
7			.2			0	0	.2	.2	.2	0	
8			.2		(*)	0	0	.2	.2	*.1	0	
9			.2			0	0	.2	.2	.1	0	
10			.1			0	0	.2	.1	.1	0	
11			0			0	.1	.1	.2	.1	0	
12			0			0	.1	.1	.2	.1	0	
13			0			0	.1	.2	.1	.1	0	
14			0			0	.1	.2	.1	.1	0	
15			0			0	0	.3	.1	.1	0	
16			0			*1.8	0	.2	.1	.1	0	
17			0			1.5	0	2.8	.1	0	0	
18			0			.8	0	4.8	.1	0	0	
19			0			.3	0	2.4	.7	0	0	
20			0			.2	0	2.6	.8	0	0	
21			0			.2	0	1.8	.5	0	0	
22			0			.2	.1	1.2	.2	0	0	
23			0			.1	.1	.7	.2	0	0	
24			0			.1	.1	.6	.1	0	0	
25			0			.1	.1	.5	.1	0	0	
26	(*)		0			.1	*.1	.4	.1	0	0	
27			0			.1	.1	.4	.1	0	0	
28			0			0	.1	*.4	0	0	0	
29			0			0	.1	.3	0	0	0	
30			0			*0	.1	.3	0	0.1	*0	
31			0			0		.2		0.3	0	
Total	0	0	1.6	0	0	5.5	1.4	21.6	5.7	6.5	0.4	0
Mean	0	0	0.05	0	0	0.18	0.05	0.70	0.19	0.21	0.01	0
Cfsm	0	0	0.010	0	0	0.036	0.010	0.140	0.038	0.042	0.0020	0
In.	0	0	0.01	0	0	0.04	0.01	0.16	0.04	0.05	0.003	0

Calendar year 1960: Max 43 Min 0 Mean 0.901 Cfsm 0.180 In. 2.45
 Water year 1960-61: Max 4.8 Min 0 Mean 0.117 Cfsm 0.023 In. 0.31

* Discharge measurement or observation of no flow made on this day.

Note.---Stage-discharge relation affected by ice Mar. 15, 16.

5-3152. Prairie Ravine near Marshall, Minn.--continued

Discharge, in cubic feet per second, water year October 1961 to September 1962

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1						0	12	0.4	0.8	3.6	0.7	
2						0	9.3	.3	.7	38	.8	
3						0	*7.8	.2	.6	31	.5	
4						0	9.0	.2	.8	34	.3	
5						0	7.5	.2	.9	29	.2	
6	(*)					0	8.3	.2	1.0	23	.2	
7						0	7.8	.2	1.0	16	.2	
8						0	5.2	.2	1.2	8.8	.2	
9						0	1.7	.2	1.3	2.3	.2	
10						0	1.6	.2	1.1	1.8	.2	
11						0	2.2	.3	.9	1.3	.1	
12						0	2.7	.3	.7	1.0	0	
13						0	2.8	.2	.4	.8	0	
14						0	2.5	.7	.3	1.1	0	
15						0	2.4	.6	.2	4.5	*0	
16						0	2.2	.7	.2	8.3	0	
17						0	1.8	.6	.2	6.0	0	
18						0	1.6	.7	.4	2.5	0	
19						0	1.7	.4	.3	8.8	0	
20						0	1.9	.6	.2	14	0	
21						0	2.1	1.3	*.2	9.6	0	
22						0	3.8	*6.0	.1	4.2	0	
23						0	2.5	10	.1	2.0	0	
24						0	.9	6.8	0	1.3	0	
25						0	*.3	3.2	0	*.8	0	
26						0.1	.3	2.2	0	.5	0	(*)
27						29	.3	2.0	0	.4	0	
28						69	.4	1.9	0	.4	0	
29					-	*43	.4	1.9	.2	.5	0	
30					-----	26	.4	1.6	.2	.4	*0	
31		-----			-----	17	-----	1.2	-----	.4	0	-----
Total	0	0	0	0	0	184.1	102.4	47.5	14.0	256.3	3.6	0
Mean	0	0	0	0	0	5.94	3.41	1.53	0.47	8.27	0.116	0
Cfsm	0	0	0	0	0	1.19	0.682	0.306	0.094	1.65	0.023	0
In.	0	0	0	0	0	1.37	0.76	0.35	0.10	1.91	0.03	0

Calendar year 1961: Max 4.8 Min 0 Mean 0.113 Cfsm 0.023 In. 0.30
 Water year 1961-62: Max 69 Min 0 Mean 1.67 Cfsm 0.334 In. 4.52

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Mar. 28. No gage-height record Mar. 25, 26, Mar. 30 to Apr. 27.

MINNESOTA RIVER BASIN

5-3152. Prairie Ravine near Marshall, Minn.--continued

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1						0	0.1	0.3	0.1	0	*43	0
2						0	.1	.2	.1	0	23	0
3						0	*.1	.1	.1	0	15	0
4						0	0	.1	0	0	12	0
5						0	.1	.1	0	9.9	7.5	*0
6						0	.1	.1	*0	17	2.9	0
7						0	.1	.1	0	9.6	1.6	0
8						0	.1	*.1	0	2.6	1.0	0
9						0	0	.1	7.0	1.3	1.3	0
10						0	0	.3	4.8	*.7	.9	0
11						0	0	.8	2.0	.4	.6	0
12						0	0	6.5	1.2	.3	.5	0
13						0	0	12	.7	.3	.4	0
14						0	0	3.2	.4	.3	.3	0
15						0	0	1.9	.3	.2	.2	0
16						0	0	1.2	.2	.3	.2	0
17						0	0	.8	.2	2.1	.2	*0
18						0	0	.5	.2	37	.2	0
19						0	0	.3	.2	52	.2	0
20						*0	0	.2	.2	38	.1	.2
21						0	0	.2	.1	21	.1	.2
22						0	0	.2	.1	13	.1	.2
23						0	0	.1	0	6.0	.1	.2
24						0	.1	.1	0	2.4	.1	.4
25	(*)					0	.1	.1	0	1.7	.1	.9
26						0	.1	.1	0	1.1	.1	1.0
27						.9	.1	.2	0	6.8	.1	.8
28						1.0	.1	.1	0	16	.1	.5
29		(*)				3.2	.2	.1	0	8.0	.1	.7
30						1.2	.5	.1	0	*16	0	.3
31						.9		.1		*58	0	
Total	0	0	0	0	0	7.2	1.9	30.3	17.9	322.0	112.0	5.4
Mean	0	0	0	0	0	0.23	0.06	0.97	0.60	10.4	3.61	0.18
Cfsm	0	0	0	0	0	0.046	0.012	0.194	0.120	2.08	0.722	0.036
In.	0	0	0	0	0	0.05	0.01	0.23	0.13	2.40	0.83	0.04

Calendar year 1962: Max 69 Min 0 Mean 1.67 Cfsm 0.334 In. 4.52
 Water year 1962-63: Max 58 Min 0 Mean 1.36 Cfsm 0.272 In. 3.69

* Discharge measurement or observation of no flow made on this day.
 Note.--No gage-height record Mar. 22-31.

5-3165. Redwood River near Redwood Falls, Minn.

Location.--Lat 44°31'25", long 95°10'20", in SE¼NE¼ sec.9, T.112 N., R.36 W., on right bank 20 ft upstream from highway bridge, 3 miles west of town of Redwood Falls, and 8.5 miles upstream from mouth.

Drainage area.--697 sq mi.

Records available.--July 1909 to September 1911 (no winter records), October 1911 to September 1912, October 1912 to September 1914 and August 1930 to September 1935 (no winter records), October 1935 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 972.33 ft above mean sea level, datum of 1929. July 1909 to September 1914, chain gage at bridge 20 ft downstream at datum 0.22 ft lower. August 1930 to Mar. 25, 1940, chain gage and Mar. 26, 1940, to Oct. 25, 1949, wire-weight gage, at bridge 20 ft downstream at present datum.

Average discharge.--29 years (1911-12, 1935-63), 99.3 cfs (71,890 acre-feet per year).

Extremes.--Maximum discharge during year, 1,410 cfs Aug. 1 (gage height, 4.63 ft); maximum gage height observed, 4.9 ft Mar. 27 (backwater from ice); minimum discharge, 0.8 cfs Feb. 5 (gage height, 1.22 ft).

1909-14, 1930-63: Maximum discharge, 19,700 cfs June 18, 1957 (gage height, 15.92 ft, from floodmark); no flow for several days in January 1940 and for part of each day Aug. 19, 20, 1959.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood and Cottonwood River basins during extreme floods.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.2	0.6	1.6	18	3.0	410
1.3	2.4	1.8	39	3.5	690
1.4	5.5	2.1	97	4.0	1,000
1.5	11	2.6	240	5.0	1,660

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	24	29	24	8.9	1.5	*3.8	166	172	82	28	1,360	82
2	31	*30	25	8.6	1.3	3.9	135	175	104	27	1,300	78
3	29	27	25	8.6	1.1	4.0	130	151	111	29	1,330	78
4	36	27	24	8.5	1.0	4.2	108	128	97	29	1,330	*76
5	36	32	18	8.5	1.0	4.3	102	108	*120	36	1,260	76
6	34	39	15	8.5	1.0	4.4	102	95	97	74	1,110	78
7	39	39	17	*8.5	1.1	4.6	91	84	80	132	869	76
8	48	36	17	8.5	1.1	4.7	74	*76	66	120	666	72
9	76	35	17	8.4	1.2	4.9	68	78	66	106	552	70
10	76	34	16	8.2	1.2	5.2	62	422	184	86	516	64
11	78	34	16	8.0	1.2	5.6	60	395	304	*72	475	58
12	70	32	13	7.6	1.3	5.9	60	470	248	64	435	53
13	62	30	11	7.2	1.3	6.5	56	678	203	49	385	49
14	58	30	10	6.4	1.4	7.3	53	636	172	46	348	48
15	56	29	10	5.7	1.4	9.5	49	465	145	39	320	48
16	51	30	10	5.2	1.5	14	46	380	125	43	288	48
17	49	26	10	5.3	1.6	20	44	375	111	226	252	48
18	48	26	10	5.4	1.7	29	39	304	102	445	223	49
19	46	26	10	4.8	1.7	42	39	240	97	810	200	74
20	43	25	10	4.5	1.9	61	46	200	86	985	181	111
21	46	25	10	3.5	2.0	87	46	169	74	849	163	93
22	39	24	10	2.9	2.2	129	43	148	66	726	151	86
23	38	22	10	2.6	2.3	191	48	130	58	606	145	97
24	36	27	9.8	2.4	2.5	250	48	118	55	485	138	120
25	36	25	9.6	*2.4	2.7	300	46	106	48	390	132	206
26	35	23	9.4	2.4	3.0	360	46	97	46	344	122	276
27	35	26	9.3	2.4	3.2	*410	44	102	41	320	125	240
28	32	26	9.3	2.3	3.5	300	48	138	35	395	111	223
29	29	24	9.3	2.2	-	272	66	113	32	582	106	213
30	28	*24	9.2	2.0	-----	240	132	97	29	*862	97	194
31	29	-----	9.2	1.7	-----	206	-----	86	-----	1,280	89	-----
Total	1,373	862	413.1	172.1	47.9	2,989.8	2,097	6,936	3,084	10,285	14,779	3,084
Mean	44.3	28.7	13.3	5.55	1.71	96.4	69.9	224	103	332	477	103
Cfsm	0.064	0.041	0.019	0.0080	0.0025	0.138	0.100	0.321	0.148	0.476	0.684	0.148
In.	0.07	0.05	0.02	0.009	0.003	0.16	0.11	0.37	0.16	0.55	0.79	0.16
Ac-ft	2,720	1,710	819	341	95	5,930	4,160	13,760	6,120	20,400	29,310	6,120

Calendar year 1962: Max 3,410 Min 1.3 Mean 226 Cfsm 0.324 In. 4.40 Ac-ft 163,800
 Water year 1962-63: Max 1,360 Min 1.0 Mean 126 Cfsm 0.181 In. 2.45 Ac-ft 91,480

Peak discharge (base, 75 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10-9	0030	2.04	84	5-13	1930	3.57	732	8-1	0130	4.63	1,410
3-27	0900	3.04	430	6-11	0400	2.79	316	9-20	0200	2.26	135
5-2	1100	2.42	178	7-7	0800	2.26	135	9-26	1500	2.72	288
5-10	1130	3.20	510	7-20	0330	4.04	1,030				

* Discharge measurement made on this day.
 Note.--Stage-discharge relation affected by ice Dec. 5 to Jan. 19, Jan. 26 to Feb. 3, Feb. 6 to Mar. 27 (no gage-height record Mar. 5-26).

5-3170. Cottonwood River near New Ulm, Minn.

Location.--Lat 44°17'40", long 94°26'40", in N½ sec.33, T.110 N., R.30 W., on left bank 600 ft upstream from highway bridge, 1.8 miles south of New Ulm, and 2 miles upstream from mouth.

Drainage area.--1,280 sq mi, approximately.

Records available.--July 1909 to December 1913, March 1931 to March 1938, August 1938 to September 1963 (winter records incomplete prior to 1936).

Gage.--Water-stage recorder. Datum of gage is 799.09 ft above mean sea level, adjustment of 1912. July 1, 1909, to Dec. 13, 1913, chain gage at site 2.7 miles upstream at different datum. Mar. 15, 1931, to Mar. 31, 1938, chain or wire-weight gage 2½ miles upstream at datum 11.41 ft higher. Aug. 23, 1938, to June 25, 1948, staff gage at present site and datum.

Average discharge.--29 years (1911-13, 1935-37, 1938-63), 247 cfs (178,800 acre-ft per year).

Extremes.--Maximum discharge during year, 3,220 cfs July 21 (gage height, 9.18 ft); minimum daily, 11 cfs Jan. 17 to Feb. 5.

1909-13, 1931-63: Maximum discharge, 14,200 cfs Mar. 30, 1962 (gage height, 15.88 ft); maximum gage height, 16.94 ft July 9, 1947 (from floodmark); minimum observed, 0.5 cfs Nov. 27, 1952 (gage height, 0.77 ft).

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair. Some regulation by dam at Cottonwood Lake and several other small lakes above station.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.0	11	2.0	132
1.1	15	2.5	247
1.3	29	3.0	397
1.5	49	4.0	745
1.7	77	6.0	1,520
		9.0	3,100

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	56	47	45	17	11	17	264	148	204	*82	1,880	148
2	57	48	45	17	11	18	239	176	197	77	2,000	146
3	54	48	44	16	11	18	219	211	199	77	2,000	144
4	*57	49	42	16	11	19	199	209	362	72	1,880	144
5	58	54	35	15	11	19	183	183	738	74	1,640	144
6	59	49	26	15	12	20	165	167	934	40	1,470	142
7	61	49	28	14	12	20	152	148	1,000	216	*1,220	138
8	64	49	28	14	12	21	144	130	546	344	843	138
9	72	48	27	13	12	22	136	118	616	296	787	136
10	64	49	26	13	12	22	130	118	*514	269	626	132
11	62	52	24	13	12	23	122	122	464	199	612	*132
12	62	48	19	12	13	24	118	163	556	107	616	126
13	62	46	23	12	13	26	110	305	731	150	535	112
14	59	47	24	12	13	36	103	*356	668	132	455	82
15	59	48	24	12	13	58	96	362	487	112	397	70
16	57	48	27	12	13	99	91	397	574	105	381	70
17	53	47	28	11	14	146	*84	391	490	130	368	65
18	52	47	*31	11	14	128	80	344	220	309	152	70
19	50	48	31	11	14	146	79	287	349	1,030	233	105
20	49	48	31	11	14	229	74	269	250	1,640	242	215
21	46	*47	30	11	15	231	71	237	176	2,760	216	199
22	47	47	27	11	15	231	71	202	174	3,030	199	195
23	*46	46	24	11	15	317	77	174	161	2,480	226	195
24	48	45	22	11	16	368	77	163	142	2,160	237	183
25	48	44	21	11	*16	650	80	78	134	1,610	209	197
26	48	45	21	11	16	*804	80	18	122	1,430	199	290
27	48	45	20	11	17	668	79	22	110	1,160	192	514
28	46	44	19	11	17	552	82	57	103	1,190	181	507
29	47	45	19	*11	-	448	103	358	94	958	170	451
30	48	45	19	11	-----	356	126	120	86	1,390	161	394
31	45	-----	18	11	-----	305	-----	229	-----	1,390	152	-----
Total	1,684	1,422	848	388	375	6,041	3,634	6,262	11,401	25,019	20,479	5,584
Mean	54.3	47.4	27.4	12.5	13.4	195	121	202	380	807	661	186
Cfsm	0.042	0.037	0.021	0.0098	0.010	0.152	0.095	0.158	0.297	0.630	0.516	0.145
In.	0.05	0.04	0.02	0.01	0.01	0.18	0.11	0.18	0.33	0.73	0.60	0.16
Ac-ft	3,340	2,820	1,680	770	744	11,980	7,210	12,420	22,610	49,620	40,620	11,080

Calendar year 1962: Max 12,500 Min 18 Mean 559 Cfsm 0.437 In. 5.94 Ac-ft 404,500
 Water year 1962-63: Max 3,030 Min 11 Mean 228 Cfsm 0.178 In. 2.42 Ac-ft 164,900

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 4-10, 19-22, 25-28, Jan. 7-23, Jan. 30 to Mar. 12. No gage-height record Jan. 25-28, Jan. 30 to Feb. 24.

5-3180. East Branch Blue Earth River near Bricelyn, Minn.

Location.--Lat 43°37'50", long 93°47'25", in NE¼NE¼ sec.23, T.102 N., R.25 W., in center of span on downstream side of highway bridge, 2 miles upstream from Brush Creek, 3 miles downstream from south Walnut Lake, and 5 miles northeast of Bricelyn.

Drainage area.--132 sq mi.

Records available.--March 1951 to September 1963. Prior to October 1957, published as East Fork Blue Earth River near Bricelyn.

Gage.--Wire-weight gage read twice daily. Datum of gage is 1,131.86 ft above mean sea level, datum of 1929 (Minnesota State Highway Department bench mark).

Average discharge.--12 years, 32.8 cfs (23,750 acre-ft per year).

Extremes.--Maximum discharge during year, 211 cfs July 19 (gage height, 7.21 ft); no flow Jan. 29 to Mar. 10, Sept. 13-30.

1951-63: Maximum discharge, 1,320 cfs Apr. 7, 1951 (gage height, 10.68 ft, from graph based on gage readings); no flow on many days.

Remarks.--Records good except those for periods of ice effect, which are poor.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 23 to May 28
June 8-13, July 3, 4)

Oct. 1 to Nov. 17

Nov. 18 to Sept. 30

4.8	18	3.9	0.4	4.4	4.8	5.5	72
5.0	31	4.0	.8	4.5	7.4	6.0	110
5.5	69	4.1	1.4	4.7	18	7.0	191
6.5	149	4.2	2.0	5.0	38	8.0	300
		4.3	3.2				

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	*32	35	7.8	3.2		0	165	30	2.6	0.4	46	0.9
2	40	32	6.8	2.9		0	*150	29	3.7	.6	42	1.1
3	51	32	6.1	2.7		0	140	29	3.6	*.8	40	1.5
4	69	32	9.0	2.6		0	129	31	3.6	.8	37	1.4
5	83	30	11	2.5		0	116	31	3.6	1.7	32	1.3
6	94	28	12	2.4		0	106	30	3.2	2.6	*27	1.1
7	100	27	11	2.4		0	96	28	2.8	2.8	30	.8
8	103	28	11	2.3		0	87	26	*9.5	2.6	42	.6
9	103	28	11	2.2		0	78	23	65	2.4	41	*.4
10	106	27	10	2.0		0	71	23	68	2.2	38	.4
11	112	25	10	1.7		.1	65	*24	42	1.8	34	.4
12	119	24	9.8	1.3		.2	58	25	42	1.3	31	.2
13	120	24	9.7	1.0		.5	52	26	40	1.1	28	0
14	120	24	9.5	.8		1.3	49	25	36	.9	26	0
15	117	23	9.4	.7		2.5	44	30	30	.6	21	0
16	110	23	9.2	.5		3.7	37	30	23	.5	17	0
17	104	24	9.0	.4		5.8	32	27	17	1.1	13	0
18	100	23	8.9	.3		8.8	31	24	10	4.5	10	0
19	94	23	*8.8	.3		*13	29	19	5.6	179	7.8	0
20	89	22	8.5	.3		19	26	17	3.9	198	6.1	0
21	83	*21	8.1	.2		29	24	12	2.8	197	4.9	0
22	74	23	7.5	.2		41	24	10	1.8	198	4.2	0
23	69	20	6.8	*.2		52	25	7.8	1.4	186	4.0	0
24	65	21	6.2	.2		64	26	6.1	1.0	163	3.9	0
25	59	22	5.5	.2		86	28	4.8	.7	136	3.7	0
26	54	20	4.7	.1		150	29	3.4	.6	113	3.2	0
27	48	17	4.3	.1	(*)	198	27	2.9	.4	90	2.4	0
28	44	14	4.2	.1		208	26	3.4	.4	76	2.3	0
29	42	13	4.0	0		205	28	3.9	.4	62	2.0	0
30	*39	10	3.8	0		194	27	3.4	.4	54	1.7	0
31	37	-----	3.5	0	-----	177	-----	3.2	-----	50	1.4	-----
Total	2,480	715	247.1	33.8	0	1,458.9	1,825	587.9	425.0	1,730.7	602.6	10.1
Mean	80.0	23.8	7.97	1.09	0	47.1	60.8	19.0	14.2	55.8	19.4	0.34
Cfsm	0.606	0.180	0.060	0.008	0	0.357	0.461	0.144	0.108	0.423	0.147	0.003
In.	0.70	0.20	0.07	0.01	0	0.41	0.51	0.17	0.12	0.49	0.17	0.003

Calendar year 1962: Max 1,140 Min 0 Mean 78.0 Cfsm 0.591 In. 8.01
Water year 1962-63: Max 208 Min 0 Mean 27.7 Cfsm 0.210 In. 2.85

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Nov. 22, 24, 25, Dec. 5 to Mar. 26 (no gage-height record Dec. 9-18, Dec. 20 to Jan. 22, Jan. 24 to Mar. 18). No gage-height record Oct. 14-20.

MINNESOTA RIVER BASIN

5-3200. Blue Earth River near Rapidan, Minn.

Location.--Lat 44°05'44", long 94°06'33", in SE¼SE¼ sec.6, T.107 N., R.27 W., on left bank 0.2 mile downstream from powerplant of Northern States Power Co., 2 miles west of Rapidan, 3½ miles downstream from Watonwan River, and 7½ miles upstream from LeSueur River.

Drainage area.--2,430 sq mi, approximately.

Records available.--July 1909 to November 1910 (no winter records), October 1939 to September 1945, July 1949 to September 1963. Published as "at Rapidan Mills" 1909-10.

Gage.--Water-stage recorder. Datum of gage is 808.80 ft above mean sea level, adjustment of 1912. July 20, 1909, to Apr. 28, 1910, chain gage at site a quarter mile upstream at different datum. Apr. 29 to Nov. 12, 1910, staff gage at site 800 ft upstream at different datum. Oct. 4 to Nov. 14, 1939, staff gage at present site and datum.

Average discharge.--20 years (1939-45, 1949-63), 751 cfs (543,700 acre-ft per year).

Extremes.--Maximum discharge during year, 11,200 cfs July 24 (gage height, 9.36 ft); minimum, 22 cfs Mar. 13, (gage height, 1.18 ft).
1909-10, 1939-45, 1949-63: Maximum discharge, 26,100 cfs Apr. 8, 1951 (gage height, 14.97 ft), from rating curve extended above 16,000 cfs by logarithmic plotting; minimum, 6.9 cfs Oct. 12, 1955 (gage height, 1.04 ft).

Remarks.--Records good. Flow regulated by Rapidan Reservoir (capacity, 2,980 acre-ft).

Rating table, water year 1962-63 (gage height, in feet, and discharge, in cubic feet per second)

1.2	24	3.0	910
1.4	64	4.0	1,840
1.6	120	5.0	3,100
2.0	278	7.0	6,220
2.4	495	10.0	12,700

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	396	366	172	52	53	99	1,540	459	508	1,040	3,940	212
2	560	418	135	134	27	99	1,510	453	502	*1,070	3,800	375
3	*638	327	278	134	27	24	1,330	453	471	865	3,300	413
4	798	233	283	131	140	153	1,300	459	477	711	2,940	387
5	850	413	236	89	110	192	1,220	459	566	856	2,460	453
6	858	372	217	27	90	185	1,110	1,110	540	1,400	*2,260	453
7	842	370	85	106	96	169	1,020	1,150	528	2,050	1,850	430
8	835	370	58	151	95	108	952	820	495	2,500	1,690	126
9	944	369	93	115	27	75	842	725	687	2,810	1,650	408
10	918	362	159	114	26	24	760	775	1,750	2,780	1,980	447
11	872	157	169	119	125	186	753	514	*3,100	2,320	1,860	447
12	835	325	167	136	125	114	732	942	3,390	1,830	1,620	*396
13	760	362	170	27	134	108	625	1,150	3,620	1,560	1,810	354
14	753	361	156	125	124	120	638	*1,060	3,320	1,320	999	305
15	739	293	132	124	124	171	625	1,300	2,370	1,230	784	102
16	711	306	53	123	27	232	514	1,160	1,910	1,090	1,040	287
17	677	309	80	113	24	394	528	910	1,620	1,070	865	242
18	658	166	*68	107	122	454	514	798	1,400	1,240	760	247
19	644	321	151	27	122	935	495	670	1,200	2,020	760	318
20	606	*157	173	29	130	1,280	465	586	1,040	5,040	638	380
21	586	308	173	112	65	1,260	459	534	880	6,880	528	204
22	554	269	98	56	99	1,240	435	477	732	*8,440	547	247
23	508	311	95	95	57	1,410	408	453	658	10,300	606	298
24	489	318	158	96	24	2,200	408	453	560	10,500	554	314
25	483	199	72	95	88	3,000	408	359	514	9,550	489	418
26	471	303	151	27	*95	*4,100	418	336	699	8,350	540	408
27	459	307	157	27	107	3,700	408	340	580	7,100	540	632
28	459	305	156	97	106	3,270	364	453	528	5,860	483	547
29	459	305	83	62	-	2,580	418	453	573	5,000	459	534
30	*424	293	50	62	-----	2,110	453	453	746	4,540	459	495
31	413	-----	149	59	-----	1,800	-----	465	-----	4,150	422	-----
Total	20,199	9,275	4,377	2,771	2,389	31,792	21,652	20,729	35,964	115,472	42,633	10,879
Mean	652	309	141	89.4	85.3	1,026	722	669	1,199	3,725	1,375	363
Cfsm	0.268	0.127	0.058	0.037	0.035	0.422	0.297	0.275	0.493	1.53	0.566	0.149
In.	0.31	0.14	0.07	0.04	0.04	0.49	0.33	0.32	0.55	1.77	0.65	0.17
Ac-ft	40,060	18,400	8,680	5,500	4,740	63,060	42,950	41,120	71,330	229,100	84,560	21,580

Calendar year 1962: Max 15,400 Min 23 Mean 1,241 Cfsm 0.511 In. 6.94 Ac-ft 898,500
Water year 1962-63: Max 10,500 Min 24 Mean 872 Cfsm 0.359 In. 4.88 Ac-ft 631,100

* Discharge measurement made on this day.

5-3205. Le Sueur River near Rapidan, Minn.

Location.--Lat 44°06'40", long 94°02'28", in SW $\frac{1}{4}$ sec.35, T.108 N., R.27 W., on right bank 600 ft downstream from highway bridge, 1.8 miles northeast of Rapidan, and 2.3 miles upstream from mouth.

Drainage area.--1,100 sq mi, approximately.

Records available.--October 1939 to September 1945, July 1949 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 775.76 ft above mean sea level, datum of 1929. Prior to Nov. 15, 1939, staff gage at same site and datum.

Average discharge.--20 years, 349 cfs (252,700 acre-ft per year).

Extremes.--Maximum discharge during year, 2,020 cfs Mar. 28 (gage height, 6.46 ft); maximum gage height, 6.64 ft Mar. 22 (backwater from ice); minimum daily, 19 cfs Mar. 7-12; minimum gage height, 1.79 ft Sept. 16-18. 1939-45, 1949-63: Maximum discharge, 21,200 cfs May 22, 1960 (gage height, 22.72 ft, from floodmark); minimum daily, 1.6 cfs Feb. 9-25, 1959; minimum gage height, that of Sept. 16-18, 1962.

Remarks.--Records good except for period of ice effect, which are fair.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.7	30	3.5	350
1.9	48	4.0	538
2.1	68	5.0	1,030
2.5	119	6.0	1,640
3.0	214	6.5	2,060

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	304	313	159	57	35	20	1,050	319	159	258	422	54
2	*390	307	159	56	35	20	905	322	155	*228	397	97
3	517	299	161	56	34	20	805	307	146	199	426	113
4	590	293	170	56	34	20	720	290	144	178	397	113
5	622	279	169	55	33	20	654	287	149	166	347	108
6	667	276	116	55	32	20	594	394	148	168	*304	104
7	672	271	92	54	31	19	551	363	140	170	285	101
8	677	258	102	54	31	19	517	307	133	162	373	91
9	926	250	105	54	31	19	492	270	162	146	287	79
10	1,130	246	104	54	30	19	472	334	408	127	302	71
11	1,180	236	103	53	29	19	452	322	*885	111	285	64
12	1,210	231	99	52	27	19	429	341	830	97	256	*54
13	1,190	228	92	51	26	20	411	*376	626	85	231	50
14	1,120	221	88	50	25	20	394	397	488	77	196	44
15	1,080	219	85	47	24	21	383	397	404	70	174	40
16	1,000	214	83	47	23	22	357	386	334	68	151	38
17	915	210	81	46	23	23	331	353	285	108	130	38
18	825	203	80	45	23	26	*299	319	243	196	111	38
19	735	199	*77	45	23	37	274	282	210	855	97	102
20	658	199	75	44	23	56	253	250	178	1,030	86	344
21	594	*196	74	43	22	220	238	221	153	1,410	75	313
22	547	188	72	*43	22	540	231	201	132	*1,430	67	250
23	500	188	70	43	21	1,020	228	184	115	1,230	75	219
24	468	180	67	42	21	1,010	224	164	98	1,040	97	219
25	441	170	64	41	21	1,250	236	151	101	825	112	250
26	414	174	62	40	*20	*1,660	250	142	287	644	91	287
27	394	166	60	39	20	1,760	266	135	248	534	81	260
28	380	162	59	38	20	1,960	274	172	240	445	79	236
29	357	162	59	37	-	1,680	290	192	325	369	72	205
30	*350	161	58	37	-----	1,430	307	188	331	376	62	184
31	328	-----	58	36	-----	1,220	-----	179	-----	476	54	-----
Total	21,181	6,699	2,903	1,470	739	14,209	12,887	8,545	8,257	13,278	6,122	4,166
Mean	683	223	93.6	47.4	26.4	458	430	276	275	428	197	139
Cfsm	0.621	0.203	0.085	0.043	0.024	0.416	0.391	0.251	0.250	0.389	0.179	0.126
In.	0.72	0.23	0.10	0.05	0.02	0.48	0.44	0.29	0.28	0.45	0.21	0.14
Ac-ft	42,010	13,290	5,760	2,920	1,470	28,180	25,560	16,950	16,380	26,340	12,140	8,260
Calendar year 1962: Max 8,960 Min 32 Mean 752 Cfsm 0.684 In. 9.28 Ac-ft 544,000												
Water year 1962-63: Max 1,960 Min 19 Mean 275 Cfsm 0.250 In. 3.41 Ac-ft 199,300												

Peak discharge (base, 1,300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-28	0700	6.46	2,020	7-21	1830	5.86	1,540

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 5 to Mar. 25.

MINNESOTA RIVER BASIN

5-3250. Minnesota River at Mankato, Minn.

Location.--Lat 44°10'10", long 94°00'15", in sec.7, T.108 N., R.26 W., on left bank at downstream side of Main Street Bridge in Mankato, 1.8 miles downstream from Blue Earth River and at mile 106.4.

Drainage area.--14,900 sq mi, approximately.

Records available.--May 1903 to September 1963 (no winter records 1904, 1906-10, 1918-29). Monthly discharge only for some periods, published in WSP 1308. Published as "near Mankato" 1903-21.

Gage.--Water-stage recorder. Datum of gage is 747.92 ft above mean sea level, datum of 1929. Prior to Aug. 6, 1910, staff gage and Aug. 6, 1910, to Oct. 19, 1921, chain gage, at site 1.8 miles upstream at datum 6.4 ft higher. Mar. 15, 1922, to Nov. 30, 1924, chain gage at present site and datum.

Average discharge.--42 years (1905, 1910-17, 1929-63), 2,408 cfs (1,743,000 acre-ft per year).

Extremes.--Maximum discharge during year, 15,600 cfs July 24 (gage height, 14.58 ft); minimum daily, 330 cfs Jan. 28, 29; minimum gage height, 1.54 ft Mar. 11.

1903-63: Maximum discharge, 66,600 cfs Apr. 9, 1951 (gage height, 26.20 ft, from floodmark); minimum observed, 26 cfs Aug. 4, 1934.

Maximum stage known, 29.9 ft Apr. 26, 1881, from floodmark, present site and datum (discharge, 90,000 cfs).

Remarks.--Records good except those for period of ice effect, which are fair. Some diurnal fluctuation at low and medium stages caused by powerplants on Blue Earth River.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Dec. 9

Dec. 10 to Sept. 30

1.5	300	2.0	605	8.0	6,540
2.0	480	3.0	1,230	11.0	10,300
3.0	1,060	4.0	2,010	14.0	14,600
4.0	1,820	6.0	4,140	15.0	16,400
5.0	2,810				
6.0	3,880				

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,750	1,560	953	560	350	385	6,120	2,060	3,010	2,700	8,440	1,860
2	1,870	1,560	854	555	360	385	5,680	2,110	2,980	*2,780	9,020	1,950
3	*2,150	1,480	953	550	365	385	5,370	2,410	2,860	2,510	9,130	1,810
4	2,280	1,360	1,020	545	370	385	4,940	2,600	3,080	2,280	8,900	1,690
5	2,400	1,280	1,030	540	370	390	4,600	2,660	3,540	2,260	8,630	1,700
6	2,430	1,280	932	535	370	395	4,300	3,160	4,120	2,590	8,460	1,650
7	2,440	1,280	777	530	370	395	4,050	3,380	4,580	3,180	*8,120	1,590
8	2,420	1,250	691	520	360	390	4,020	3,050	5,200	3,690	7,940	1,350
9	2,740	1,220	444	500	360	380	3,730	2,830	5,550	4,010	7,380	1,450
10	3,100	1,200	465	480	355	380	3,590	2,930	6,680	4,100	7,160	1,620
11	3,250	1,070	505	460	350	385	3,390	2,820	*8,600	3,720	6,360	1,550
12	3,210	1,100	565	440	350	390	3,320	3,330	9,040	3,130	5,610	*1,450
13	3,050	1,200	590	420	350	400	3,130	*4,140	9,210	2,690	5,180	1,360
14	2,940	1,140	618	400	350	400	6,980	4,850	9,240	2,380	4,600	1,200
15	2,850	1,110	620	390	350	415	2,740	5,550	8,480	2,180	3,390	1,160
16	2,740	1,090	630	370	350	445	2,500	5,850	7,810	2,020	3,500	981
17	2,550	1,110	638	360	355	520	2,400	5,780	7,420	2,030	3,070	1,040
18	2,430	1,000	638	350	360	600	2,260	5,640	6,880	2,160	2,720	942
19	2,330	967	630	350	360	710	2,200	5,380	6,070	4,210	2,360	1,120
20	2,180	*1,030	610	350	360	920	2,100	5,190	5,520	7,740	2,100	1,480
21	2,070	1,020	610	340	360	1,300	2,060	5,020	4,830	11,000	2,060	1,380
22	1,980	988	600	340	360	1,900	2,010	4,730	4,340	*13,200	1,870	1,410
23	1,920	1,010	600	340	360	2,600	1,920	4,360	3,930	15,000	2,030	1,530
24	1,800	1,010	595	340	370	4,290	1,810	4,130	3,620	15,400	1,920	1,620
25	1,770	912	590	340	370	6,330	1,770	3,820	3,270	14,400	1,770	1,880
26	1,690	939	580	340	*381	*8,530	1,790	3,470	3,380	12,600	1,720	2,040
27	1,680	981	*589	335	385	9,200	1,790	3,040	3,020	11,000	1,690	2,380
28	1,680	981	590	330	385	9,260	1,740	3,040	2,800	9,770	1,630	2,520
29	1,680	981	590	*330	-	8,540	1,830	2,930	2,600	8,460	1,570	2,460
30	1,660	974	585	335	-----	7,740	2,000	3,220	2,640	7,910	1,700	2,400
31	*1,640	-----	575	340	-----	6,560	-----	3,040	-----	8,300	2,010	-----
Total	70,680	34,083	20,667	12,915	10,136	75,305	96,140	116,520	154,330	189,400	142,040	48,573
Mean	2,280	1,136	667	417	362	2,429	3,205	3,759	5,144	6,110	4,582	1,619
Cfs/m	0.153	0.076	0.045	0.028	0.024	0.163	0.215	0.252	0.345	0.410	0.308	0.109
In.	0.18	0.09	0.05	0.03	0.03	0.19	0.24	0.29	0.39	0.47	0.35	0.12
Ac-ft	140,200	67,600	40,990	25,620	20,100	149,400	190,700	231,100	306,100	375,700	281,700	96,340
Calendar year 1962:	Max 39,300	Min 255	Mean 5,212	Cfs/m 0.350	In. 4.75	Ac-ft 3,774,000						
Water year 1962-63:	Max 15,400	Min 330	Mean 2,660	Cfs/m 0.179	In. 2.43	Ac-ft 1,926,000						

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 23.

5-3300. Minnesota River near Carver, Minn.

Location.--Lat 44°43'28", long 93°37'58", in NE¼SW¼ sec.31, T.115 N., R.23 W., on left bank 2½ miles south of Carver and at mile 36 upstream from Mississippi River.

Drainage area.--16,200 sq mi, approximately.

Records available.--September 1934 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 690.00 ft above mean sea level, datum of 1929. Prior to Dec. 5, 1934, staff gage at same site and datum. Auxiliary chain gage 2½ miles upstream at same datum read twice daily.

Average discharge.--29 years, 3,044 cfs (2,204,000 acre-ft per year).

Extremes.--Maximum discharge during year, 14,400 cfs July 28; maximum gage height, 16.66 ft July 28 (backwater from Mississippi River); minimum daily discharge, 480 cfs Feb. 25-27; minimum gage height, 3.81 ft Jan. 13. 1934-63: Maximum discharge, 64,100 cfs Apr. 11, 1951 (gage height, 27.71 ft); maximum gage height, 28.31 ft Apr. 16, 1952; minimum discharge, 79 cfs Nov. 17, 1955; minimum gage height, 2.66 ft Nov. 22, 1935.

Remarks.--Records good except those for period of ice effect, which are fair.

Cooperation.--Auxiliary gage readings furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,110	1,930	1,200	615	515	486	*7,220	2,240	3,150	2,790	8,680	2,000
2	2,080	1,910	1,120	605	510	495	6,730	2,280	3,160	2,750	8,790	2,170
3	2,100	1,880	1,060	595	520	500	6,040	2,340	3,230	2,810	9,010	2,080
4	*2,250	1,840	1,030	590	525	*507	5,800	2,460	3,140	2,700	9,230	2,070
5	2,350	1,760	1,080	585	530	509	5,300	2,560	3,200	2,550	*9,120	1,980
6	2,450	1,680	1,100	595	525	511	5,050	2,630	4,380	2,420	9,060	1,910
7	2,500	1,690	*1,090	600	520	513	4,840	2,930	4,680	2,510	9,070	1,880
8	2,530	1,670	976	605	520	515	4,680	3,310	5,300	2,810	8,390	1,830
9	2,540	1,640	781	610	520	512	4,540	3,300	5,410	3,400	8,200	1,770
10	2,630	1,630	660	600	515	510	4,370	3,110	6,190	3,790	7,700	1,600
11	2,920	1,610	610	585	510	511	4,300	3,020	6,830	4,020	7,460	1,690
12	3,070	1,570	610	570	505	513	3,990	3,100	8,320	*3,820	6,970	1,740
13	3,110	1,420	630	550	505	516	3,850	3,340	9,090	3,280	6,350	*1,700
14	3,060	1,490	660	530	505	518	3,410	4,080	*9,370	2,810	5,760	1,620
15	2,960	1,540	705	515	500	525	3,230	*4,910	9,540	2,570	5,260	1,550
16	2,900	1,520	735	505	505	600	2,940	5,360	9,220	2,370	4,380	1,460
17	2,810	1,460	745	500	515	650	2,760	5,820	8,550	2,360	3,870	1,310
18	2,720	1,430	750	495	520	740	2,600	5,830	8,030	2,480	3,580	1,300
19	2,600	1,400	755	495	520	920	*2,530	5,800	7,450	2,780	3,230	1,340
20	2,520	1,310	745	500	510	1,300	2,440	5,500	6,780	4,780	2,770	1,360
21	2,460	1,290	720	500	500	1,750	2,360	5,340	5,910	6,530	2,570	1,490
22	2,360	1,310	695	505	495	2,500	2,300	5,120	5,520	8,610	2,440	1,620
23	2,260	1,350	660	505	490	3,500	2,270	4,900	4,950	9,940	2,300	1,590
24	2,200	1,300	630	505	485	4,600	2,200	4,680	4,360	11,100	2,340	1,640
25	2,100	1,320	615	505	480	5,720	2,130	4,460	4,150	12,400	2,290	1,790
26	2,070	1,290	610	505	480	6,660	2,070	4,210	3,680	13,500	2,160	1,890
27	2,010	1,220	620	510	480	7,660	2,040	3,720	3,340	14,200	2,060	2,040
28	1,960	1,250	*635	*510	485	8,600	2,050	3,450	3,200	14,400	1,990	2,210
29	1,920	1,260	645	515	-	8,890	2,080	3,200	3,180	13,400	1,950	2,420
30	1,920	1,260	635	515	-----	8,690	2,130	3,140	3,030	11,000	1,880	2,450
31	*1,900	-----	630	515	-----	8,100	-----	3,170	-----	8,910	1,850	-----
Total	75,370	45,230	24,137	16,835	14,190	78,521	108,250	119,310	166,340	183,790	160,710	53,500
Mean	2,431	1,508	779	543	507	2,533	3,608	3,849	5,545	5,929	5,184	1,783
Cfsm	0.150	0.093	0.048	0.034	0.031	0.156	0.223	0.238	0.342	0.366	0.320	0.110
In.	0.17	0.10	0.06	0.04	0.03	0.18	0.25	0.27	0.38	0.42	0.37	0.12
Ac-ft	149,500	89,710	47,880	33,390	28,150	155,700	214,700	236,600	329,900	364,500	318,800	106,100
Calendar year 1962 :	Max	39,400	Min	350	Mean	6,028	Cfsm	0.372	In.	5.06	Ac-ft	4,364,000
Water year 1962-63 :	Max	14,400	Min	480	Mean	2,866	Cfsm	0.177	In.	2.39	Ac-ft	2,075,000

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 24. No gage-height record Nov. 1 to Dec. 2.

MINNESOTA RIVER BASIN

5-3309. Nine Mile Creek at Bloomington, Minn.

Location.--Lat 44°48'46", long 93°18'07", in NW¼ sec.21, T.27 N., R.24 W., on left bank between 105th and 106th street in Bloomington, Minn., 1.2 miles downstream from bridge on Old Shakopee Road and 2.1 miles upstream from mouth.

Records available.--January to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 731 ft (from topographic map). Prior to May 16, 1963, staff gage 30 ft upstream at datum 0.81 ft higher.

Extremes.--Maximum observed discharge during period, 80 cfs July 16 (gage height, 2.65 ft); minimum observed, 2.2 cfs July 25, 26 (gage height, 1.51 ft).

Remarks.--Records good except for periods of no gage-height record, which are poor.

Rating table, May 16 to Sept. 30 (gage height, in feet,
and discharge, in cubic feet per second)
(Shifting-control method used Aug. 3-20, Sept. 6-9, 21-30)

1.5	2.1	1.8	11
1.6	3.8	2.0	26
1.7	6.5	2.3	50

Discharge, in cubic feet per second, January to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1				4.5	2.8	2.3	23	23	13	4.8	3.8	4.6
2				4.5	2.8	2.3	22	25	13	4.6	4.1	13
3				4.5	2.7	2.4	22	28	15	4.6	3.8	12
4				4.4	2.7	2.4	21	30	14	4.3	3.4	13
5				*4.4	2.6	*2.4	*20	30	20	4.3	4.1	9.9
6				4.4	2.6	2.5	20	31	18	4.1	3.4	7.2
7				4.4	2.5	2.7	22	34	18	3.2	*3.2	5.3
8				4.4	*2.4	3.0	25	35	17	3.6	5.4	5.6
9				4.4	2.4	3.2	23	40	17	3.8	11.	*3.6
10				4.4	2.4	3.3	22	47	19	3.6	8.9	3.2
11				4.4	2.4	3.3	20	48	21	3.4	7.2	6.6
12				4.4	2.4	3.5	19	53	22	3.2	10	7.2
13				4.4	2.4	3.5	18	50	22	3.4	12	6.8
14				4.4	2.3	3.6	18	45	19	2.8	9.9	6.5
15				4.2	2.3	3.6	17	43	16	3.2	7.2	4.8
16				4.1	2.3	3.6	15	43	14	10	6.5	3.6
17				4.0	2.3	3.8	14	41	14	5.3	5.3	4.8
18				4.0	2.3	4.0	17	35	12	8.0	5.1	4.6
19				3.8	2.3	5.0	16	30	11	7.2	6.8	8.1
20				3.8	2.3	8.0	16	*27	*9.9	5.3	5.3	8.9
21				3.6	2.3	10	15	23	8.9	4.8	4.1	8.4
22				3.6	2.3	20	15	19	8.0	4.1	4.6	5.3
23				3.4	2.3	*43	21	18	6.8	*3.4	6.5	5.1
24				3.4	2.3	38	20	18	6.5	2.8	5.3	9.5
25				3.4	2.3	36	18	18	6.5	3.0	5.1	6.5
26				3.2	2.3	35	16	19	6.5	2.8	5.9	6.5
27				3.2	2.3	30	16	22	6.5	6.6	5.1	5.3
28				3.2	2.3	27	17	23	6.5	6.2	4.8	4.6
29				3.0	-	25	22	22	5.3	6.5	4.6	3.6
30				3.0	-----	24	25	19	4.3	5.9	4.6	3.8
31		-----		2.9	-----	23	-----	16	-----	4.6	6.2	-----
Total				121.7	67.6	379.4	575	955	390.7	143.4	183.2	197.9
Mean				3.93	2.41	12.2	19.2	30.8	13.0	4.63	5.91	6.60
Ac-ft				-	-	-	-	-	-	-	-	-

Calendar year : Max - Min - Mean - Ac-ft -
Water year : Max - Min - Mean - Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Jan. 15.

No gage-height record Jan. 1-3, Jan. 16 to Feb. 4, Feb. 6, 7, Feb. 9 to Mar. 4, Mar. 6-22, Mar. 24 to Apr. 4, Apr. 6-21, Apr. 23 to May 15, May 18, 19.

5-3310. Mississippi River at St. Paul, Minn.

Location.--Lat 44°56'40", long 93°05'20", in SE¼NE¼ sec.6, T.28 N., R.22 W., on left bank in St. Paul, 300 ft upstream from Robert Street Bridge, 6 miles downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.

Drainage area.--36,800 sq mi, approximately.

Records available.--March 1892 to September 1963 (prior to 1901, fragmentary during some winters). Records prior to March 1892, published in the 19th Annual Report, Part 4, have been found to be unreliable and should not be used. Monthly discharge only for some periods, published in WSP 1308. Gage-height records (winter records incomplete) collected at same site since 1866 are contained in reports of U. S. Weather Bureau, War Department, and Mississippi River Commission.

Gage.--Water-stage recorder. Datum of gage is 684.16 ft above mean sea level, adjustment of 1912. Prior to Mar. 18, 1925, staff or chain gage at several sites within 300 ft of present site at same datum. Mar. 18, 1925, to Mar. 10, 1933, water-stage recorder and Mar. 11, 1933, to Sept. 14, 1939, staff gage, at present site and datum. Since September 1938, auxiliary water-stage recorder 5.4 miles downstream.

Average discharge.--65 years (1894-95, 1896-97, 1900-1963), 9,830 cfs (adjusted for diversion).

Extremes.--Maximum discharge during year, 31,600 cfs June 15 (gage height, 7.90 ft); minimum daily, 2,260 cfs Dec. 12.

1892-1963: Maximum discharge, 125,000 cfs Apr. 16, 1952 (gage height, 22.02 ft); minimum daily, 632 cfs Aug. 26, 1934.

Maximum stage known since at least 1870, that of Apr. 16, 1952. Flood of Apr. 29, 1881, reached a stage of 19.7 ft (discharge, 107,000 cfs), determined by Corps of Engineers.

Remarks.--Records good. Slight regulation except during extreme floods by reservoirs on headwaters and by powerplants. Beginning June 20, 1938, sewage from Minneapolis and St. Paul, which formerly entered above station, was diverted to a sewage-disposal plant, thence to river below station. Figures of daily discharge do not include this diversion.

Cooperation.--Records of Mississippi River at Twin City lock and dam computed and furnished by Ford Motor Co. Gage-height record at South St. Paul furnished by Corps of Engineers. Diversion through sewage-disposal plant furnished by Minneapolis-St. Paul Sanitary District.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	8,080	7,190	6,490	4,430	3,480	3,340	21,600	10,200	17,200	10,200	16,400	5,160
2	8,190	7,220	6,410	4,660	3,420	3,080	21,400	9,410	15,900	9,090	16,100	6,110
3	8,640	6,830	6,250	4,620	3,330	3,150	19,600	9,620	19,100	9,520	15,100	6,030
4	7,580	7,010	6,130	4,540	3,390	3,240	17,700	10,000	19,600	8,830	14,300	7,000
5	7,990	7,160	6,460	4,590	3,550	3,320	18,200	10,500	19,600	8,580	14,700	6,990
6	7,800	6,990	6,280	4,670	3,690	3,340	17,700	10,300	20,700	8,470	13,800	5,670
7	8,440	6,990	6,120	4,660	3,650	3,490	19,300	9,830	21,600	7,350	13,800	6,060
8	8,320	7,050	5,110	4,710	3,260	3,440	20,000	9,840	22,800	7,250	13,300	6,410
9	8,500	6,740	3,530	4,640	3,510	3,490	18,500	9,920	23,400	8,140	13,200	6,140
10	8,580	6,970	3,320	4,670	3,230	3,560	17,400	11,500	24,500	8,770	12,700	*5,380
11	8,610	7,020	2,420	4,330	3,660	3,380	16,500	10,600	25,400	8,790	11,900	5,010
12	8,630	7,380	2,260	4,150	3,420	3,570	16,400	11,700	27,000	6,990	11,500	4,950
13	8,930	6,430	2,410	3,720	3,600	3,350	15,800	12,500	28,600	7,330	*11,500	5,240
14	9,070	*6,590	2,790	4,020	3,710	3,620	15,200	13,300	30,100	6,430	11,800	4,140
15	*8,800	6,840	3,330	4,300	3,660	3,790	13,800	14,900	31,300	6,720	12,400	4,480
16	8,270	6,980	4,220	4,000	3,640	3,950	13,800	15,900	31,100	6,240	11,200	4,590
17	8,710	6,720	4,480	4,050	3,580	4,060	12,200	17,500	30,200	6,260	10,100	4,810
18	8,920	6,490	4,780	3,800	3,650	4,580	12,700	18,700	*28,800	4,380	10,200	4,760
19	7,790	6,420	4,830	3,570	3,730	4,740	11,600	18,400	26,800	5,600	9,420	5,060
20	7,760	6,530	4,850	3,380	3,630	5,660	11,500	18,200	24,500	6,530	8,830	5,470
21	7,740	6,600	4,780	3,620	3,650	5,810	11,000	*17,800	22,200	9,290	7,950	5,060
22	7,240	6,410	5,100	3,620	3,580	6,860	10,100	17,600	20,500	11,200	8,040	5,030
23	6,670	6,330	4,810	3,610	3,560	7,870	10,100	17,100	18,400	12,000	7,730	5,150
24	7,070	6,290	4,670	3,790	3,460	9,410	10,300	16,300	17,200	*12,200	7,640	5,330
25	7,040	6,030	4,300	3,660	3,560	11,200	*9,890	16,400	16,300	13,900	6,560	6,080
26	7,110	6,240	4,490	3,550	3,540	13,900	9,580	14,600	14,500	14,500	6,780	5,780
27	6,910	6,380	4,660	3,470	3,540	15,600	8,950	14,700	12,900	16,500	6,500	5,820
28	6,970	6,180	4,550	3,500	3,360	17,500	9,270	14,200	12,200	16,300	6,160	5,880
29	7,150	6,810	4,610	3,680	-	20,700	9,360	15,600	12,400	17,600	9,090	6,020
30	6,650	6,620	4,590	3,700	-----	22,300	9,170	16,200	11,800	18,500	6,230	5,500
31	6,970	-----	4,110	3,460	-----	22,600	-----	16,200	-----	17,300	5,680	-----
Total	245,130	201,440	143,140	125,170	99,040	227,900	428,620	429,520	646,600	310,760	327,610	165,110
Mean	7,907	6,715	4,617	4,038	3,537	7,352	14,290	13,860	21,550	10,020	10,570	5,503
(⁷)	+308	+271	+250	+249	+249	+283	+282	+331	+347	+343	+335	+321
Mean*	8,215	6,986	4,867	4,287	3,786	7,635	14,572	14,191	21,897	10,363	10,905	5,824
Cfsm	0.223	0.190	0.132	0.116	0.103	0.207	0.396	0.386	0.595	0.282	0.296	0.158
In.	0.26	0.21	0.15	0.13	0.11	0.24	0.44	0.44	0.66	0.33	0.34	0.18

Calendar year 1962: Max 56,200 Min 2,020 Mean 14,590 Mean* 14,879 Cfsm* 0.404 In.* 5.49
 Water year 1962-63: Max 31,300 Min 2,260 Mean 9,178 Mean* 9,476 Cfsm* 0.258 In.* 3.49

* Discharge measurement made on this day.

⁷ Diversion, equivalent in cubic feet per second, through sewage-disposal plant.

* Adjusted for diversion.

Note.--Stage-fall-discharge relation affected by ice or indefinite slope Nov. 4 to Mar. 20, Aug. 21 to Sept. 30.

ST. CROIX RIVER BASIN

5-3362. Glaisby Brook near Kettle River, Minn.

Location.--Lat 46°27'19", long 92°51'34", in SE¼NW¼ sec.22, T.46 N., R.20 W., on left bank 20 ft upstream from bridge No. 2468 on State Highways 27 and 73, 1.0 mile upstream from mouth, and 2.4 miles south of Kettle River.

Records available.--October 1959 to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 1,105 ft (from topographic map)

Extremes.--1959-60: Maximum discharge during year, 204 cfs Apr. 25 (gage height, 4.37 ft); minimum, 0.1 cfs Aug. 3 (gage height, 2.00 ft).

1960-61: Maximum discharge during year, 301 cfs May 16 (gage height, 4.83 ft); minimum daily, 0.1 cfs July 9.

1961-62: Maximum discharge during year, 628 cfs May 23 (gage height, 6.17 ft); minimum daily, 0.3 cfs Aug. 3, Sept. 7; minimum gage height, 2.08 ft Aug. 3.

1962-63: Maximum discharge during year, 115 cfs June 11 (gage height, 3.81 ft); maximum gage height, 4.34 ft Mar. 25 (backwater from ice); minimum daily, 0.1 cfs Aug. 8, Sept. 1

1959-63: Maximum discharge, 628 cfs May 23, 1962 (gage height, 6.17 ft); minimum, 0.1 cfs Aug. 3, 1960, July 9, 1961, Aug. 8 and Sept. 1, 1963.

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair.

Rating table, water years 1959-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Oct. 13-24, 1960,
Sept. 12 to Dec. 5, 1962)

1.9	0	2.3	2.8	3.5	76
2.0	.1	2.4	5.1	4.0	141
2.1	.6	2.5	8.5	5.0	338
2.2	1.4	2.7	19	6.0	585
		3.0	36		

Discharge, in cubic feet per second, water year October 1959 to September 1960

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.7	13	1.5	1.2	0.7	0.4	17	62	74	4.5	0.2	1.2
2	4.8	11	1.5	1.1	.7	.4	14	54	61	6.1	.2	1.2
3	7.4	9.5	1.6	1.1	.8	.4	12	48	48	11	.1	1.1
4	6.8	8.5	1.6	1.0	.8	.4	16	96	37	9.0	.2	.8
5	5.1	7.4	1.5	1.0	.8	.4	*26	134	28	5.8	.2	.8
6	4.8	6.1	1.4	1.0	.8	.4	35	127	23	4.2	.2	.8
7	4.2	5.1	1.3	1.0	.8	.4	43	96	19	3.1	.3	.7
8	6.1	4.8	1.2	1.1	*.9	.4	43	74	16	2.3	.3	.8
9	13	4.0	1.2	1.1	.8	.4	31	60	13	1.9	.7	.7
10	12	4.3	1.2	1.1	.8	.4	29	51	12	1.5	.5	.6
11	10	3.9	1.2	1.1	.8	.5	26	41	14	1.4	.6	.5
12	9.0	3.1	1.3	1.1	.8	.5	23	35	11	1.3	.4	.5
13	7.8	2.6	1.4	1.1	.8	.6	68	30	8.5	1.2	.6	.4
14	7.4	2.1	1.5	1.1	.7	*.5	111	27	6.8	.9	.6	.4
15	7.4	1.8	1.6	1.0	.6	.5	109	24	5.8	.7	*.5	.4
16	9.0	*1.6	1.5	.9	.6	.4	89	22	4.8	1.3	.5	.3
17	9.0	1.5	1.5	.9	.6	.4	71	21	4.2	1.2	.4	.3
18	7.8	1.5	1.2	.9	.6	.5	60	19	3.7	1.4	.6	.3
19	*6.8	1.4	1.0	.9	.6	.4	53	20	3.1	1.1	.6	*.3
20	6.4	1.4	.7	.9	.5	.4	48	27	*2.8	.9	.8	.3
21	5.8	1.5	.7	.9	.4	.4	46	55	2.9	.7	.8	.3
22	5.8	1.5	.7	.9	.4	.4	45	70	3.7	.6	.7	.4
23	6.8	1.5	.7	.8	.4	.4	66	66	7.4	.4	.7	.4
24	7.4	1.5	.8	.8	.4	.4	152	*55	23	.3	.7	.6
25	7.4	1.5	.9	.8	.4	.4	192	46	24	.4	.9	.6
26	6.8	1.5	1.0	.7	.4	.4	154	43	17	.3	.9	.6
27	7.1	1.5	1.4	.7	.4	.6	122	74	11	.2	1.3	.6
28	7.4	1.5	1.3	.7	.4	1.1	48	92	8.5	*.2	1.4	.5
29	7.8	1.5	*1.3	.7	.4	3.0	84	108	8.5	.2	1.1	.5
30	12	1.5	1.2	.7	-----	11	71	108	6.1	.3	.9	.6
31	15	-----	1.2	.7	-----	21	-----	93	-----	.2	.8	-----
Total	237.8	109.6	38.1	29.0	18.1	47.8	1,904	1,878	507.8	64.6	18.7	17.5
Mean	7.67	3.65	1.23	0.94	0.62	1.54	63.5	60.6	16.9	2.08	0.60	0.58
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year : Max - Min - Mean - Ac-ft -
Water year 1959-60: Max 192 Min 0.1 Mean 13.3 Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 10-26, Dec. 1-9, 11-13, Dec. 18 to Jan. 27, Mar. 27 to Apr. 2.

ST. CROIX RIVER BASIN

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5-3362. Glaisby Brook near Kettle River, Minn.--continued

Discharge, in cubic feet per second, water year October 1960 to September 1961

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.6	0.8	0.6	0.2	0.2	0.2	3.9	54	10	0.8	0.6	0.3
2	.5	.8	*.6	.2	.2	.2	3.4	48	14	.8	.4	.3
3	.5	.8	.6	.2	.2	.2	3.1	42	14	.4	.6	.2
4	.5	.8	.7	.2	.2	.2	2.5	36	11	.4	.5	.2
5	.4	.8	1.4	.2	.2	.2	2.2	31	7.8	.4	.4	.4
6	.4	.8	1.2	.2	.2	.2	1.9	31	6.8	.3	.3	.8
7	.4	.8	1.0	.2	.2	.2	1.9	40	5.1	.2	.3	.5
8	.5	.8	.9	.2	.2	.2	1.7	46	4.2	.2	.3	.5
9	.4	.8	.8	.2	.2	.2	1.6	46	3.3	.1	.2	.4
10	.4	.8	.7	.2	.2	.2	1.6	41	3.1	.2	.3	1.0
11	.4	.8	.7	.2	.2	.2	1.6	42	2.6	.2	.3	.8
12	.6	.8	.6	.2	.2	.2	1.6	41	2.3	.3	.2	.8
13	.8	.8	.6	.2	.2	.2	1.6	39	2.1	.5	.2	1.9
14	.8	.8	.5	.2	.2	.2	1.7	73	1.9	.9	.2	2.0
15	.8	.8	.5	.2	.2	.2	1.7	198	3.7	.8	.2	1.3
16	.6	.9	.4	.2	.2	.3	2.0	281	1.1	.6	.2	*.9
17	.6	.9	.4	.2	.2	.3	*2.1	194	.8	.6	*.2	1.1
18	.6	.8	.3	.2	.2	.3	7.4	153	.7	.6	.4	.6
19	.6	.8	*.3	.2	.2	.3	22	119	.6	.4	.4	.5
20	.6	.8	.3	.2	.2	.3	68	92	.5	*.3	.3	.4
21	.6	.8	.3	.2	.2	.3	117	69	.6	.6	.4	.6
22	.6	.8	.3	.2	.2	.6	128	55	1.0	.9	.4	.5
23	.6	.7	.3	.2	.2	1.1	111	46	1.1	1.0	.4	.5
24	.4	.7	.3	.2	.2	*1.5	89	38	1.1	.9	.4	.6
25	*.4	.7	.2	.2	.2	1.6	78	31	*.9	.8	.3	.6
26	.3	.7	.2	*.2	.2	1.8	75	26	.6	.6	.3	.6
27	.3	.7	.2	.2	.2	2.5	74	21	.4	.5	.4	.6
28	.3	.7	.2	.2	*.2	5.0	69	18	.3	.4	.6	.4
29	.4	.7	.2	.2	-	4.9	62	15	.2	.5	.5	.5
30	.9	.6	.2	.2	-----	4.6	58	12	.2	.8	.3	.4
31	.9	-----	.2	.2	-----	4.3	-----	*11	-----	.8	.3	-----
Total	16.7	23.3	15.7	6.2	5.6	32.7	994.5	1,989	102.0	16.8	10.8	20.2
Mean	0.54	0.78	0.51	0.20	0.02	1.05	33.2	64.2	3.40	0.54	0.35	0.67
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1960: Max 192 Min 0.1 Mean 12.4 Ac-ft -
 Water year 1960-61: Max 281 Min 0.1 Mean 8.86 Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 8-10, 15-19, 28-30, Dec. 4-18, Dec. 22 to Apr. 17
 (no gage-height record Dec. 8-18, Dec. 26 to Jan. 25, Jan. 27 to Feb. 27, Mar. 1-18, 20, Mar. 28 to Apr. 16,
 18, 19).

ST. CROIX RIVER BASIN

5-3362. Glaisby Brook near Kettle River, Minn.--continued

Discharge, in cubic feet per second, water year October 1961 to September 1962

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.4	1.6	*1.1	0.8	0.4	0.5	10	54	40	8.5	0.4	1.0
2	.4	4.2	1.3	.8	.4	.5	9.4	48	34	24	.4	.6
3	.6	7.8	1.5	.8	.4	.5	9.4	43	28	32	.3	.6
4	.7	6.1	1.6	.8	.4	.5	11	38	26	26	.4	1.0
5	.7	4.2	1.5	.8	.4	.5	14	34	23	19	.4	.8
6	.7	*3.5	1.4	.7	.4	.5	18	29	22	17	.8	.4
7	.7	2.9	1.3	.7	.4	.5	24	25	19	18	.8	.3
8	.7	2.4	1.2	.7	.4	.5	31	22	17	15	.6	.4
9	.7	2.1	1.2	.7	.4	.6	38	21	15	11	.5	.8
10	.8	1.7	1.1	.6	.4	.6	58	22	14	7.8	.6	5.1
11	1.7	1.7	1.0	.6	.5	.6	54	22	12	6.1	2.6	6.4
12	1.0	2.3	.9	.6	.5	.6	62	21	9.0	4.8	5.4	4.5
13	.8	2.3	.9	.6	.5	.7	58	46	7.4	3.1	4.0	2.6
14	.7	2.5	.8	.6	.5	.7	54	64	6.1	2.6	2.8	1.7
15	.6	2.1	.8	.6	.5	.7	49	118	4.8	2.1	1.9	1.4
16	.6	1.9	.8	.6	.5	.8	48	204	4.2	1.9	1.4	.8
17	.6	1.7	.8	.5	.5	.8	62	144	4.5	1.5	1.1	.8
18	.6	1.6	.8	.5	.5	.8	88	101	63	1.1	.8	.7
19	.6	1.2	.8	.5	.5	.8	101	100	33	1.5	.8	.7
20	.6	1.1	.8	.5	.5	.9	100	88	20	1.6	.7	.6
21	.6	1.2	.8	.5	.5	.9	92	72	14	1.3	.7	.4
22	.6	1.2	.8	.5	.5	1.0	86	79	20	1.5	.8	.4
23	*.6	1.2	.8	.5	.5	1.1	76	407	14	*1.4	1.2	.5
24	.6	1.2	.8	.5	.5	1.2	69	495	10	1.3	1.2	*.6
25	.8	1.2	.8	.5	.5	1.4	*62	264	*6.4	1.0	.9	.6
26	.8	1.2	.7	.5	*.5	*1.6	53	148	4.8	.8	.7	.6
27	.8	1.1	*.7	.5	.5	1.8	52	100	3.7	.8	*.7	.6
28	.9	.8	.7	.5	.5	2.5	58	*72	4.8	.7	.6	*.6
29	1.9	.9	.8	*.4	-	3.8	59	59	24	.6	.7	.7
30	1.7	.9	.8	.4	-----	7.2	60	51	16	.8	.9	.6
31	1.6	-----	.8	.4	-----	11	-----	44	-----	.7	2.4	-----
Total	25.1	65.8	30.1	18.2	13.0	46.1	1,565.8	3,035	519.7	215.5	37.5	36.8
Mean	0.81	2.19	0.97	0.59	0.46	1.49	52.2	97.9	17.3	6.95	1.21	1.23
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1961: Max 281 Min 0.1 Mean 9.04 Ac-ft -
 Water year 1961-62: Max 495 Min 0.3 Mean 15.4 Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 4 to Apr. 15 (no gage-height record Mar. 1-25).

5-3362. Glaisby Brook near Kettle River, Minn.--continued

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.3	0.6	0.8	0.6	0.7	1.0	24	40	14	7.4	0.6	0.1
2	.3	.6	.8	*.6	.8	1.0	30	37	18	5.8	.6	.3
3	.4	.7	.9	.6	.8	1.0	42	33	18	4.2	.5	.3
4	.6	.6	1.2	.6	.6	1.1	54	29	14	3.3	*.4	.3
5	.7	.4	1.2	.6	.8	1.1	47	26	12	3.1	.3	.3
6	.8	.6	1.1	.6	.8	1.1	33	23	12	2.3	.3	.2
7	.8	.6	1.0	.5	.8	1.1	29	22	15	1.6	.2	.2
8	.9	.6	1.0	.5	.8	1.1	34	22	22	1.4	.1	.2
9	.9	.6	.9	.5	.9	1.1	*34	22	32	1.2	.2	.2
10	.9	.6	.9	.5	.9	1.1	31	29	74	1.3	.2	.2
11	18	17	18	15	19	1.1	26	32	109	1.2	.3	.2
12	.9	.7	.8	.5	.9	1.2	23	31	94	122	.9	.4
13	.9	.7	.8	.5	.9	1.2	20	46	65	1.2	1.0	.4
14	.9	.8	.8	.5	.8	1.3	17	54	48	.9	.6	.4
15	.9	.8	.8	.5	.8	1.3	16	55	37	.8	.6	.4
16	.8	.6	.8	.4	.8	1.3	18	48	25	.8	.9	.8
17	.7	.6	.9	.4	.8	1.4	22	44	21	.9	.9	.7
18	.7	.7	.9	.3	.8	1.5	20	41	14	.9	.6	.8
19	.7	.7	.9	.3	.8	1.6	19	39	12	.8	.6	.2
20	.6	.8	.8	.3	.9	1.6	20	36	11	.8	.5	.3
21	.6	.8	.8	.3	.9	1.8	18	32	8.2	.6	.4	.3
22	.6	.7	.7	.4	.9	2.3	*15	28	5.8	.4	.4	.3
23	.6	.7	.7	.4	.9	3.4	12	25	4.0	.4	.4	.3
24	.6	.7	.7	.4	.9	10	10	22	3.3	.5	.4	.4
25	.6	.7	.7	.5	*1.0	*21	10	20	4.2	2.8	.3	.6
26	.6	*.7	.6	.5	1.0	36	13	17	21	1.9	.3	.4
27	.6	.9	.6	.6	1.0	62	12	16	21	.9	.4	*.4
28	.6	.9	.6	.6	1.0	54	12	*16	*12	1.3	*.3	.6
29	.6	.9	.6	*.7		40	20	17	8.5	1.1	.3	.7
30	.6	.9	.6	.7		30	35	15	8.2	.8	.3	.7
31	*.6		.6	.7		26		14		.8	.2	
Total	21.1	20.9	25.3	15.6	24.1	310.7	716	931	764.2	52.6	14.0	11.6
Mean	0.68	0.70	0.82	0.50	0.86	10.0	23.9	30.0	25.5	1.70	0.45	0.39
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1962: Max 495 Min 0.3 Mean 15.2 Ac-ft -
 Water year 1962-63: Max 109 Min 0.1 Mean 7.96 Ac-ft -

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 7 to Apr. 4 (no gage-height record Jan. 24-27, Jan. 30 to Feb. 24, Feb. 26 to Mar. 22).

5-3385. Snake River near Pine City, Minn.

Location.--Lat 45°50'30", long 92°56'00", in SE¼NW¼ sec.26, T.39 N., R.21 W., on left bank at site of former powerplant and dam, half a mile downstream from Cross Lake and 1½ miles northeast of Pine City.

Drainage area.--958 sq mi.

Records available.--June 1913 to September 1917, July 1951 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 919.00 ft above mean sea level, datum of 1929. June 25, 1913, to Sept. 30, 1917, staff gage at site 500 ft downstream at different datum. July 1 to Oct. 28, 1951, staff gage at present site and datum.

Average discharge.--16 years, 531 cfs.

Extremes.--Maximum discharge during year, 2,910 cfs June 13 (gage height, 5.77 ft); minimum, 16 cfs Nov. 22 (gage height, 2.76 ft), result of freezeup.
1913-17, 1951-63: Maximum discharge, 7,730 cfs May 28, 1962; maximum gage height, 8.30 ft Apr. 12, 13, 1952; minimum discharge, 12 cfs Nov. 29, 30, 1960; minimum gage height, 2.65 ft Jan. 15, 1955.
A discharge measurement of 12,500 cfs was made May 9, 1950.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to June 25 June 26 to Sept. 30

3.0	56	4.0	729	3.0	70
3.2	133	5.0	1,870	3.2	144
3.5	301	6.0	3,290	3.4	246
				3.7	447

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	163	107	133	62	44	48	1,140	898	1,590	235	84	90
2	158	107	138	61	44	49	1,030	1,080	1,730	*212	97	101
3	158	107	138	60	44	49	940	1,180	1,830	190	101	112
4	158	116	153	60	44	49	845	1,180	1,960	172	104	116
5	158	*107	148	60	44	49	750	1,160	2,080	158	101	120
6	153	116	*120	60	44	49	690	1,090	2,200	149	97	*120
7	153	129	116	61	44	49	639	1,000	2,330	136	90	116
8	158	116	120	63	44	49	639	887	2,420	128	84	112
9	158	112	116	66	44	50	639	782	2,470	120	77	108
10	148	112	112	68	45	50	659	709	2,630	112	77	101
11	143	112	113	70	46	51	659	689	*2,780	104	73	97
12	138	112	114	*70	46	52	639	649	2,850	101	153	94
13	138	112	115	70	47	54	591	709	2,880	101	201	94
14	138	112	116	69	48	56	544	750	2,740	101	229	87
15	138	116	114	67	*48	60	491	876	2,510	94	218	90
16	148	116	110	65	49	62	482	1,030	2,260	90	201	97
17	138	116	98	63	50	66	465	1,160	1,940	90	190	97
18	133	120	94	59	49	76	431	1,220	1,640	90	185	101
19	*116	120	87	57	49	86	473	1,210	1,350	94	172	108
20	112	120	83	55	49	98	526	1,190	1,090	101	162	116
21	112	129	83	53	48	120	573	1,160	876	101	149	128
22	112	99	81	52	48	*152	*610	1,080	699	97	144	120
23	116	112	80	51	48	194	679	994	582	90	144	112
24	107	112	80	49	48	251	689	1,000	491	87	136	108
25	112	116	78	48	47	349	679	994	416	90	128	120
26	103	116	76	47	48	447	659	994	377	87	120	120
27	103	120	74	46	48	563	639	994	336	94	116	*124
28	103	124	68	46	48	699	629	1,000	296	108	112	120
29	103	129	66	46	-	908	669	1,080	268	101	108	120
30	107	133	64	45	-----	1,140	750	1,250	252	*90	104	120
31	112	-----	63	45	-----	1,250	-----	1,440	-----	87	97	-----
Total	4,097	3,475	3,151	1,794	1,305	7,225	19,848	31,435	47,873	3,610	4,054	3,269
Mean	132	116	102	57.9	46.6	233	662	1,014	1,596	116	131	109
Cfs/m	0.138	0.121	0.106	0.060	0.049	0.243	0.691	1.06	1.67	0.121	0.137	0.114
In.	0.16	0.13	0.12	0.07	0.05	0.28	0.77	1.22	1.86	0.14	0.16	0.13

Calendar year 1962: Max 7,570 Min 56 Mean 572 Cfs/m 0.597 In. 8.09
Water year 1962-63: Max 2,880 Min 44 Mean 359 Cfs/m 0.375 In. 5.09

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10-17, Dec. 22 to Mar. 22.

5-3400. Sunrise River near Stacy, Minn.

Location.--Lat 45°24'30", long 92°55'55", in NW¼NW¼ sec.26, T.34 N., R.21 W., on right bank on upstream side of highway bridge, 2½ miles northeast of Stacy, and 3 miles downstream from West Branch Sunrise River.

Drainage area.--167 sq mi.

Records available.--January 1949 to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 855 ft (from topographic map). Prior to Nov. 10, 1949, chain gage at same site and datum.

Average discharge.--14 years, 66.0 cfs.

Extremes.--Maximum discharge during year, 252 cfs May 16 (gage height, 6.27 ft); minimum daily, 12 cfs July 15, 16; minimum gage height, 2.54 ft July 16.

1949-63: Maximum discharge, 806 cfs Apr. 12, 1952 (gage height, 7.88 ft); minimum observed, 3.6 cfs July 17, 1949 (gage height, 1.98 ft).

Remarks.--Records good except those for period of ice effect, which are fair. At high stages a small part of flow discharges into the Rum River and Coon Creek basins from West Arm of Coon Lake and South Coon Lake, respectively.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used June 25 to Sept. 30)

3.0	39	6.0	222
4.0	86	7.0	368
5.0	148		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	66	53	58	31	17	17	86	131	118	36	18	13
2	66	52	58	31	17	18	90	118	117	*34	28	21
3	66	51	57	30	17	19	94	111	124	32	29	*22
4	69	53	54	30	17	19	90	111	134	30	25	21
5	70	*54	49	30	17	19	91	111	138	28	*22	19
6	68	55	*45	31	17	20	89	109	157	26	22	17
7	71	55	45	31	17	20	88	110	*153	22	21	17
8	83	54	43	30	16	21	98	116	156	19	18	16
9	85	53	40	29	*16	21	100	115	160	18	18	21
10	83	53	38	29	16	21	96	138	175	16	18	18
11	80	54	36	*28	16	22	99	169	191	14	20	18
12	78	53	34	27	16	22	102	189	194	14	41	48
13	74	53	35	26	16	23	104	210	192	15	39	35
14	73	52	35	25	16	24	100	233	188	14	31	28
15	73	52	36	24	16	25	95	245	171	12	27	24
16	73	52	37	23	17	26	91	251	152	13	26	26
17	70	52	37	23	17	28	90	245	135	21	24	29
18	68	52	38	23	17	30	90	223	119	18	22	29
19	*66	51	37	22	17	32	89	192	108	18	21	39
20	64	51	36	21	16	32	90	168	97	17	20	40
21	63	51	36	21	16	39	83	151	89	16	19	38
22	64	45	35	20	16	*56	*75	138	79	15	20	36
23	64	48	35	20	16	61	79	128	71	15	21	34
24	62	50	34	19	16	73	92	127	63	15	20	33
25	61	52	33	18	16	95	90	130	57	16	19	33
26	59	53	33	18	16	110	88	125	54	15	17	34
27	58	54	34	18	16	117	86	121	49	16	16	36
28	57	55	33	18	17	104	86	128	45	23	15	32
29	56	56	32	17	-	98	104	132	42	22	14	32
30	55	57	32	17	-----	94	136	128	39	19	14	29
31	54	-----	31	17	-----	88	-----	122	-----	20	13	-----
Total	2,099	1,576	1,216	748	460	1,394	2,791	4,725	3,567	609	678	838
Mean	67.7	52.5	39.2	24.1	16.4	45.0	93.0	152	119	19.6	21.9	27.9
Cfsm	0.405	0.314	0.235	0.144	0.098	0.269	0.557	0.910	0.713	0.117	0.131	0.167
In.	0.47	0.35	0.27	0.17	0.10	0.31	0.62	1.05	0.79	0.14	0.15	0.19

Calendar year 1962 Max 311 Min 24 Mean 85.8 Cfsm 0.514 In. 6.98
Water year 1962-63 Max 251 Min 12 Mean 56.7 Cfsm 0.340 In. 4.61

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Nov. 23 to Mar. 26.

5-3405. St. Croix River at St. Croix Falls, Wis.

Location.--Lat 45°24'30", long 92°38'45", in NW¼ sec.30, T.34 N., R.18 W., on left bank 1,800 ft downstream from powerplant of Northern States Power Co., in St. Croix Falls, and at mile 52.2.

Drainage area.--5,930 sq mi, approximately.

Records available.--January 1902 to September 1963 in reports of Geological Survey. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Croix Falls."

Gage.--Water-stage recorder. Datum of gage is 690.47 ft above mean sea level, adjustment of 1912. Prior to July 1905, gage heights and discharge measurements were used to determine flow. July 1905 to February 1940, records were computed from power generation at the St. Croix Falls powerplant 1,800 ft upstream.

Average discharge.--61 years (1902-63); 4,024 cfs.

Extremes.--Maximum discharge during year, 10,500 cfs Mar. 30 (gage height, 5.40 ft); minimum, 118 cfs Jan. 23 (gage height, 0.93 ft); minimum daily, 562 cfs Feb. 5.
1902-63: Maximum discharge, 54,900 cfs May 8, 1950 (gage height, 25.19 ft); minimum daily, 75 cfs July 17, 1910.

Remarks.--Records good. Flow regulated by powerplant upstream.

Rating table, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to June 19				June 20 to Sept. 30			
1.4	497		3.0	3,710	1.8	1,080	
1.8	1,000		4.0	6,950	2.4	2,270	
2.4	2,180		5.0	9,500	3.0	3,800	

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,860	2,220	2,490	1,850	1,380	1,640	7,660	5,960	5,680	2,270	1,580	1,460
2	2,520	2,700	2,060	1,880	1,380	1,590	7,100	7,290	6,100	2,310	2,160	1,620
3	2,710	1,760	2,540	1,790	1,220	1,750	6,450	6,960	6,350	1,840	2,090	1,580
4	2,050	2,210	2,410	1,860	1,600	1,640	6,950	6,390	5,360	2,010	1,840	1,560
5	3,160	2,290	2,410	1,920	562	1,810	6,450	6,030	6,060	1,700	1,600	1,620
6	2,450	2,100	2,150	1,970	1,600	1,670	6,130	5,990	6,370	1,680	1,620	1,700
7	2,450	2,440	1,890	1,980	2,080	1,620	5,600	5,860	6,160	1,640	1,800	1,640
8	3,010	2,020	1,460	1,950	1,350	1,700	5,610	5,390	6,290	1,660	1,680	1,640
9	2,460	2,430	1,010	1,690	1,090	1,750	5,720	5,280	6,350	1,940	1,580	1,580
10	2,650	1,930	1,790	2,000	1,430	1,660	5,930	5,550	7,220	1,800	1,440	1,420
11	2,740	2,230	1,400	1,850	1,700	1,640	5,830	6,230	7,320	1,700	1,310	1,860
12	2,830	2,200	1,140	1,890	1,500	1,660	5,570	6,390	7,550	1,480	2,140	1,740
13	2,700	2,170	1,300	1,780	1,700	1,760	5,360	6,390	7,550	1,360	2,400	1,720
14	2,380	2,330	1,720	1,880	1,620	1,660	4,400	6,840	7,380	1,400	2,890	1,600
15	2,560	2,330	2,040	1,680	1,560	1,790	4,080	7,320	6,670	1,340	2,860	1,560
16	2,560	2,180	2,050	1,590	1,560	1,840	4,500	7,660	6,130	1,330	2,230	1,580
17	2,620	2,360	2,000	1,700	1,570	2,150	4,000	7,580	5,630	1,520	2,290	1,800
18	3,150	2,010	2,210	1,850	1,660	2,160	4,220	7,300	5,230	1,540	1,990	2,120
19	2,420	2,290	2,280	1,410	1,720	2,230	3,970	6,960	4,310	1,520	2,160	1,800
20	2,640	2,290	2,150	2,090	1,700	1,990	4,130	6,680	3,580	1,440	2,090	2,120
21	2,380	2,200	2,100	1,780	1,600	2,490	5,130	6,190	3,630	1,440	1,970	1,900
22	2,300	2,300	1,560	1,400	1,700	2,130	5,130	5,870	3,010	1,440	1,680	1,720
23	2,120	2,090	1,920	1,600	1,820	2,540	4,830	5,800	2,940	1,440	1,940	1,680
24	2,930	1,710	1,960	1,450	1,310	3,310	4,840	5,680	2,490	1,440	1,680	1,760
25	2,630	1,880	1,620	1,370	1,540	3,980	4,120	5,540	2,850	1,480	1,680	1,970
26	2,010	2,370	1,780	1,440	1,600	3,630	4,400	5,620	2,450	1,460	1,820	2,120
27	2,160	2,510	1,820	1,500	1,720	4,660	4,160	4,860	2,420	1,340	1,560	2,030
28	2,760	2,590	1,600	1,600	1,660	5,050	4,290	5,310	2,720	1,580	1,540	2,120
29	2,490	2,500	1,800	1,450	-	5,910	4,770	5,900	2,510	1,660	1,540	1,840
30	2,100	2,620	1,890	1,520	-----	7,040	5,340	5,960	2,580	1,600	1,500	2,160
31	1,900	-----	1,800	1,440	-----	7,460	-----	6,570	-----	1,620	1,460	-----
Total	78,700	67,260	58,350	53,160	42,932	83,910	156,670	193,350	150,890	49,980	58,120	53,020
Mean	2,539	2,242	1,882	1,715	1,533	2,707	5,222	6,237	5,030	1,612	1,875	1,767
Cfsm	0.428	0.378	0.317	0.289	0.259	0.456	0.881	1.05	0.848	0.272	0.316	0.298
In.	0.49	0.42	0.37	0.33	0.27	0.53	0.98	1.21	0.95	0.31	0.36	0.33

Calendar year 1962: Max 30,000 Min 1,010 Mean 4,180 Cfsm 0.705 In. 9.57
Water year 1962-63: Max 7,660 Min 562 Mean 2,867 Cfsm 0.483 In. 6.55

Note.--Stage-discharge relation affected by ice Jan. 22-24, Jan. 26 to Feb. 4, Feb. 6, 11-15, 18-23, Feb. 26 to Mar. 1.

5-3445. Mississippi River at Prescott, Wis.

Location.--Lat 44°44'45", long 92°48'00", in sec.9, T.26 N., R.20 W., on left bank at Prescott, 200 ft downstream from St. Croix River, 300 ft south of Chicago, Burlington & Quincy Railroad bridge, 800 ft south of bridge on U. S. Highway 10, and at mile 811.4 upstream from Ohio River.

Drainage area.--44,800 sq mi, approximately.

Records available.--June 1928 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 600.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Aug. 2, 1932, staff gage at railroad bridge 300 ft upstream at following datums: June 3, 1928, to Sept. 30, 1929, 69.27 ft higher; Oct. 1, 1929, to Sept. 30, 1930, 67.68 ft higher; Oct. 1, 1930, to Aug. 1, 1932, 69.28 ft higher. Aug. 2, 1932, to Oct. 30, 1938, water-stage recorder at present site at datum 69.28 ft higher. Auxiliary water-stage recorder 10.7 miles downstream from base gage.

Average discharge.--35 years, 14,760 cfs.

Extremes.--Maximum discharge during year, 41,400 cfs June 16 (gage height, 80.08 ft); minimum daily, 4,170 cfs Dec. 11; minimum gage height, 74.27 ft July 15.

1928-63: Maximum discharge, 155,000 cfs Apr. 16-18, 1952 (gage height, 89.03 ft); minimum daily, 1,380 cfs July 13, 1940; minimum gage height, 65.08 ft Aug. 29, 1934, present datum.

Remarks.--Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14,300	11,000	10,800	7,230	5,790	6,200	30,700	16,600	22,600	15,400	18,400	8,880
2	14,000	11,600	10,600	7,070	5,520	6,340	30,400	17,600	23,000	14,000	16,300	9,860
3	13,700	11,400	9,660	7,400	5,540	6,070	29,700	18,600	24,400	12,600	17,800	11,500
4	13,700	10,200	9,730	7,760	5,540	6,170	27,600	19,000	25,500	12,200	18,400	10,000
5	12,400	11,100	9,800	7,750	5,530	6,010	26,100	19,000	25,800	11,400	17,200	9,650
6	12,500	11,400	9,370	7,640	5,920	6,120	25,800	18,600	25,900	11,400	16,900	10,000
7	13,500	10,700	9,350	7,480	6,260	6,180	24,900	17,900	26,900	11,300	17,300	10,300
8	14,300	11,200	9,630	7,890	6,920	6,230	26,100	17,900	28,200	9,650	16,600	8,590
9	14,300	12,100	8,410	8,150	6,460	6,380	26,300	17,500	29,700	9,180	16,600	8,360
10	13,900	12,200	4,850	7,030	5,980	6,370	24,700	18,600	30,800	11,800	16,200	8,550
11	13,900	12,400	4,170	5,810	5,820	6,230	23,400	19,400	31,800	14,000	14,300	*8,010
12	14,000	12,300	4,180	5,490	5,720	6,710	22,000	18,900	33,400	13,300	*13,500	7,640
13	14,100	11,800	4,350	5,490	5,840	6,720	21,500	20,500	35,800	12,000	14,600	8,350
14	13,900	11,900	5,020	5,630	5,920	6,740	21,000	21,500	37,400	9,220	15,300	8,050
15	13,200	*11,100	6,480	5,680	6,110	7,490	19,900	21,900	39,500	8,160	16,700	7,060
16	12,400	10,900	7,180	5,870	6,020	7,770	18,600	23,700	41,000	7,150	17,200	7,610
17	*12,900	10,700	8,520	6,860	5,960	11,000	19,200	25,200	41,000	8,100	16,100	8,170
18	13,600	11,000	8,640	7,090	6,740	8,280	18,800	26,500	39,900	8,950	14,800	8,340
19	14,100	9,260	7,930	6,790	6,580	10,300	19,100	26,000	*39,200	8,250	13,900	8,030
20	13,100	9,790	7,580	6,670	6,760	10,300	18,700	25,300	37,100	10,100	13,900	7,640
21	12,000	9,890	7,660	5,520	6,250	9,140	17,800	25,700	34,500	10,800	12,600	8,730
22	11,700	9,170	7,900	5,800	5,820	8,560	17,000	*25,000	31,800	13,800	11,500	8,850
23	10,900	9,030	6,950	5,400	5,630	13,100	17,100	23,900	28,800	16,300	11,600	8,920
24	10,900	9,440	7,280	5,350	5,610	16,200	16,600	23,200	25,300	16,000	12,100	8,700
25	10,800	9,530	7,640	6,130	5,700	18,300	16,500	22,400	22,500	*16,200	12,300	9,670
26	11,900	9,540	7,470	5,970	5,590	20,000	17,000	22,000	21,600	16,400	10,700	9,900
27	11,900	9,420	7,180	5,880	6,290	22,300	16,000	21,000	20,200	17,500	9,140	8,960
28	11,700	9,530	7,100	5,490	6,110	23,800	14,700	20,500	18,300	19,600	9,300	9,430
29	11,600	10,000	7,180	5,690	-	25,000	*16,400	20,900	17,100	20,500	9,960	9,730
30	10,800	10,800	7,200	5,520	-----	27,800	16,600	22,300	16,700	22,400	8,980	9,900
31	10,600	-----	7,020	5,620	-----	30,300	-----	22,700	-----	22,400	8,360	-----
Total	396,600	320,400	236,830	199,150	167,930	358,110	640,200	659,800	875,700	410,060	438,540	267,380
Mean	12,790	10,680	7,640	6,424	5,998	11,550	21,340	21,280	29,190	13,230	14,150	8,913
Cfsm	0.285	0.238	0.171	0.143	0.134	0.258	0.476	0.475	0.652	0.295	0.316	0.199
In.	0.33	0.27	0.20	0.17	0.14	0.30	0.53	0.55	0.73	0.34	0.36	0.22

Calendar year 1962: Max 75,800 Min 4,170 Mean 19,960 Cfsm 0.446 In. 6.05
 Water year 1962-63: Max 41,000 Min 4,170 Mean 13,620 Cfsm 0.304 In. 4.14

* Discharge measurement made on this day.

Note.--Stage-fall-discharge relation affected by ice Nov. 19 to Mar. 23. No gage-height record at auxiliary gage Apr. 19-28, July 26 to Aug. 11.

5-3552. Cannon River at Welch, Minn.

Location.--Lat 44°33'50", long 92°43'55", in NW¼SW¼ sec.27, T.113 N., R.16 W., on right bank 0.3 mile downstream from highway bridge at Welch and 1.8 miles upstream from Belle Creek.

Drainage area.--1,320 sq mi, approximately.

Records available.--June 1909 to January 1914 (no winter records 1909-11), November 1930 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 699.16 ft above mean sea level, datum of 1929. Prior to Nov. 11, 1930, chain gage on highway bridge at site 0.3 mile upstream at datum 3.00 ft lower. Nov. 11, 1930, to Oct. 11, 1938, water-stage recorder at site 0.3 mile upstream at present datum.

Average discharge.--34 years (1911-13, 1931-63), 463 cfs.

Extremes.--Maximum discharge during year, 1,780 cfs July 16 (gage height, 4.67 ft); minimum, 48 cfs Aug. 14, 28 (gage height, 1.27 ft).

1909-14, 1930-63: Maximum discharge, 15,800 cfs Apr. 2, 1952 (gage height, 12.00 ft), from rating curve extended above 9,100 cfs by logarithmic plotting; maximum gage height, 12.04 ft Mar. 23, 1936 (site then in use); minimum discharge, 2.5 cfs Jan. 3, 1950 (gage height, 0.06 ft, backwater from ice).

Maximum stage known, 17.1 ft, present datum, in April 1888, from floodmark at mill about 2,400 ft upstream.

Remarks.--Records good except those for periods of ice effect, which are fair. Diurnal fluctuation caused by powerplants above station.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

1.4	66	2.5	370
1.6	100	3.0	609
1.8	142	4.0	1,220
2.0	192		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	304	256	174	180	148	205	764	388	220	130	140	72
2	344	272	148	220	154	170	534	314	98	135	129	129
3	406	213	196	195	90	103	477	436	290	130	117	141
4	491	104	228	170	190	260	287	386	315	71	72	146
5	478	215	213	97	192	232	270	178	265	140	131	142
6	352	274	*210	147	195	230	229	317	226	116	134	145
7	227	242	221	400	203	235	135	706	219	69	136	123
8	385	268	161	420	180	245	299	712	162	120	123	74
9	616	228	118	450	150	190	284	416	96	119	138	122
10	638	178	216	360	92	145	252	420	342	117	118	129
11	599	106	203	*240	190	250	242	758	604	114	72	121
12	576	*222	200	160	180	258	256	686	530	110	123	118
13	*562	198	200	93	178	215	208	803	462	104	130	116
14	390	218	203	225	*173	280	106	868	454	69	125	72
15	418	290	150	203	160	420	245	816	368	102	124	68
16	620	260	116	198	130	380	268	803	194	230	*130	99
17	558	174	185	200	90	430	270	*796	280	549	118	106
18	443	100	200	206	203	540	267	784	323	174	72	112
19	346	192	188	125	202	803	*260	415	250	340	131	*169
20	253	252	182	90	180	771	206	314	*242	338	126	140
21	118	238	180	220	175	*796	98	438	240	98	126	114
22	288	193	178	210	190	716	272	408	150	*264	132	76
23	392	211	106	200	130	855	388	380	82	236	140	124
24	341	203	232	205	94	940	368	286	188	200	132	216
25	329	108	204	210	168	816	370	172	138	164	77	228
26	280	199	218	130	208	803	298	100	159	156	136	152
27	182	226	209	88	230	933	271	218	164	140	142	146
28	106	220	197	210	223	1,020	179	358	134	77	131	126
29	240	220	165	200	-	985	234	362	117	178	123	76
30	254	235	100	203	-----	894	208	146	76	163	130	134
31	292	-----	195	175	-----	803	-----	292	-----	153	116	-----
Total	11,828	6,315	5,696	6,430	4,698	15,923	8,545	14,476	7,388	5,106	3,774	3,736
Mean	382	210	184	207	168	514	285	467	246	165	122	125
Cfsm	0.289	0.159	0.139	0.157	0.127	0.389	0.216	0.354	0.186	0.125	0.092	0.095
In.	0.33	0.18	0.16	0.18	0.13	0.45	0.24	0.41	0.21	0.14	0.11	0.11

Calendar year 1962: Max 6,370 Min 82 Mean 634 Cfsm 0.480 In. 6.52
 Water year 1962-63: Max 1,020 Min 66 Mean 257 Cfsm 0.195 In. 2.65

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 11-22, Dec. 27 to Jan. 5, Jan. 7 to Mar. 18.

5-3730. South Fork Zumbro River near Rochester, Minn.

Location.--Lat 44°04'00", long 92°27'55", in SE¼ sec.14, T.107 N., R.14 W., on left bank 30 ft upstream from ford, a quarter of a mile downstream from sewage plant, 1.6 miles north of Rochester, 2 miles downstream from Cascade Creek, and 2¼ miles downstream from Silver Lake Dam.

Drainage area.--304 sq mi.

Records available.--January 1952 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 951.0 ft above mean sea level, datum of 1929 (levels by City of Rochester Sewage Department).

Average discharge.--11 years, 111 cfs.

Extremes.--Maximum discharge during year, 2,660 cfs Mar. 24 (gage height, 8.78 ft); minimum, 26 cfs Sept. 16, (gage height, 1.62 ft).

1952-63: Maximum discharge, 18,000 cfs Mar. 29, 1962 (gage height, 18.46 ft); minimum, 8.4 cfs Dec. 7, 1955.

Previous maximum stage known since at least 1908, about 17.5 ft July 21, 1951, from information by sewage plant superintendent.

Remarks.--Records good. Slight regulation at times from Silver Lake and at very low flows from sewage-plant effluent.

Rating tables, water year 1962-63 (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Feb. 28

Mar. 1 to Sept. 30

1.8	27	1.6	25	3.0	281
2.0	49	1.8	38	3.5	430
2.3	93	2.0	60	4.0	580
2.6	150	2.3	103	5.0	886
3.0	242	2.6	175	7.0	1,690

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	106	90	70	43	36	38	210	145	58	42	43	33
2	106	90	68	47	35	41	234	126	58	43	43	51
3	122	90	70	47	34	39	226	126	75	38	39	40
4	154	93	68	48	36	46	195	114	64	37	34	53
5	180	92	*64	47	40	46	168	110	64	39	38	39
6	150	92	60	47	42	46	150	103	63	42	36	38
7	148	90	59	52	41	46	148	98	84	38	36	35
8	171	85	64	52	42	46	162	93	108	38	36	33
9	224	85	54	53	42	43	165	93	103	37	44	33
10	237	84	53	*49	42	42	145	112	86	37	35	34
11	193	*79	47	43	42	48	131	97	74	34	32	34
12	*165	84	47	43	42	53	124	101	68	34	50	34
13	150	79	47	43	*43	57	119	124	*66	35	38	31
14	142	79	47	42	41	*68	110	119	59	34	35	30
15	146	79	47	41	41	75	108	101	56	46	34	27
16	138	79	47	37	43	182	108	*95	53	61	34	31
17	128	77	52	37	43	1,540	101	75	53	*88	33	30
18	126	74	56	40	44	902	*100	83	52	119	30	*47
19	122	77	57	38	46	*424	105	78	48	131	43	189
20	119	77	56	37	41	273	100	78	46	76	34	70
21	113	77	54	37	41	226	90	75	44	58	34	52
22	113	70	56	37	40	496	95	74	43	52	32	44
23	109	72	42	37	40	1,440	101	72	41	37	54	46
24	104	70	47	37	37	1,660	101	70	41	41	38	39
25	104	70	47	37	41	764	108	67	41	41	34	39
26	100	76	47	36	38	1,080	112	64	41	40	34	38
27	100	73	46	34	40	490	112	66	42	38	*34	37
28	99	70	47	34	38	337	119	66	42	36	38	34
29	99	70	46	37	-	275	168	67	79	38	41	34
30	97	70	42	37	-----	242	188	62	48	55	38	35
31	93	-----	47	36	-----	213	-----	60	-----	59	37	-----
Total	4,158	2,393	1,654	1,285	1,131	11,278	4,103	2,814	1,800	1,544	1,161	1,310
Mean	134	79.8	53.4	41.5	40.4	364	137	90.8	60.0	49.8	37.5	43.7
Cfsm	0.441	0.262	0.176	0.137	0.133	1.20	0.451	0.299	0.197	0.164	0.123	0.144
In.	0.51	0.29	0.20	0.16	0.14	1.38	0.50	0.34	0.22	0.19	0.14	0.16

Calendar year 1962: Max 8,370 Min 33 Mean 175 Cfsm 0.576 In. 7.79

Water year 1962-63: Max 1,660 Min 27 Mean 94.9 Cfsm 0.312 In. 4.23

Peak discharge (base, 1,000 cfs)

* Discharge measurement made on this day.

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-17	1400	7.44	1,910				
3-24	0300	8.78	2,660				

ZUMBRO RIVER BASIN

5-3740. Zumbro River at Zumbro Falls, Minn.

Location.--Lat 44°17'12", long 92°25'56", in sec.36, T.110 N., R.14 W., on left bank in Zumbro Falls, 1,000 ft downstream from Spring Creek, 0.7 mile upstream from bridge on U. S. Highway 63, and 6.3 miles downstream from North Fork.

Drainage area.--1,130 sq mi, approximately.

Records available.--June 1909 to September 1917, April to November 1929, March 1930 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 811.26 ft above mean sea level, datum of 1929. Prior to Nov. 11, 1933, chain gage on bridge 800 ft downstream at same datum.

Average discharge.--41 years (1909-17, 1930-63), 475 cfs.

Extremes.--Maximum discharge during year, 5,130 cfs Mar. 24 (gage height, 13.76 ft); minimum, 48 cfs Dec. 23 (gage height, 6.21 ft).

1909-17, 1929-63: Maximum discharge, 35,900 cfs July 22, 1951 (gage height, 30.80 ft, from floodmark); minimum, 27 cfs Jan. 12, 1935 (gage height, 6.30 ft).

Flood of April 1888 reached stage of about 30.5 ft at present site or 29.7 ft original site. Flood in 1859 is known to have exceeded that of 1888 (gage height, not determined).

Remarks.--Records good except those for periods of ice effect or no gage-height record, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)

6.2	47	7.5	449
6.4	75	8.0	734
6.7	140	9.0	1,380
7.0	227	14.0	5,360

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	252	324	126	182	182	190	888	360	206	250	188	84
2	339	322	175	105	182	181	882	530	118	164	194	96
3	260	254	280	160	92	101	869	544	226	147	107	188
4	272	140	280	246	156	b160	862	284	240	103	94	256
5	314	194	*286	216	198	b225	844	145	186	190	144	171
6	568	313	286	109	142	b245	278	249	234	148	96	101
7	558	290	291	b120	146	b280	172	366	430	94	142	90
8	478	514	238	b185	180	b310	446	226	268	126	146	86
9	523	490	b100	b225	176	b335	574	260	260	129	108	98
10	624	276	b220	*b215	103	109	544	808	580	129	144	184
11	920	*140	b260	b230	94	b340	476	894	644	130	90	114
12	*844	240	b250	b240	146	b480	512	926	366	135	196	132
13	594	263	b165	b160	*186	b510	183	552	354	96	154	202
14	320	264	b135	121	184	*338	140	527	*350	86	137	98
15	452	264	b130	b220	191	346	198	456	197	131	135	83
16	560	414	101	138	186	594	130	*490	133	178	140	77
17	543	260	b115	130	107	2,090	*168	550	176	676	110	107
18	394	135	b160	306	124	*3,020	301	286	174	*262	86	*107
19	512	380	b190	221	b240	1,720	378	161	174	508	126	316
20	285	250	b180	96	b205	1,130	252	280	236	499	129	234
21	156	387	b195	98	b190	992	128	299	230	259	128	188
22	401	250	b140	b215	b195	1,450	238	282	172	182	88	98
23	499	242	67	122	148	3,250	495	203	109	228	197	106
24	298	192	b110	152	98	4,580	290	278	175	240	142	194
25	198	121	92	152	94	2,740	286	244	158	240	94	194
26	285	294	86	206	180	2,460	324	126	151	189	137	192
27	249	292	b170	92	175	1,800	262	234	172	112	*147	194
28	143	296	b205	84	192	1,260	130	175	236	98	147	182
29	196	295	b195	181	-	998	391	227	159	151	145	90
30	316	237	101	176	-----	926	436	230	105	181	172	92
31	318	-----	b250	173	-----	907	-----	314	-----	173	98	-----
Total	12,671	8,333	5,579	5,276	4,492	34,067	12,077	11,506	7,219	6,234	4,161	4,354
Mean	409	278	180	170	160	1,099	403	371	241	201	134	145
Cfsm	0.362	0.246	0.159	0.150	0.142	0.973	0.357	0.328	0.213	0.178	0.119	0.128
In.	0.42	0.27	0.18	0.17	0.15	1.12	0.40	0.38	0.24	0.21	0.14	0.14

Calendar year 1962: Max 23,600 Min 59 Mean 554 Cfsm 0.490 In. 6.65
 Water year 1962-63: Max 4,580 Min 67 Mean 318 Cfsm 0.281 In. 3.82

* Discharge measurement made on this day.

b Stage-discharge relation affected by ice.

Note.--No gage-height record Dec. 2-5.

WHITEWATER RIVER BASIN

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5-3765. South Fork Whitewater River near Altura, Minn.

Location.--Lat 44°04'10", long 91°58'49", in SE¼ sec.14, T.107 N., R.10 W., on left bank 500 ft upstream from highway bridge, 1.4 miles upstream from small tributary entering from the west, 2 miles west of Altura, and 2.4 miles upstream from Keefer Creek.

Drainage area.--76.8 sq mi.

Records available.--October 1939 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 761.80 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers).

Average discharge.--24 years, 27.5 cfs.

Extremes.--Maximum discharge during year, 954 cfs July 17 (gage height, 4.74 ft); minimum, 6.9 cfs Mar. 1 (gage height, 0.76 ft).
1939-63: Maximum discharge, 5,460 cfs Aug. 31, 1947 (gage height, 10.61 ft); minimum, 3.8 cfs Mar. 24, 1940; minimum gage height, 0.74 ft Jan. 20, 1951.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating tables, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Mar. 17, Apr. 5-20, Aug. 9 to Sept. 30)

Oct. 1 to Mar. 16

Mar. 17 to Sept. 30

0.9	9.2
1.0	12
1.1	15
1.2	20
1.3	28

0.8	12	1.6	78
0.9	14	2.0	144
1.1	21	2.5	242
1.3	36	3.0	361

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	16	13	12	11	10	16	17	15	15	17	11
2	17	16	13	12	11	10	15	16	15	14	17	11
3	17	16	12	12	11	10	15	16	18	15	17	10
4	17	16	12	12	11	11	14	16	18	15	16	11
5	19	16	*12	12	11	11	14	16	16	15	16	10
6	18	16	12	12	11	11	14	15	16	15	20	10
7	18	16	12	12	11	11	14	15	16	14	17	10
8	20	15	12	12	11	11	13	15	17	14	15	10
9	22	15	11	*12	11	10	13	15	18	14	14	10
10	28	*15	11	12	11	10	13	16	18	14	13	10
11	*24	15	11	12	11	11	13	15	17	14	13	10
12	23	15	12	11	11	11	13	16	16	14	13	10
13	22	14	12	12	*11	*11	13	33	*16	15	13	10
14	21	14	12	12	11	11	13	24	16	15	12	10
15	21	14	12	11	11	12	13	*20	15	15	12	10
16	21	14	12	11	11	113	*13	19	15	44	12	10
17	21	14	12	12	11	*546	13	18	15	*265	12	10
18	20	14	12	12	11	256	13	18	15	43	12	*10
19	20	14	12	12	11	110	14	17	15	151	12	12
20	19	14	12	12	11	*38	13	17	15	54	11	13
21	19	14	12	12	11	47	13	17	15	33	11	12
22	18	14	12	11	10	187	14	17	15	27	11	12
23	18	14	11	11	10	315	14	17	14	24	12	11
24	18	14	11	11	10	198	14	16	14	21	12	11
25	18	14	11	11	10	103	15	16	14	20	12	11
26	17	14	12	11	10	130	15	16	14	19	*12	11
27	17	13	12	11	10	46	15	16	14	18	12	11
28	17	14	12	11	10	27	15	16	14	18	12	11
29	16	13	12	11	-	21	16	15	14	17	12	11
30	16	13	12	11	-----	18	18	15	15	17	12	11
31	16	-----	12	11	-----	17	-----	15	-----	18	11	-----
Total	596	436	368	359	301	2,334	421	530	465	1,007	413	320
Mean	19.2	14.5	11.9	11.6	10.8	75.3	14.0	17.1	15.5	32.5	13.3	10.7
Cfsm	0.250	0.189	0.155	0.151	0.141	0.980	0.182	0.223	0.202	0.423	0.173	0.139
In.	0.29	0.21	0.18	0.17	0.15	1.13	0.20	0.26	0.23	0.49	0.20	0.15

Calendar year 1962: Max 2,310 Min 9.2 Mean 25.3 Cfsm 0.329 In. 4.47
Water year 1962-63: Max 546 Min 10 Mean 20.7 Cfsm 0.270 In. 3.66

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-17	0300	3.99	586	7-17	0100	4.74	954
3-23	1600	3.85	628	7-19	0600	2.30	202

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 7, 9-16, Dec. 23 to Jan. 2, Jan. 11 to Feb. 10, Feb. 12, 14, Feb. 21 to Mar. 3, Mar. 9, 10.

5-3785. Mississippi River at Winona, Minn.

Location.--Lat 44°03'20", long 91°38'15", in sec.23, T.107 N., R.7 W., on right bank at Winona pumping station in Winona, 9½ miles upstream from Trempealeau River and at mile 725.7 upstream from the Ohio River.

Drainage area.--59,200 sq mi, approximately.]

Records available.--June 1928 to September 1963. Gage-height records collected in this vicinity since 1878 are contained in reports of Mississippi River Commission.

Gage.--Water-stage recorder. Datum of gage is 639.64 ft above mean sea level, datum of 1929. June 10, 1928, to Apr. 15, 1931, staff gage at site 800 ft upstream. Prior to Oct. 1, 1929, at datum 0.20 ft higher and Oct. 1, 1929, to Apr. 15, 1931, at datum 0.12 ft lower. Apr. 16, 1931, to Nov. 12, 1934, staff gage at present site and datum. Since Mar. 31, 1937, auxiliary water-stage recorder 2.7 miles upstream at tailwater of navigation dam 5A.

Average discharge.--35 years, 24,290 cfs.

Extremes.--Maximum discharge during year, 51,440 cfs Apr. 2 (gage height, 7.53 ft); maximum gage height, 8.12 ft, Mar. 25; minimum daily, 7,460 cfs July 10; minimum gage height, 4.89 ft Jan. 18.
1928-63: Maximum discharge, 190,000 cfs Apr. 20, 1952 (gage height, 17.91 ft); minimum, 2,250 cfs Dec. 29, 1933 (gage height, -1.18 ft); minimum gage height, -3.38 ft Aug. 31, 1934.

Remarks.--Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

Cooperation.--Gage-height record at dam 5A furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20,700	16,800	18,800	12,700	10,900	11,700	48,700	25,200	31,900	20,300	24,400	10,000
2	21,800	17,900	18,500	12,700	11,200	11,700	50,900	26,700	31,000	15,200	21,600	11,800
3	21,500	18,200	18,500	13,200	11,100	11,800	51,300	29,800	30,000	14,800	23,800	11,900
4	22,700	18,500	18,000	13,500	11,200	12,400	50,900	33,700	30,500	15,800	24,800	12,700
5	20,500	17,800	17,800	13,500	11,200	12,800	50,400	33,200	32,700	13,800	22,800	13,600
6	20,900	17,600	18,400	13,500	11,200	13,000	49,000	28,600	33,300	11,000	21,600	13,700
7	20,100	17,700	18,000	14,100	11,200	12,900	48,600	27,700	34,100	12,200	22,200	14,200
8	23,400	17,900	18,100	14,400	11,200	12,800	46,400	29,700	34,300	11,200	22,700	14,900
9	26,500	17,800	17,600	13,700	11,300	12,900	46,300	30,500	34,800	9,250	22,600	12,600
10	24,800	18,100	14,200	13,200	11,300	13,000	42,800	33,100	38,300	7,460	20,900	11,100
11	26,000	18,300	8,350	12,800	11,300	13,000	43,100	34,000	39,700	8,720	18,300	10,600
12	27,600	17,600	8,640	12,200	11,200	13,200	41,500	33,200	*36,400	11,400	17,600	*10,300
13	28,000	17,600	8,700	12,100	11,100	13,300	38,800	39,100	37,300	15,200	17,200	10,500
14	26,600	17,700	9,150	11,300	11,000	13,400	35,300	44,400	38,900	14,600	*18,300	11,200
15	23,900	17,400	9,220	10,300	10,700	13,900	33,900	*43,600	40,300	14,400	18,100	10,600
16	23,500	*17,200	9,020	10,200	10,500	14,700	28,100	46,300	40,900	13,100	20,700	9,440
17	24,200	18,200	10,100	10,300	10,600	19,700	*27,400	49,300	41,700	8,490	20,000	8,990
18	*23,100	19,000	11,400	10,900	11,000	26,800	29,100	49,800	44,200	11,600	20,000	9,560
19	22,600	18,300	12,600	11,500	11,500	30,900	29,900	49,700	43,400	12,400	16,700	13,000
20	21,400	17,200	13,600	11,700	11,900	31,800	28,600	46,900	42,800	12,400	16,100	15,700
21	17,900	17,400	13,500	11,300	11,400	26,600	29,900	42,300	43,000	12,700	14,400	13,900
22	19,600	17,100	13,600	10,900	10,900	23,100	26,100	42,200	42,300	14,100	14,400	14,100
23	19,700	17,500	13,900	10,800	10,800	28,800	24,800	39,200	38,500	18,100	14,900	12,700
24	17,800	16,300	14,000	10,800	10,800	38,800	25,700	37,900	36,800	20,200	15,100	10,400
25	17,100	16,700	13,900	10,700	10,900	41,900	27,000	37,200	33,300	19,600	14,500	10,800
26	16,400	17,400	13,800	10,700	11,000	41,000	27,500	37,100	31,400	*20,000	12,800	12,100
27	16,300	17,200	13,300	10,600	11,400	41,700	26,800	33,700	29,400	21,000	10,600	14,300
28	16,900	16,600	12,700	10,600	11,700	46,900	25,600	30,400	24,600	21,000	10,600	14,700
29	18,200	16,700	12,600	10,600	-	47,600	27,600	32,000	28,000	20,700	11,200	14,000
30	17,100	17,900	12,600	10,600	-----	49,800	29,200	31,100	23,200	23,000	11,200	14,500
31	16,600	-----	12,600	10,600	-----	48,600	-----	30,100	-----	26,200	10,000	-----
Total	663,400	527,600	425,180	366,000	311,500	750,500	1,091,200	1,127,700	1,067,000	469,920	550,100	367,890
Mean	21,400	17,590	13,720	11,810	11,120	24,210	36,370	36,380	35,570	15,160	17,750	12,260
Cfsm	0.361	0.297	0.232	0.199	0.188	0.409	0.614	0.615	0.601	0.256	0.300	0.207
In.	0.42	0.33	0.27	0.23	0.20	0.47	0.69	0.71	0.67	0.30	0.35	0.23

Calendar year 1962: Max 91,900 Min 8,350 Mean 30,310 Cfsm 0.512 In. 6.96
Water year 1962-63: Max 51,300 Min 7,460 Mean 21,150 Cfsm 0.357 In. 4.87

* Discharge measurement made on this day.

Note.--Fall-stage-discharge relation affected by ice Dec. 9 to Mar. 26.

5-3790. Gilmore Creek at Winona, Minn.

Location.--Lat 44°02'40", long 91°41'25", sec.29, T.107 N., R.7 W., on left bank at west edge of Winona, 1,500 ft upstream from bridge on U.S. Highway 14, 2½ miles upstream from Lake Winona, and 6½ miles upstream from mouth.

Drainage area.--8.95 sq mi.

Records available.--October 1939 to July 31, 1963 (discontinued).

Gage.--Water-stage recorder. Datum of gage is 672.92 ft above mean sea level, adjustment of 1912. Prior to Nov. 4, 1939, staff gage at same site and datum.

Average discharge.--23 years (1939-62), 3.67 cfs.

Extremes.--Maximum discharge during period, 638 cfs Mar. 23 (gage height, 1.86 ft); minimum daily, 2.1 cfs Dec. 6-9; minimum gage height, 0.12 ft Mar. 27.

1939-63: Maximum discharge, 5,360 cfs July 21, 1951 (gage height, 9.47 ft), from rating curve extended above 260 cfs on basis of slope-area measurement at gage height 6.74 ft and logarithmic plotting; minimum, 0.4 cfs several days in July and August 1941.

Remarks.--Records poor. Some regulation at low flow by swimming pool three-quarters of a mile above station. Water diverted above station at times since May 1961 to maintain water level in pond. Records include diversion.

Rating table, Oct. 1, 1962 to July 31, 1963, except periods of ice effect
(gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Dec. 4-8)

0.1	2.1	0.4	13
.2	4.2	.6	28
.3	7.8	.8	53

Discharge, in cubic feet per second, water year October 1962 to July 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.9	4.2	3.3	2.8	3.0	3.1	3.7	3.5	3.3	2.7		
2	3.1	4.2	3.3	3.0	3.1	3.1	3.5	3.5	3.1	2.9		
3	3.1	4.2	3.1	3.3	3.2	3.3	3.5	3.7	3.1	3.3		
4	3.3	4.2	*2.9	3.3	3.3	3.1	3.5	3.7	3.1	3.1		
5	3.1	4.2	2.7	3.1	3.4	3.1	3.5	3.1	3.1	3.1		
6	3.1	4.2	2.1	3.1	3.5	3.1	3.5	3.3	3.1	3.1		
7	2.9	4.2	2.1	3.1	3.3	3.1	3.5	3.3	3.1	3.1		
8	3.3	4.0	2.1	3.1	3.2	3.1	3.7	3.3	3.3	3.1		
9	3.7	4.0	*3.1	3.1	3.1	3.1	3.5	3.3	3.1	3.1		
10	3.7	*3.5	2.2	2.9	3.0	3.1	3.7	3.7	3.1	3.1		
11	*4.0	3.5	2.3	2.9	3.0	3.1	3.5	3.5	3.1	3.1		
12	4.2	3.5	2.4	2.9	*2.9	3.1	3.5	3.5	3.1	2.9		
13	4.2	3.5	2.6	2.8	3.0	*2.9	3.5	4.0	*3.1	3.1		
14	4.5	3.5	2.7	2.8	3.0	4.5	3.5	3.3	3.1	3.1		
15	4.5	3.7	2.8	2.8	3.1	5.1	3.5	*3.1	3.1	3.1		
16	4.5	3.5	2.9	2.8	3.3	8.8	*3.7	3.1	2.9	3.5		
17	4.2	3.5	2.7	2.8	3.1	17	3.3	3.1	2.9	*3.5		
18	3.7	3.5	2.7	2.8	3.1	8.8	3.7	3.1	2.9	3.3		
19	4.2	3.5	2.5	2.8	3.1	4.8	3.7	3.3	2.9	3.5		
20	4.0	3.5	2.7	2.8	3.1	*4.0	3.5	3.3	2.9	3.3		
21	4.0	3.5	2.7	2.8	3.1	5.8	3.5	3.3	2.9	3.1		
22	4.0	3.5	2.7	2.8	3.1	18	3.5	3.3	2.9	3.1		
23	4.2	3.5	2.7	2.8	3.1	88	3.7	3.3	2.7	3.1		
24	4.2	3.5	2.7	2.8	3.1	19	3.5	3.3	2.7	2.9		
25	4.2	3.5	2.7	2.8	3.1	20	3.5	3.3	2.7	2.9		
26	4.2	3.5	2.7	2.9	3.1	5.8	3.5	3.3	2.7	2.9		
27	4.2	3.5	2.7	2.9	3.1	3.1	3.5	3.1	2.7	2.9		
28	4.2	3.5	2.7	2.9	3.1	2.9	3.5	3.1	2.7	2.9		
29	4.2	3.5	2.7	2.9	-	3.1	3.7	3.3	2.7	2.9		
30	4.2	3.5	2.7	2.9	-----	3.7	3.5	3.3	2.7	3.5		
31	4.2	-----	2.7	2.9	-----	3.5	-----	3.3	-----	3.7		
Total	120	111.1	81.9	90.4	87.6	266.2	106.4	103.6	88.8	96.9		
Mean	3.87	3.70	2.64	2.92	3.13	8.59	3.55	3.34	2.96	3.13		
Cfsm	0.432	0.413	0.295	0.326	0.350	0.960	0.397	0.373	0.331	0.350		
In.	0.50	0.46	0.34	0.38	0.36	1.11	0.44	0.43	0.37	0.40		

Calendar year 1962: Max 105 Min 1.5 Mean 3.70 Cfsm 0.413 In. 5.61
Water year 1962-63: Max - Min - Mean - Cfsm - In. -

Peak discharge (base, 60 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-22	1830-2000	0.87	66	3-23	1630	1.86	638
				3-25	2000	1.06	111

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 9-15, Dec. 23 to Jan. 2, Jan. 11 to Feb. 5, Feb. 12-15, 20-27.

ROOT RIVER BASIN

5-3836. North Branch Root River tributary near Stewartville, Minn.

Location.--Lat 43°51'20", long 92°26'50", near center of sec.36, T.105 N., R.14 W., on right bank just upstream from culvert on State Highway 30, 2 miles upstream from mouth and 2 miles east of Stewartville.

Drainage area.--0.73 sq mi.

Records available.--March 1959 to September 1963.

Gage.--Water-stage recorder. Altitude of gage is 1,205 ft (from topographic map).

Extremes.--Maximum discharge during year, 24 cfs Apr. 29; maximum gage height, 9.96 ft Mar. 16 (backwater from ice); no flow for many days.
1959-63: Maximum discharge, 328 cfs July 2, 1960 (gage height, 13.47 ft); no flow most of period.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.2					0	0					
2	.2					0	0					
3	.3					0	0					
4	.6					0	0					
5	.2					0	0					
6	.2					0	0					
7	.3					0	0					
8	.2					0	0					
9	3.2					0	0					
10	.3					0	0					
11	.3	(*)				0	0					
12	*.2					0	0					
13	.2					0	0					
14	.2					0	0		(*)			
15	.2					*0	0					
16	.2					b .1	0	(*)				(*)
17	.2					b .3	0					
18	.2					b .2	*0			(*)		
19	.1					*b .7	0					
20	.1					b .6	0					
21	.1					b .5	0					
22	.1					b .4	0					
23	0					b .2	0					
24	0					b .2	0					
25	0					bl.2	0					
26	0					2.2	0					
27	0					** .6	0					
28	0					.2	0				(*)	
29	0					.1	3.5					
30	0					0	1					
31	0					0						
Total	7.8	0	0	0	0	7.5	3.6	0	0	0	0	0
Mean	0.25	0	0	0	0	0.24	0.12	0	0	0	0	0
Cfsm	0.342	0	0	0	0	0.329	0.164	0	0	0	0	0
In.	0.40	0	0	0	0	0.38	0.18	0	0	0	0	0

Calendar year 1962 Max 36 Min 0 Mean 0.296 Cfsm 0.405 In. 5.50
Water year 1962-63: Max 3.5 Min 0 Mean 0.052 Cfsm 0.071 In. 0.96

Peak discharge (base, 30 cfs).--No peak above the base.

* Discharge measurement or observation of no flow made on this day.

** Field estimate made on this day.

b Stage-discharge relation affected by ice.

5-3840. Root River near Lanesboro, Minn.

Location.--Lat 43°44'58", long 91°58'43", in sec.1, T.103 N., R.10 W., on left bank half a mile upstream from highway bridge, 1½ miles upstream from South Branch, and 2½ miles northeast of Lanesboro.

Drainage area.--615 sq mi.

Records available.--February to November 1910, February 1911 to September 1914, July 1915 to September 1917, August 1940 to September 1963. Published as North Branch Root River near Lanesboro, 1910-17.

Gage.--Water-stage recorder. Datum of gage is 791.84 ft above mean sea level, adjustment of 1912. Prior to Oct. 1, 1917, chain gage at site half a mile downstream at datum about 1.5 ft higher.

Average discharge.--28 years (1911-14, 1915-17, 1940-63); 322 cfs.

Extremes.--Maximum discharge during year, 7,250 cfs Mar. 23 (gage height, 9.66 ft); maximum gage height, 10.28 ft Mar. 17 (result of ice jam); minimum discharge, 92 cfs Aug. 22, 23.
1910-17, 1940-63: Maximum discharge, 22,100 cfs Mar. 29, 1962 (gage height, 16.11 ft); minimum, 29 cfs Aug. 27, 1949 (gage height, 1.08 ft).

Remarks.--Records good except those for period of ice effect, which are fair. Diurnal fluctuation at times during medium and low flow caused by power plant above station.

Rating tables, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)

Oct. 1 to Mar. 17

March 18 to Sept. 30

1.9	147	1.5	90	4.0	1,080
2.0	173	1.7	119	6.0	2,580
2.5	348	2.0	197	8.0	4,710
3.0	570	2.5	375	9.0	6,180
4.0	1,050	3.0	595		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	206	203	160	141	120	118	404	505	159	146	143	138
2	218	203	160	141	119	118	388	371	156	119	121	129
3	244	200	*160	141	117	118	439	324	258	111	114	124
4	312	200	165	141	118	118	404	293	186	107	111	116
5	584	200	163	141	119	118	347	272	159	107	104	114
6	639	197	160	141	119	118	312	279	148	111	104	111
7	478	194	159	141	118	118	283	254	148	112	112	107
8	478	*191	158	*141	117	118	275	235	225	111	114	104
9	*667	188	156	141	117	118	272	235	189	107	104	102
10	731	188	154	140	117	119	268	268	203	105	101	100
11	671	185	150	139	*117	*122	251	392	*183	104	99	101
12	519	182	149	139	117	123	238	371	169	104	101	100
13	423	182	147	138	117	129	225	*496	161	111	102	99
14	384	179	145	137	117	150	212	439	151	109	101	97
15	352	179	141	132	117	220	*203	388	143	105	99	97
16	332	176	142	128	117	350	200	339	138	*105	99	96
17	308	176	144	127	117	900	194	301	133	124	97	*99
18	292	173	145	125	117	*2,380	191	279	129	143	96	96
19	284	170	147	124	117	1,530	197	258	124	127	95	129
20	268	170	148	122	117	840	200	241	121	183	94	225
21	258	170	149	121	117	672	191	225	117	151	*94	156
22	250	168	148	119	117	1,030	183	216	114	131	93	131
23	240	163	147	118	118	3,090	186	203	112	121	94	117
24	230	163	144	117	118	4,990	186	197	111	114	100	112
25	227	160	144	117	118	2,230	189	189	111	111	97	109
26	224	160	143	118	118	1,970	189	186	109	107	97	107
27	221	163	142	118	118	1,370	191	189	109	104	97	104
28	221	160	142	119	118	805	191	183	107	104	235	104
29	218	160	142	120	-	622	235	177	107	104	331	102
30	212	160	142	121	-----	528	559	169	141	107	225	102
31	209	-----	141	120	-----	457	-----	161	-----	141	169	-----
Total	10,900	5,363	4,637	4,028	3,293	25,689	7,803	8,635	4,421	3,716	3,743	3,428
Mean	352	179	150	130	118	829	260	279	147	120	121	114
Cfsm	0.572	0.291	0.244	0.211	0.192	1.35	0.423	0.454	0.239	0.195	0.197	0.185
In.	0.66	0.32	0.28	0.24	0.20	1.55	0.47	0.52	0.27	0.22	0.23	0.21

Calendar year 1962: Max 19,500 Min 75 Mean 378 Cfsm 0.615 In. 8.35
Water year 1962-63: Max 4,990 Min 93 Mean 235 Cfsm 0.382 In. 5.17

Peak discharge (base, 3,500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-17	1700	8.18	4,960	3-23	2400	9.66	7,250

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 6 to Mar. 17.

ROOT RIVER BASIN

5-3845. Rush Creek near Rushford, Minn.

Location.--Lat 43°50'00", long 91°46'40", on line between sec.3 and 10, T.104 N., R.8 W., on downstream side near center of span of highway bridge, 1½ miles northwest of Rushford and 3 miles upstream from mouth.

Drainage area.--129 sq mi.

Records available.--August 1942 to September 1963.

Gage.--Chain gage read twice daily. Datum of gage is 735.00 ft above mean sea level, adjustment of 1912. Prior to June 14, 1950, water-stage recorder at site 100 ft upstream; at datum 5 ft higher, Aug. 5, 1942, to Oct. 27, 1945; at datum 3 ft higher, Oct. 28, 1945, to Aug. 3, 1949; at present datum thereafter.

Average discharge.--21 years, 54.1 cfs.

Extremes.--Maximum discharge during year, 1,530 cfs Mar. 23 (gage height, 7.15 ft); minimum daily, 33 cfs Feb. 20-25; minimum gage height, 1.86 ft Oct. 2.

1942-63: Maximum discharge, 11,600 cfs Mar. 26, 1950 (gage height, 13.54 ft, from floodmark), from rating curve extended above 1,400 cfs on basis of contracted-opening measurements at gage heights 11.0 and 13.5 ft; minimum, 17 cfs May 22, 1959; minimum gage height, 1.84 ft Sept. 24, 29, 1962.

Flood of June 28, 29, 1942, reached a discharge of 11,000 cfs (by slope-area measurement of peak flow).

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	52	40	40	38	37	35	45	45	42	36	36	36
2	48	40	39	37	37	36	44	47	41	36	37	37
3	52	40	39	38	37	36	44	46	41	35	35	36
4	53	41	*39	39	37	36	44	46	40	36	36	36
5	51	41	40	38	36	36	45	45	40	36	35	36
6	50	41	40	38	36	36	43	44	39	36	35	36
7	52	41	40	39	36	36	45	44	39	36	37	36
8	52	*40	39	*40	36	36	46	44	39	36	36	36
9	54	41	39	40	36	35	44	44	42	35	36	36
10	*53	40	38	40	36	34	43	46	39	35	36	36
11	52	41	39	40	*36	35	43	45	*38	36	35	36
12	51	41	38	39	36	*36	44	46	38	38	37	36
13	50	41	38	39	36	37	44	51	38	41	36	36
14	49	40	38	38	35	38	44	*47	37	43	36	36
15	49	41	39	38	35	38	44	47	37	41	36	36
16	49	40	39	38	35	51	*45	46	37	40	35	36
17	48	40	39	37	35	489	45	45	36	39	35	*36
18	48	40	38	37	35	*315	45	45	36	*37	36	36
19	47	40	39	37	34	204	47	44	37	40	36	48
20	46	39	40	37	33	*104	46	46	36	38	35	40
21	46	39	40	37	33	86	45	44	36	37	*35	39
22	46	38	38	37	33	211	46	44	35	37	35	38
23	44	39	38	37	33	597	47	44	36	37	38	38
24	44	40	38	37	33	230	46	44	36	36	36	38
25	43	40	38	37	33	79	46	43	36	36	35	37
26	43	40	38	37	34	87	46	43	36	36	36	37
27	42	40	38	37	34	58	44	43	36	35	36	37
28	42	40	38	37	35	54	44	42	35	35	59	37
29	42	40	38	37	--	44	45	42	36	35	40	37
30	42	39	38	37	-----	43	44	41	35	39	38	37
31	41	-----	38	37	-----	43	-----	41	-----	38	37	-----
Total	1,481	1,203	1,200	1,174	982	3,235	1,343	1,384	1,129	1,151	1,141	1,112
Mean	47.8	40.1	38.7	37.9	35.1	104	44.8	44.6	37.6	37.1	36.8	37.1
Cfsm	0.371	0.311	0.300	0.294	0.272	0.806	0.347	0.346	0.291	0.288	0.285	0.288
In.	0.43	0.35	0.35	0.34	0.28	0.93	0.39	0.40	0.33	0.33	0.33	0.32

Calendar year 1962: Max 1,420 Min 32 Mean 48.1 Cfsm 0.373 In. 5.07
 Water year 1962-63: Max 597 Min 33 Mean 45.3 Cfsm 0.351 In. 4.77

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 10-14, Dec. 23 to Jan. 2, Jan. 12 to Feb. 6, Feb. 11-15, Feb. 18 to Mar. 1, Mar. 9.

5-3850. Root River near Houston, Minn.

Location.--Lat 43°46'05", long 91°35'11", in sec.32, T.104 N., R.6 W., on right bank 1 mile west of Houston and 2½ miles upstream from South Fork.

Drainage area.--1,270 sq mi, approximately.

Records available.--May 1909 to September 1917, May to November 1929, March 1930 to September 1963. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder. Datum of gage is 671.86 ft above mean sea level, datum of 1929. May 28, 1909, to Sept. 30, 1917, staff gage at site 1½ miles downstream at different datum. May 4, 1929, to Sept. 27, 1933, chain gage at present site and datum.

Average discharge.--41 years (1909-17, 1930-63), 647 cfs.

Extremes.--Maximum discharge during year, 10,700 cfs Mar. 24 (gage height, unknown); minimum, 263 cfs Aug. 27. 1909-17, 1929-63: Maximum discharge, 37,000 cfs Apr. 1, 1952; maximum gage height, 15.10 ft Mar. 27, 1961; minimum discharge, 65 cfs Dec. 26, 1933, Feb. 25, 1935.

Remarks.--Records fair. Slight diurnal fluctuation at low flows caused by powerplants above station.

Rating table, water year 1962-63, except period of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Mar. 19, 21, Aug. 10-28)

1.5	274	4.0	1,590
1.6	294	6.0	3,220
2.0	414	8.0	6,010
2.5	651	10.0	9,860
3.0	940		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	472	495	410	380	335	320	820	790	427	352	339	372
2	458	486	402	381	333	321	770	678	418	352	345	365
3	495	486	402	387	332	325	730	610	410	334	326	358
4	546	481	*406	390	330	327	715	571	528	331	313	345
5	615	476	402	397	330	329	680	523	418	328	298	337
6	1,000	476	394	400	329	330	660	509	402	334	300	326
7	904	476	394	400	328	332	645	495	410	334	300	326
8	802	467	383	402	327	335	622	472	423	334	304	318
9	952	*463	379	*403	325	338	600	463	523	331	307	315
10	*1,060	467	375	403	323	342	580	738	513	326	307	309
11	1,140	463	370	402	323	350	570	922	*490	323	307	320
12	1,010	454	362	395	*323	*358	540	760	463	323	304	315
13	880	458	359	385	323	375	530	1,260	449	342	304	309
14	796	454	352	380	323	400	510	*1,220	427	334	302	309
15	754	449	354	375	323	440	498	1,040	410	328	298	311
16	716	445	356	370	323	460	*490	910	398	328	286	302
17	678	440	359	365	321	4,830	486	820	391	358	288	*313
18	651	427	361	362	320	5,520	486	749	391	372	288	307
19	626	427	365	360	320	*3,520	513	683	379	*486	286	294
20	610	432	370	355	320	2,290	490	631	372	454	286	387
21	585	427	370	350	320	*1,400	472	590	372	410	284	398
22	561	423	370	345	320	1,240	463	561	365	372	278	355
23	542	418	371	343	320	3,500	467	532	362	355	*280	342
24	523	423	371	341	320	9,500	458	518	355	342	278	339
25	509	414	371	341	320	4,350	454	509	358	334	278	334
26	499	418	371	340	319	1,800	445	495	349	320	274	326
27	499	418	372	340	319	1,500	440	486	345	313	276	326
28	504	418	372	340	319	1,380	440	486	339	309	432	320
29	499	410	373	340	-	1,170	472	463	334	307	423	318
30	499	414	376	339	-----	1,050	495	454	331	304	454	315
31	499	-----	378	338	-----	920	-----	436	-----	320	406	-----
Total	20,884	13,405	11,650	11,449	9,068	49,652	16,541	20,374	12,152	10,690	9,751	9,911
Mean	674	447	376	369	324	1,602	551	657	405	345	315	330
Cfs/m	0.531	0.352	0.296	0.291	0.255	1.26	0.434	0.517	0.319	0.272	0.248	0.260
In.	0.61	0.39	0.34	0.34	0.27	1.45	0.48	0.60	0.36	0.31	0.29	0.29

Calendar year 1962: Max 20,800 Min 256 Mean 743 Cfs/m 0.585 In. 7.93
Water year 1962-63: Max 9,500 Min 274 Mean 536 Cfs/m 0.422 In. 5.73

Peak discharge (base, 5,000 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-17	2130	8.76	7,350	3-24	unknown	unknown	10,700

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 10 to Mar. 15.

ROOT RIVER BASIN

5-3855. South Fork Root River near Houston, Minn.

Location.--Lat 43°44', long 91°34', in NE¼SW¼ sec.9, T.103 N., R.6 W., on left bank 50 ft downstream from bridge on State Highway 76, half a mile upstream from Badger Creek and 1½ miles south of Houston.

Drainage area.--275 sq mi.

Records available.--January 1953 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 680.41 ft above mean sea level, datum of 1929.

Average discharge.--10 years, 123 cfs.

Extremes.--Maximum discharge during year, 3,160 cfs Mar. 17 (gage height, 11.37 ft); minimum, 71 cfs Sept. 1, 10 (gage height, 1.98 ft).
1953-63: Maximum discharge, 8,420 cfs Mar. 29, 1962 (gage height, 13.35 ft); maximum gage height, 13.74 ft Mar. 26, 1961 (backwater from ice); minimum discharge, 11. cfs Nov. 28, 1961 (gage height, 1.47 ft).

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, water year 1962-63, except periods of ice effect (gage height, in feet, and discharge, in cubic feet per second)
(Shifting-control method used Apr. 8-16)

1.9	61	7.0	796
2.0	73	9.0	1,250
2.5	134	10.0	1,640
3.0	196	11.0	2,570
5.0	467		

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	116	114	101	96	93	86	148	119	105	86	107	72
2	114	114	101	97	94	86	146	120	105	85	91	77
3	121	113	101	98	94	86	144	121	107	84	87	83
4	141	113	*101	99	95	87	133	121	108	81	85	78
5	167	113	101	99	96	88	129	117	105	85	86	75
6	150	113	102	99	97	90	121	116	101	87	86	74
7	148	111	99	99	97	90	115	120	104	85	85	73
8	151	109	99	97	96	89	116	116	124	83	85	73
9	158	*109	97	*97	95	88	111	131	126	84	87	72
10	*161	109	96	96	95	88	108	292	115	83	85	72
11	157	108	95	95	94	88	105	175	*104	84	83	80
12	153	108	93	94	*93	*88	104	152	99	83	86	81
13	146	108	94	93	93	90	104	167	101	107	85	78
14	142	107	96	92	92	100	104	*162	99	110	83	77
15	148	107	99	92	92	120	104	148	97	92	80	77
16	147	107	101	91	92	165	*104	144	97	98	81	75
17	152	107	102	91	92	2,440	102	141	95	104	79	*87
18	138	105	102	90	91	*1,090	102	138	92	99	78	86
19	135	105	101	90	90	767	115	130	93	*134	78	91
20	133	107	99	90	89	392	113	126	92	121	78	97
21	130	105	97	90	89	*236	111	122	90	98	77	86
22	129	104	98	90	88	550	111	120	89	91	*75	84
23	125	103	98	89	87	1,390	114	117	89	90	78	84
24	122	103	96	89	87	1,230	111	116	90	89	77	85
25	122	102	95	90	86	427	113	115	89	87	77	83
26	120	102	93	90	86	410	113	114	87	89	75	83
27	120	102	92	91	85	238	111	114	89	89	75	81
28	119	101	92	92	85	197	114	111	89	86	84	81
29	117	101	92	92	--	179	134	110	89	87	81	83
30	116	101	93	92	--	167	128	108	87	89	74	81
31	115	--	94	93	--	150	--	107	--	121	74	--
Total	4,213	3,211	3,020	2,893	2,563	11,392	3,488	4,110	2,957	2,891	2,542	2,409
Mean	136	107	97.4	93.3	91.5	367	116	133	98.6	93.3	82.0	80.3
Cfsm	0.495	0.389	0.354	0.339	0.333	1.33	0.422	0.484	0.359	0.339	0.298	0.292
In.	0.57	0.43	0.41	0.39	0.35	1.54	0.47	0.56	0.40	0.39	0.34	0.33

Calendar year 1962: Max 4,040 Min 70 Mean 135 Cfsm 0.491 In. 6.68
Water year 1962-63: Max 2,440 Min 72 Mean 125 Cfsm 0.455 In. 6.18

Peak discharge (base, 900 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-17	1400	11.37	3,160	3-24	0200	10.84	2,370

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 9-19, Dec. 23 to Jan. 6, Jan. 10 to Mar. 16 (no gage-height record Jan. 15-31, Mar. 13-15).

5-4570. Cedar River near Austin, Minn.

Location.--Lat 43°38'10", long 92°58'20", in NE¼SE¼ sec.15, T.102 N., R.18 W., on left bank 200 ft upstream from abandoned powerhouse, 500 ft downstream from highway bridge, 1.1 miles downstream from Turtle Creek, and 1.1 miles south of Austin.

Drainage area.--425 sq mi.

Records available.--May 1909 to September 1914, October 1944 to September 1963.

Gage.--Water-stage recorder. Datum of gage is 1,162.10 ft above mean sea level, datum of 1929. May 1909 to April 1912 staff gage in tailwater of powerplant 200 ft downstream at datum 3.1 ft lower. May 1912 to September 1914 chain gage on highway bridge 500 ft downstream at datum 1.1 ft lower.

Average discharge.--24 years, 169 cfs.

Extremes.--Maximum discharge during year, 2,330 cfs Mar. 24 (gage height, 7.36 ft); minimum, 37 cfs July 12;

minimum gage height, 2.21 ft Mar. 10.

1909-14, 1944-63: Maximum discharge, 9,530 cfs Mar. 29, 1962; maximum gage height, 17.81 ft Mar. 26, 1950; no flow for several days in 1911.

Remarks.--Records good except those for periods of ice effect or shifting-control method, which are fair.

Rating table, water year 1962-63, except periods of ice effect or backwater from aquatic growth (gage height, in feet, and discharge, in cubic feet per second)

2.2	44	4.0	598
2.5	91	6.0	1,550
3.0	233	8.0	2,660

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	199	118	85	58	54	52	239	202	55	64	98	56
2	221	115	85	61	52	52	268	169	62	58	69	61
3	233	113	*85	62	51	52	271	146	62	55	54	61
4	396	110	89	61	54	55	230	169	61	52	45	59
5	483	110	85	59	55	55	193	227	85	62	48	59
6	330	105	72	59	59	55	172	175	108	61	46	58
7	330	*108	80	62	61	55	158	137	85	50	46	58
8	*463	108	72	*66	62	55	166	123	78	48	45	54
9	590	105	66	67	61	54	166	196	137	46	45	59
10	662	105	67	64	58	52	158	364	*149	46	43	58
11	425	103	61	62	*58	*55	149	214	101	44	42	59
12	337	108	58	61	58	58	137	172	82	41	49	62
13	278	110	58	60	58	61	132	*208	80	42	48	56
14	243	108	59	59	56	69	121	208	74	42	45	54
15	227	108	61	58	55	82	*115	166	66	41	44	54
16	211	103	64	57	55	205	126	143	61	*41	43	*58
17	190	96	66	56	54	980	121	132	61	46	44	61
18	175	91	69	56	56	877	110	115	62	112	41	59
19	166	91	70	55	56	*577	113	98	64	432	*46	74
20	155	93	70	54	55	385	108	85	64	330	50	64
21	146	98	70	53	55	310	96	80	58	149	50	59
22	152	89	69	53	55	519	103	83	55	85	51	58
23	146	93	65	53	52	1,300	110	69	42	66	59	59
24	140	91	63	52	51	2,190	110	66	52	52	54	56
25	140	89	60	52	52	1,520	132	61	61	49	52	58
26	135	98	56	52	51	1,600	146	59	80	49	56	58
27	132	98	60	52	52	1,050	143	61	67	46	58	59
28	129	96	61	52	51	531	137	62	67	45	166	58
29	126	91	59	52	-	385	221	62	78	43	184	54
30	123	89	56	52	-----	304	278	55	87	58	98	55
31	121	-----	58	52	-----	252	-----	55	-----	82	64	-----
Total	7,804	3,040	2,099	1,772	1,547	13,847	4,729	4,162	2,244	2,437	1,883	1,758
Mean	252	101	67.7	57.2	55.3	447	158	134	74.8	78.6	60.7	58.6
Cfsm	0.593	0.238	0.159	0.135	0.130	1.05	0.372	0.315	0.176	0.185	0.143	0.138
In.	0.68	0.27	0.18	0.16	0.14	1.21	0.41	0.36	0.20	0.21	0.16	0.15

Calendar year 1962: Max 8,720 Min 54 Mean 302 Cfsm 0.711 In. 0.96
 Water year 1962-63: Max 2,190 Min 41 Mean 130 Cfsm 0.306 In. 4.13

Peak discharge (base, 1,400 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-24	1130	7.36	2,330				

* Discharge measurement made on this day.

Note.--Stage-discharge relation affected by ice Dec. 11, 23-27, Jan. 13-16, 20-25, 27-29, Feb. 21. Backwater from aquatic growth May 17 to Sept. 30.

5-4760. West Fork Des Moines River at Jackson, Minn.

Location.--Lat 43°37'10", long 94°59'10", in SE¼SW¼ sec.24, T.102 N., R.35 W., on right bank in Jackson, 200 ft downstream from dam at powerplant.

Drainage area.--1,220 sq mi, approximately.

Records available.--May 1909 to December 1913, August 1930 to September 1963 (winter records incomplete prior to 1936). Published as Des Moines River at Jackson, 1909-13, as Des Moines River near Jackson, 1930-35, and as West Fork Des Moines River near Jackson, 1936-44.

Gage.--Water-stage recorder. Datum of gage is 1,287.75 ft above mean sea level, datum of 1929. May 31, 1909, to Dec. 20, 1913, staff gage at site 0.6 mile downstream at datum 0.99 ft lower. Aug. 22, 1930, to Sept. 30, 1944, chain gage at site 7 miles upstream at datum 17.10 ft higher. Oct. 1, 1944, to Oct. 26, 1949, wire-weight gage at site 600 ft upstream at datum 10.64 ft higher.

Average discharge.--28 years (1935-63), 265 cfs.

Extremes.--Maximum discharge during year, 1,640 cfs Aug. 2, 3 (gage height, 8.84 ft); minimum daily, 2.0 cfs Jan. 30 to Feb. 3; minimum gage height, 2.79 ft Jan. 30, 31.
1909-13, 1930-63: Maximum discharge, 8,360 cfs June 8, 1953 (gage height, 17.43 ft, from floodmark), from rating curve extended above 3,500 cfs on basis of contracted-opening measurement of peak flow; no flow at times.

Remarks.--Records good except those for periods of ice effect, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes.

Discharge, in cubic feet per second, water year October 1962 to September 1963

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	48	22	24	7.2	2.0	5.9	197	96	41	173	1,570	249
2	52	22	24	8.0	2.0	6.5	187	90	58	157	*1,630	256
3	72	33	24	8.9	2.0	6.5	*189	94	135	*159	1,640	244
4	72	37	24	8.9	2.1	6.5	178	86	154	801	1,630	232
5	70	34	23	8.9	4.1	6.5	148	76	150	1,230	1,620	217
6	65	29	18	8.9	11	7.2	126	70	148	1,020	1,600	*222
7	62	26	16	8.9	6.5	7.2	121	66	*139	854	1,580	212
8	66	24	11	11	7.2	8.0	121	62	192	759	1,510	198
9	63	22	10	12	7.2	8.9	119	75	880	684	1,470	187
10	65	24	9.3	11	6.5	8.9	113	*82	771	815	1,410	173
11	59	28	7.2	11	5.9	8.9	111	52	709	534	1,330	161
12	55	26	6.1	9.8	5.9	9.8	113	53	642	472	1,240	148
13	54	31	5.6	8.9	5.9	14	114	59	*591	427	1,160	138
14	53	28	5.6	8.0	5.9	33	113	66	687	378	1,050	128
15	51	29	6.4	6.5	5.4	94	102	59	774	336	944	124
16	48	31	8.9	5.9	5.0	146	91	55	826	358	858	120
17	46	29	11	5.4	5.0	195	103	47	826	418	756	113
18	46	28	12	5.4	5.4	135	96	50	784	579	690	110
19	41	28	*12	5.0	5.9	*111	82	47	725	1,140	621	118
20	38	24	14	4.1	6.5	70	82	45	651	1,520	564	128
21	37	24	14	3.7	5.9	85	79	44	579	1,490	507	110
22	36	26	14	3.4	5.4	106	81	41	510	1,000	455	122
23	33	24	9.8	*3.4	5.0	265	81	36	449	1,010	446	166
24	*30	24	8.9	3.4	5.0	370	79	37	405	1,040	460	205
25	26	26	7.2	3.0	5.0	538	84	36	380	1,050	432	234
26	26	24	7.2	3.0	5.0	414	86	32	336	1,040	391	239
27	24	22	7.2	2.8	*5.4	412	81	34	289	1,000	378	236
28	24	*22	7.2	2.6	5.4	367	79	41	249	1,170	357	249
29	24	24	7.2	2.3	-	304	91	68	215	1,410	326	249
30	22	26	7.2	2.0	-----	258	102	46	191	1,430	295	252
31	22	-----	7.2	2.0	-----	221	-----	39	-----	1,460	269	-----
Total	1,430	797	369.2	195.3	149.5	4,228.8	3,349	1,784	13,486	25,714	29,189	5,540
Mean	46.1	26.6	11.9	6.30	5.34	136	112	57.5	450	829	942	185
Cfsm	0.038	0.022	0.010	0.005	0.004	0.111	0.092	0.047	0.369	0.680	0.772	0.152
In.	0.04	0.02	0.01	0.006	0.005	0.13	0.10	0.05	0.41	0.78	0.89	0.17

Calendar year 1962: Max 5,260 Min 3.4 Mean 597 Cfsm 0.489 In. 6.63
Water year 1962-63: Max 1,640 Min 2.0 Mean 236 Cfsm 0.193 In. 2.61

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-25	1145	5.79	577	7-16	2345	5.99	703
6-9	1130	7.28	1,120	7-20	1330-	8.73	1,600
6-17	0700-	6.41	835		1600		
	0800			8-2,3	1900-	8.84	1,640
7-5	1000-	7.94	1,340		0400		
	1100						

* Discharge measurement made on this day.
Note.--Stage-discharge relation affected by ice Dec. 5-7, 9-15, 27-30, Jan. 10, 19, Feb. 1-4.

6-6030. Little Sioux River near Lakefield, Minn.

Location.--Lat 43°37'10", long 95°16'30", in SE¼ sec.21, T.102 N., R.37 W., on left bank at upstream side of highway bridge, a quarter of a mile upstream from Jackson County ditch 11 and 6.7 miles southwest of Lakefield.

Drainage area.--17.1 sq mi.

Records available.--July 1948 to April 1963 (discontinued).

Gage.--Water-stage recorder and concrete control. Datum of gage is 1,405.28 ft above mean sea level, datum of 1929.

Average discharge.--14 years (1948-62), 3.88 cfs (2,810 acre-ft per year).

Extremes.--Maximum discharge during period, 11 cfs Apr. 4 (gage height, 3.47 ft); no flow on many days.

1948-62: Maximum discharge, 2,550 cfs June 7, 1953 (gage height, 10.20 ft), from rating curve extended above 170 cfs on basis of contracted opening determination of combined flow of Little Sioux River and Jackson County ditch; no flow on many days each year.

Remarks.--Records good except those for periods of ice effect, which are fair.

Rating table, Oct. 1 1962 to Apr. 30, 1963, except period of ice effect
(gage height, in feet, and discharge, in cubic feet per second)

2.5	0	3.1	1.0
2.9	.3	3.2	2.0
3.0	.5	3.3	4.6

Discharge, in cubic feet per second, water year October 1962 to April 1963.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1						0	2.9					
2						0	2.4					
3						0	*2.0					
4						0	4.4					
5						0	1.9					
6						0	1.4					
7						0	1.2					
8						0	.9					
9						0	.9	(*)				
10						0	.8					
11						0	.7					
12						0	.7					
13						0	.6					
14						0	.6					
15						0	.5					
16						0	.3					
17						0	.1					
18						0	0					
19						0.1	.1					
20						.1	0					
21						.1	0					
22						.2	.1					
23						.5	.3					
24	(*)					1.3	.4					
25						3.4	.3					
26						4.2	.2					
27						3.2	.1					
28		(*)				1.9	.1					
29						1.7	.1					
30						2.9	.2					
31						2.9						
Total	0	0	0	0	0	22.5	24.2					
Mean	0	0	0	0	0	0.73	0.81					
Ac-ft	0	0	0	0	0	45	48					

Calendar year 1962: Max 229 Min 0 Mean 7.74 Ac-ft 5,610

Water year 1962-63: Max - Min - Mean - Ac-ft -

* Discharge measurement or observation of no flow made on this day.

Note.--Stage-discharge relation affected by ice Mar. 20-24.

Peak discharge (base, 30 cfs).--No peak above the base.

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or floodflow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations and the second is a table of annual maximum stage and discharge at crest-stage stations. Discharge measurements made at miscellaneous sites for both low flow and high flow are given in a third table.

Low-flow partial-record stations

Measuring of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. Most of these measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will give a picture of the low-flow potentiality of the stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same, site.

Discharge measurements made at low-flow partial-record stations during water year 1963

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Measurements	
					Date	Discharge (cfs)
Crow Wing River basin						
5-2427	Little Sand Lake Outlet near Dorset, Minn.	NE¼ sec.36, T.141 N., R.34 W., ½ mile below Little Sand Lake and 3 miles northeast of Dorset.	a74	1930-41 1942, 1956-63	10- 4-62 11- 3-62 11-29-62 1-11-63 2- 7-63 3-15-63 3-30-63 5-15-63 6-14-63 7-12-63 8- 8-63 9- 6-63 9-23-63	23.1 ✓ 14.5 ✓ 12.1 ✓ 19.6 ✓ 19.3 ✓ 22.3 ✓ 24.7 ✓ 30.2 ✓ 47.3 ✓ 31.4 ✓ 23.6 ✓ 25.8 ✓ 21.2 ✓

a Approximately

≠ Operated as a continuous-record gaging station.

Crest-stage partial-record stations

The following table contains annual maximum discharges for crest-stage stations. A crest-stage gage is a device which will register the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from discharge measurements made by indirect measurements of peak flow or by current meter. The date of the maximum discharge is not always certain but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. Only the maximum discharge for each water year is given. Information on some lower floods may have been obtained but is not published herein. The years given in the period of record represent water years for which the annual maximum has been determined.

Annual maximum discharge at crest-stage partial-record stations

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Streams tributary to Lake Superior							
4-0113.7	South Branch Devils Track River near Grand Marais, Minn.	NW $\frac{1}{4}$ sec.9, T.61 N., R.1 E., at culvert on County Highway 12, 1 $\frac{1}{4}$ miles above mouth, and 2 $\frac{1}{4}$ miles north of Grand Marais.	-	1961-63	4 -20-61 5 -23-62 6 -15-63	17.50 16.25 a15.54	156 74 19
4-0114	South Branch Devils Track River tributary near Grand Marais, Minn.	NE $\frac{1}{4}$ sec.9, T.61 N., R.1 E., at culvert on County Highway 12, a quarter mile above mouth, and 2 $\frac{1}{4}$ miles north of Grand Marais.	-	1961-63	4 - 7-63	b 9.67	(\neq)
4-0132	Caribou River near Little Marais, Minn.	NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.36, T.58 N., R.6 W., at culvert on U.S. Highway 61, 0.2 mile above mouth and 5.2 miles northeast of Little Marais.	22.8	1961-63	4 - 7-63	b13.23	307
4-0151.5	Crow Creek near Silver Creek, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.23, T.54 N., R.10 W., at culvert on County Highway 3, 2.3 miles northeast of Silver Creek, and 4.0 miles above mouth.	1.07	1960-63	4 - 2-63	b 9.20	(\neq)
4-0152	Encampment River tributary at Silver Creek, Minn.	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.33 T.54 N., R.10 W., at culvert on County Highway 3, 0.3 mile north of Silver Creek and 1.4 miles above mouth.	.96	1960-63	4 - 7-63	6.55	20
4-0153	Little Stewart River near Two Harbors, Minn.	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.24, T.53 N., R.11 W., at culvert on county highway, 2.0 miles above mouth, and 2.7 miles north of Two Harbors.	5.54	1960-63	4 - 7-63	b10.05	65
4-0154	Miller Creek at Duluth, Minn.	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.13, T.50 N., R.15 W., at culvert on U.S. Highway 53, 0.2 mile northwest of Duluth city limits.	4.92	1960-63	4 - 2-63	c13.94	43
4-0177	McKinley Lake tributary at McKinley, Minn.	SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.18, T.58 N., R.16 W. at culvert on State Highway 135 at west edge of McKinley.	-	1960-63	4 - 2-63	8.51	18
4-0187	Mud Hen Creek tributary near Central Lakes, Minn.	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.14, T.56 N., R.17 W., at culvert on U.S. Highway 53, 0.3 mile above mouth and 3.2 miles north of Central Lakes	-	1960-63	4 - 2-63	b 8.16	(\neq)
4-0188	East Two River tributary at Virginia, Minn.	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.12, T.58 N., R.18 W., at culvert on U.S. Highway 169, 0.2 mile west of Virginia city limits, and 1.1 miles above mouth.	4.26	1959-63	6 -10-63	6.37	40
4-0241	Rock Creek near Blackhoof, Minn.	SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.21, T.47 N., R.16 W., at culvert on State Highway 23, 4.0 miles above mouth, and 4.4 miles east of Blackhoof.	-	1961-63	4 - 2-63	b12.68	(\neq)
4-0241.1	Rock Creek tributary near Blackhoof, Minn.	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.21, T.47 N., R.16 W., at culvert on State highway 23, 0.1 mile above mouth, and 4.5 miles east of Blackhoof.	-	1961-63	4 - 2-64	b 9.42	(\neq)
4-0242	South Fork Nemadji River near Holyoke, Minn.	E $\frac{1}{4}$ SE $\frac{1}{4}$ sec.6, T.46 N., R.16 W., at culvert on State Highway 23, 2.0 miles northwest of Holyoke, and 4 $\frac{1}{4}$ miles above Net River	-	1961-63	6 -10-63	9.84	152
Red River of the North Basin							
5-0608	Buffalo River near Callaway, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.17, T.141 N., R.41 W. at culvert on U.S. Highway 59, 2.7 miles north of Callaway.	-	1960-63	4 - 3-63	b12.04	43
5-0612	Whisky Creek at Barnesville, Minn.	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.29, T.137 N., R.45 W., at culvert on State Highway 34, 0.7 mile above Blue Eagle Lake, and 1.0 mile northeast of Barnesville.	25.3	1961-63	6 - 1-63	6.07	236
5-0614	Hay Creek above Downer, Minn.	NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.30, T.138 N., R.45 W., at culvert on county road, 3.1 miles east of Downer.	5.81	1961-63	5 -26-63	7.78	(\neq)

\neq Discharge not determined.

a Backwater from debris.

b Backwater from ice.

c Affected by shifting control.

DISCHARGE AT PARTIAL RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
Red River of the North basin--continued							
5-0622.8	Wild Rice River tributary near Bagley, Minn.	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.21, T.146 N., R.37 W., at culvert on State Highway 92, 5.0 miles south of Bagley.	-	1961-63	5 -27-63	8.34	42
5-0624.7	Marsh River tributary near Mahnomen, Minn.	SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.36, T.145 N., R.43 W. at culvert on State Highway 31, a quarter mile above mouth, and 5 $\frac{1}{4}$ miles west of Mahnomen.	-	1961-63	5 -28-63	-	d 15
5-0627	Wild Rice River tributary near Twin Valley, Minn.	SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.12, T.144 N., R.45 W., at culvert on State Highway 31, 1 $\frac{1}{4}$ miles above mouth, and 4 $\frac{1}{4}$ miles northwest of Twin Valley.	-	1961-63	5 -28-63	10.83	12
5-0628	Coon Creek near Twin Valley, Minn.	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.26, T.144 N., R.45 W., at bridge on County Highway 28, 1.1 mile above mouth, and 4.0 miles west of Twin Valley.	-	1962-63	5 -28-63	11.35	415
5-0632	South Branch Wild Rice River near Ogema, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.11, T.142 N., R.42 W., at culvert on county highway, 2 miles northwest of Ogema.	-	1963	6 - 2-63	8.21	70
5-0736	South Branch Battle River at Northome, Minn.	NE $\frac{1}{4}$ sec.25, T.151 N., R.29 W., at culvert on U.S. Highway 71, three-quarters of a mile west of Northome, and 3 miles above Battle Lake.	-	1960-63	5 -27-63	14.25	56
5-0737.5	South Branch Cormorant River tributary near Blackduck, Minn.	NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.32, T.150 N., R.30 W., at culvert on County Highway 304, 3 miles above mouth, and 3 $\frac{1}{4}$ miles north of Blackduck.	-	1960-63	5 -27-63	15.87	182
5-0738	Perry Creek near Shooks, Minn.	NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.151 N., R.30 W., at culvert on State Highway 72, 5 miles west of Shooks.	-	1960-63	5 -27-63	7.10	50
5-0766	Red Lake River tributary near Thief River Falls, Minn.	SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.8, T.153 N., R.43 W., at culvert on County Highway 7, 0.5 mile above mouth, and 3.1 miles south of Thief River Falls.	-	1962-63	4 - 4-63	7.29	(A)
5-0781	Lost River at Gonvick, Minn.	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.16, T.149 N., R.38 W., at culvert on county highway, a half mile south of Gonvick, and 3 miles below Pine Lake.	-	1960-63	6 - 9-63	7.67	121
5-0781.8	Lost River tributary near Clearbrook, Minn.	NW $\frac{1}{4}$ sec.13, T.148 N., R.38 W., at culvert on county highway, 3 $\frac{1}{4}$ miles south of Clearbrook.	-	1960-63	4 - 6-60 5 -27-63	8.56 11.04	e 33 81
5-0782	Lost River tributary at Clearbrook, Minn.	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.29, T.149 N., R.37 W., at culvert on county highway at north edge of Clearbrook, and three-quarters of a mile above mouth.	-	1960-63	5 -27-63	10.57	56
5-0784	Clearwater River tributary near Plummer, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.22, T.151 N., R.43 W., at culvert on county highway, 1 $\frac{1}{4}$ miles above mouth, and 5 $\frac{1}{4}$ miles southwest of Plummer.	-	1961-63	7 -12-63	6.59	20
Lake of the Woods basin							
5-1287	Pike River tributary near Wahlsten, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.32, T.61 N., R.15 W., at culvert on State Highway 135, 1.2 miles south of Wahlsten, and 2.7 miles above mouth.	-	1961-63	6 -10-63	5.73	8.2
5-1297.1	South Branch Little Fork River near Britt, Minn.	NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.28, T.60 N., R.18 W., at culvert adjacent to U.S. Highway 53, 0.6 mile below Sand Lake, and 5.9 miles west of Britt.	-	1961-63	6 -10-63	c 6.75	13
5-1303	Borin Creek near Chisholm, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.9, T.59 N., R.20 W., at culvert on State Highway 73, 1.2 miles above mouth, and 7.8 miles north of Chisholm.	13.7	1959-63	4 - 3-63	b12.00	83
Split Hand Creek basin							
5-2150	Split Hand Creek tributary near Hill City, Minn.	SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.13, T.53 N., R.26 W., at culvert on U.S. Highway 169, 6 $\frac{1}{4}$ miles north of Hill City.	-	1961-63	5 -28-63	4.45	(A)
Swan River basin							
5-2166	O'Brien Creek tributary near Keewatin, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.27, T.57 N., R.22 W., at culvert on U.S. Highway 169, 0.2 mile above mouth, and 2.6 miles southwest of Keewatin.	-	1959-63	4 - 2-63	b17.85	(A)
5-2167	O'Brien Creek near Nashwauk, Minn.	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.33, T.57 N., R.22 W., at culvert on U.S. Highway 169, 1.5 miles east of Nashwauk, and 3.0 miles above Welcome Creek.	-	1959-63	4 - 2-63	c 8.21	48
A Discharge not determined. b Backwater from ice. c Affected by shifting control. d Estimated; gage height unknown e Revised.							

A Discharge not determined.

b Backwater from ice.

c Affected by shifting control.

d Estimated; gage height unknown

e Revised.

Annual maximum discharge at crest-stage partial-record stations--continued

Annual maximum discharge at crest-stage partial-record stations--continued							
Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Swan River basin--continued							
5-2169.8	Swan River tributary at Warba, Minn.	NW $\frac{1}{4}$ sec.34, T.54 N., R.23 W., at culvert on U.S. Highway 2, three-quarters of a mile above mouth, and 1 mile southeast of Warba.	-	1961-63	4 - 2-63	b 6.87	(\nearrow)
Mississippi River basin							
5-2177	Mississippi River tributary near Jacobson, Minn.	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.8, T.52 N., R.23 W., at culvert on State Highway 34, 1 $\frac{1}{2}$ miles west of Jacobson.	-	1961-63	4 - 2-63	b 7.12	(\nearrow)
Crow Wing River basin							
5-2441	Kitten Creek near Sebek, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.15, T.137 N., R.35 W., at culvert on county highway, 3 $\frac{1}{2}$ miles above mouth, and 3 $\frac{1}{2}$ miles north of Sebek.	-	1961-63	5 -14-61 6 - 1-63	9.81 9.37	41 36
5-2442	Cat River near Nimrod, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.36, T.137 N., R.34 W., at bridge on State Highway 227, 2 $\frac{1}{2}$ miles west of Nimrod, and 3 miles above mouth.	-	1961-63	6 - 1-63	5.47	(\nearrow)
Platte River basin							
5-2678	Big Mink Creek tributary near Lastrup, Minn.	NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.14, T.41 N., R.30 W., at culvert on State Highway 25, 1.4 miles above mouth, and 2.1 miles west of Lastrup.	-	1961-63	3 -15-63	b 8.80	(\nearrow)
Sauk River basin							
5-2703	Sauk River tributary at Spring Hill, Minn.	NE $\frac{1}{4}$ sec.27, T.124 N., R.33 W., at culvert on State Highway 4, 1 mile east of Spring Hill, and 1 $\frac{1}{2}$ miles about mouth.	-	1960-63	3 -23-63	b11.26	(\nearrow)
5-2703.1	Sauk River tributary near St. Martin, Minn.	SE $\frac{1}{4}$ sec.19, T.124 N., R.32 W., at culvert on county highway, 4 $\frac{1}{2}$ miles northwest of St. Martin.	-	1960, 1962-63	5 -26-63	7.59	15
Elk River basin							
5-2739	Mayhew Creek at Silver Corners, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.28, T.38 N., R.30 W., at culvert on State Highway 25 at Silver Corners, 3.7 miles above Mayhew Lake.	-	1961-63	5 -14-61 5 -23-62 6 - 8-63	12.66 14.82 12.69	77 318 79
5-2742	Stony Brook tributary near Foley, Minn.	NW $\frac{1}{4}$ sec.2, T.36 N., R.29 W., at culvert on State Highway 25, a quarter mile above mouth, and 1 $\frac{1}{2}$ miles south of Foley.	-	1960-63	8 -11-63	7.74	25
Crow River basin							
5-2761	North Fork Crow River tributary near Paynesville, Minn.	NW $\frac{1}{4}$ sec.12, T.122 N., R.33 W., at culvert on county highway, 1 mile above mouth, and 3 miles west of Paynesville.	-	1960-63	9 -15-63	16.42	5.3
5-2783.5	Fountain Creek near Montrose, Minn.	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.22, T.118 N., R.26 W., at culvert on County Highway 30, 3.3 miles southwest of Montrose.	-	1962-63	6 -10-63	5.40	(\nearrow)
5-2787	Otter Creek near Lester Prairie, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.28, T.117 N., R.27 W., at culvert on State Highway 7, 2.1 miles northwest of Lester Prairie, and 4.4 miles above mouth.	-	1961-63	6 -11-63	7.46	89
5-2787.5	Otter Creek tributary near Lester Prairie, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.33, T.117 N., R.27 W., at culvert on County Highway 63, 1.7 miles northwest of Lester Prairie, and 3.3 miles above mouth.	-	1962-63	6 -10-63	7.98	21
5-2788.5	Buffalo Creek tributary near Brown-ton, Minn.	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.13, T.115 N., R.30 W., at culvert on State Highway 15, 0.6 mile above mouth, and 2.6 miles northwest of Brown-ton.	-	1961-63	6 -10-63	13.71	(\nearrow)
5-2790.3	South Fork Crow River tributary near Mayer, Minn.	NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.36, T.117 N., R.26 W., at culvert on State Highway 7, 0.7 mile above mouth, and 1.4 miles north of Mayer.	-	1962-63	8 -24-63	b 5.84	(\nearrow)

\nearrow Discharge not determined.
b Backwater from ice.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations--continued

Annual maximum discharge at crest-stage partial-record stations--continued							
Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Rum River basin							
5-2841	Mille Lacs Lake tributary near Wealthwood, Minn.	NW¼NE¼ sec.25, T.45 N., R.27 W., at culvert on State Highway 18, 0.2 mile above mouth, and 2.0 miles west of Wealthwood.	-	1961-63	6-10-63	7.91	3.8
5-2846	Robinson Brook near Onamia, Minn.	NE¼SE¼ sec.11, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 6¼ miles south of Onamia.	-	1960-63	5-23-62 6- 8-63	15.52 16.75	e 140 232
5-2846.2	Rum River tributary near Onamia, Minn.	E¼ sec.14, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 7¼ miles south of Onamia.	-	1960-63	6- 8-63	13.37	172
5-2849.2	Stanchfield Creek tributary near Day, Minn.	NW¼SE¼ sec.13, T.37 N., R.25 W., at culvert on County Highway 60, 0.5 mile above mouth, and 1.5 miles southwest of Day.	-	1961-63	5-28-63	6.80	(f)
Minnesota River basin							
5-2991	Lazarus Creek tributary near Canby, Minn.	N¼ sec.6, T.114 N., R.45 W., at culvert on State Highway 68, 3 miles west of Canby, and ¾ miles above mouth.	3.4	1960-63	7-26-63	18.49	1,000
5-3012	Minnesota River tributary near Montevideo, Minn.	NE¼NE¼ sec.21, T.117 N., R.41 W., at culvert on U.S. Highway 212, 1 mile above mouth, and ¾ miles west of Montevideo.	-	1960-63	6-10-63	7.49	(f)
5-3029.7	Lake Emily tributary near Starbuck, Minn.	NW¼ sec.27, T.124 N., R.39 W., at culvert on State Highway 29, 6¼ miles south of Starbuck.	-	1962-63	-	f	<2
5-3034.5	Hassel Creek near Clontarf, Minn.	NW¼SE¼ sec.4, T.122 N., R.39 W., at culvert on State Highway 29, a quarter mile above Lake Hassel, and 5¼ miles east of Clontarf.	-	1962-63	6- 3-63	8.41	(f)
5-3052	Spring Creek near Montevideo, Minn.	SW¼SW¼ sec.32, T.118 N., R.40 W., at culvert on State Highway 29, 1¼ miles above mouth, and 2¼ miles north of Montevideo.	16.3	1959-63	8-26-63	13.92	77
5-3112	North Branch Yellow Medicine River near Ivanhoe, Minn.	NW¼ sec.2, T.111 N., R.46 W., at culvert on State Highway 19, 5¼ miles west of Ivanhoe.	-	1960-63	7-26-63	14.30	(f)
5-3112.5	North Branch Yellow Medicine River tributary near Wilno, Minn.	SE¼NE¼ sec.33, T.113 N., R.45 W., at culvert on U.S. Highway 75, 1¼ miles above mouth, and 4¼ miles northwest of Wilno.	-	1960-63	7-26-63	9.23	28
5-3113	North Branch Yellow Medicine River tributary near Porter, Minn.	E¼ sec.16, T.113 N., R.45 W., at culvert on U.S. Highway 75, 6¼ miles southwest of Porter.	-	1960-63	7-26-63	14.76	(f)
5-3138	Chetomba Creek tributary near Blomkest, Minn.	SW¼SW¼ sec.35, T.118 N., R.35 W., at culvert on U.S. Highway 71, 2¼ miles northwest of Blomkest.	-	1959-63	6- 5-63	8.52	(f)
5-3149	Redwood River at Ruthton, Minn.	NW¼NW¼ sec.11, T.108 N., R.44 W., at culvert on State Highway 23, 0.1 mile northeast of Ruthton.	-	1959-63	7-19-63	14.22	204
5-3165.5	West Fork Beaver Creek near Olivia, Minn.	SW¼SW¼ sec.14, T.116 N., R.35 W., at culvert on U.S. Highway 71, 5¼ miles northwest of Olivia.	-	1959-63	3-30-60 4- 8-62 6- 5-63	6.17 7.53 7.45	e 70 e 98 110
5-3167	Spring Creek near Sleepy Eye, Minn.	NE¼SE¼ sec.24, T.111 N., R.33 W., at culvert on county highway, ¾ miles above mouth, and 7¼ miles north of Sleepy Eye.	30.0	1959-63	3-26-63	b11.25	161
5-3168	Cottonwood River tributary near Balaton, Minn.	NW¼NW¼ sec.19, T.109 N., R.42 W., at culvert on U.S. Highway 14, 4¼ miles west of Balaton.	-	1959-63	3-10-59 3-30-60 3-14-61 7- 4-62 7-19-63	b 6.54 b 6.87 5.24 5.73 6.74	12 64 16 31 73
5-3168.5	Meadow Creek tributary near Marshall, Minn.	E¼ sec.34, T.111 N., R.41 W., at culvert on U.S. Highway 59, 1¼ miles above mouth, and 4¼ miles south of Marshall.	-	1961-63	7-19-63	13.94	(f)
5-3169	Dry Creek near Jeffers, Minn.	NE¼NE¼ sec.31, T.108 N., R.36 W., at culvert on County Highway 10, 4¼ miles north of Jeffers.	3.24	1961-63	7- 7-62 7-19-63	6.50 9.96	158 508
5-3178.2	Coon Creek near Frost, Minn.	E¼NE¼ sec.22, T.101 N., R.26 W., at bridge on State Highway 254, 3.2 miles south of Frost.	-	1960-63	7-18-63	13.72	(f)
5-3178.5	Foster Creek near Alden, Minn.	NE¼NE¼ sec.9, T.102 N., R.23 W., at culvert on U.S. Highway 16, 1.2 miles southwest of Alden.	-	1959-63	7-18-63	5.21	(f)
5-3181	East Branch Blue Earth River tributary near Blue Earth, Minn.	W¼SE¼ sec.24, T.102 N., R.27 W., at culvert on County Highway 13, a quarter mile above mouth, and 4¼ miles east of Blue Earth.	-	1960-63	7-19-63	8.57	406

(f) Discharge not determined.

< Less than.

b Backwater from ice.

e Revised

f Peak stage did not reach bottom of gage.

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
Minnesota River basin--continued							
5-3183	North Fork Watonwan River near Delft, Minn.	E½ sec.11, T.106 N., R.36 W., at culvert on U.S. Highway 71, 1½ miles northwest of Delft.	13.1	1960-63	7-19-63	g17.30	345
5-3202	LeSueur River tributary near Mankato, Minn.	SE¼SW¼ sec.28, T.108 N., R.26 W., at culvert on State Highway 22, 0.2 mile above mouth, and 1.5 miles southeast of Mankato Airport.	.073	1959-63	7-18-63	21.11	29
5-3203	Cobb River tributary near Mapleton, Minn.	SW¼NE¼ sec.4, T.106 N., R.26 W., at culvert on State Highway 22, 1.0 mile above mouth, and 6.3 miles north of Mapleton.	7.25	1959-63	7-18-63	15.89	137
5-3204	Maple River tributary near Mapleton, Minn.	SW¼ sec.1, T.105 N., R.27 W., at culvert on State Highway 30, 1 mile above mouth, and ¾ miles west of Mapleton.	5.75	1959-63	10- 9-62	15.61	43
5-3204.4	Maple River tributary near Amboy, Minn.	NW¼ sec.19, T.105 N., R.27 W., at culvert on State Highway 30, 1½ miles east of Amboy.	13.8	1959-63	7-19-63	c14.30	130
5-3251	Minnesota River tributary near North Mankato, Minn.	SW¼SW¼ sec.13, T.109 N., R.27 W., at culvert on county road, 200 ft above U.S. Highway 169, 0.4 mile above mouth, and 4.2 miles north of North Mankato.	-	1961-63	-	(f)	(f)
5-3301.5	Sand Creek tributary near Montgomery, Minn.	NE¼ sec.18, T.111 N., R.22 W., at culvert on State Highway 21, ¾ miles east of Montgomery.	0.29	1961-63	7-18-63	8.11	(f)
5-3302	Rice Lake tributary near Montgomery, Minn.	N¼ sec.13, T.111 N., R.23 W., at culvert on State Highway 21, 1¼ miles above Rice Lake, and 2¼ miles east of Montgomery.	2.49	1960-63	3-23-63	b 6.13	10
5-3303	Sand Creek near New Prague, Minn.	NE¼NW¼ sec.1, T.112 N., R.23 W., at culvert on State Highways 13 and 19, 1.9 miles east of New Prague.	65	1960-63	3-23-63	b 9.85	54
5-3305.5	Raven Stream tributary near New Prague, Minn.	NW¼ sec.28, T.113 N., R.23 W., at culvert on county road, 1.6 miles above mouth, and 2.3 miles northwest of New Prague.	23	1960-63	3-23-63	9.86	73
5-3306	Sand Creek tributary near Jordan, Minn.	NW¼NE¼ sec.5, T.113 N., R.23 W., at culvert on State Highway 21, 0.8 mile above mouth, and 2.8 miles south of Jordan.	2.62	1960-63	3-23-64	b12.60	(f)
St. Croix River basin							
5-3363	Moose River tributary at Moose Lake, Minn.	SE¼NE¼ sec.19, T.46 N., R.19 W., at culvert on State Highway 27, 0.9 mile above mouth, and 1.2 mile west of Moose Lake.	-	1960-63	6-10-63	7.54	12
5-3364.8	Kettle River tributary near Sandstone, Minn.	NE¼SE¼ sec.33, T.43 N., R.20 W., at culvert on U.S. Highway 61, 1.3 miles above mouth, and 2.2 miles north of Sandstone.	-	1960-63	3-24-63	b15.27	7.1
5-3366	Kettle River tributary at Sandstone, Minn.	SE¼SE¼ sec.4, T.42 N., R.20 W., at culvert on U.S. Highway 61 at Sandstone, and 0.2 mile above mouth.	-	1960-63	3-24-63	b 6.97	(f)
5-3382	Mission Creek near Hinckley, Minn.	SW¼SW¼ sec.25, T.41 N., R.21 W., at culvert on U.S. Highway 61, 1.2 miles south of Hinckley.	-	1960-63	3-24-63	b13.66	21
Vermillion River basin							
5-3459	Vermillion River tributary near Hastings, Minn.	NE¼SE¼ sec.35, T.115 N., R.18 W., at culvert on county highway, 2.0 miles above mouth, and 4.1 miles west of Hastings.	-	1960-63	3-15-63	15.51	(f)
Cannon River basin							
5-3527	Turtle Creek tributary near Pratt, Minn.	NW¼ sec.8, T.106 N., R.19 W., at culvert on U.S. Highway 218, 1 mile above mouth, and 1½ miles southeast of Pratt.	-	1960-63	7-19-63	15.89	37
5-3528	Turtle Creek tributary near Steele Center, Minn.	NW¼NW¼ sec.11, T.106 N., R.20 W., at culvert on township road, 1¼ miles above mouth and 1½ miles northeast of Steele Center.	-	1960-63	7-19-63	4.64	(f)
5-3551	Little Cannon River tributary near Kenyon, Minn.	SE¼ sec.9, T.110 N., R.18 W., at culvert on State Highway 56, a quarter mile above mouth, and 5 miles north of Kenyon.	-	1960-63	3-15-63	b12.52	18
5-3551.5	Pine Creek near Cannon Falls, Minn.	NE¼NE¼ sec.6, T.112 N., R.17 W., at culvert on State Highway 20, 2.0 miles above mouth, and 2.1 miles north of Cannon Falls.	-	1960-63	3-27-60 3-20-61 5-12-62 3-16-63	1.70 1.65 2.78 1.41	34 31 133 18

(f) Discharge not determined.

b Backwater from ice.

c Affected by shifting control.

f Peak stage did not reach bottom of gage.

g Backwater from aquatic growth.

Annual maximum discharge at crest-stage partial-record stations--continued

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
Cannon River basin--continued							
5-3551.8	Cannon River tributary near Miesville, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.113 N., R.17 W., at culvert on State Highway 50, 2.9 miles west of Miesville.	-	1960-63	7-17-63	13.96	(∇)
5-3552.3	Cannon River tributary near Welch, Minn.	SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.11, T.113 N., R.16 W., at culvert on U.S. Highway 61, 1.2 miles above mouth, and 2.7 miles northeast of Welch.	-	1960-63	3-16-63	b 8.85	8.0
Zumbro River basin							
5-3733.5	Zumbro River tributary near South Troy, Minn.	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.6, T.108 N., R.13 W., at culvert on county road, 0.8 mile above mouth, and 1.3 miles south of South Troy.	.16	1962-63	3-16-63	b 8.01	(∇)
5-3737	North Fork Zumbro River tributary near Wanamingo, Minn.	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.32, T.110 N., R.17 W., at culvert on County Highway 1, 3 $\frac{1}{4}$ miles above mouth, and 4 $\frac{1}{4}$ miles southwest of Wanamingo.	-	1960-63	5-12-63	10.00	(∇)
5-3739	Trout Brook tributary near Goodhue, Minn.	SE $\frac{1}{4}$ sec.4, T.110 N., R.15 W., at culvert on State Highway 58, three-quarter mile above mouth, and 3 miles south of Goodhue.	.41	1960-63	7-17-63	8.50	163
East Indian Creek basin							
5-3758	East Indian Creek tributary near Weaver, Minn.	NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.23, T.109 N., R.10 W., at culvert on County Highway 14, 0.3 mile above mouth, and 2.5 miles northwest of Weaver.	.21	1962-63	3-16-63	b 7.98	(∇)
Garvin Brook basin							
5-3783	Straight Valley Creek near Rollingstone, Minn.	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.12, T.107 N., R.9 W., at bridge on county highway, 0.2 mile above mouth, and 1.5 miles southwest of Rollingstone.	5.16	1959-63	3-23-63	12.20	(∇)
Root River basin							
5-3837	Mill Creek tributary near Chatfield, Minn.	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.14, T.105 N., R.12 W., at culvert on county highway, 0.8 mile above mouth, and 4.5 miles northwest of Chatfield.	2.36	1959-63	9-18-63	12.54	(∇)
5-3837.2	Mill Creek near Chatfield, Minn.	SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.23, T.105 N., R.12 W., at bridge on county highway, 3.4 miles northwest of Chatfield, and 4.8 miles above mouth.	22.4	1962-63	6- 9-63	12.39	(∇)
5-3838.5	Bear Creek near Grand Meadow, Minn.	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.14, T.103 N., R.15 W., at bridge on county highway, 1 $\frac{1}{4}$ miles northwest of Grand Meadow, and 4 miles above North Fork Bear Creek.	-	1962-63	3-23-63	b16.76	290
5-3841	Trout Creek tributary near Lanesboro, Minn.	SW $\frac{1}{4}$ sec.6, T.102 N., R.9 W., at culvert on county highway, three-quarter mile above mouth, and 4 miles south of Lanesboro.	4.08	1959-63	3-23-63	12.98	85
5-3841.5	Root River tributary near Whalan, Minn.	SW $\frac{1}{4}$ sec.17, T.103 N., R.9 W., at culvert on private road, 1 $\frac{1}{4}$ miles southwest of Whalan.	.30	1959-63	5-13-63	5.78	15
5-3842	Whalan Creek near Whalan, Minn.	SE $\frac{1}{4}$ sec.21, T.103 N., R.9 W., at bridge on county highway, 1 $\frac{1}{4}$ miles southeast of Whalan, and 2 $\frac{1}{4}$ miles above mouth.	7.85	1959-63	3-23-63	15.11	221
5-3843	Big Springs Creek near Arendahl, Minn.	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.7, T.104 N., R.9 W., at culvert on State Highway 250, 2.0 miles west of Arendahl.	.14	1959-63	3-23-63	8.07	6.2
5-3844	Pine Creek near Arendahl, Minn.	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.3, T.104 N., R.9 W., at bridge on County Highway 25, 1.3 miles northeast of Arendahl, and 4.9 miles above Hemingway Creek.	28.1	1959-63	3-23-63	b12.21	476
Iowa River basin							
5-4570.8	Rose Creek tributary near Dexter, Minn.	SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.22, T.103 N., R.16 W., at culvert on county highway, 1 $\frac{1}{4}$ miles above mouth, and 2 $\frac{1}{4}$ miles southwest of Dexter.	-	1962-63	5-10-63	7.70	(∇)
5-4589.5	Shell Rock River tributary near Albert Lea, Minn.	SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.25, T.103 N., R.22 W., at culvert on State Highway 13, 0.4 mile above mouth, and 2.4 miles northwest of Albert Lea city limits.	-	1960-63	7-18-63	17.80	(∇)

∇ Discharge not determined
b Backwater from ice.

Annual maximum discharge at crest-stage partial-record stations--continued.

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Dis-charge (cfs)
Des Moines River basin							
5-4747.5	Beaver Creek tributary near Slayton, Minn.	NW¼NW¼ sec.17, T.106 N., R.41 W., at culvert on State Highway 47, 2¼ miles west of Slayton, and 2¼ miles above mouth.	-	1961-63	7-27-63	17.04	(f)
5-4747.6	Beaver Creek tributary above Slayton, Minn.	NE¼NE¼ sec.17, T.106 N., R.41 W., at culvert on State Highway 30, three-quarters of a mile above mouth, and 1½ miles west of Slayton.	-	1961-63	7-27-63	17.91	(f)
5-4754	Warren Lake tributary near Windom, Minn.	SE¼NE¼ sec.14, T.105 N., R.36 W., at culvert on U.S. Highway 71, a quarter mile above Warren Lake, and 2.4 miles north of Windom.	1.38	1960-63	7-18-63	5.68	56
5-4758	West Fork Des Moines tributary near Jackson, Minn.	NW¼SE¼ sec.27, T.103 N., R.35 W., at culvert on county highway, three-quarters of a mile above mouth, and 5½ miles north of Jackson.	1.42	1960-63	10-30-59 3-22-61 3-28-62 6- 9-63	13.71 b13.77 b16.34 14.72	21 5.9 49
5-4759	West Fork Des Moines River tributary near Lakefield, Minn.	SE¼SE¼ sec.32, T.103 N., R.35 W., at culvert on County Highway 19, 1½ miles above mouth, and 5½ miles east of Lakefield.	4.52	1960-63	3-29-60 3-25-61 3-28-62 6- 9-63	6.75 b 6.90 b 8.86 7.00	104 96 61 119
5-4761	Story Brook near Petersburg, Minn.	SW¼NW¼ sec.24, T.101 N., R.35 W., at bridge on U.S. Highway 71, 3 miles above mouth, and 4 miles west of Petersburg.	-	1960-63	7-18-63	7.82	177
5-4769	East Fork Des Moines River tributary near Dunnell, Minn.	SW¼NW¼ sec.2, T.101 N., R.33 W., at bridge on State Highway 4, a half mile above mouth, and 1½ miles north of Dunnell.	7.88	1960-63	7-4-63	10.82	66
Big Sioux River basin							
6-4829.2	Rock River tributary near Hatfield, Minn.	NE¼NE¼ sec.1, T.105 N., R.45 W., at culvert on County Highway 16, 1¼ miles south of Hatfield, and 3¼ miles above mouth.	-	1961-63	3-23-63	b15.28	(f)
6-4829.5	Mound Creek near Hardwick, Minn.	SE¼SE¼ sec.15, T.104 N., R.45 W., at culvert on county highway, 2¼ miles northwest of Hardwick.	2.77	1959-63	-	f	<5
6-4829.6	Mound Creek tributary at Hardwick, Minn.	SE¼ sec.34, T.104 N., R.45 W., at culvert on U.S. Highway 75, half a mile above mouth, and 1 mile southwest of Hardwick.	.23	1959-63	-	f	<2
6-4830.5	Rock River tributary near Luverne, Minn.	NE¼ sec.10, T.101 N., R.45 W., at culvert on U.S. Highway 75, 5.8 miles south of Luverne.	-	1959-63	7-27-63	12.93	(f)
6-4831.5	Kanaranzi Creek tributary near Adrian, Minn.	E¼ sec.16, T.102 N., R.42 W., at culvert on private road, a quarter mile above mouth, and 3 miles east of Adrian.	-	1959-63	6- 9-63	9.55	58
6-4832	North Branch Kanaranzi Creek tributary near Lismore, Minn.	SW¼SW¼ sec.31, T.104 N., R.42 W., at culvert on county highway adjacent to State Highway 91, 60 ft above mouth and 1¼ miles northeast of Lismore.	-	1959-63	5-16-60 4-13-62 6- 9-63	17.84 b18.52 20.92	62 72 240
Little Sioux River basin							
6-6035.2	Little Sioux River tributary near Spafford, Minn.	NW¼NE¼ sec.27, T.102 N., R.38 W., at culvert on U.S. Highway 16, 0.4 mile west of Spafford, and a half mile above mouth.	4.06	1959-63	7-24-63	6.32	14
6-6035.3	Little Sioux River near Spafford, Minn.	NE¼NE¼ sec.34, T.102 N. R.37 W., at bridge on county highway, 1.6 miles below Jackson County ditch No. 11, and 5.8 miles east of Spafford.	-	1962-63	7-18-63	7.66	(f)

(f) Discharge not determined.

< Less than.

b Backwater from ice.

f Peak stage did not reach bottom of gage.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Measurements at miscellaneous sites

Measurements of streamflow at points other than gaging stations or partial-record stations are given in the following table. Those that are measurements of base flow are designated by an asterisk (*).

Discharge measurements made at miscellaneous sites during water year 1963

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Stream tributary to Lake Superior						
Cascade River	Lake Superior	SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.24, T.61 N., R.2 W., at highway bridge 3 $\frac{1}{2}$ miles above mouth and 8 $\frac{1}{2}$ miles west of Grand Marais, Minn.	-	1912,	9-24-63	*12.3
Poplar River	.....do.....	SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.33, T.60 N., R.3 W., at bridge on U.S. Highway 61 at Lutsen, Minn.	114	1911-17 1928-47 1952-61 1962	5-29-63 9-24-63	171 *24.3
Red River of the North basin						
South Branch Wild Rice River	Wild Rice River	On line between sec.8 and 9, T.142 N., R.45 W., at bridge on County Road 63, 5 $\frac{1}{2}$ miles northeast of Felton, Minn.	-	1959-62	10-26-62 4-11-63 4-24-63 5-24-63 6-26-63 7-25-63 8-23-63	*6.90 35.9 18.0 *12.4 *9.10 *2.31 9.66
State Ditch No. 45	.....do.....	On line between sec.15 and 16, T.141 N., R.46 W., at culvert on State Highway 9, 3 miles south of Felton, Minn.	-	1959-62	10-26-62 4-11-63 4-24-63 5-24-63 6-26-63 7-25-63 8-28-63	*2.41 3.73 3.34 *3.45 *2.48 * .97 4.19
Lake of the Woods basin						
South Branch Little Fork River	Little Fork River	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.31, T.62 N., R.18 W., at bridge on U.S. Highway 53, 3.1 miles south of Cook, Minn.	-	1958-62	4-18-63	128
Little Fork River	Rainy River..	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.13, T.62 N., R.19 W., at bridge on U.S. Highway 53, 0.6 mile west of Cook, Minn.	-	1950, 1958-62	10-11-62 12- 4-62 2-12-63 4-18-63 5-16-63 6-18-63 7-17-63 8-22-63 9-27-63	*11.5 *7.99 * .60 71.8 65.7 68.5 *16.8 17.4 *5.91
Platte River basin						
Platte River	Mississippi River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.31, T.40 N., R.31 W., at bridge on County Road 35, below Rice lake and 6 miles southeast of Little Falls, Minn.	-	1938,	5-16-63 7-24-63 8-27-63	301 *24.4 *61.4

* Base flow
≠ Operated as a continuous-record gaging station.

* Base flow

≠ Operated as a continuous-record gaging station.

Rice
River

DISCHARGE AT PARTIAL RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at miscellaneous sites during water year 1963

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Crow River basin						
South Fork Crow River	Crow River	SE $\frac{1}{4}$ sec.11, T.118 N., R.25 W., at Delano, Minn.	-	1962,	6- 6-63 ✓	1,000 ✓
Bassett Creek basin						
Bassett Creek	Mississippi River	W $\frac{1}{4}$ sec.28, T.118 N., R.21 W., at bridge on County Highway 66 in Golden Valley, Minn. and a quarter of a mile west of underpass on State Highway 100.	-	-	3-25-63 ✓ 4-12-63 ✓ 5-10-63 ✓ 5-13-63 ✓ 6-21-63 ✓ 7-29-63 ✓ 8- 7-63 ✓ 9- 20-63 ✓	23.1 ✓ *20.8 ✓ 45.2 ✓ 42.8 ✓ *25.2 ✓ 4.67 ✓ *5.70 ✓ *3.46 ✓
North Fork Bassett Creek	Bassett Creek	NW $\frac{1}{4}$ sec.21, T.118 N., R.21 W. at culvert on 34th Ave., North at Crystal, Minn., and three-quarters of a mile above mouth.	-	-	3-25-63 ✓ 4-12-63 ✓ 5-10-63 ✓ 5-13-63 ✓ 6-21-63 ✓ 7-29-63 ✓ 8- 7-63 ✓ 9-20-63 ✓	18.5 ✓ *5.54 ✓ 11.3 ✓ 1.58 ✓ *1.43 ✓ 0 ✓ 0 ✓ 0 ✓
South Fork Bassett Creek	Bassett Creek	Near center of W $\frac{1}{4}$ sec.19, T.29 N., R.24 W., at culvert on Olsen Highway, Golden Valley, Minn. and a quarter of a mile east of State Highway 100.	-	-	3-25-63 ✓ 4-12-63 ✓ 5-10-63 ✓ 5-13-63 ✓ 6-21-63 ✓ 7-29-63 ✓ 8- 7-63 ✓ 9-20-63 ✓	3.53 ✓ *1.57 ✓ 9.00 ✓ 6.15 ✓ *1.75 ✓ 1.50 ✓ *1.11 ✓ *1.54 ✓
Bassett Creek	Mississippi River	SE $\frac{1}{4}$ sec.20, T.29 N., R.24 W., at Fruen Mill, Minneapolis, Minn., and 700 feet downstream from Glenwood Ave.	-	1952, 1954-55	3-25-63 ✓ 4-12-63 ✓ 5-10-63 ✓ 5-13-63 ✓ 6-21-63 ✓ 7-29-63 ✓ 8- 7-63 ✓ 9-20-63 ✓	64.4 ✓ *7.76 ✓ 117 ✓ 72.1 ✓ *34.3 ✓ 8.02 ✓ *6.84 ✓ *6.15 ✓
Mississippi River main stem						
Mississippi River	Gulf of Mexico	At Washington Ave. bridge in Minneapolis, Minn. and 9 miles above Minnesota River	-	1912, 1953-54 1957	5-23-63 ✓ 6-17-63 ✓	11,700 ✓ 21,100 ✓
Mississippi River	Gulf of Mexico	At Hastings, Minn.	37,100	1929 1931-39, 1945-48, 1950, 1953-57, 1959-62	5-22-63 ✓ 6-19-63 ✓	16,710 ✓ 30,300 ✓
St. Croix River basin						
St. Croix River	Mississippi River	At Prescott, Wis.	7,650	1939, 1946-48, 1950, 1953-57 1959-62	5-22-63 ✓ 6-19-63 ✓	9,150 ✓ 7,410 ✓
Root River basin						
Root River....	Mississippi River	SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.21, T.104 N., R.8 W., at bridge on U.S. Highway 16, 2.8 miles west of Rushford, Minn.	-	1959-62	11- 9-62 ✓	*308 ✓
Des Moines River basin						
West Fork Des Moines River	Des Moines River	Near center of sec.20, T.105 N., R.38 W., at outlet of Talcot Lake, $\frac{3}{4}$ miles northeast of Dundee, Minn.	-	-	8-3 -63 ✓ 9-10-63 ✓	665 ✓ 19.1 ✓

* Base flow

Discharge measurements made at miscellaneous sites during water year 1963

Discharge measurements made at miscellaneous sites during water year 1963						
Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Minnesota River basin						
Stony Run	Minnesota River	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.30, T.121 N., R.45 W., at culvert on U.S. Highway 75, $\frac{1}{2}$ mile northwest of Odessa, Minn., and 1 mile above mouth.	-	-	8-28-63 9-24-63	*1.21 *1.75
South Fork Yellow Bank River	Yellow Bank River	SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.25, T.120 N., R.46 W., at bridge $\frac{1}{2}$ mile above confluence with North Fork and 4 $\frac{1}{2}$ miles northwest of Bellingham, Minn.	-	-	9-24-63	7.67
Lac qui Parle Co. ditch No. 13	Minnesota River	Near center of sec.24, T.120 N., R.45 W., at bridge 3 miles above mouth and 4 miles northeast of Bellingham, Minn.	-	-	9-26-63	*2.39
Five Mile Creek	Minnesota River	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.12, T.120 N., R.44 W., at bridge on State Highway 7, 2 $\frac{1}{2}$ miles east of Correll, Minn. and 3 $\frac{1}{2}$ miles above mouth.	-	-	9-27-63	*2.68
Pomme de Terre River	Minnesota River	NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.13, T.129 N., R.42 W., at highway bridge 1 $\frac{1}{2}$ mile below Pomme de Terre Lake and 4 miles east of Elbow Lake, Minn.	-	-	9-24-63	*4.77
Mud Creek	Pomme de Terre River	On line between secs. 22 and 23, T.124 N., R. 42 W., 1 mile above mouth and 3 miles south of Morris, Minn.	-	-	9-25-63	*.37
Emily Creek	Minnesota River	NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.26, T.119 N., R.43 W., 1 mile above mouth and 4 $\frac{1}{2}$ miles west of Milan, Minn.	-	-	9-24-63	*2.81
Lac qui Parle River	Minnesota River	On line between secs. 3 and 10, T.115 N., R.44 W., at bridge on state highway 67 and 8 miles northeast of Canby, Minn.	-	-	9-23-63 9-26-63	*3.57 15.3
West Br. Lac qui Parle River	Lac qui Parle River	At dam in Dawson, Minn.	-	-	9-26-63	*3.92
Chippewa River	Minnesota River	On line between secs. 17 and 18, T.125 N., R.40 W., at highway bridge 1 $\frac{1}{2}$ miles north of Cyrus, Minn.	-	-	9-25-63	*9.43
North Branch Yellow Medicine River	Yellow Medicine River	Near center of line between secs. 1 and 2, T.113 N., R.43 W., 3 miles above confluence with So. Br. Yellow Medicine River and 4 $\frac{1}{2}$ miles north of Minneota, Minn.	-	-	9-23-63	*7.75
Three Mile Creek	Redwood River	NW $\frac{1}{4}$ sec.2, T.112 N., R.41 W., at bridge on State Highway 23, 1 mile north of Green Valley, Minn.	-	1958-62	10-25-62 5- 8-63 6- 5-63	*5.85 *11.4 *4.76
Clear Creek	.....do.....	SE $\frac{1}{4}$ sec.29, T.112 N., R.37 W., at county highway bridge, $\frac{1}{2}$ mile southeast of Seaforth, Minn., and 1 mile above mouth.	-	1958-62	11- 2-62 5- 7-63 6- 5-63	*3.57 *7.66 29.1
Ramsey Creekdo.....	Near center of N $\frac{1}{2}$ sec.35, T.113 N., R.36 W., at bridge, 1 $\frac{1}{2}$ miles northwest of Redwood Falls, Minn., and 2 $\frac{1}{2}$ miles above mouth	-	1958-62	11- 2-62 5- 7-63 6- 4-63	*6.85 *10.3 40.6

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