George Carlson

1966

Water Resources Data for Minnesota

Part 1. Surface Water Records

Part 2. Water Quality Records

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; and with other State, municipal, and Federal agencies

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

WATER RESOURCES DATA FOR MINNESOTA

1966

Part 1: Surface Water Records

Prepared in cooperation with

Minnesota Department of Conservation, Division of Waters
Minnesota Department of Highways
Nine Mile Creek Watershed District, through the Minnesota Division of Waters
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
Eveleth Taconite Company, through the Minnesota Division of Waters
Hanna Mining Company, through the Minnesota Division of Waters
Pickands Mather and Company, through the Minnesota Division of Waters
Corps of Engineers, U. S. Army
U. S. Department of State
U. S. Sports, Fisheries and Wildlife

Copies of this report may be obtained from
District Chief, Water Resources Division
U. S. Geological Survey
1002 Post Office Building
St. Paul, Minnesota 55101

1967

CALENDAR FOR WATER YEAR 1966

OCTOBER 1965

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

NOVEMBER 1965

S	M	T	W	T	F	S
	1	2	3	4	5	6
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28	29	30				

DECEMBER 1965

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			1	2	3	4
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

JANUARY 1966

S	M	T	W	T	F	S
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

FEBRUARY 1966

S	M	T	W	T	F	S
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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

MARCH 1966

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

APRIL 1966

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
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17	18	19	20	21	22	23
24	25	26	27	28	29	30

MAY 1966

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

JUNE 1966

S	M	T	W	T	F	S
			1	2	3	4
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

JULY 1966

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

AUGUST 1966

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

SEPTEMBER 1966

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

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WATER RESOURCES DATA FOR MINNESOTA, 1966

Part 1. Surface Water Records

INTRODUCTION

The surface-water records for the 1966 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 D. B. Anderson, district engineer, Surface Water Branch.

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, John R. Jamieson, Commissioner.

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.

Hydrologic bench-mark station is one that provides hydrologic data for a basin in which the hydrologic regimes will likely be governed solely by natural conditions. Data

collected at a bench-mark station may be used to separate effects of natural from manmade changes in other basins which have been developed and in which the physiography, climate, and geology are similar to those in the underdeveloped bench-mark basin.

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 (cfsm) 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.

Gage height is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

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.

Water year in Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1964, is called the "1964 water year."

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 8-digit number for each station, such as 05-0615.00, includes the part number "05" and a 6-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 05-0615.00 would appear as 5-0615, 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.

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 a 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, 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 1966 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".

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. The maximum day and the minimum day may be shown in the monthly summary below the table for some stations.

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. The maximum day and the minimum day for each month are shown for many stations in the line with the respective headings. 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.

GPO 803-695-2

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 local standard time, for example, 12:30 a.m. is 0030, 1:30 p.m. is 1330.

In a general footnote, introduced by the word "Note", certain periods are indicated for which the discharge is computed or estimated by special methods because of no gage-height record, backwater from various sources, or other unusual conditions. Periods of no gage-height record are indicated if the period is continuous for a month or more or includes the maximum discharge for the year. Periods of backwater from an unusual source, of indefinite stage-discharge relation, or of any other unusual condition at the gage are indicated only if they are a month or more in length and the accuracy of the records is affected. Days on which the stage-discharge relation is affected by ice are not indicated. The methods used in computing discharge for various unusual conditions 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 under "Remarks" states the degree of accuracy of the records. "Excellent" means that about 95 percent of the daily discharges are within 5 percent; "good" within 10 percent; and "fair" within 15 percent. "Poor" means that daily discharges have less than "fair" accuracy.

For most gaging stations equipped with digital recorders the figures of mean daily discharge are shown to the nearest hundredth of a cfs for discharges less than 1 cfs. This has been done as a matter of uniformity in the computer program and should not be construed to indicate an accuracy greater than that used in the past.

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.

OTHER DATA AVAILABLE

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. Most gaging-station records in the State through 1962 have been analyzed with an electronic computer to give: (1) the number of days in each year that the daily discharge was between selected limits (duration tables); (2) the lowest mean discharge for selected numbers of consecutive days in each year; and (3) the highest mean discharge for selected numbers of consecutive days in each year.

At or near some gaging stations, water-quality records also are collected. Data are obtained on the chemical quality of the stream water, on water temperature, on suspended-sediment concentration, and on the particle-size distribution of suspended sediment and bed material. These data are given in Part 2 of this report. Under the "Remarks" paragraph of the gaging-station description, reference is made to water-quality records collected on a regular basis.

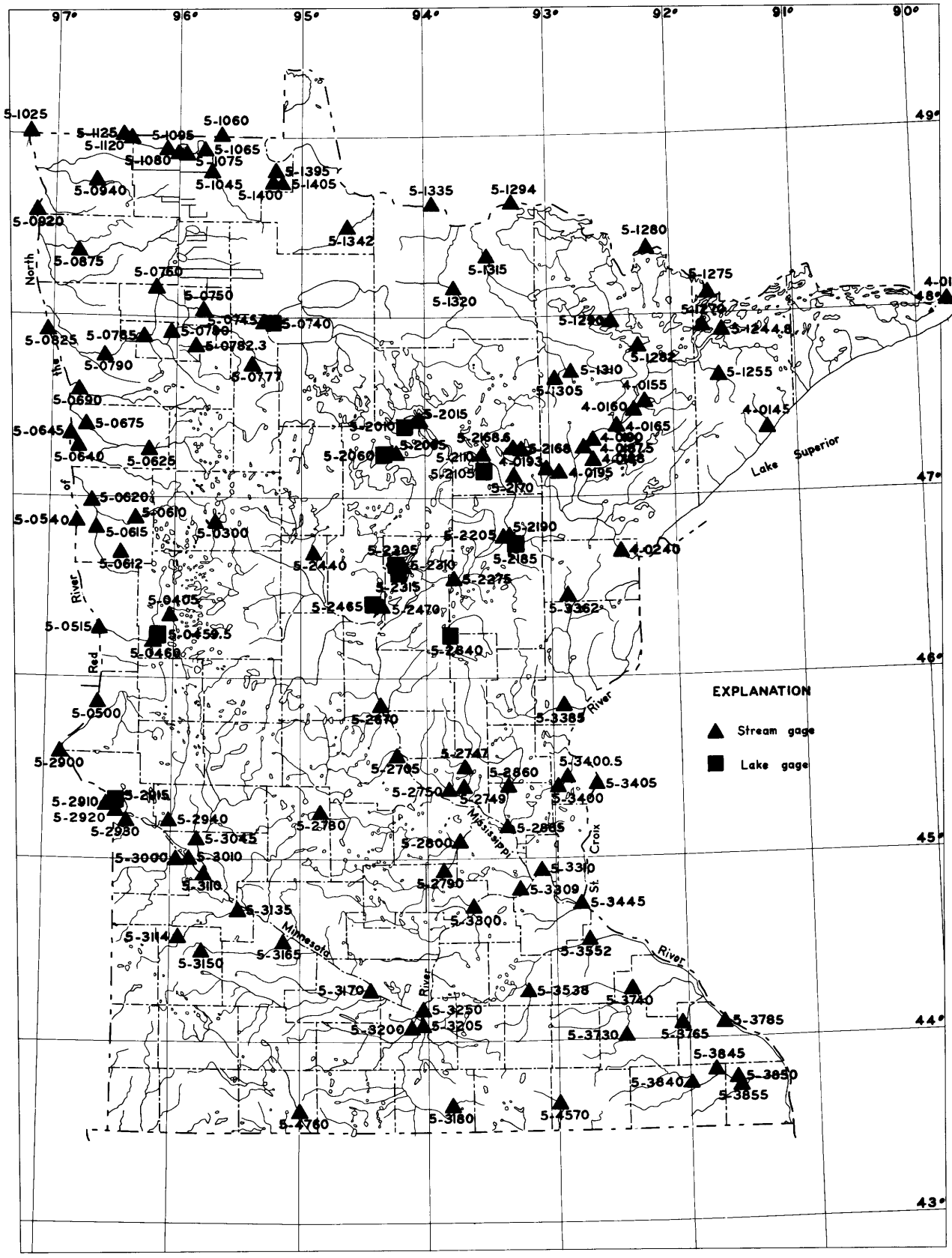

Figure 1.-- Map of Minnesota showing location of lake and stream gaging stations.

4-0105. Pigeon River at Middle Falls, near Grand Portage, Minn.
(Formerly published as 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, 2½ miles upstream from Grand Portage Port of Entry, 3½ miles upstream from mouth, and 4.7 miles northeast of village of Grand Portage.

Drainage area.--600 sq mi.

Records available.--June to October 1921, April to November 1922, March 1923 to September 1965. Published as "at International Bridge" April 1924 to September 1940, and as "below International Bridge" October 1940 to September 1965. 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, 5¾ miles upstream at datum 100.24 ft higher.

Average discharge.--43 years (1923-66), 485 cfs.

Extremes.--Maximum discharge during year, 4,050 cfs May 19 (gage height, 7.12 ft); maximum gage height, 7.27 ft Apr. 23 (backwater from ice); minimum discharge, 89 cfs Sept. 28 (gage height, 0.55 ft).
1923-66: 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 winter months, which are fair.

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

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,300	491	315	315	220	180	305	1,710	1,620	554	201	136
2	2,040	487	320	315	215	180	310	1,670	1,540	527	204	134
3	1,480	471	320	315	210	180	310	1,560	1,540	534	196	132
4	1,110	440	320	310	205	180	315	1,710	1,520	524	191	130
5	900	412	320	310	205	175	320	2,500	1,450	500	189	132
6	788	384	325	310	200	175	330	3,480	1,620	484	194	130
7	748	369	325	310	200	175	340	3,460	1,850	468	191	125
8	760	357	325	305	200	175	355	3,190	1,680	440	198	119
9	724	345	320	305	205	175	370	2,720	1,510	446	206	114
10	674	340	320	305	205	180	390	2,430	1,360	430	204	112
11	626	330	315	300	205	185	420	2,330	1,260	418	198	114
12	597	315	310	300	200	190	450	2,310	1,200	396	191	114
13	568	295	305	300	195	200	505	2,390	1,140	378	184	121
14	534	270	300	295	190	205	570	2,320	1,080	357	184	125
15	504	290	295	290	185	210	640	2,320	1,040	343	179	119
16	478	285	290	290	185	210	780	2,930	1,000	328	172	114
17	458	275	290	285	180	215	900	3,330	957	319	174	109
18	458	280	295	285	175	225	1,050	3,850	910	314	179	107
19	474	295	300	285	175	245	1,200	4,030	869	305	182	104
20	465	305	305	280	170	260	1,400	3,880	843	294	182	106
21	443	310	310	280	170	270	1,650	3,600	801	285	174	106
22	424	310	310	275	170	280	1,960	3,420	772	280	194	107
23	409	310	315	270	175	280	2,390	3,420	744	274	208	107
24	387	305	315	265	175	280	3,020	3,400	720	258	216	106
25	366	300	320	255	175	285	3,690	3,150	701	252	208	101
26	372	300	320	250	175	290	3,800	2,780	682	229	196	96
27	381	300	320	245	180	290	3,400	2,470	663	206	161	92
28	369	305	320	240	180	295	2,680	2,220	644	198	144	92
29	360	310	315	235		300	2,220	2,030	608	196	140	104
30	360	310	315	230	------	300	1,920	1,870	582	194	138	101
31	430	------	315	225	------	300	------	1,740	------	196	138	------
Total	20,987	10,096	9,690	8,780	5,325	7,090	37,990	84,220	32,906	10,927	5,716	3,409
Mean	677	337	313	283	190	229	1,266	2,717	1,097	352	184	114
Cfsm	1.13	0.562	0.522	0.472	0.317	0.382	2.11	4.53	1.83	0.587	0.307	0.190
In.	1.30	0.63	0.60	0.54	0.33	0.44	2.35	5.22	2.04	0.68	0.35	0.21

Calendar year 1965: Max 4,220 Min 132 Mean 575 Cfsm 0.958 In. 13.02
Water year 1965-66: Max 4,030 Min 92 Mean 650 Cfsm 1.08 In. 14.69

Peak discharge (base, 3,000 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4 -25	2330	6.98	3,900	5 -19	2030	7.12	4,050
5 - 6	2200	6.66	3,580				

4-0145. Baptism River near Beaver Bay, Minn.

Location.--Lat 47°20'15", long 91°12'00", in SE¼NE¼ 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 1966. 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.--39 years, 159 cfs.

Extremes.--Maximum discharge during year, 2,160 cfs May 19 (gage height, 4.85 ft, from recorded range in stage); minimum recorded, 15 cfs Sept. 10, 13 (gage height, 1.98 ft).

1927-66: Maximum discharge recorded, 9,350 cfs Aug. 9, 1939 (gage height, 8.11 ft), from rating curve extended above 4,000 cfs; maximum gage height, 11.06 ft Apr. 12, 1965 (from floodmark, backwater from ice); minimum daily discharge, 0.4 cfs Jan. 5, 6, 1940.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	744	149	47	49	40	43	119	480	220	67	24	24
2	544	146	48	50	40	44	124	450	215	54	24	24
3	349	134	48	50	40	45	119	550	225	136	20	21
4	248	119	50	50	41	47	117	900	250	238	19	21
5	196	113	50	49	41	51	115	1,450	290	208	31	20
6	167	108	50	48	41	52	113	2,000	240	158	57	20
7	149	100	52	48	41	54	110	1,700	195	119	82	19
8	146	100	52	48	41	56	117	1,400	170	90	104	18
9	144	92	52	48	41	56	134	1,210	150	191	93	16
10	134	83	50	47	43	58	155	1,080	155	204	85	16
11	121	75	50	47	42	59	184	1,050	165	146	74	16
12	110	66	50	47	41	64	216	934	180	110	60	16
13	104	61	48	47	39	70	259	981	240	85	54	17
14	98	57	47	47	37	80	312	914	210	78	76	18
15	92	55	47	47	36	86	376	900	180	64	76	21
16	86	55	47	47	36	88	487	940	260	51	65	22
17	93	54	46	47	35	95	525	1,350	320	47	55	20
18	241	56	46	47	35	105	544	1,850	280	40	45	19
19	238	58	46	47	35	125	620	2,120	256	45	37	18
20	259	58	45	47	35	140	715	1,900	215	71	32	18
21	243	58	45	46	35	135	677	1,550	176	68	31	18
22	204	56	45	46	36	130	848	1,350	141	58	69	17
23	176	55	45	45	36	131	1,090	1,180	104	48	115	17
24	152	53	46	44	36	128	1,420	1,000	124	44	102	17
25	141	52	46	44	37	119	1,700	905	208	38	80	17
26	126	50	46	43	37	119	1,480	740	216	34	63	18
27	113	48	47	42	38	119	1,110	610	164	30	51	18
28	102	48	47	41	40	119	850	500	131	27	41	19
29	93	47	48	41		119	700	400	102	22	32	21
30	93	47	48	40	-----	117	570	310	83	20	29	19
31	144	-----	48	40	-----	119	-----	248	-----	19	27	-----
Total	5,850	2,253	1,482	1,429	1,075	2,773	15,906	32,952	5,865	2,610	1,753	565
Mean	189	75.1	47.8	46.1	38.4	89.5	530	1,062	196	84.2	56.5	18.8
Max	744	149	52	50	42	140	1,700	2,120	320	238	115	24
Min	86	47	45	40	35	43	110	248	83	19	19	16
Cfsm	1.35	0.536	0.341	0.329	0.274	0.639	3.79	7.59	1.40	0.601	0.404	0.134
In.	1.55	0.60	0.39	0.38	0.29	0.74	4.23	8.75	1.56	0.69		0.15

Cal yr 1965: Total 64,844 Mean 178 Max 2,380 Min 13 Cfsm 1.27 In. 17.23
Wtr yr 1966: Total 74,513 Mean 204 Max 2,120 Min 16 Cfsm 1.46 In. 19.79

Peak discharge (base, 1,300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-24	2030	4.76	1,980	5- 6	unkn.	4.81	2,080
				5-19	unkn.	4.85	2,160

Note.--No gage-height record May 15-24, Sept 15-30.

4-0155. 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 1966.

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.--11 years, 18.3 cfs.

Extremes.--Maximum discharge during year, 119 cfs Apr. 20 (gage height, 4.80 ft); maximum gage height, 5.69 ft Mar. 17 (backwater from ice); minimum daily discharge, 6.6 cfs Feb. 19-21; minimum gage height, 3.47 ft Jan. 29.

1955-66: Maximum discharge, 213 cfs Apr. 22, 1961; maximum gage height, 5.75 ft Mar. 28, 1957 (backwater from ice); minimum daily discharge, 1.5 cfs Jan. 26 to Feb. 4, 1963; minimum gage height, 3.10 ft Feb. 2, 3, 4, 1963.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	70	27	16	12	8.2	8.2	53	58	25	18	20	16
2	68	26	16	12	8.4	7.9	55	63	30	18	19	16
3	59	25	15	11	8.6	7.5	53	64	36	46	19	15
4	51	23	15	11	8.9	7.2	51	68	34	50	17	16
5	44	22	16	11	9.3	7.0	50	72	34	49	16	15
6	39	22	16	11	9.5	7.0	48	68	40	45	20	15
7	38	21	17	11	9.7	7.0	47	61	41	39	22	15
8	43	22	17	10	10	7.0	48	56	43	36	28	14
9	42	21	17	10	11	6.8	55	49	43	38	31	14
10	36	20	16	10	12	6.8	63	46	42	34	29	13
11	33	20	16	10	12	6.8	68	45	44	32	26	13
12	32	18	16	9.8	11	7.0	79	41	68	31	22	13
13	30	18	15	9.6	9.7	7.4	88	39	53	28	22	14
14	30	17	15	9.4	8.5	8.5	89	39	49	25	27	14
15	30	17	15	9.3	7.6	12	87	41	47	23	25	13
16	28	18	15	9.0	7.0	20	85	46	39	21	22	13
17	27	17	14	8.8	6.8	29	84	49	34	22	20	12
18	27	17	14	8.6	6.8	36	83	53	29	22	20	13
19	28	18	14	8.6	6.6	41	83	49	24	22	18	13
20	51	17	14	8.4	6.6	43	113	48	21	22	18	13
21	53	17	14	8.4	6.6	44	94	43	21	20	18	13
22	49	18	14	8.4	6.8	42	95	40	19	20	32	12
23	46	18	14	8.2	6.9	40	95	41	20	20	34	12
24	42	19	14	8.2	7.1	37	94	47	22	20	31	12
25	37	19	13	8.2	7.3	36	89	42	31	19	27	12
26	34	19	13	8.0	7.5	34	81	38	31	21	23	12
27	31	18	13	8.0	7.9	33	77	34	26	20	20	13
28	28	18	13	7.8	8.0	33	69	32	24	19	18	13
29	27	17	12	7.8		34	64	29	20	19	17	12
30	27	17	12	7.8	-----	43	60	26	19	18	17	11
31	28	-----	12	8.0	-----	48	-----	25	-----	19	16	-----
Total	1,208	586	453	289.3	236.3	707.1	2,200	1,452	1,009	836	694	402
Mean	39.0	19.5	14.6	9.33	8.44	22.8	73.3	46.8	33.6	27.0	22.4	13.4
Max	70	27	17	12	12	48	113	72	68	50	34	16
Min	27	17	12	7.8	6.6	6.8	47	25	19	18	16	11
Cfsm	1.48	0.741	0.555	0.355	0.321	0.867	2.79	1.78	1.28	1.03	0.852	0.510
In.	1.71	0.83	0.64	0.41	0.33	1.00	3.11	2.05	1.43	1.18	0.98	0.57

Wtr yr1965:	Total	9,072.4	Mean	24.9	Max	79	Min	6.7	Cfsm	0.946	In.	12.83
Wtr yr1966:	Total	10,072.7	Mean	27.6	Max	113	Min	6.6	Cfsm	1.05	In.	14.24

Peak discharge (base, 60 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
4-20	0500	4.80	119	7-3	1300	4.32	61
6-12	0500	4.45	76				

4-0160. 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 2¾ miles upstream from mouth.

Drainage area.--156 sq mi.

Records available.--August 1942 to September 1966.

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.--24 years, 122 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 1,390 cfs Apr. 27 (gage height, 5.84 ft); minimum, 21 cfs Sept. 30; minimum gage height, 1.65 ft Aug. 5.
1942-66: Maximum discharge, 3,230 cfs May 10, 1950 (gage height, 7.86 ft); minimum, 2.2 cfs Jan. 30, 31 1961; minimum gage height, 0.88 ft Mar. 2, 1963.

Remarks.--Records good except those for winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. 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 (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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	139	117	64	61	39	34	142	635	172	104	27	52
2	142	112	63	61	36	34	148	535	166	83	26	48
3	128	106	63	61	34	33	135	485	172	130	25	42
4	118	104	62	61	32	32	120	460	174	150	24	39
5	126	98	61	60	31	31	112	347	190	177	24	36
6	137	93	57	58	31	30	114	416	212	192	31	34
7	150	89	57	56	31	29	112	530	241	183	32	31
8	164	85	61	56	33	29	111	635	218	168	41	29
9	172	83	61	55	35	30	109	692	220	160	48	29
10	174	79	61	54	39	31	109	670	225	144	49	28
11	172	75	59	54	41	33	118	600	215	132	52	28
12	170	68	58	53	41	34	142	510	264	120	53	28
13	166	62	58	53	41	36	168	430	264	104	63	29
14	162	58	57	52	40	37	179	344	278	97	78	28
15	155	60	57	49	37	41	190	350	278	85	79	23
16	146	63	56	48	35	50	230	363	250	76	84	27
17	133	62	55	47	32	63	376	401	218	70	87	27
18	128	61	54	47	31	75	630	460	190	64	90	27
19	125	60	53	45	31	90	800	535	162	59	89	29
20	168	60	53	44	30	108	993	600	144	53	78	28
21	179	60	54	43	30	111	1,020	610	128	46	65	28
22	192	63	56	42	31	115	1,030	580	114	42	83	27
23	177	68	58	41	32	111	1,050	505	104	39	90	26
24	168	70	56	41	33	108	1,080	430	102	35	98	26
25	160	72	57	40	32	108	1,180	401	125	31	90	25
26	155	73	59	39	31	106	1,320	369	123	32	77	24
27	146	71	58	38	31	106	1,350	337	128	29	85	24
28	137	68	58	38	33	106	1,160	299	126	28	69	24
29	128	66	59	38		106	965	258	118	26	61	24
30	123	65	59	39	----------	106	770	220	105	25	63	22
31	120	----------	61	39	----------	118	----------	192	----------	25	59	---------
Total	4,660	2,271	1,805	1,513	953	2,081	15,963	14,199	5,426	2,709	1,920	892
Mean	150	75.7	58.2	48.8	34.0	67.1	532	458	181	87.4	61.9	29.7
(✓)	+68.1	+20.2	+5.3	-0.62	-3.65	+0.50	+73.7	+30.1	+24.6	+17.1	-2.6	+3.3
Mean	≠ 218	95.7	63.5	48.2	30.4	66.6	606	488	206	104	59.3	33.0
Max	192	117	64	61	41	118	1,350	692	278	192	98	52
Min	118	58	53	38	30	29	109	192	102	25	24	22
Cfsm	≠ 1.40	0.613	0.407	0.309	0.195	0.427	3.88	3.13	1.32	0.667	0.380	0.212
In.	≠ 1.61	0.69	0.47	0.36	0.20	0.49	4.33	3.61	1.47	0.77	0.44	0.24

Calendar year 1965: Max 665 Min 13 Mean 109 Mean ≠ 125 Cfsm ≠ 0.801 In. ≠ 11.26
Water year 1965-66: Max 1,350 Min 22 Mean 149 Mean ≠ 170 Cfsm ≠ 1.09 In. ≠ 14.68

✓ 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

4-0165. 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 1½ miles south of Aurora.

Drainage area.--312 sq mi.

Records available.--August 1942 to September 1966.

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.--24 years, 236 cfs (adjusted for storage and diversion).

Extremes.--Maximum discharge during year, 2,070 cfs Apr. 27 (gage height, 5.09 ft); minimum daily, 44 cfs Feb. 22-26; minimum gage height, 0.95 ft Sept. 30.
1942-66: 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 winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	452	307	142	108	78	52	374	1,500	514	174	71	101
2	532	300	139	105	78	54	336	1,380	514	160	66	94
3	482	289	137	105	78	52	329	1,290	537	229	65	86
4	416	275	135	103	76	50	329	1,220	514	248	66	84
5	405	258	133	100	76	48	304	1,080	509	289	68	79
6	405	245	130	100	76	46	296	1,090	556	304	97	75
7	412	235	132	98	76	46	275	1,190	584	282	90	70
8	444	229	135	96	77	46	242	1,290	523	258	105	68
9	452	219	135	94	86	46	238	1,340	491	248	114	64
10	448	210	138	94	93	48	272	1,320	473	229	110	63
11	440	199	140	94	94	48	329	1,240	461	213	110	63
12	420	185	138	92	94	48	428	1,140	551	196	105	63
13	405	170	135	92	91	50	556	1,050	500	183	114	63
14	393	158	132	92	83	55	651	944	486	164	132	63
15	382	152	130	90	75	70	675	909	469	147	132	63
16	363	155	128	90	71	105	729	914	432	134	134	62
17	348	160	125	90	67	160	876	962	385	126	135	60
18	344	155	122	90	63	200	1,100	1,050	336	117	139	59
19	348	150	120	88	55	250	1,260	1,140	289	107	135	59
20	440	142	120	88	47	260	1,590	1,200	255	99	121	59
21	478	138	118	88	45	255	1,620	1,200	226	93	112	58
22	491	135	115	88	44	255	1,580	1,160	205	88	137	57
23	457	132	115	86	44	255	1,620	1,090	188	80	154	56
24	428	132	115	86	44	250	1,700	1,020	191	76	154	53
25	405	132	112	86	44	250	1,790	968	229	72	151	51
26	389	133	110	86	44	260	1,950	898	229	74	135	49
27	370	135	110	84	46	270	2,060	838	226	70	137	48
28	348	138	110	84	48	285	2,010	774	222	69	124	48
29	329	139	110	82		307	1,860	709	208	66	110	50
30	318	141	108	82	----------	344	1,680	642	188	65	110	48
31	318	----------	108	80	----------	370	----------	570	----------	63	107	----------
Total	12,662	5,548	3,877	2,841	1,893	4,835	29,059	33,118	11,491	4,723	3,540	1,916
Mean	408	185	125	91.6	67.6	156	969	1,068	383	152	114	63.9
(≠)	+68.1	+20.2	+5.3	-0.62	-3.65	+0.50	+73.7	+30.1	+24.6	+17.1	-2.6	+3.3
Mean ≠	476	205	130	91.0	64.0	156	1,043	1,098	408	169	111	67.2
Max	532	307	142	108	94	370	2,060	1,500	584	304	154	101
Min	318	132	108	80	44	46	238	570	188	63	65	48
Cfsm ≠	1.53	0.657	0.417	0.292	0.205	0.500	3.34	3.52	1.31	0.542	0.356	0.215
In. ≠	1.76	0.73	0.48	0.34	0.21	0.58	3.73	4.06	1.46	0.62	0.41	0.24

Calendar year 1965: Max 1,160 Min 32 Mean 246 Mean ≠ 262 Cfsm ≠ 0.840 In. ≠ 11.42
Water year 1965-66: Max 2,060 Min 44 Mean 316 Mean ≠ 336 Cfsm ≠ 1.08 In. ≠ 14.62

≠ 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.

4-0187.5 St. Louis River at Forbes, Minn.

Location.--Lat 47°21'48", long 92°35'56", in NE¼SE¼ sec.3, T.56 N., R.18 W., on right bank at downstream side of highway bridge, 0.5 mile downstream from Eveleth Taconite Company dam, 0.6 mile south of Forbes, 1.8 miles upstream from Elbow Creek.

Records available.--August 1964 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,293.11 ft above mean sea level, datum of 1929. Prior to Oct. 28, 1964, wire-weight gage at same site and datum.

Extremes.--Maximum discharge during year, 4,140 cfs Apr. 23 (gage height 14.60 ft); minimum, 32 cfs Nov. 16 (gage height 5.37 ft, result of regulation).

1964-66: Maximum discharge, that of Apr. 23, 1966; minimum, that of Nov. 16, 1965.

Flood of June 1964 reached a stage of about 12.3 ft, from information furnished by Eveleth Taconite Company (discharge, 2,780 cfs).

Remarks.--Records good except those for winter months, which are fair. There is some regulation at medium and low flows and diversion for iron-ore processing at Eveleth Taconite Company dam ½ mile upstream. Diversion began Dec. 5, 1965.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,040	713	310	230	155	105	1,050	3,580	941	431	143	226
2	1,170	813	305	225	130	110	1,500	3,190	919	435	172	317
3	1,190	798	300	225	155	110	1,900	3,110	1,030	456	117	207
4	1,150	717	290	225	150	110	2,100	2,910	987	515	161	225
5	1,080	630	285	225	145	110	2,200	2,720	953	589	117	166
6	1,060	618	280	220	140	110	2,200	2,540	1,060	603	201	190
7	1,050	574	275	220	140	115	2,150	2,390	1,040	621	291	213
8	1,110	546	265	220	135	115	2,100	2,330	991	585	310	166
9	1,140	515	235	215	135	115	2,050	2,280	837	603	431	132
10	1,120	476	270	215	130	115	2,050	2,260	865	585	418	178
11	1,080	440	270	210	125	120	2,100	2,240	873	526	344	181
12	1,010	420	270	210	120	120	2,150	2,130	1,340	526	344	117
13	938	410	265	205	115	125	2,200	1,990	1,260	431	337	89
14	915	405	260	205	110	125	2,270	1,850	1,110	442	424	123
15	877	400	255	200	105	130	2,380	1,740	1,010	360	438	187
16	835	395	250	200	105	135	2,470	1,710	960	363	397	178
17	794	390	250	195	100	180	2,580	1,620	888	330	301	161
18	794	380	245	195	100	320	2,720	1,730	816	259	344	161
19	802	375	245	190	100	380	2,990	1,760	746	262	314	67
20	1,070	365	240	185	95	420	3,480	1,790	680	266	262	78
21	1,200	355	240	180	85	450	3,810	1,810	596	246	278	117
22	1,190	350	235	180	75	480	4,040	1,800	540	175	330	91
23	1,160	340	235	175	115	500	4,130	1,770	487	219	421	89
24	1,090	265	235	175	110	500	4,100	1,720	518	219	456	78
25	1,040	365	230	170	110	500	4,040	1,670	661	140	342	85
26	998	360	210	165	105	505	3,980	1,550	717	140	376	70
27	945	350	230	165	105	500	3,960	1,360	618	190	349	110
28	892	340	230	160	105	490	3,970	1,280	522	158	317	67
29	835	330	220	155		480	3,920	1,220	550	158	318	98
30	787	320	225	140	----------	520	3,810	1,100	512	166	275	84
31	768	----------	230	150	----------	700	----------	1,030	----------	98	246	----------
Total	31,130	13,755	7,885	6,030	3,300	8,795	84,400	62,180	25,027	11,097	9,574	4,251
Mean	1,004	458	254	195	118	284	2,813	2,006	834	358	309	142
Ac-ft												

Calendar year 1965: Max 2,540 Min 60 Mean 551 Ac-ft
Water year 1965-66: Max 4,130 Min 67 Mean 733 Ac-ft

4-0189. East Two River near Iron Junction, Minn.

Location.--Lat 47°24'04", long 92°39'52", in NW¼NW¼ sec.29, T.57 N., R.18 W., on right bank downstream from bridge on State Highway 37 and 2.2 miles southwest of Iron Junction.

Drainage area.--40.0 sq mi (revised).

Records available.--June to September 1966. Occasional low-flow measurements, water years 1957-62.

Gage.--Water-stage recorder.

Extremes.--Maximum daily discharge during period June to September, 72 cfs Aug. 9; minimum daily, 12 cfs July 24, 29-31.

Remarks.--Records good.

Cooperation.--Records computed by U. S. Steel Corporation and reviewed by Geological Survey.

Discharge, in cubic feet per second, June to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1										20	13	20
2										18	13	20
3										20	13	19
4										23	13	19
5										23	14	18
6										22	18	18
7										21	26	18
8										19	60	18
9										19	72	17
10										19	65	17
11										18	52	17
12										17	42	17
13										16	38	17
14										16	48	17
15										15	45	17
16										14	38	17
17										14	33	16
18										14	28	16
19										13	26	16
20										13	25	16
21										13	25	16
22										13	29	16
23										13	36	16
24									23	12	38	16
25									34	13	34	16
26									31	13	30	16
27									25	13	25	16
28									23	13	24	16
29									21	12	22	16
30					- - - - -					12	21	16
31		- - - - -			- - - - -		- - - - -		- - - - -	12	20	- - - - -
Total										493	986	510
Mean										15.9	31.8	17.0
Max										23	72	20
Min										12	13	16
Cfsm										0.398	0.795	0.425
In.										0.46	0.92	0.47

Cal yr	: Total	Mean	Max	Min	Cfsm	In.
Wtr yr	: Total	Mean	Max	Min	Cfsm	In.

4-0190. West Two River near Iron Junction, Minn.

Location.--Lat 47°24'05", long 92°42'10", in SW¼SW¼ sec.24, T.57 N., R.19 W., on right bank 40 ft upstream from bridge on State Highway 37, 5 miles southwest of Iron Junction, and 9¼ miles upstream from St. Louis River.

Drainage area.--68.4 sq mi.

Records available.--October 1953 to September 1962, October 1965 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,322.05 ft above mean sea level, datum of 1929 (Minnesota Highway Department bench mark).

Average discharge.--10 years, 46.2 cfs.

Extremes.--Maximum discharge during year, 524 cfs Apr. 19 (gage height, 8.20 ft); minimum daily, 8 cfs Feb. 19 to Mar. 4.
1953-62, 1966: Maximum discharge, 916 cfs Apr. 17, 1954 (gage height, 9.85 ft); minimum daily, 3.0 cfs Jan. 22 to Feb. 6, 1957; minimum gage height, 2.34 ft to Aug. 15-17, 24-28, 1961.

Remarks.--Records good.

Cooperation.--Records for 1966 water year computed by U. S. Steel Corporation and reviewed by Geological Survey

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	229	31	16	20	19	8	228	159	26	22	12	23
2	331	29	16	20	19	8	256	165	30	20	11	22
3	386	26	16	20	19	8	300	184	33	22	10	20
4	307	25	16	20	19	8	501	215	33	31	10	20
5	184	25	16	20	19	9	395	258	46	28	12	20
6	118	26	16	20	18	10	368	280	57	25	18	20
7	93	27	16	20	18	12	340	262	51	22	28	20
8	106	25	16	20	17	12	320	210	38	20	51	18
9	127	20	17	20	16	12	296	155	32	20	48	18
10	135	19	17	20	15	13	272	138	28	20	45	18
11	116	19	17	21	14	14	253	120	29	20	39	17
12	85	19	17	21	14	15	304	87	46	19	33	17
13	66	19	18	21	13	15	388	75	42	19	34	16
14	55	19	18	21	12	16	500	70	34	20	45	16
15	49	19	18	21	11	16	510	72	30	18	41	15
16	44	19	18	21	10	17	494	94	28	17	39	15
17	42	18	18	21	10	19	491	105	25	17	35	15
18	43	18	18	22	9	20	498	113	22	17	33	15
19	47	18	19	22	8	22	500	107	20	18	29	14
20	106	16	19	21	8	24	486	96	19	17	28	13
21	198	16	19	21	8	28	447	87	18	16	28	13
22	250	16	19	21	8	30	362	74	16	15	34	12
23	224	16	19	21	8	34	341	67	15	15	38	12
24	145	16	19	20	8	38	353	67	17	15	34	12
25	96	16	19	20	8	43	344	62	36	15	32	12
26	71	15	19	20	8	52	320	54	62	16	28	12
27	55	15	20	20	8	76	291	47	45	16	26	12
28	43	15	20	20	8	104	253	39	33	17	25	13
29	37	16	20	20		132	217	34	27	16	25	14
30	35	15	20	18	-----	160	182	32	24	18	24	12
31	32	-----	20	19	-----	188	-----	30	-----	15	23	-----
Total	3,855	593	556	632	352	1,163	10,810	3,558	962	586	918	476
Mean	124	19.8	17.9	20.4	12.6	37.5	360	115	32.1	18.9	29.6	15.9
Max	386	31	20	22	19	188	510	280	62	31	51	23
Min	32	15	16	18	8	8	182	30	15	15	10	12
Cfsm	1.81	0.289	0.262	0.298	0.184	0.548	5.26	1.68	0.469	0.276	0.433	0.232
In.	2.10		0.30	0.34	0.19	0.63	5.88	1.93	0.52	0.32	0.50	0.26

Cal yr	: Total		Mean		Max		Min		Cfsm		In.	
Wtr yr 1966:	Total	24,461	Mean	67.0	Max	510	Min	8	Cfsm	0.980	In.	13.30

4-0193. West Swan River near Silica, Minn.

Location.--Lat 47°17'36", long 93°02'30", in SW¼NW¼ sec.32, T.56 N., R.21 W., on right bank 10 ft upstream from pilings 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 1963 to September 1966.

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 during year, 338 cfs Oct. 1 (gage height, 4.80 ft, falling stage); 177 cfs Apr. 13 (gage height, 3.72 ft); minimum, 0.8 cfs July 8, 9.
1963-66: Maximum discharge, 340 cfs Sept. 30, 1965 (gage height, 4.81 ft); minimum, 0.3 cfs Aug. 8, 1963.

Remarks.--Records good. Ninety three discharge measurements were made during the year.

Cooperation.--An additional eighty discharge measurements furnished by M. A. Hanna Mining Co.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	278	5.2	2.8	6.8	2.0	1.0	105	21	2.0	2.4	2.0	3.2
2	146	4.4	3.2	6.5	2.0	1.1	145	30	10	1.9	2.4	3.1
3	77	4.4	3.3	6.0	1.9	1.1	155	42	19	1.9	1.9	3.0
4	45	4.1	3.4	5.6	1.9	1.2	140	59	10	1.6	2.0	2.7
5	28	4.1	3.4	5.4	1.9	1.2	124	58	7.5	1.4	2.4	2.7
6	20	3.9	3.4	5.3	1.9	1.1	92	41	9.3	1.2	4.1	3.1
7	16	4.0	3.5	6.0	1.8	1.1	73	26	6.1	1.0	12	3.1
8	23	3.7	3.5	6.7	1.8	1.1	61	19	4.1	.9	28	3.0
9	25	3.2	3.5	6.1	2.2	1.0	64	14	3.1	1.1	28	2.5
10	22	3.2	3.4	5.2	2.6	1.0	73	11	2.0	1.5	19	2.7
11	16	3.2	3.7	4.3	3.8	1.0	87	9.3	3.1	1.6	14	2.8
12	13	5.9	5.5	3.7	4.5	1.1	111	7.8	15	1.6	10	3.0
13	10	9.5	14	3.5	6.0	1.4	141	6.9	6.6	1.5	10	2.8
14	9.6	7.5	23	3.4	7.0	1.8	136	6.9	5.4	1.5	21	3.4
15	8.7	1.8	24	3.4	7.5	2.5	102	13	4.1	1.4	18	2.8
16	6.9	5.0	16	3.5	5.8	5.0	107	33	3.1	1.3	12	2.5
17	8.4	5.5	13	3.5	3.0	12	117	30	3.0	1.4	8.7	2.5
18	9.3	4.0	11	3.4	1.2	17	117	34	2.3	9.0	6.4	2.6
19	9.3	3.6	9.5	3.2	.9	23	84	27	1.9	5.9	5.6	2.5
20	57	3.5	8.8	3.0	.9	31	76	21	1.6	2.5	4.9	2.6
21	70	3.5	8.4	2.8	.9	41	71	16	1.6	1.8	5.6	2.7
22	43	3.6	8.2	2.6	.9	48	87	12	1.5	1.6	6.9	2.6
23	24	4.0	8.0	2.4	.9	60	98	10	1.5	1.7	9.9	2.7
24	16	3.5	7.2	2.3	.9	70	71	12	2.2	1.4	9.0	2.8
25	11	3.3	6.6	2.2	.9	65	52	8.7	25	1.3	7.2	2.4
26	9.6	3.2	6.2	2.2	1.0	62	38	6.9	33	1.4	5.4	2.5
27	7.8	3.0	6.0	2.1	1.0	51	28	5.2	13	1.5	5.1	2.6
28	6.1	2.6	6.0	2.1	1.0	40	26	3.9	6.1	1.4	4.4	3.0
29	6.1	2.5	5.8	2.1		35	24	3.1	3.9	1.4	4.0	3.6
30	5.9	2.6	5.7	2.0	-----	34	21	2.8	3.0	1.4	3.4	3.9
31	5.4	-----	5.8	2.0	-----	44	-----	2.5	-----	1.3	3.2	-----
Total	1,033.1	125.0	235.8	119.3	68.1	656.7	2,626	593.0	210.0	58.8	276.5	85.4
Mean	33.3	4.17	7.61	3.85	2.43	21.2	87.5	19.1	7.00	1.90	8.92	2.85
Max	278	9.5	24	6.8	7.5	70	155	59	33	9.0	28	3.9
Min	5.4	2.5	2.8	2.0	0.9	1.0	21	2.5	1.5	0.9	1.9	2.4
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Cal yr1965: Total 6,190.9 Mean 17.0 Max 210 Min 1.8 Ac-ft -
Wtr yr1966: Total 6,087.7 Mean 16.7 Max 278 Min 0.8 Ac-ft -

4-0195. East Swan River near Toivola, Minn.

Location.--Lat 47°16'55", long 92°50'05", in NE¼NE¼ sec.2, T.55 N., R.20 W., on left bank 350 ft downstream from bridge on St. Louis County Road 442, 4.8 miles upstream from confluence with West Swan River, 8 miles northwest of Toivola, and 8¾ miles upstream from St. Louis River.

Drainage area.--112 sq mi.

Records available.--September 1953 to September 1962, October 1964 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,260.46 ft above mean sea level, datum of 1929.

Average discharge.--11 years (1953-62, 1964-66), 91.8 cfs.

Extremes.--Maximum discharge during year, 1,080 cfs Apr. 4 (gage height, 17.18 ft, backwater from ice); minimum discharge, 23 cfs July 31 (gage height 3.50 ft).

1953-62, 1964-66: Maximum discharge, 1,690 cfs Apr. 15, 1956 (gage height, 17.94 ft); maximum gage height, 18.45 ft Apr. 12, 1954 (backwater from ice); minimum daily discharge, 12 cfs Feb. 22-26, 1965; minimum gage height, 3.15 ft Aug. 24, 1961.

Flood in May 1950 reached a stage of about 20.0 ft, from information by local residents.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	470	82	41	63	28	38	580	319	52	30	29	42
2	450	76	40	64	28	39	685	378	72	27	39	45
3	390	75	40	62	28	40	840	449	214	31	30	42
4	300	72	39	60	28	40	1,020	480	149	35	29	40
5	210	67	39	58	28	40	1,030	468	137	33	32	40
6	180	65	39	56	28	40	940	404	218	34	48	40
7	160	64	40	54	29	40	850	336	153	32	80	37
8	205	63	40	52	29	42	820	245	109	31	223	35
9	245	56	41	50	35	44	810	237	88	33	199	34
10	215	49	42	49	55	47	830	200	74	46	149	33
11	198	50	43	48	59	54	850	177	71	37	108	33
12	162	70	50	46	64	58	860	157	190	37	80	32
13	148	100	68	45	64	68	830	142	154	35	76	34
14	136	96	82	44	61	80	762	138	114	34	162	37
15	131	68	93	43	58	94	698	147	94	32	145	38
16	119	53	95	42	56	110	640	229	80	30	105	35
17	115	47	92	40	52	140	629	241	73	29	78	32
18	133	44	90	39	45	180	661	267	62	40	65	31
19	127	40	88	38	40	240	652	246	53	37	56	31
20	249	39	83	37	36	280	736	212	48	30	51	32
21	383	38	80	36	34	320	708	182	44	29	55	31
22	348	37	75	35	33	350	678	155	39	28	72	31
23	258	38	72	34	33	330	684	135	35	28	118	34
24	202	39	68	33	33	310	609	134	38	28	109	33
25	163	40	64	32	34	280	524	121	144	26	85	35
26	142	40	61	31	35	240	451	104	235	27	65	36
27	123	41	60	30	36	230	401	90	120	29	54	37
28	109	42	58	30	37	220	383	78	67	28	48	36
29	96	42	59	29		240	363	70	45	26	44	37
30	91	41	60	28	-----	320	336	62	34	25	41	37
31	87	-----	62	28	-----	450	-----	55	-----	24	39	-----
Total	6,345	1,674	1,904	1,336	1,126	5,004	20,860	6,658	3,006	971	2,514	1,070
Mean	205	55.8	61.4	43.1	40.2	161	695	215	100	31.3	81.1	35.7
Max	470	100	95	64	64	450	1,030	480	235	46	223	45
Min	87	37	39	28	28	38	336	55	34	24	29	31
Cfsm	1.83	0.498	0.548	0.385	0.359	1.44	6.21	1.92	0.893	0.279	0.724	0.319
In.	2.11	0.56	0.63	0.44	0.37	1.66	6.93	2.21	1.00	0.32	0.83	0.36

Cal yr 1965:	Total	41,541	Mean	114	Max	1,360	Min	12	Cfsm	1.02	In.	13.79
Wtr yr 1966:	Total	52,468	Mean	144	Max	1,030	Min	24	Cfsm	1.29	In.	17.42

Peak discharge (base, 400 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10-1	Unkwn	Unkwn	470	5-4	0830	10.09	489
4-4	2100	17.18	1,080				

Note.--No gage-height record Oct. 1-11.

4-0240. 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 1966. Monthly discharge only for some periods, published in WSP 1307. Published as "near Thomson" 1908-50.

Gage.--Digital 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. Aug. 4, 1953, to May 13, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--58 years, 2,202 cfs (unadjusted).

Extremes.--Maximum discharge during year, 17,700 cfs Apr. 21 (gage height, 9.74 ft); minimum, 1,020 cfs July 18 (gage height, 3.15 ft).
1908-66: 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, 80 cfs 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). Records of chemical analyses for the water year 1965 are published in Part 2 of this report.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,660	2,570	2,430	2,300	2,170	1,970	6,880	14,100	2,010	1,910	1,540	1,590
2	7,300	2,490	2,740	2,420	2,090	2,000	9,280	14,300	1,880	1,770	1,680	1,500
3	7,160	2,370	2,630	2,490	2,090	2,120	10,600	14,400	1,890	1,760	1,560	1,390
4	6,690	2,540	2,600	2,260	2,080	2,090	11,600	13,800	2,590	1,670	1,360	1,390
5	5,990	2,570	2,440	2,480	2,050	2,080	12,000	13,100	2,780	1,930	1,320	1,390
6	5,360	2,480	2,380	2,370	2,050	2,120	11,700	12,200	2,960	2,040	2,350	1,550
7	4,780	2,330	2,300	2,200	2,080	2,120	10,900	11,500	3,590	2,010	4,060	1,580
8	4,640	2,330	2,550	2,230	2,120	2,120	9,880	10,800	2,990	1,850	5,610	1,490
9	4,800	2,430	2,400	2,280	2,120	2,190	8,920	10,200	2,620	2,610	5,970	1,490
10	4,780	2,540	2,330	2,520	2,260	2,300	8,890	9,610	2,180	2,540	4,790	1,560
11	4,440	2,400	2,280	2,490	2,440	2,280	10,000	9,160	1,800	1,880	4,200	1,540
12	3,960	2,870	2,520	2,510	2,520	2,310	11,100	8,890	1,760	1,850	3,600	1,580
13	3,740	3,220	2,850	2,370	2,620	2,540	12,300	8,440	2,680	1,700	3,000	1,710
14	3,350	2,700	3,120	2,360	2,620	2,520	13,600	8,080	2,850	1,540	3,470	1,890
15	3,040	2,650	2,990	2,310	2,600	2,650	13,100	7,840	2,480	1,410	3,880	1,530
16	2,840	2,800	2,740	2,280	2,510	2,940	12,600	8,020	2,180	1,280	2,990	1,530
17	2,720	2,310	2,750	2,230	2,360	3,460	12,100	8,470	2,010	1,400	2,480	1,430
18	4,400	2,540	2,750	2,270	2,300	5,240	12,300	10,200	2,090	2,620	2,160	1,460
19	5,830	2,460	2,550	2,260	2,210	5,040	12,700	10,100	2,130	1,960	1,800	1,480
20	7,480	2,520	2,490	2,240	2,160	4,160	16,100	9,400	2,210	1,410	1,710	1,490
21	9,190	2,520	2,680	2,280	2,170	4,380	17,400	8,590	2,360	1,260	2,190	1,430
22	8,650	2,550	2,620	2,240	2,050	4,860	16,400	8,050	2,210	1,470	2,780	1,410
23	7,450	2,430	2,680	2,150	2,050	5,220	15,400	7,690	2,040	1,530	3,210	1,360
24	6,360	2,460	2,440	2,210	2,050	4,660	14,700	7,420	2,240	1,470	3,320	1,320
25	5,520	2,340	2,440	2,130	2,000	4,280	13,700	6,880	3,050	1,740	2,990	1,330
26	4,860	2,240	2,340	2,200	1,900	4,020	12,700	5,720	4,320	2,260	2,480	1,330
27	4,320	1,810	2,130	2,150	1,960	3,660	11,900	4,500	3,800	2,110	1,960	1,290
28	3,720	2,110	1,920	2,020	1,960	3,300	11,400	3,750	2,990	1,700	1,960	1,310
29	3,240	2,280	2,150	2,000		3,330	11,900	2,960	2,240	1,520	1,790	1,330
30	2,900	2,520	2,600	2,090	----------	3,740	13,400	2,520	1,760	1,520	1,820	1,330
31	2,770	----------	2,460	2,090	----------	4,900	----------	2,280	----------	1,520	1,640	----------
Total	157,940	74,380	78,300	70,430	61,590	100,600	365,450	272,970	74,690	55,240	85,670	44,010
Mean	5,095	2,479	2,526	2,272	2,200	3,245	12,182	8,805	2,490	1,782	2,764	1,467
(✓)	+1,239	-268	-337	-1,134	-1,330	-414	+2,855	-187	+264	-647	+373	-998
Mean	≠ 6,334	2,211	2,189	1,138	870	2,831	15,037	8,618	2,754	1,135	3,137	469
Max	9,190	3,220	3,120	2,520	2,620	5,240	17,400	14,400	4,320	2,620	5,970	1,890
Min	2,720	1,810	1,920	2,000	1,900	1,970	6,880	2,280	1,760	1,260	1,320	1,290
Cfsm	≠ 1.85	0.645	0.638	0.332	0.254	0.825	4.38	2.51	0.803	0.331	0.915	0.137
In.	≠ 2.13	0.72	0.74	0.38	0.26	0.95	4.89	2.90	0.90	0.38	1.05	0.15

Calendar year 1965:	Max	22,600	Min	578	Mean	3,081	Mean ≠	3,188	Cfsm ≠	0.929	In. ≠12.61
Water year 1965-66:	Max	17,400	Min	1,260	Mean	3,949	Mean ≠	3,905	Cfsm ≠	1.14	In. ≠15.45

✓ 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.

5-0300. 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 1966.

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

Average discharge.--29 years, 54.2 cfs (39,240 acre-ft per year).

Extremes.--Maximum discharge during year, 283 cfs May 3 (gage height, 4.51 ft); maximum gage height recorded, 4.91 ft Mar. 9 (backwater from ice); minimum discharge, 32 cfs July 23, 24 (gage height 3.32 ft).
1937-66: 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 winter months or no gage-height record, which are fair. Flow partly regulated by dams of Minnesota Department of Conservation on several lakes above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	65	53	57	58	53	51	138	264	227	79	100	106
2	65	53	57	58	53	51	147	270	221	79	87	109
3	64	53	58	58	53	50	147	283	210	81	73	115
4	64	54	58	58	52	49	113	277	210	81	70	106
5	63	54	59	58	52	48	67	280	204	109	64	100
6	63	55	60	58	52	47	124	277	196	102	61	79
7	61	56	62	58	53	47	154	277	190	94	60	73
8	61	57	63	58	53	48	169	264	185	85	56	87
9	60	58	64	58	54	50	174	264	174	85	55	85
10	59	59	65	58	55	53	182	264	169	83	52	87
11	58	60	64	59	56	58	185	270	162	79	51	87
12	57	59	64	59	57	64	187	270	152	76	50	85
13	57	58	63	59	57	70	190	267	150	74	64	78
14	57	58	63	58	56	75	193	264	147	76	76	78
15	58	57	62	58	56	78	198	264	140	67	74	74
16	59	56	61	58	55	79	198	261	133	60	74	70
17	60	56	61	58	54	81	204	264	128	55	76	66
18	60	55	60	58	53	78	201	264	124	51	74	64
19	60	55	60	58	52	74	207	264	117	48	72	62
20	61	54	60	57	51	76	210	267	113	45	78	59
21	61	54	60	57	50	79	210	264	106	41	85	52
22	60	54	59	57	50	85	212	261	104	40	96	54
23	60	55	59	56	50	83	215	274	96	37	105	51
24	58	56	59	56	50	80	215	274	90	34	115	50
25	57	57	58	55	49	79	224	264	109	40	109	47
26	56	57	58	55	50	85	239	264	106	61	106	46
27	55	58	58	55	51	94	239	261	100	67	109	46
28	54	58	58	54	51	98	251	254	96	64	117	46
29	54	57	58	54		109	261	248	89	57	115	45
30	53	56	58	54	-----	119	261	242	85	54	109	44
31	53	-----	58	53	-----	133	-----	236	-----	51	106	-----
Total	1,833	1,682	1,864	1,768	1,478	2,271	5,715	8,217	4,333	2,055	2,539	2,151
Mean	59.1	56.1	60.1	57.0	52.8	73.3	190	265	144	66.3	81.9	71.7
Max	65	60	65	59	57	133	261	283	227	109	117	115
Min	53	53	57	53	49	47	67	236	85	34	50	44
Ac-ft	3,640	3,340	3,700	3,510	2,930	4,500	11,340	16,300	8,590	4,080	5,040	4,270

Cal yr 1965:	Total	30,614	Mean	83.9	Max	261	Min	17	Ac-ft	60,720
Wtr yr 1966:	Total	35,906	Mean	98.4	Max	283	Min	34	Ac-ft	71,220

Note.--No gage-height record Oct. 1 to Dec. 8, Jan. 27 to Mar. 8.

GPO 803-695-3

5-0405. 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 left bank 990 ft downstream from bridge on U. S. Highway 52, 3 miles northwest of Fergus Falls and 7½ miles upstream from mouth.

Drainage area.--482 sq mi.

Records available.--June 1909 to December 1912, July 1942 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,176.98 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 and Nov. 7, 1955 to Sept. 30, 1963, water-stage recorder at site 900 ft upstream at datum 3.00 ft higher.

Average discharge.--27 years (1909-12, 1942-66), 75.6 cfs (54,730 acre-ft per year).

Extremes.--Maximum discharge during year, 560 cfs Apr. 1 (gage height, 4.73 ft); maximum gage height, 8.99 ft Mar. 21 (backwater from ice); minimum daily discharge, 44 cfs Feb. 20-23.
1909-12, 1942-66: Maximum discharge, 756 cfs Mar. 29, 1943 (gage height, 8.53 ft present datum); maximum gage height, that of Mar. 21, 1966; no flow on many days in 1946, 1949-50.

Remarks.--Records good except those for winter months, which are fair. Flow affected by storage in lakes above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	117	90	71	72	52	49	520	335	275	163	206	120
2	115	90	72	71	52	49	410	320	280	149	170	117
3	113	88	72	70	53	49	345	315	275	142	152	114
4	110	88	73	69	53	48	325	305	270	135	135	114
5	110	90	74	67	54	47	325	310	275	132	126	111
6	108	88	75	66	54	46	310	310	280	126	117	108
7	108	86	76	64	55	45	305	305	280	123	114	106
8	106	88	77	63	55	45	300	310	275	120	111	104
9	104	85	77	62	55	46	300	320	270	117	108	101
10	104	84	77	61	55	47	295	305	256	123	108	99
11	104	82	76	60	54	49	295	305	246	123	106	97
12	100	81	76	60	54	51	295	310	238	120	104	92
13	96	80	75	60	53	53	295	315	228	117	120	90
14	94	79	74	59	52	55	290	320	224	114	123	92
15	92	78	74	59	51	59	285	320	215	111	126	90
16	92	77	74	58	49	62	285	325	207	111	126	88
17	92	76	73	58	47	68	295	330	194	108	123	88
18	94	76	73	58	46	76	300	325	186	104	120	88
19	96	76	73	57	45	84	300	320	178	101	117	88
20	100	76	72	57	44	94	295	315	170	97	129	84
21	100	76	72	56	44	100	315	315	167	94	138	84
22	100	76	72	55	44	104	315	300	160	92	138	82
23	98	76	71	54	44	107	310	305	152	94	138	80
24	96	76	71	53	45	112	315	305	142	111	135	78
25	96	76	71	52	46	116	310	305	228	111	132	78
26	92	76	71	51	46	123	305	305	242	135	129	77
27	92	74	71	50	47	133	315	300	242	123	129	75
28	92	73	72	50	48	147	340	290	228	114	123	75
29	90	72	72	50		166	350	285	203	106	123	77
30	90	71	73	50	- - - - -	230	345	285	182	104	120	77
31	90	- - - - -	73	51	- - - - -	340	- - - - -	280	- - - - -	101	120	- - - - -
Total	3,091	2,404	2,273	1,823	1,397	2,800	9,590	9,595	6,768	3,621	3,966	2,774
Mean	99.7	80.1	73.3	58.8	49.9	90.3	320	310	226	117	128	92.5
Max	117	90	77	72	55	340	520	335	280	163	206	120
Min	90	71	71	50	44	45	285	280	142	92	104	75
Ac-ft	6,130	4,770	4,510	3,620	2,770	5,550	19,020	19,030	13,420	7,180	7,870	5,500

Cal yr 1965:	Total	45,290	Mean	124	Max	535	Min	25	Ac-ft	89,830
Wtr yr 1966:	Total	50,102	Mean	137	Max	520	Min	44	Ac-ft	99,380

5-0459.5 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 1966.

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, 16,920 acre-ft May 23 (elevation, 1,072.38 ft); minimum, 1,870 acre-ft Mar. 8 (elevation, 1,051.40 ft).

1953-66: Maximum contents, 16,920 acre-ft June 17, 1962, May 23, 1966 (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 gate; 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 1965 to September 1966

	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	1,070.28	14,420	-
Oct. 31	1,069.64	13,700	-720
Nov. 30	1,069.19	13,210	-490
Dec. 31	1,068.45	12,450	-760
Calendar year 1965	-	-	+4,550
Jan. 31	1,063.21	7,970	-4,480
Feb. 28	1,053.27	2,510	-5,460
Mar. 31	1,067.85	11,860	+9,350
Apr. 30	1,068.32	12,320	+460
May 31	1,071.49	15,840	+3,520
June 30	1,060.65	6,170	-9,670
July 31	1,060.33	5,960	-210
Aug. 31	1,066.22	10,400	+4,440
Sept. 30	1,069.76	13,840	+3,440
Water year 1965-66	-	-	-580

5-0460. 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 1966. 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.--36 years, 275 cfs (199,100 acre-ft per year).

Extremes.--Maximum discharge during year, 1,490 cfs June 1 (gage height, 4.59 ft); minimum, 92 cfs March 15 (gage height, 2.22 ft).
1930-66: 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 except those for periods of no gage-height record, which are fair. Flow regulated by Orwell Reservoir beginning Mar. 21, 1953 (see preceding page) and powerplants upstream.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	502	524	425	547	520	405	1,050	1,110	1,470	879	490	457
2	530	524	410	536	510	415	1,040	1,120	1,460	855	639	451
3	530	524	400	530	497	410	1,030	1,130	1,420	825	662	446
4	530	524	400	524	480	400	1,030	1,130	1,390	790	604	451
5	530	524	405	519	470	405	1,020	1,160	1,370	697	587	446
6	536	524	410	513	455	395	1,010	1,210	1,310	530	593	446
7	530	496	415	507	447	410	1,010	1,210	1,280	553	599	429
8	530	496	440	496	420	420	1,000	1,230	1,270	559	559	429
9	530	500	460	485	377	451	1,000	1,240	1,240	570	485	434
10	530	500	480	474	377	536	998	1,240	1,200	570	468	429
11	530	500	540	468	400	645	1,010	1,240	1,200	582	468	423
12	530	500	580	462	434	645	1,040	1,250	1,200	587	451	412
13	530	480	580	451	434	743	1,040	1,250	1,200	599	423	412
14	530	447	580	446	430	610	1,040	1,250	1,180	604	423	412
15	530	447	575	440	450	95	1,030	1,260	1,150	610	446	406
16	496	455	570	434	480	97	1,030	1,260	1,150	610	474	395
17	479	460	570	423	475	113	1,030	1,270	1,120	610	502	395
18	496	485	565	412	470	120	1,030	1,270	1,110	530	513	395
19	519	485	565	406	456	123	1,030	1,270	1,090	479	507	390
20	519	485	565	401	447	386	1,040	1,270	1,060	485	513	384
21	524	485	565	406	400	856	1,040	1,270	1,020	490	524	372
22	513	488	560	440	375	1,010	1,020	1,290	1,010	462	524	372
23	519	480	560	446	387	1,020	1,020	1,320	1,000	446	530	378
24	513	480	555	490	405	1,010	1,030	1,380	978	451	530	384
25	513	480	550	547	390	1,000	1,030	1,380	965	434	530	390
26	513	480	555	582	386	1,000	1,040	1,380	953	418	530	395
27	519	488	560	577	375	1,000	1,040	1,380	934	440	536	401
28	519	485	560	564	367	998	1,070	1,400	928	451	530	401
29	519	450	564	555		998	1,090	1,410	915	457	524	406
30	519	430	559	547	-----	1,010	1,100	1,410	897	462	519	406
31	524	-----	553	530	-----	1,040	-----	1,460	-----	462	479	-----
Total	16,132	14,626	16,076	15,158	12,114	18,766	30,988	39,450	34,470	17,497	16,162	12,347
Mean	520	488	518	489	433	605	1,033	1,272	1,149	564	521	412
Max	536	524	580	582	520	1,040	1,100	1,460	1,470	879	662	457
Min	479	430	400	401	367	95	998	1,110	897	418	423	372
Ac-ft	32,000	29,010	31,890	30,060	24,030	37,220	61,460	78,250	68,370	34,700	32,060	24,490

Cal yr 1965:	Total	194,176	Mean	532	Max	1,280	Min	161	Ac-ft	385,142
Wtr yr 1966:	Total	243,786	Mean	668	Max	1,470	Min	95	Ac-ft	483,500

Note.--No gage-height record Nov. 7 to Dec. 28, Jan. 26 to Mar. 8.

5-0500. Bois de Sioux River near White Rock, S. Dak.

Location.--Lat 45°51'45", long 96°34'25", in SW¼SW¼ 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 1966.

Gage.--Water-stage recorder. Datum of gage is 960.00 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Jan. 14, 1943, staff gage at same site at datum 0.11 ft lower. Jan. 15, 1943, to Sept. 30, 1963, water-stage recorder at same site at datum 0.11 ft lower.

Average discharge.--25 years, 86.5 cfs (62,620 acre-ft per year).

Extremes.--Maximum discharge during year, 921 cfs Apr. 29 (gage height, 8.77 ft); no flow July 31.
1941-66: Maximum discharge, 1,620 cfs Aug. 6, 1962 (gage height, 11.41 ft, present datum); no flow at times in most years.

Remarks.--Records good except those for period of no gage-height record and those for winter months, 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).

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	25	110	43	21	29	59	21	644	776	61	0.02	2.3
2	19	106	40	21	32	60	20	657	774	43	5.6	2.6
3	20	105	38	20	37	64	20	676	779	19	5.6	3.5
4	22	110	37	20	43	65	19	630	774	5.3	4.1	2.1
5	26	108	35	20	47	70	19	641	771	60	3.5	1.2
6	29	109	33	19	52	72	18	636	765	3.5	4.1	1.2
7	26	108	32	19	58	69	17	628	763	2.8	4.7	6.5
8	29	99	31	19	64	66	17	636	752	2.8	3.1	1.7
9	44	104	31	19	72	66	15	622	746	4.4	2.6	.39
10	44	100	30	19	67	68	15	609	725	2.8	1.6	.39
11	46	98	30	19	62	70	15	633	722	3.3	1.3	.78
12	52	94	29	19	59	74	15	630	698	4.4	6.6	.93
13	57	92	29	19	57	77	15	636	513	11	4.1	.14
14	57	91	29	19	56	82	15	625	357	3.3	2.5	.19
15	63	88	29	19	55	86	14	617	364	1.9	3.8	.12
16	65	87	28	19	54	90	14	698	281	3.5	3.8	.12
17	64	84	27	19	53	94	17	855	135	6.6	2.6	.12
18	64	80	27	19	52	85	254	855	158	3.8	2.1	.12
19	70	76	27	19	52	74	663	858	264	3.5	1.6	.10
20	59	73	27	19	52	63	633	846	233	1.2	4.3	.10
21	70	72	27	19	51	56	633	835	214	.04	27	.08
22	72	71	26	19	51	50	741	812	185	.22	24	.09
23	66	67	26	19	52	44	860	846	285	.07	17	.16
24	86	66	25	20	53	38	863	840	215	.34	16	.06
25	86	64	25	20	54	34	869	823	192	.49	14	.05
26	91	60	24	20	55	30	860	818	133	2.9	10	.06
27	94	58	23	21	57	26	860	818	106	4.7	9.0	.07
28	100	53	23	22	58	24	895	804	109	1.3	5.9	.05
29	102	49	22	24		23	884	798	79	.08	5.3	9.2
30	103	45	22	25	----------	23	660	793	61	.02	4.2	.12
31	104	----------	21	26	----------	22	----------	787	----------	0	5.7	----------
Total	1,855	2,527	896	622	1,484	1,824	9,961	22,606	12,929	257.26	205.72	34.54
Mean	59.8	84.2	28.9	20.1	53.0	58.8	332	729	431	8.30	6.64	1.15
Ac-ft	3,680	5,010	1,780	1,230	2,940	3,620	19,760	44,840	25,640	510	408	68

Calendar year 1965: Max 1,300 Min 0 Mean 203 Ac-ft 147,100
Water year 1965-66: Max 895 Min 0 Mean 151 Ac-ft 109,500

Note.--No gage-height record Feb. 16 to Mar. 16.

5-0515. 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 1966. Gage-height records collected in this vicinity since 1917 are contained in reports of the 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.--23 years (1943-66), 534 cfs (386,600 acre-ft per year).

Extremes.--Maximum discharge during year, 4,760 cfs Mar. 18 (gage height, 12.91 ft); maximum gage height, 13.93 ft Mar. 16 (backwater from ice); minimum discharge, 120 cfs Nov. 17 (gage height 3.12 ft).
1942-66: 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 the winter period, which are fair. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft above mean sea level, adjustment of 1912); Lake Traverse (capacity, 137,000 acre-ft); available for flood control; numerous other controlled lakes and ponds and several powerplants.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	752	606	590	420	540	420	1,270	2,380	2,080	1,080	794	391
2	1,080	609	590	480	510	440	1,270	2,360	2,080	1,050	704	355
3	1,200	602	560	420	500	460	1,230	2,300	2,060	1,020	668	346
4	1,130	609	510	500	480	460	1,180	2,200	2,040	973	679	337
5	1,000	606	480	520	460	320	1,160	2,060	2,060	919	606	337
6	901	609	460	500	460	300	1,140	1,980	2,050	834	550	343
7	818	609	440	460	460	340	1,120	1,970	2,020	686	556	343
8	784	598	440	460	440	400	1,100	1,940	2,000	648	623	343
9	760	598	460	500	420	440	1,100	1,930	1,980	626	556	340
10	721	595	480	500	400	500	1,080	1,920	1,970	623	475	340
11	693	595	520	500	380	600	1,070	1,930	1,960	630	436	346
12	682	595	600	520	440	800	1,060	1,930	1,940	634	421	340
13	672	560	560	500	440	1,500	1,100	1,940	1,920	634	460	337
14	658	500	500	480	440	2,500	1,100	1,940	1,790	637	427	346
15	654	450	500	480	440	3,500	1,100	1,960	1,660	634	400	346
16	648	400	520	460	440	4,200	1,090	1,950	1,600	630	379	346
17	623	290	520	440	440	4,500	1,090	2,010	1,530	620	391	346
18	595	680	460	440	420	4,530	1,110	2,110	1,360	609	406	346
19	609	800	520	460	420	4,060	1,310	2,120	1,200	550	424	349
20	616	620	560	460	440	3,160	1,750	2,120	1,420	487	466	349
21	623	490	560	420	460	2,270	1,800	2,120	1,400	481	553	346
22	616	450	540	420	460	2,120	1,830	2,120	1,390	484	567	346
23	612	420	520	500	380	1,840	2,020	2,110	1,360	472	620	352
24	616	480	520	520	400	1,340	2,260	2,100	1,380	463	609	355
25	616	400	460	560	460	1,480	2,260	2,140	1,500	451	574	358
26	626	420	460	600	440	1,660	2,180	2,160	1,410	478	532	361
27	630	480	380	620	440	1,630	2,130	2,140	1,330	430	500	361
28	630	530	420	600	420	1,450	2,120	2,120	1,280	418	472	367
29	630	570	540	600		1,410	2,280	2,110	1,210	427	454	370
30	634	600	580	580	----------	1,300	2,450	2,100	1,150	430	454	370
31	620	----------	560	580	----------	1,250	----------	2,090	----------	427	448	----------
Total	22,449	16,371	15,810	15,500	12,430	51,180	44,760	64,360	50,130	19,485	16,204	10,512
Mean	724	546	510	500	444	1,651	1,492	2,076	1,671	629	523	350
Ac-ft	44,530	32,470	31,360	30,740	24,650	101,500	88,780	127,700	99,430	38,650	32,140	20,850

Calendar year 1965: Max 5,560 Min 115 Mean 856 Ac-ft 619,300
Water year 1965-66: Max 4,530 Min 290 Mean 929 Ac-ft 672,800

5-0540. Red River of the North at Fargo, N. Dak.

Location.--Lat 46°51'40", long 96°47'00", in NW¼NE¼ sec.18, T.139 N., R.48 W., at city waterplant on 4th St. s in Fargo, 25 miles upstream from mouth of Sheyenne River and at mile 453.

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

Records available.--May 1901 to September 1966. Published as "at Moorhead, Minn." 1901. Monthly discharge only 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 Sept. 30, 1960, water-stage recorder at site 2 miles upstream at datum 5.6 ft higher. Oct. 1, 1960, to Sept. 30, 1962, water-stage recorder at present site at datum 5.6 ft higher. Since Oct. 1, 1960, auxiliary water-stage recorder 2 miles upstream.

Average discharge.--65 years, 522 cfs (377,900 acre-ft per year, unadjusted); median of yearly mean discharges, 430 cfs (311,000 acre-ft per year, unadjusted).

Extremes.--Maximum discharge during year, 10,700 cfs Mar. 22 (gage height, 30.16 ft); minimum, 235 cfs Nov. 29 (gage height, 13.92 ft).

1901-66: 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 (discharge, 25,000 cfs).

Remarks.--Records good except those for the winter period, which are fair. Flow regulated by Orwell Reservoir (capacity, 14,100 acre-ft at elevation 1,070 ft above mean sea level, adjustment of 1912), Lake Traverse (capacity, 137,000 acre-ft, available for flood control), other controlled lakes and ponds and several power plants. Some small diversions for municipal supply. Figures of daily discharge do not include diversion by City of Fargo. Records of chemical analyses for water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	719	664	370	520	570	460	5,000	2,700	2,180	1,700	594	620
2	829	664	470	550	580	440	4,250	2,840	2,140	1,570	645	601
3	1,100	645	538	530	570	460	3,700	2,890	2,130	1,450	1,110	557
4	1,340	632	569	500	570	480	3,400	2,840	2,120	1,340	1,430	494
5	1,420	626	576	460	580	490	3,000	2,740	2,160	1,260	1,370	451
6	1,350	626	569	500	570	450	2,550	2,610	2,120	1,170	1,210	426
7	1,190	626	538	480	560	370	2,150	2,440	2,110	1,080	1,030	408
8	1,030	632	519	470	560	310	2,080	2,300	2,080	964	901	401
9	973	632	501	450	550	320	1,970	2,200	2,040	829	847	401
10	892	632	488	440	540	370	1,870	2,130	1,980	748	883	395
11	874	626	476	480	510	430	1,790	2,110	1,960	726	838	395
12	820	638	488	480	480	520	1,720	2,100	1,940	719	719	383
13	788	638	519	460	460	630	1,660	2,090	1,920	691	748	383
14	772	632	538	470	460	1,000	1,580	2,090	1,890	677	788	383
15	756	582	544	490	480	1,700	1,530	2,120	1,880	657	788	383
16	733	507	538	500	480	3,100	1,480	2,120	1,810	657	874	377
17	733	470	507	470	460	4,500	1,420	2,120	1,690	649	812	377
18	726	494	513	480	440	6,500	1,380	2,120	1,620	645	705	377
19	705	414	544	480	440	7,800	1,340	2,140	1,530	632	664	377
20	657	414	532	470	430	9,000	1,340	2,220	1,400	620	657	383
21	645	638	519	480	420	10,400	1,530	2,240	1,350	569	684	377
22	645	756	525	470	440	10,600	1,810	2,270	1,380	526	748	364
23	651	677	550	450	420	8,100	2,000	2,360	1,420	501	1,040	370
24	657	626	550	440	440	8,700	2,100	2,300	1,400	526	1,200	364
25	645	588	532	460	420	7,800	2,240	2,250	1,410	513	1,260	370
26	651	588	525	490	400	6,500	2,480	2,230	1,470	532	1,200	370
27	651	476	513	500	430	5,200	2,610	2,230	1,700	544	1,060	370
28	657	340	494	520	460	4,800	2,730	2,240	1,840	576	919	377
29	651	246	450	560		4,700	2,730	2,230	1,840	544	796	383
30	651	275	420	590	----------	5,000	2,630	2,220	1,780	513	719	383
31	664	----------	460	590	----------	5,300	----------	2,190	----------	494	657	----------
Total	25,575	17,004	15,875	15,230	13,720	116,430	68,070	71,680	54,290	24,622	27,896	12,300
Mean	825	567	512	491	490	3,756	2,269	2,312	1,810	794	900	410
Ac-ft	50,730	33,730	31,490	30,210	27,210	230,900	135,000	142,200	107,700	48,840	55,330	24,400
+	558	559	557	562	519	547	499	586	637	812	602	654

Adjusted for diversion by City of Fargo

Mean	834	576	521	500	499	3,765	2,277	2,322	1,820	807	910	421
Ac-ft	51,290	34,290	32,040	30,770	27,730	231,500	135,500	142,800	108,300	49,650	55,930	25,050

	Observed								Adjusted			
Calendar year 1965:	Max	11,300	Min	130	Mean	1,101	Ac-ft	797,000	Mean	1,110	Ac-ft	803,900
Water year 1965-66:	Max	10,600	Min	246	Mean	1,268	Ac-ft	917,700	Mean	1,277	Ac-ft	924,800

+ Diversion in acre-feet by City of Fargo.

5-0610. 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 1966.

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.--21 years, 73.9 cfs (53,500 acre-ft per year).

Extremes.--Maximum discharge during year, 1,520 cfs Mar. 18 (gage height, 10.42 ft, backwater from ice); maximum gage height, 10.58 ft Mar. 17 (backwater from ice); minimum daily discharge, 17 cfs Feb. 20-26.
1945-66: 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, spring of 1921, from information by local resident.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	68	37	25	23	22	18	778	391	117	39	73	43
2	64	36	25	23	22	19	740	380	114	37	100	41
3	60	36	25	23	22	19	700	364	110	37	97	39
4	55	36	25	23	22	19	642	351	105	37	99	37
5	53	35	25	23	22	18	591	332	108	37	106	35
6	53	34	25	23	21	18	532	308	111	35	112	33
7	54	33	25	23	21	18	477	285	108	39	83	33
8	54	33	25	23	21	18	425	267	101	45	61	32
9	53	30	25	23	21	18	394	245	97	40	52	32
10	50	29	25	23	20	18	361	229	91	56	46	31
11	48	28	25	23	20	19	337	219	83	53	41	32
12	46	28	25	23	20	20	316	213	79	50	37	30
13	45	27	25	23	20	22	295	207	78	45	60	31
14	45	27	25	23	19	28	280	202	75	41	116	31
15	39	26	25	23	19	230	267	204	73	39	110	31
16	35	26	24	22	19	330	254	204	68	35	104	31
17	33	26	24	22	18	860	245	196	63	33	99	31
18	33	26	24	22	18	1,500	243	189	59	31	78	31
19	34	26	24	22	18	1,270	235	186	56	27	60	35
20	33	26	24	22	17	1,060	210	182	54	26	57	32
21	33	26	24	22	17	1,000	214	181	50	24	64	31
22	44	26	24	22	17	840	221	176	48	23	80	30
23	48	26	24	22	17	710	233	177	47	25	89	29
24	46	26	24	22	17	700	245	177	47	29	85	29
25	44	26	24	22	17	685	257	169	49	58	78	28
26	41	26	24	22	17	665	273	163	51	76	70	29
27	40	26	24	22	18	650	308	154	51	88	60	29
28	39	26	23	22	18	640	348	145	48	78	54	28
29	39	25	23	22		657	380	137	45	58	50	28
30	39	25	23	22	- - - - -	694	398	131	41	47	45	28
31	39	- - - - -	23	22	- - - - -	700	- - - - -	124	- - - - -	44	41	- - - - -
Total	1,407	863	755	697	540	13,463	11,199	6,888	2,227	1,332	2,307	960
Mean	45.4	28.8	24.4	22.4	19.3	434	373	222	74.2	42.9	74.4	32.0
Max	68	37	25	23	22	1,500	778	391	117	88	116	43
Min	33	25	23	22	17	18	210	124	41	23	37	28
Ac-ft	2,790	1,710	1,500	1,380	1,070	26,700	22,210	13,660	4,420	2,640	4,580	1,900

Cal yr 1965: Total 33,552 Mean 919 Max 1,210 Min 14 Ac-ft 66,550
Wtr yr 1966: Total 42,638 Mean 117 Max 1,500 Min 17 Ac-ft 84,570

5-0612. Whisky Creek at Barnesville, Minn.

Location.--Lat 46°39'33", long 96°23'54", in NE¼NW¼ sec.29, T.137 N., R.45 W., on right bank 18 ft upstream from culvert on State Highway 34, 0.7 mile upstream from Blue Eagle Lake, and 1.0 mile northeast of Barnesville.

Drainage area.--62.5 sq mi, of which 25.3 sq mi contribute directly to surface runoff.

Records available.--Water years 1961-64 (annual maximum), October 1964 to September 1966 (discontinued).

Gage.--Water-stage recorder and crest-stage gage. Altitude of gage is 1,030 ft (from topographic map). Prior to Oct. 6, 1964, crest-stage gage at present site and datum.

Extremes.--Maximum discharge during year, 260 cfs Mar. 14 (gage height, 8.25 ft, from crest-stage gage, backwater from ice); no flow Jan. 16 to Feb. 5, Feb. 15-23.

1961-66: Maximum discharge, 292 cfs June 8, 1962 (gage height, 6.52 ft); maximum gage height, 8.29 ft Mar. 28, 1962 (backwater from ice).

1946-66: Minimum discharge, no flow Jan. 16 to Feb. 5, Feb. 15-23, 1966.

Remarks.--Records fair except those for periods of no gage-height record and those for winter months, which are poor.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sept.
1	18	0.6	0.3	0.3	0	0.4	24	24	1.4	1.8	0.4	0.2
2	15	.4	.4	.3	0	.6	22	20	1.5	1.0	.4	.2
3	10	.3	.6	.2	0	.8	20	18	1.6	2.2	.3	.2
4	8.1	.3	.9	.2	0	.8	18	16	1.6	0.9	.3	.2
5	6.9	.2	1.5	.2	0	.9	16	15	5.1	.8	.2	.2
6	6.3	.1	2.6	.2	0.1	.9	14	13	10	.5	.2	.2
7	7.2	.1	4.2	.1	.1	.9	11	12	11	.4	.4	.2
8	8.8	.1	4.2	.1	.1	1.1	9.1	11	7.2	.4	.8	.2
9	9.1	.1	3.8	.1	.1	2.2	9.1	9.1	4.2	.4	.4	1.4
10	8.5	.1	3.5	.1	.1	5.6	9.1	8.5	2.6	1.8	.3	.3
11	6.9	.1	3.4	.1	.1	15	8.8	8.8	1.8	5.0	.2	.2
12	6.3	.2	3.2	.1	.1	53	9.1	9.4	1.8	1.6	.2	.2
13	5.7	1.0	2.5	.1	.1	175	8.5	10	1.4	.7	8.6	.2
14	5.4	.8	2.0	.1	.1	210	8.8	11	1.8	.5	13	.2
15	5.1	1.2	1.7	.1	0	160	9.4	12	3.2	.3	10	.2
16	4.8	1.1	1.4	0	0	94	10	13	2.2	.3	3.3	.2
17	4.8	.8	1.2	0	0	76	12	12	0.7	.2	.7	.2
18	5.7	.8	1.0	0	0	62	13	10	.5	.2	.3	.3
19	6.9	.8	.8	0	0	50	9.8	8.5	.4	.2	.2	.3
20	7.8	.8	.6	0	0	42	9.1	8.1	.4	.2	.6	.3
21	7.2	.9	.6	0	0	36	10	7.8	.4	.2	6.6	.3
22	6.6	.9	.5	0	0	32	14	9.4	.4	.2	10	.3
23	6.3	1.0	.5	0	0	31	18	7.5	.7	.2	8.8	.3
24	5.4	1.1	.5	0	0.1	30	18	6.9	.7	.3	4.0	.3
25	5.1	1.1	.4	0	.1	29	17	6.3	18	.2	1.2	.3
26	4.8	.9	.3	0	.1	28	23	4.5	34	6.8	.5	.4
27	4.8	.7	.2	0	.2	27	26	5.7	44	3.7	.4	.4
28	4.2	.5	.2	0	.3	28	34	3.3	24	4.0	.3	.4
29	2.6	.4	.2	0		29	34	2.2	7.2	2.1	.2	.5
30	1.5	.3	.2	0	-----	28	28	2.2	5.1	.5	.2	.7
31	1.0	-----	.3	0	-----	27	-----	1.5	-----	.3	.2	-----
Total	206.8	17.7	43.7	2.3	1.7	1,276.2	472.8	306.7	194.9	37.9	73.2	9.5
Mean	6.67	0.59	1.41	0.07	0.06	41.2	15.8	9.89	6.50	1.22	2.36	0.32
Max	18	1.2	4.2	0.3	0.1	210	34	24	44	6.8	13	1.4
Min	1.0	0.1	0.2	0	0	0.4	8.5	1.5	0.4	0.2	0.2	0.2
Cfsm	0.107	0.009	0.023	0.001	0.001	0.659	0.253	0.158	0.104	0.020	0.038	0.005
In.												
Ac-ft	410	35	87	4.6	3.4	2,530	938	608	387	75	145	19

Cal yr 1965:	Total	3,045.2	Mean	8.34	Max	170	Min	0.1	Cfsm	0.133	In.	Ac-ft 6,040
Wtr yr 1966:	Total	2,643.4	Mean	7.24	Max	210	Min	0	Cfsm	0.116	In.	Ac-ft 5,240

Note.--No gage-height record Nov. 10 to Dec. 9, Dec. 29 to Apr. 4.

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 Whisky Creek and 1 mile east of Sabin.

Drainage area.--522 sq mi.

Records available.--March 1945 to September 1966.

Gage.--Wire-weight 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. Aug. 17, 1948, to July 26, 1965, chain gage at same site and datum.

Average discharge.--21 years, 57.2 cfs (41,410 acre-ft per year).

Extremes.--Maximum discharge during year, 3,310 cfs Mar. 15 (gage height, 16.78 ft, backwater from ice); no flow Jan. 27 to Mar. 3.
1945-66: 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 winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	58	35	7.8	2.3		0	285	446	23	126	75	32
2	69	35	7.6	2.2		0	263	374	21	73	51	27
3	72	33	7.4	2.1		0	236	297	18	47	38	22
4	75	31	7.2	1.9		0.1	210	238	17	38	35	20
5	78	32	7.1	1.8		.2	185	193	21	42	36	18
6	78	29	7.0	1.6		.3	159	155	24	36	39	15
7	76	29	6.9	1.4		.8	137	126	29	30	34	12
8	73	28	6.7	1.3		2.2	133	103	34	24	29	11
9	69	25	6.6	1.1		6.0	126	87	34	23	25	9.3
10	65	21	6.5	1.0		17	98	74	32	19	30	7.7
11	60	18	6.3	.9		45	94	67	30	18	30	8.8
12	54	16	6.0	.7		166	86	62	30	16	27	9.7
13	48	15	5.8	.6		410	78	59	24	21	31	6.2
14	45	14	5.5	.5		1,080	75	56	21	26	42	5.2
15	44	13	5.2	.5		2,880	73	60	20	24	66	4.9
16	41	13	5.0	.4		3,060	72	58	17	22	104	3.2
17	40	12	4.8	.4		2,420	71	63	15	18	128	3.1
18	38	11	4.5	.3		1,700	70	61	13	15	133	2.9
19	38	11	4.3	.3		1,080	64	58	12	12	103	3.1
20	38	10	4.0	.3		798	65	52	11	8.9	64	3.7
21	37	9.8	3.8	.2		635	75	49	9.1	7.4	52	1.5
22	40	9.4	3.6	.2		516	102	46	7.9	6.5	59	3.2
23	40	9.3	3.5	.2		435	139	44	9.1	4.0	98	2.7
24	42	9.0	3.4	.2		389	164	40	6.9	3.5	149	2.4
25	42	8.8	3.2	.1		368	168	39	7.9	3.0	187	2.4
26	40	8.8	3.1	.1		357	175	38	6.5	11	178	2.4
27	38	8.6	3.0	0		345	224	35	16	35	139	2.1
28	37	8.4	2.8	0		337	364	34	84	53	90	2.1
29	36	8.3	2.7	0		332	431	32	161	85	62	3.5
30	33	8.1	2.5	0	- - - - -	324	470	28	178	96	47	5.3
31	35	- - - - -	2.4	0	- - - - -	315	- - - - -	25	- - - - -	90	38	- - - - -
Total	1,579	519.5	156.2	22.6	0	18,018.6	4,892	3,099	932.4	1,033.3	2,219	252.4
Mean	50.9	17.3	5.04	0.73	0	581	163	100	31.1	33.3	71.6	8.41
Max	78	35	7.8	2.3	0	3,060	470	446	178	126	187	32
Min	33	8.1	2.4	0	0	0	64	25	6.5	3.0	25	1.5
Ac-ft	3,130	1,030	310	45	0	35,740	9,700	6,150	1,850	2,050	4,400	501

Cal yr 1965: Total 33,463.5 Mean 91.7 Max 3,850 Min 0 Ac-ft 66,370
Wtr yr 1966: Total 32,724.0 Mean 89.7 Max 3,060 Min 0 Ac-ft 64,910

5-0620. 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 1966. 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.--35 years, 123 cfs (89,050 acre-ft per year).

Extremes.--Maximum discharge during year, 5,000 cfs Mar. 18 (gage height, 23.31 ft, from graph based on gage readings, backwater from ice); minimum, 24 cfs July 24, 25 (gage height, 2.85 ft).
1931-66: Maximum discharge, 6,140 cfs June 11, 1962 (gage height, 23.56 ft); no flow at times in 1936.

Remarks.--Record fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	120	83	67	54	28	29	1,260	898	154	207	163	118
2	124	82	68	53	29	30	1,220	926	144	206	181	106
3	132	81	68	52	29	31	1,180	908	136	169	186	96
4	141	81	69	50	30	32	1,110	848	129	127	181	87
5	140	80	69	48	30	33	1,030	763	127	98	169	78
6	139	80	69	46	30	35	948	673	135	85	166	71
7	142	80	68	45	30	37	860	592	144	77	173	65
8	148	80	68	43	30	40	776	521	139	70	174	60
9	151	77	68	41	30	43	695	463	135	69	147	55
10	147	74	68	40	30	46	624	416	133	73	116	51
11	141	73	68	39	30	52	561	379	130	79	98	48
12	133	72	68	38	30	58	511	351	125	81	89	46
13	126	72	68	37	30	66	472	332	117	76	89	44
14	116	71	68	36	30	82	445	321	110	68	102	42
15	108	71	68	35	30	190	418	314	110	65	149	41
16	104	71	68	34	30	550	396	312	104	62	191	40
17	99	71	68	33	30	3,330	382	305	95	58	225	38
18	91	70	67	33	29	5,000	372	295	86	53	247	37
19	86	70	67	32	29	3,660	359	286	81	47	256	36
20	86	70	66	31	28	3,500	353	274	75	41	233	34
21	90	70	65	31	28	3,400	349	265	70	35	201	34
22	86	70	64	30	28	3,390	354	252	68	29	185	34
23	80	70	63	30	28	2,900	375	246	67	27	199	30
24	83	70	62	29	28	2,500	400	239	64	25	223	28
25	91	69	61	28	28	2,150	425	235	65	27	253	27
26	94	68	60	28	28	1,900	461	223	73	34	281	26
27	91	68	60	27	28	1,720	537	211	72	65	287	25
28	87	67	59	27	28	1,580	658	198	70	95	262	25
29	86	67	58	27		1,470	776	186	72	120	217	25
30	85	67	57	27	-----	1,380	850	175	129	140	172	25
31	84	-----	56	28	-----	1,320	-----	165	-----	148	141	-----
Total	3,431	2,195	2,023	1,132	816	40,554	19,157	12,572	3,159	2,556	5,756	1,472
Mean	111	73.2	65.3	36.5	29.1	1,308	639	406	105	82.4	186	49.1
Max	151	83	69	54	30	5,000	1,260	926	154	207	287	118
Min	80	67	56	27	28	29	349	165	64	25	89	25
Ac-ft	6,810	4,350	4,010	2,250	1,620	80,440	38,000	24,940	6,270	5,070	11,420	2,920

Cal yr 1965:	Total	73,626	Mean	202	Max	5,900	Min	15	Ac-ft	146,000
Wtr yr 1966:	Total	94,823	Mean	260	Max	5,000	Min	25	Ac-ft	188,100

Note.--No gage-height record Oct. 29 to Dec. 8.

5-0625. 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 small tributary.

Drainage area.--888 sq mi.

Records available.--June 1909 to September 1917, July 1930 to September 1966. 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.--44 years, 164 cfs (118,700 acre-ft per year).

Extremes.--Maximum discharge during year, 2,120 cfs Apr. 2 (gage height, 8.90 ft); maximum gage height, 11.51 ft Mar. 17 (backwater from ice); minimum daily discharge, 31 cfs Feb. 19-22.

1909-17, 1930-66: 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 periods of no gage-height record and those for winter months, 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.

Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	131	112	67	111	47	35	1,390	1,300	376	121	95	157
2	133	108	69	108	48	35	2,000	1,250	356	114	89	150
3	133	100	73	104	49	35	1,840	1,180	334	118	95	145
4	128	97	78	100	49	35	1,760	1,140	316	118	85	139
5	125	101	83	97	50	35	1,480	1,080	303	125	95	128
6	119	97	88	93	50	34	1,350	1,130	292	117	78	119
7	126	88	93	90	50	34	1,250	999	290	109	70	114
8	125	103	98	88	51	34	1,200	940	275	104	79	98
9	125	80	99	85	51	34	1,160	880	253	99	74	93
10	121	74	100	82	50	36	1,130	850	230	99	72	85
11	113	69	102	80	48	39	1,080	800	238	99	68	89
12	110	65	103	78	45	45	1,050	770	240	99	60	89
13	109	64	104	76	43	56	1,020	750	250	104	79	80
14	105	63	105	73	40	74	986	740	248	91	113	80
15	103	62	106	71	38	120	988	730	236	84	165	79
16	100	62	107	69	36	230	978	730	219	81	182	79
17	105	61	108	67	34	540	973	730	202	75	178	71
18	117	61	110	65	32	1,760	968	730	187	69	163	63
19	156	60	112	63	31	1,500	950	720	174	68	157	68
20	157	60	113	60	31	1,200	942	710	163	58	165	62
21	157	60	114	58	31	1,000	940	700	154	53	166	50
22	156	60	116	54	31	1,500	991	680	154	49	189	48
23	149	60	117	52	32	1,270	1,030	660	152	50	217	45
24	143	61	117	49	32	960	1,060	630	154	50	242	42
25	140	61	116	47	32	1,060	1,070	614	162	53	232	42
26	131	61	115	46	33	1,000	1,110	599	156	63	212	42
27	124	61	114	45	33	880	1,150	566	153	65	198	40
28	124	62	113	45	34	880	1,240	522	145	69	189	40
29	117	63	113	46		1,120	1,290	479	133	85	179	44
30	110	64	113	46	-----	1,140	1,320	443	128	73	170	42
31	112	-----	113	46	-----	1,170	-----	407	-----	72	168	-----
Total	3,904	2,200	3,179	2,194	1,131	17,891	35,696	24,359	6,673	2,634	4,324	2,423
Mean	126	73.3	102	70.8	40.4	577	1,190	786	222	84.9	139	80.8
Max	157	112	117	111	51	1,760	2,000	1,300	376	125	242	157
Min	100	60	67	45	31	34	940	407	128	49	60	40
Ac-ft	7,740	4,360	6,300	4,350	2,240	35,500	70,800	48,300	13,200	5,220	8,580	4,810

Cal yr 1965:	Total	96,159	Mean	263	Max	3,080	Min	22	Ac-ft	190,700
Wtr yr 1966:	Total	106,608	Mean	292	Max	2,000	Min	31	Ac-ft	186,200

Note.--No gage-height record Nov. 14 to Dec. 22, Dec. 26 to Feb. 2.

5-0640. 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 1966.

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.--22 years, 228 cfs (165,100 acre-ft per year).

Extremes.--Maximum discharge during year, 4,120 cfs Mar. 31 (gage height, 28.30 ft, backwater from Red River of the North); maximum gage height, 29.12 ft Mar. 26 (backwater from Red River of the North); minimum daily discharge, 44 cfs Sept. 29, 30; minimum gage height, 2.48 ft Sept. 26, 27, 29, 30.
1944-66: Maximum discharge 6,800 cfs Apr. 14, 1965; maximum gage height 29.52 ft Apr. 15, 1965 (from floodmark, backwater from Red River of the North); no flow for some days in 1948-49.

Remarks.--Records good except those for winter months, which are fair. Large part of high flow diverted into Marsh River basin at overflow section 3½ 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	183	118	83	130	60	49	4,080	2,340	441	165	125	216
2	199	133	84	126	60	49	3,960	2,060	414	155	133	194
3	205	118	86	123	61	50	3,730	1,870	394	154	165	181
4	186	111	88	117	62	49	3,400	1,700	369	161	204	178
5	176	117	90	113	63	49	3,010	1,550	365	148	200	167
6	171	116	92	108	64	48	2,560	1,430	357	155	176	158
7	166	116	95	104	65	48	2,100	1,310	361	143	160	147
8	171	111	100	102	65	47	1,800	1,200	335	135	143	137
9	170	105	104	97	66	47	1,640	1,110	325	142	138	123
10	166	102	108	95	66	48	1,540	1,020	304	136	135	112
11	163	98	112	92	65	51	1,480	941	312	136	127	113
12	157	94	115	90	64	57	1,440	875	320	134	118	107
13	148	92	117	88	63	68	1,430	839	329	129	129	108
14	140	89	118	86	61	96	1,390	818	327	119	138	112
15	138	87	120	84	58	160	1,360	797	329	103	185	97
16	136	85	122	81	56	279	1,350	789	305	102	258	94
17	140	82	124	79	54	600	1,310	801	286	93	312	92
18	136	84	126	77	51	1,080	1,270	787	250	89	282	91
19	153	83	130	75	48	1,600	1,240	756	232	84	251	84
20	181	82	134	74	46	2,160	1,220	738	219	78	241	76
21	214	82	137	72	45	2,850	1,180	714	204	74	256	78
22	229	81	141	70	45	3,650	1,220	694	211	72	270	73
23	212	81	140	69	46	3,450	1,360	673	219	70	291	58
24	194	81	139	67	46	3,400	1,420	670	197	68	315	55
25	188	81	138	66	47	3,410	1,440	666	221	66	364	50
26	168	81	138	64	47	3,480	1,480	673	222	92	353	46
27	160	81	137	62	48	3,560	1,690	630	214	165	316	46
28	146	81	136	60	49	3,670	2,130	602	205	190	288	46
29	145	81	135	60		3,810	2,630	556	195	181	266	44
30	138	82	134	60	-----	4,010	2,640	518	178	170	240	44
31	133	-----	133	60	-----	4,110	-----	472	-----	150	220	-----
Total	5,212	2,835	3,656	2,651	1,571	46,035	58,500	30,599	8,640	3,859	6,799	3,127
Mean	168	94.5	118	85.5	56.1	1,485	1,950	987	288	124	219	104
Max	205	133	141	130	66	4,110	4,080	2,340	441	190	364	216
Min	133	81	83	60	45	47	1,180	472	178	66	118	44
Ac-ft	10,340	5,620	7,250	5,260	3,120	91,310	116,000	60,690	17,140	7,650	13,490	6,200

Cal yr 1965: Total	139,133	Mean	381	Max	6,660	Min	18	Ac-ft	276,000
Wtr yr 1966: Total	173,484	Mean	475	Max	4,110	Min	44	Ac-ft	344,100

5-0645. 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 1966.

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.

Average discharge.--5 years, 2.036 cfs (1,474,000 acre-ft per year).

Extremes.--Maximum discharge during year, 26,800 cfs Mar. 27 (gage height, 35.35 ft, backwater from ice); minimum, 573 cfs Sept. 27 (gage height, 3.77 ft).
1936-37, 1942-66: Maximum discharge, that of Mar. 27, 1966; maximum gage height, that of Mar. 27, 1966; 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 the winter period, which are fair. Some regulation by many controlled lakes and reservoirs on tributaries.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,290	1,050	610	790	735	735	23,700	7,580	3,290	2,380	993	1,380
2	1,300	1,040	600	785	735	740	22,900	7,120	3,210	2,310	1,140	1,260
3	1,310	1,030	610	790	735	745	21,900	6,830	3,110	2,270	1,230	1,170
4	1,440	1,010	690	795	735	750	20,400	6,630	3,030	2,170	1,310	1,100
5	1,670	982	780	790	735	750	18,500	6,440	3,000	2,010	1,700	1,020
6	1,880	967	830	780	735	745	16,700	6,200	3,000	1,860	1,940	952
7	1,920	963	840	770	735	740	15,000	5,900	2,990	1,740	1,960	895
8	1,840	959	835	765	735	740	13,200	5,530	2,960	1,600	1,780	838
9	1,730	948	830	750	735	730	11,500	5,130	2,930	1,510	1,580	801
10	1,610	933	825	740	740	725	9,900	4,760	2,880	1,400	1,460	765
11	1,520	963	820	730	740	725	8,600	4,480	2,840	1,260	1,430	744
12	1,450	974	820	730	740	780	7,700	4,250	2,820	1,170	1,420	722
13	1,390	955	820	730	740	850	6,850	4,100	2,780	1,130	1,400	700
14	1,340	910	820	730	740	950	5,950	3,990	2,740	1,120	1,400	686
15	1,310	853	800	730	740	1,300	5,200	3,930	2,720	1,140	1,480	686
16	1,270	868	830	730	740	2,600	4,800	3,920	2,680	1,170	1,570	679
17	1,270	838	880	730	740	4,200	4,550	3,910	2,630	1,180	1,720	668
18	1,240	834	880	730	740	7,000	4,270	3,880	2,540	1,190	1,820	661
19	1,260	830	875	730	740	9,000	4,110	3,840	2,420	1,180	1,770	661
20	1,320	850	890	730	740	10,400	3,980	3,820	2,340	1,160	1,660	661
21	1,340	860	910	730	740	13,000	3,880	3,810	2,250	1,130	1,580	643
22	1,300	830	910	730	740	16,400	4,010	3,800	2,200	1,100	1,610	630
23	1,250	850	915	730	740	19,000	4,450	3,810	2,220	1,060	1,710	613
24	1,200	860	915	730	740	21,300	4,820	3,830	2,260	997	1,860	596
25	1,160	890	910	730	735	24,100	4,990	3,800	2,280	952	2,060	592
26	1,130	770	915	730	735	26,000	5,180	3,750	2,270	997	2,180	579
27	1,090	620	905	730	730	26,400	5,720	3,710	2,210	1,060	2,160	573
28	1,080	625	890	730	730	25,900	6,820	3,650	2,250	1,140	2,020	579
29	1,080	633	890	735		25,300	8,200	3,560	2,400	1,140	1,840	579
30	1,070	630	870	735	----------	25,200	8,280	3,470	2,440	1,110	1,660	579
31	1,060	----------	845	735	----------	24,500	----------	3,390	----------	1,040	1,500	----------
Total	42,120	26,325	25,760	23,100	20,645	292,305	286,060	142,820	79,690	42,676	50,943	23,012
Mean	1,359	878	831	745	737	9,429	9,535	4,607	2,656	1,377	1,643	767
Ac-ft	83,540	52,210	51,090	45,820	40,950	579,800	567,400	283,300	158,100	84,650	101,000	45,640

Calendar year 1965: Max 25,600 Min 225 Mean 2,311 Ac-ft 1,673,000
Water year 1965-66: Max 26,400 Min 600 Mean 2,892 Ac-ft 2,094,000

5-0675. Marsh River near Shelly, Minn.

Location.--Lat 47°24'45", long 96°45'50", in NE¼NW¼ sec.3, T.145 N., R.48 W., near center of span on downstream truss of bridge, 3¾ miles southeast of Shelly and 10 miles upstream from mouth.

Drainage area.--151 sq mi.

Records available.--March 1944 to September 1966. Monthly discharge only for March 1944, published in WSP 1308.

Gage.--Wire-weight gage read once or twice daily. Datum of gage is 841.14 ft above mean sea level, datum of 1929 (levels by Corps of Engineers). Prior to Oct. 1, 1965, chain gage at datum 3.0 ft higher. Oct. 1, 1965 to June 27, 1966, chain gage at same datum.

Average discharge.--22 years, 86.6 cfs (62,700 acre-ft per year).

Extremes.--Maximum discharge during year, 1,460 cfs Apr. 2 (gage height, 13.85 ft, from graph based on gage readings, backwater from Red River of the North); maximum gage height, 16.09 ft Mar. 23, backwater from ice; no flow for many days.

1944-66: Maximum discharge, 4,660 cfs May 11, 1950(gage height, 18.96 ft, from floodmark); no flow for many days most years.

Remarks.--Records fair. Large part of high flow of Wild Rice River diverted into Marsh River basin at overflow section 3½ 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	26	15	1.0	1.2	0	0	1,290	222	12	5.4	0.8	5.6
2	35	13	1.0	.8	0	0	1,400	179	11	5.7	.8	3.3
3	29	11	1.2	.6	0	0	1,260	139	10	7.0	.9	1.2
4	24	10	1.3	.5	.1	0	950	90	10	8.5	.8	1.2
5	18	9.9	1.4	.4	.2	0	650	77	11	7.0	1.7	6.0
6	19	6.0	1.6	.3	.2	0	350	68	11	6.3	7.0	7.2
7	22	5.8	1.8	.2	.3	0	195	67	14	3.2	3.0	8.8
8	20	5.6	2.5	.2	.3	0	142	56	13	2.6	1.6	8.8
9	20	5.2	3.2	.2	.3	0	119	43	11	4.4	1.0	8.1
10	19	4.9	3.5	.1	.2	0	99	39	10	4.7	.9	6.0
11	17	4.7	3.6	.1	.1	0	90	35	13	3.8	1.0	4.3
12	15	4.4	3.7	.1	.1	0	85	33	16	3.0	1.3	2.9
13	14	3.9	3.8	0	.1	0	77	30	15	2.0	1.8	2.0
14	13	3.8	3.9	0	0	2.0	77	29	13	1.5	2.3	1.0
15	12	3.9	4.0	0	0	8.0	77	30	14	1.2	3.8	.2
16	11	4.2	4.0	0	0	30	77	35	11	1.0	6.0	.1
17	17	4.4	4.1	0	0	95	76	14	11	.8	5.3	.1
18	26	4.7	4.1	0	0	190	75	11	8.8	.7	.8	.2
19	40	4.7	4.0	0	0	420	68	58	7.8	.4	.5	.2
20	63	4.7	3.8	0	0	850	63	51	6.7	.2	.4	.3
21	69	4.9	3.8	0	0	1,350	68	38	5.2	.1	.1	.3
22	55	5.0	4.1	0	0	1,240	91	28	4.8	0	.1	.3
23	41	4.4	3.2	0	0	940	106	25	7.4	0	1.2	.2
24	38	4.1	2.8	0	0	895	102	26	8.4	0	1.6	.1
25	34	3.8	2.5	0	0	840	97	27	9.2	0	2.0	.2
26	30	3.5	2.4	0	0	770	91	24	8.5	.2	1.6	.2
27	28	3.1	2.2	0	0	720	98	22	7.7	.7	1.0	.1
28	24	1.8	1.9	0	0	740	194	20	7.4	1.2	.6	.1
29	21	1.4	1.5	0		840	339	17	6.1	.8	.3	.2
30	18	1.0	1.3	0	- - - - -	1,000	339	15	5.7	.6	.7	.5
31	16	- - - - -	1.2	0	- - - - -	1,140	- - - - -	13	- - - - -	.9	1.8	- - - - -
Total	834	162.8	84.4	4.7	1.9	12,070	8,745	1,561	299.7	73.9	52.7	69.7
Mean	26.9	5.43	2.72	0.15	0.07	389	292	50.4	9.99	2.38	1.70	2.32
Max	69	15	4.1	1.2	0.3	1,350	1,400	222	16	8.5	7.0	8.8
Min	11	1.0	1.0	0	0	0	63	11	4.8	0	0.1	0.1
Ac-ft	1,654	323	167	9.3	3.8	23,940	17,340	3,100	594	146	104	138

Cal yr 1965: Total 20,848.3 Mean 57.1 Max 2,950 Min 0 Ac-ft 41,350
Wtr yr 1966: Total 23,959.8 Mean 65.6 Max 1,400 Min 0 Ac-ft 47,520

5-0690. Sandhill River at Climax, Minn.

Location.--Lat 47°36'10", long 96°47'40", in SE¼SE¼ 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 1966 (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.--20 years (1946-66), 64.5 cfs (46,700 acre-ft per year).

Extremes.--Maximum discharge during year, 4,220 cfs Apr. 2 (gage height, 17.33 ft, from graph based on gage readings); minimum, 13 cfs Sept. 23 (gage height, 1.30 ft).
1943-66: Maximum discharge, 4,560 cfs Apr. 14, 1965 (gage height 17.81 ft); minimum not determined.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	90	45	30	26	14	19	3,350	627	72	41	19	42
2	76	44	30	25	14	19	4,120	578	70	39	25	45
3	74	40	31	24	14	20	3,620	342	64	44	18	39
4	71	38	32	24	14	20	2,860	270	59	49	17	35
5	66	37	33	23	15	20	2,180	258	66	36	16	30
6	61	38	33	22	15	21	1,560	251	84	32	18	26
7	73	34	34	21	16	21	1,050	238	80	30	20	26
8	72	28	35	21	16	21	736	220	69	27	18	24
9	69	26	35	20	17	22	639	202	67	30	20	23
10	67	25	36	20	17	23	567	190	60	32	21	21
11	62	25	36	19	17	24	515	181	80	28	20	20
12	57	26	36	19	17	25	466	172	87	24	19	18
13	54	28	36	18	18	27	424	165	81	23	19	22
14	54	31	36	18	17	33	402	159	81	22	29	22
15	53	32	35	18	17	51	382	157	90	21	40	22
16	51	32	35	17	17	86	354	163	96	20	29	20
17	59	32	35	17	17	157	344	155	92	19	22	19
18	60	31	35	17	16	302	321	145	71	18	20	18
19	85	31	34	16	16	268	290	136	62	16	21	18
20	119	31	34	16	16	260	271	132	48	15	24	17
21	100	31	33	15	16	286	265	128	44	14	28	17
22	82	32	33	15	16	333	274	124	43	14	42	15
23	84	33	32	15	16	253	277	127	47	15	58	13
24	84	33	32	15	16	370	266	126	51	14	55	14
25	83	32	31	15	17	559	260	120	74	16	42	16
26	84	32	31	15	17	584	262	114	70	24	33	15
27	82	31	30	14	17	800	268	110	65	43	32	14
28	75	31	29	14	18	1,100	395	103	58	26	31	14
29	63	30	28	14		1,500	686	92	52	19	32	16
30	58	30	28	14	- - - - -	2,000	634	82	48	15	34	16
31	51	- - - - -	27	14	- - - - -	2,700	- - - - -	76	- - - - -	14	37	- - - - -
Total	2,219	969	1,015	561	453	11,924	28,038	5,943	2,031	780	859	657
Mean	71.6	32.3	32.7	18.1	16.2	385	935	192	67.7	25.2	27.7	21.9
Max	119	45	36	26	18	2,700	4,120	627	96	49	58	45
Min	51	25	27	14	14	19	260	76	43	14	16	13
Ac-ft	4,400	1,920	2,010	1,110	898	23,650	55,610	11,790	4,030	1,550	1,700	1,300

Cal yr 1965:	Total	43,994	Mean	120	Max	4,360	Min	8.0	Ac-ft	87,260
Wtr yr 1966:	Total	55,449	Mean	152	Max	4,120	Min	13	Ac-ft	110,000

5-0740. 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 1966 (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, 6.92 ft May 28 (affected by wind action); maximum daily, 6.80 ft May 27; minimum, 4.46 ft Nov. 3 (affected by wind action).
1930-66: 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 1965 to September 1966

Oct. 31.....5.22	Feb. 28.....5.04	June 30.....6.38
Nov. 30.....5.31	Mar. 31.....5.33	July 31.....6.11
Dec. 31.....5.26	Apr. 30.....6.49	Aug. 31.....6.23
Jan. 31.....5.11	May 31.....6.75	Sept.30.....5.68

Note.--Mean daily gage heights are available.

GPO 803-695-4

5-0745. 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 1966. 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.--33 years, 420 cfs (304,100 acre-ft per year).

Extremes.--Maximum daily discharge during year, 1,480 cfs May 19; maximum gage height, 7.18 ft Aug. 17 (affected by backwater from aquatic vegetation); minimum daily discharge, 68 cfs Mar. 22, 23.
1933-66: 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.
Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	830	893	1,030	990	960	910	78	574	1,240	1,100	808	1,020
2	811	900	1,030	990	960	910	79	606	1,260	1,100	804	1,020
3	826	923	1,020	990	960	910	81	833	1,250	1,140	796	1,020
4	826	961	1,010	990	960	910	82	1,320	1,240	1,140	811	1,010
5	833	968	1,010	990	950	900	84	1,380	1,240	1,120	826	1,010
6	837	980	1,000	1,000	950	900	86	1,380	1,240	1,100	867	1,020
7	837	984	1,010	1,000	950	900	88	1,360	1,230	1,090	911	1,010
8	837	988	1,010	1,000	950	900	89	1,360	1,220	1,080	893	1,020
9	848	984	1,000	1,000	950	900	90	1,370	1,220	1,100	885	1,020
10	844	992	1,000	1,000	950	900	91	1,360	1,210	1,080	874	1,030
11	841	992	990	1,000	940	900	92	1,370	1,200	1,080	870	1,040
12	844	1,010	990	1,000	940	900	93	1,360	1,180	1,090	870	1,030
13	844	999	990	1,000	940	900	94	1,360	1,160	1,090	961	1,040
14	852	1,000	990	1,000	940	900	95	1,340	1,150	1,070	976	1,050
15	856	1,000	990	1,000	940	900	97	1,350	1,130	1,060	980	1,060
16	852	1,000	990	1,000	930	825	98	1,360	1,120	1,040	976	1,070
17	870	1,000	980	1,000	930	600	100	1,350	1,120	1,030	976	1,090
18	882	1,000	980	990	930	440	200	1,400	1,100	1,020	972	1,110
19	893	1,000	980	980	930	300	357	1,480	1,100	992	972	1,110
20	911	880	980	980	930	200	416	1,440	1,090	968	980	1,110
21	904	690	980	980	930	130	564	1,390	1,090	946	988	1,110
22	904	760	980	980	920	68	598	1,360	1,100	934	999	1,100
23	908	870	980	980	920	68	616	1,340	1,100	919	984	1,100
24	893	900	980	980	920	69	651	1,340	1,100	908	972	1,100
25	904	950	980	970	920	70	616	1,320	1,120	904	976	1,090
26	900	1,000	980	970	920	71	564	1,300	1,100	900	980	1,090
27	904	1,020	990	970	920	72	525	1,300	1,100	885	976	1,080
28	896	1,030	990	970	910	73	666	1,280	1,100	867	976	1,080
29	896	1,030	990	970		74	609	1,280	1,100	848	988	1,090
30	900	1,030	990	970	- - - - -	75	598	1,270	1,090	815	988	1,090
31	904	- - - - -	990	960	- - - - -	76	- - - - -	1,260	- - - - -	811	999	- - - - -
Total	26,887	28,734	30,810	30,600	26,250	16,751	8,497	39,793	34,700	31,227	28,834	31,820
Mean	867	958	994	987	938	540	283	1,284	1,157	1,007	930	1,061
Max	911	1,030	1,030	1,000	960	910	666	1,480	1,260	1,140	999	1,110
Min	811	690	980	960	910	68	78	574	1,090	811	796	1,010
Ac-ft	53,330	56,990	61,110	60,690	52,070	33,230	16,850	78,930	68,830	61,940	57,190	63,110

Calendar yr 1965:	Total	248,605	Mean	681	Max	1,030	Min	9	Ac-ft	493,100
Water yr 1966:	Total	334,903	Mean	918	Max	1,480	Min	68	Ac-ft	664,270

5-0750. 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 1966. 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.--37 years, 444 cfs (321,400 acre-ft per year).

Extremes.--Maximum discharge during year, 3,340 cfs Apr. 3 (gage height, 12.68 ft); minimum daily, 300 cfs Mar. 28.

1929-66: 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 winter months, which are fair. Flow regulated by outlet dam on Lower Red Lake.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	983	1,080	1,070	1,020	950	990	1,800	1,690	1,400	1,070	812	1,160
2	967	1,080	1,060	1,020	950	990	2,560	1,670	1,390	1,070	814	1,180
3	946	1,070	1,060	1,010	950	990	3,250	1,800	1,350	1,110	812	1,180
4	942	1,060	1,050	1,000	950	970	2,990	1,770	1,340	1,130	804	1,170
5	946	1,090	1,050	1,000	960	960	2,460	1,850	1,370	1,120	824	1,150
6	962	1,110	1,050	990	960	950	1,920	1,850	1,400	1,090	896	1,140
7	965	1,120	1,040	990	960	950	1,630	1,850	1,390	1,070	952	1,140
8	954	1,130	1,040	990	970	950	1,570	1,790	1,360	1,070	975	1,130
9	952	1,110	1,040	990	970	960	1,470	1,760	1,330	1,100	975	1,130
10	954	1,090	1,020	980	970	970	1,360	1,730	1,310	1,100	970	1,120
11	954	1,080	1,010	980	970	990	1,360	1,710	1,290	1,100	959	1,130
12	957	1,060	1,010	980	980	1,010	1,400	1,690	1,270	1,080	946	1,130
13	959	1,020	1,010	980	980	1,060	1,420	1,660	1,240	1,060	996	1,130
14	967	990	1,000	980	980	1,090	1,430	1,650	1,210	1,050	1,060	1,140
15	972	940	1,000	970	980	1,140	1,450	1,700	1,200	1,030	1,090	1,140
16	980	880	1,000	970	980	1,250	1,360	1,750	1,190	1,010	1,090	1,130
17	1,000	660	1,000	970	970	1,410	1,230	1,710	1,180	991	1,080	1,130
18	1,020	750	1,000	970	960	1,650	1,090	1,680	1,170	972	1,070	1,130
19	1,230	880	1,000	970	960	1,580	1,090	1,690	1,170	949	1,070	1,130
20	1,240	850	1,000	970	960	1,500	1,110	1,760	1,160	936	1,080	1,130
21	1,210	880	1,000	970	960	1,600	1,240	1,780	1,150	922	1,100	1,130
22	1,180	880	1,000	970	960	1,450	1,420	1,750	1,150	902	1,220	1,130
23	1,160	840	1,000	970	960	710	1,480	1,690	1,150	882	1,290	1,130
24	1,150	860	1,000	970	970	440	1,510	1,640	1,140	867	1,280	1,130
25	1,140	920	1,000	970	970	400	1,470	1,590	1,130	864	1,250	1,130
26	1,130	1,000	980	960	970	350	1,420	1,560	1,110	876	1,220	1,130
27	1,120	1,080	960	960	980	310	1,400	1,530	1,090	874	1,180	1,140
28	1,120	1,080	960	960	980	300	1,440	1,520	1,080	867	1,170	1,140
29	1,110	1,070	980	950		380	1,600	1,490	1,080	852	1,150	1,140
30	1,090	1,070	1,010	950	- - - - -	600	1,760	1,450	1,080	836	1,140	1,150
31	1,090	- - - - -	1,020	950	- - - - -	1,120	- - - - -	1,420	- - - - -	814	1,140	- - - -
Total	32,350	29,730	31,420	30,310	27,060	30,020	48,690	52,180	36,880	30,664	32,415	34,170
Mean	1,044	991	1,014	978	966	968	1,623	1,683	1,229	989	1,046	1,139
Max	1,240	1,130	1,070	1,020	980	1,650	3,250	1,850	1,400	1,130	1,290	1,180
Min	942	660	960	950	950	300	1,090	1,420	1,080	814	804	1,120
Ac-ft	64,170	58,970	62,320	60,120	53,670	59,540	96,580	103,500	73,150	60,820	64,290	67,780

Cal yr 1965 Total 289,967 Mean 794 Max 2,680 Min 526 Ac-ft 575,150
Wtr yr 1966: Total 415,889 Mean 1,139 Max 3,250 Min 300 Ac-ft 824,900

5-0760. 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 1966. 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.--49 years, 142 cfs (102,800 acre-ft per year).

Extremes.--Maximum discharge during year, 3,320 cfs Apr. 3 (gage height, 15.66 ft, backwater from ice); minimum daily, 6.4 cfs Feb. 20, 21.
1909-17, 1919-26, 1928-66: 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 winter months, which are fair. Some regulation by Thief and Mud Lakes. Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	452	516	150	64	16	7.0	1,150	2,880	925	221	257	150
2	378	504	142	63	16	6.9	1,890	2,910	898	175	247	185
3	330	486	134	60	15	6.8	3,160	2,930	852	162	247	273
4	301	475	128	58	14	6.7	3,080	2,840	836	175	239	270
5	281	475	124	56	14	6.7	2,970	2,730	822	223	239	265
6	278	519	118	54	13	6.6	2,900	2,610	824	242	299	265
7	301	472	114	52	13	6.6	2,860	2,540	809	291	360	262
8	338	457	110	50	13	6.7	2,860	2,460	790	273	564	257
9	429	474	107	49	12	6.9	2,900	2,380	768	357	516	255
10	423	489	104	48	12	7.0	2,980	2,280	736	426	412	247
11	401	456	103	47	12	7.2	3,010	2,180	729	384	344	247
12	395	310	101	46	12	7.4	3,050	2,080	813	338	317	242
13	384	252	99	45	11	7.7	3,020	1,940	809	301	398	239
14	381	300	97	44	11	8.0	3,000	1,780	777	291	660	239
15	370	320	94	43	9.5	8.3	2,970	1,670	739	273	606	239
16	368	312	92	42	8.6	8.7	2,950	1,740	694	265	472	226
17	446	300	90	41	7.6	9.2	2,960	1,690	660	257	392	145
18	564	290	87	40	7.0	9.7	2,930	1,580	636	252	370	136
19	819	282	85	39	6.6	10	2,870	1,540	594	249	327	133
20	1,060	272	84	39	6.4	12	2,880	1,660	579	247	281	131
21	912	260	81	37	6.4	37	2,870	1,650	582	242	255	128
22	787	250	80	35	6.5	90	2,880	1,570	567	239	270	119
23	764	240	78	32	6.6	250	2,880	1,480	561	226	320	51
24	701	228	76	30	6.7	550	2,890	1,400	540	223	322	57
25	645	216	75	28	6.8	610	2,850	1,310	335	236	283	36
26	609	204	73	25	6.9	640	2,810	1,230	286	304	249	19
27	582	192	72	23	7.0	635	2,770	1,140	255	346	216	12
28	555	182	71	21	7.0	630	2,760	968	247	341	188	10
29	537	170	69	20		650	2,810	991	244	304	168	10
30	525	160	67	18	- - - - -	680	2,900	984	231	278	155	9.5
31	522	- - - - -	66	17	- - - - -	790	- - - - -	964	- - - - -	265	148	- - - - -
Total	15,838	10,063	2,971	1,266	283.6	5,718.1	84,810	58,107	19,143	8,406	10,121	4,857.5
Mean	511	335	95.8	40.8	10.1	184	2,827	1,874	638	271	326	162
Max	1.060	516	150	64	16	790	3,160	2,930	925	426	660	273
Min	278	160	66	17	6.4	6.6	1,150	964	231	162	148	9.5
Ac-ft	31,410	19,960	5,890	2,510	563	11,340	168,200	115,300	37,970	16,670	20,070	9,630

Cal yr 1965: Total 176,116 Mean 483 Max 3,840 Min 0.1 Ac-ft 349.300
Wtr yr 1966: Total 221,584.2 Mean 607 Max 3,160 Min 6.4 Ac-ft 439,500

5-0777. Ruffy Brook near Gonvick, Minn.

Location.--Lat 47°44'50", long 95°24'45", on line between secs. 5 and 8, T.149 N., R.37 W., on downstream side of bridge on County Highway 17, 4 miles upstream from mouth, and 4¾ miles east of Gonvick.

Drainage area.--45.2 sq mi.

Records available.--April 1960 to September 1966. Monthly and daily figures for April 1, 1960 to June 30, 1960 published in WSP 1913.

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.

Average discharge.--6 years, 15.7 cfs.

Extremes.--Maximum discharge during year, 265 cfs Apr. 2 (gage height, 5.53 ft, from graph based on gage readings, backwater from ice); maximum gage height, 6.10 ft Apr. 1 (from graph based on gage readings, backwat from ice); minimum discharge, 0.3 cfs July 24 (gage height, 1.09 ft).
1960-66: Maximum discharge, 412 cfs Apr. 13, 1965 (gage height, 6.38 ft); minimum, that of July 24, 1966; minimum gage height, 1.09 ft Aug. 20, 1964, July 24, 1966.

Remarks.--Records good except those for winter months, which are fair.
Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9.5	7.0	4.8	4.7	3.5	2.6	230	68	7.6	3.4	1.8	8.2
2	8.7	7.0	4.8	4.6	3.4	2.6	258	75	7.6	3.0	1.8	7.9
3	6.8	6.5	4.8	4.6	3.4	2.5	230	69	7.4	7.4	1.8	7.6
4	6.0	6.0	4.9	4.5	3.3	2.5	183	63	6.6	5.4	1.8	6.4
5	5.5	8.7	4.9	4.5	3.3	2.4	146	54	7.4	4.1	2.2	5.4
6	5.0	5.5	4.9	4.5	3.2	2.4	123	54	9.3	4.1	5.7	4.5
7	5.8	5.5	5.0	4.4	3.2	2.4	111	49	9.3	4.1	17	3.7
8	5.8	4.5	5.0	4.3	3.1	2.5	106	45	7.9	3.2	8.8	3.2
9	5.8	4.5	5.0	4.3	3.1	2.5	78	37	7.9	4.1	4.5	2.8
10	6.2	4.2	5.0	4.3	3.0	2.6	69	30	6.6	6.2	3.7	2.8
11	6.5	4.2	5.0	4.3	2.9	2.6	70	26	6.6	5.2	3.0	2.6
12	6.5	4.4	4.9	4.3	2.8	2.8	73	23	6.6	5.0	3.7	2.0
13	5.5	4.6	4.9	4.3	2.7	4.0	84	23	6.6	4.3	94	2.6
14	5.5	4.7	4.9	4.3	2.6	17	98	22	7.1	2.0	66	2.0
15	5.5	4.7	4.9	4.3	2.5	28	111	26	7.4	2.0	35	2.0
16	5.5	4.7	4.9	4.3	2.5	38	118	32	12	1.8	22	1.6
17	6.5	4.8	4.8	4.3	2.4	45	133	27	7.1	1.8	18	1.6
18	8.4	4.8	4.8	4.3	2.4	43	124	26	5.7	1.4	17	1.6
19	8.7	4.8	4.8	4.2	2.3	40	111	31	5.0	1.2	16	1.6
20	29	4.8	4.8	4.2	2.3	38	97	33	4.1	1.0	18	1.4
21	27	4.8	4.8	4.2	2.3	40	98	37	4.1	0.8	47	1.4
22	23	4.8	4.8	4.1	2.3	62	105	36	5.9	0.6	54	1.2
23	32	4.9	4.8	4.0	2.3	100	113	30	6.2	0.8	44	1.4
24	17	4.9	4.8	4.0	2.4	98	121	29	6.2	3.2	23	1.6
25	11	4.9	4.7	3.8	2.5	80	105	23	9.3	43	15	1.2
26	10	4.9	4.7	3.8	2.5	60	93	16	7.9	7.1	11	1.6
27	11	4.9	4.7	3.8	2.6	46	98	16	6.2	2.8	9.9	1.6
28	8.7	4.9	4.7	3.6	2.6	51	99	13	5.4	1.6	8.8	1.8
29	8.7	4.9	4.7	3.6		62	87	13	3.9	1.6	8.2	2.4
30	8.1	4.8	4.7	3.6	-----	110	74	7.6	3.9	1.0	7.9	2.4
31	7.6	-----	4.7	3.5	-----	169	-----	7.6	-----	1.0	7.9	----
Total	316.8	154.6	149.9	129.5	77.4	1,161.4	3,546	1,041.2	204.8	134.2	578.5	88.1
Mean	10.2	5.15	4.84	4.18	2.76	37.5	118	33.6	6.83	4.33	18.7	2.94
Max	32	8.7	5.0	4.7	3.5	169	258	75	12	43	94	8.2
Min	5.0	4.2	4.7	3.5	2.3	2.4	69	7.6	3.9	0.6	1.8	1.2
Ac-ft	628	307	297	257	154	2,300	7,030	2,070	406	266	1,150	175

Cal yr1965:	Total	7,070.3	Mean	19.4	Max	398	Min	1.5	Ac-ft	14,026
Wtr yr1966:	Total	7,582.4	Mean	20.8	Max	258	Min	0.6	Ac-ft	15,040

Peak discharge (base, 65 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-24	2100	5.88	110	4-17	1200	3.58	138
4-2	0900	5.53	265	8-13	0400	3.84	149

5-0780. 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 1966.

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.--27 years, 173 cfs (125,200 acre-ft per year).

Extremes.--Maximum discharge during year, 2,000 cfs Apr. 3 (gage height, 10.73 ft, backwater from ice); maximum gage height, 11.12 ft Apr. 2 (backwater from ice); minimum discharge, 42 cfs July 25 (gage height, 2.50 ft).

1939-66: Maximum discharge, 3,640 cfs June 9, 1962 (gage height, 11.90 ft); maximum gage height, 11.97 ft Apr. 11, 1965 (backwater from ice); minimum discharge, 7.9 cfs July 8, 1940.

Remarks.--Records good except those for period of no gage-height record and those for winter months, which are fair. Slight regulation by Clearwater Lake.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	265	129	76	71	62	55	1,600	1,340	192	72	55	239
2	238	123	75	70	62	56	1,920	1,300	182	64	54	229
3	196	121	75	70	62	57	1,980	1,250	167	64	66	220
4	161	115	75	70	62	57	1,930	1,180	160	70	55	201
5	144	106	75	70	61	55	1,820	1,020	158	77	64	188
6	160	103	75	69	61	53	1,860	800	168	70	66	178
7	174	100	76	68	61	52	1,780	700	178	65	76	170
8	161	97	76	68	60	52	1,680	580	160	63	120	160
9	150	81	77	68	59	54	1,600	510	149	74	137	137
10	139	65	78	67	58	55	1,490	454	142	92	119	120
11	129	78	78	67	57	57	1,380	411	140	89	106	113
12	118	85	78	66	56	62	1,310	368	149	87	98	110
13	112	72	77	66	56	78	1,290	342	144	86	108	108
14	108	80	77	66	55	110	1,310	323	136	74	218	107
15	103	92	76	66	54	165	1,330	331	131	77	364	104
16	100	95	76	65	53	195	1,350	393	120	72	397	98
17	192	93	75	65	53	215	1,310	388	112	63	355	92
18	279	91	75	64	53	245	1,250	364	106	61	306	88
19	690	90	74	64	52	280	1,100	355	100	58	263	86
20	718	88	74	64	52	320	1,030	375	94	54	245	80
21	570	87	74	64	52	390	1,000	377	91	52	239	68
22	440	86	73	64	52	460	980	353	90	50	256	64
23	357	86	73	64	52	505	1,040	331	91	47	342	58
24	291	85	73	63	52	540	1,080	327	92	47	425	55
25	253	85	72	63	53	560	1,100	312	100	45	441	54
26	221	84	72	63	53	560	1,050	285	101	51	402	53
27	192	84	72	62	54	560	1,020	261	106	47	353	53
28	171	82	71	62	54	550	1,300	252	94	50	318	53
29	156	80	71	62		550	1,430	241	87	51	287	54
30	150	77	71	62	------	630	1,400	217	83	57	260	55
31	137	------	71	62	------	860	------	198	------	55	245	------
Total	7,275	2,740	2,311	2,035	1,571	8,438	41,720	15,938	3,823	1,984	6,840	3,395
Mean	235	91.3	74.5	65.6	56.1	272	1,391	514	127	64.0	221	113
Ac-ft	14,430	5,430	4,580	4,040	3,120	16,740	82,750	31,610	7,580	3,940	13,570	6,730

Calendar year 1965: Max 3,480 Min 31 Mean 255 Ac-ft 184,900
Water year 1965-66: Max 1,980 Min 45 Mean 269 Ac-ft 194,500

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10-20	0200	6.08	754	4-29	Unknown	8.14	1,450
4-3	1800	10.73	2,000	Or 30			

5-0782.3 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.--April 1960 to September 1966. Monthly and daily figures for April 1, 1960 to June 30, 1960 published in WSP 1913.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,126.94 ft above mean sea level, adjustment of 1912 (levels by Corps of Engineers). Prior to Sept. 9, 1960, reference points at same site at datum 8.00 ft higher. September 9, 1960 to Sept. 30, 1964, wire-weight gage at same site at datum 8.00 ft higher.

Average discharge.--6 years, 80.8 cfs (58,500 acre-ft per year).

Extremes.--Maximum discharge during year, 2,240 cfs Apr. 2 (gage height, 12.60 ft, from graph based on gage readings); minimum, 2.2 cfs July 19; minimum gage height, 2.05 ft Aug. 3.

1960-66: Maximum discharge, that of Apr. 2, 1966; no flow Feb. 16 to Mar. 21, 1963, Feb. 15 to Mar 2, 1964.

Maximum stage known since at least 1897, 18.39 ft Apr. 21, 1950 (present datum), from floodmarks (discharge, 2,790 cfs).

Remarks.--Records good except those for winter months, which are fair.

Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	65	53	26	13	2.8	2.9	2,060	535	62	10	5.0	31
2	65	55	26	12	2.8	2.9	2,110	523	60	8.2	4.0	22
3	54	54	26	11	2.9	2.9	1,860	456	56	17	2.8	21
4	37	49	27	10	2.9	2.8	1,570	385	51	31	3.7	21
5	41	44	28	9.6	3.0	2.8	1,200	346	70	24	9.1	19
6	46	46	28	9.1	3.0	2.7	973	290	7.3	17	15	16
7	41	44	29	8.8	3.1	2.6	743	259	70	12	20	13
8	39	43	29	8.4	3.1	2.7	645	235	65	6.8	20	12
9	31	39	29	8.2	3.1	2.7	558	211	56	17	18	11
10	30	37	28	8.0	3.2	2.9	500	197	51	13	15	11
11	29	36	28	7.8	3.1	3.1	482	182	49	11	15	11
12	33	35	27	7.5	2.9	3.5	502	173	65	12	12	11
13	23	34	26	7.2	2.8	4.2	510	165	62	12	30	11
14	21	33	25	7.0	2.7	7.0	520	157	51	11	88	12
15	20	33	24	6.8	2.5	11	510	175	46	8.2	142	12
16	21	32	23	6.6	2.5	18	496	222	40	4.6	116	8.6
17	23	31	22	6.3	2.4	24	521	204	37	4.0	80	8.2
18	30	31	21	6.1	2.3	30	492	187	30	4.6	52	6.3
19	80	30	21	5.8	2.3	35	450	183	20	2.2	30	7.7
20	189	30	21	5.4	2.3	41	507	182	15	3.0	19	9.1
21	183	30	20	4.9	2.3	48	458	175	14	5.3	15	9.1
22	176	30	20	4.5	2.3	54	465	150	14	5.0	25	6.3
23	135	30	19	4.0	2.3	68	516	145	15	5.3	32	6.3
24	124	30	19	3.6	2.4	78	539	140	16	4.0	38	5.6
25	93	29	18	3.3	2.5	83	507	133	19	8.6	42	5.3
26	82	28	17	3.0	2.6	84	464	116	26	6.8	30	5.0
27	75	28	16	2.9	2.7	83	459	97	21	6.3	26	5.0
28	66	27	15	2.7	2.8	81	489	86	16	6.0	23	6.3
29	64	26	15	2.7		85	648	77	16	6.0	17	15
30	64	26	15	2.7	- - - - -	400	590	73	10	6.0	14	5.3
31	61	- - - - -	14	2.7	- - - - -	1,230	- - - - -	65	- - - - -	5.3	13	- - - - -
Total	2,041	1,073	702	201.6	75.6	2,498.7	22,344	6,524	1,196	293.2	971.6	343.1
Mean	65.8	35.8	22.6	6.5	2.7	80.6	744	210	39.8	9.4	31.3	11.4
Max	189	55	29	13	3.2	1,230	2,110	535	73	31	142	31
Min	20	26	14	2.7	2.3	2.6	450	65	10	2.2	2.8	5.0
Ac-ft	4,050	2,130	1,390	400	150	4,960	44,320	12,940	2,370	582	1,930	680

Cal yr 1965:	Total	37,189.2	Mean	102	Max	1,600	Min	1.4	Ac-ft	73,760
Wtr yr 1966:	Total	38,263.8	Mean	104	Max	2,110	Min	2.2	Ac-ft	75,890

5-0785. 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 1966. 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.--40 years, 298 cfs (215,700 acre-ft per year).

Extremes.--Maximum discharge during year, 8,920 cfs Apr. 3 (gage height, 11.02 ft); minimum 65 cfs July 25, 26, (gage height 1.97 ft).
1909-17, 1934-66: 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 winter months, which are fair. Flight regulation by Clearwater Lake and several smaller lakes.
Records of chemical analyses for the water year 1966 are published in part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	713	298	150	125	84	74	6,400	3,160	409	162	74	335
2	560	280	150	122	84	76	7,790	3,040	388	150	74	316
3	438	267	152	122	84	76	8,710	2,910	355	157	73	312
4	363	257	158	122	84	74	7,380	2,780	328	166	76	287
5	305	251	160	120	82	72	5,670	2,380	328	178	78	264
6	283	236	160	120	82	72	4,200	2,010	351	166	76	251
7	335	233	160	117	82	70	3,200	1,780	392	150	102	242
8	347	228	158	115	82	70	2,910	1,460	380	132	119	228
9	308	200	158	112	82	70	2,780	1,280	355	134	143	208
10	283	165	158	110	82	70	2,700	1,180	328	137	155	183
11	254	180	158	108	82	72	2,650	1,070	328	130	141	169
12	233	195	155	105	80	76	2,600	993	380	128	128	162
13	222	132	152	105	78	78	2,570	926	351	126	155	155
14	210	115	150	102	76	82	2,640	867	347	123	166	155
15	202	150	150	102	74	88	2,700	892	316	111	367	150
16	196	160	148	100	72	110	2,780	944	280	108	516	148
17	334	165	144	100	70	140	2,690	1,000	251	104	520	143
18	611	160	140	98	70	155	2,630	938	222	96	442	134
19	1,500	155	140	96	68	180	2,460	890	210	90	376	130
20	1,850	155	137	94	66	240	2,230	878	194	84	332	126
21	1,410	155	135	92	66	400	2,180	878	178	76	316	123
22	1,100	160	132	92	66	680	2,150	838	176	73	343	113
23	878	165	132	90	66	810	2,180	780	181	71	396	108
24	719	165	130	90	66	870	2,340	747	178	69	524	108
25	606	165	130	88	68	920	2,410	713	216	67	588	104
26	529	160	130	88	68	950	2,280	665	213	69	574	100
27	459	158	128	88	70	960	2,220	616	210	82	516	98
28	409	155	125	86	70	960	3,200	565	205	86	455	96
29	367	152	125	86		950	3,590	529	186	86	405	94
30	339	152	125	84	----------	1,300	3,500	489	174	82	363	92
31	320	----------	125	84	----------	2,000	----------	447	----------	80	335	----------
Total	16,683	5,569	4,455	3,163	2,104	12,745	103,740	33,645	8,410	3,473	8,928	5,134
Mean	538	186	144	102	75.1	411	3,458	1,247	280	112	288	171
Ac-ft	33,090	11,050	8,840	6,270	4,170	25,280	205,760	76,650	16,680	6,890	17,710	10,180

Calendar year 1965: Max 7,860 Min 45 Mean 587 Ac-ft 424,800
Water year 1965-66: Max 8,710 Min 66 Mean 584 Ac-ft 422,600

5-0790. Red Lake River at Crookston, Minn.

Location.--Lat 47°46'32", long 96°36'33", in SW¼SW¼ 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, 0.6 mile downstream from bridge on State Highway 81, and 53 miles above mouth.

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

Records available.--May 1901 to September 1966. 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.--Digital 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, graphic water-stage recorder, Oct. 1, 1919 to Sept. 30, 1930, chain gage and Oct. 1, 1930, to June 10, 1965, graphic water-stage recorder, at present site and datum.

Average discharge.--65 years, 1,026 cfs (742,800 acre-ft per year).

Extremes.--Maximum discharge during year, 21,500 cfs Apr. 3 (gage height, 24.41 ft); minimum, 808 cfs July 22 (gage height, 4.65 ft).
1901-66: Maximum discharge, 27,400 cfs May 7, 1950 (gage height, 25.70 ft); maximum gage height, 25.82 ft Apr. 12, 1965 (backwater from ice); no flow for part of July 13, 1960 (caused by regulation of power-plant upstream).

Remarks.--Records good except those for period of no gage-height record or winter months, which are fair. Diurnal fluctuation caused by powerplant upstream.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	2,530	2,060	1,230	1,130	1,060	1,010	9,480	9,400	2,930	1,550	1,170	1,64
2	2,600	2,020	1,300	1,160	1,050	1,020	16,500	8,960	2,800	1,510	1,100	1,62
3	2,270	1,990	1,360	1,160	1,050	1,040	19,900	9,130	2,830	1,490	1,090	1,64
4	1,960	1,940	1,400	1,140	1,050	1,060	19,400	8,790	2,720	1,550	1,080	1,75
5	1,780	1,880	1,430	1,130	1,050	1,060	17,900	7,890	2,670	1,550	1,090	1,76
6	1,670	1,870	1,440	1,120	1,040	1,050	17,000	7,170	2,710	1,640	1,080	1,72
7	1,690	1,950	1,440	1,130	1,040	1,030	15,400	6,500	2,750	1,580	1,240	1,69
8	1,770	1,910	1,400	1,140	1,040	1,030	12,700	6,120	2,760	1,570	1,440	1,65
9	1,780	1,890	1,390	1,140	1,040	1,040	10,700	5,710	2,680	1,560	1,660	1,62
10	1,860	1,770	1,370	1,130	1,030	1,070	9,810	5,480	2,600	1,620	1,840	1,61
11	1,810	1,870	1,340	1,120	1,030	1,100	9,300	5,240	2,560	1,800	1,700	1,57
12	1,740	1,950	1,300	1,110	1,030	1,160	8,950	5,040	2,730	1,760	1,550	1,55
13	1,690	1,860	1,270	1,100	1,030	1,200	8,690	4,820	2,950	1,640	1,550	1,56
14	1,670	1,160	1,240	1,090	1,030	1,260	8,660	4,650	2,860	1,510	1,640	1,58
15	1,630	967	1,220	1,080	1,030	1,320	8,650	4,470	2,730	1,430	2,200	1,57
16	1,620	940	1,200	1,070	1,030	1,380	8,590	4,400	2,580	1,360	2,420	1,56
17	1,710	920	1,170	1,060	1,040	1,430	8,380	4,640	2,420	1,330	2,350	1,57
18	2,250	900	1,160	1,050	1,050	1,500	8,120	4,610	2,300	1,290	2,160	1,50
19	3,030	880	1,140	1,040	1,060	1,530	7,610	4,340	2,190	1,240	1,970	1,42
20	4,820	865	1,120	1,030	1,060	1,550	7,050	4,250	2,110	1,190	1,870	1,42
21	4,970	860	1,110	1,030	1,070	1,620	6,750	4,390	2,040	1,160	1,750	1,40
22	4,190	858	1,100	1,030	1,060	1,900	6,810	4,420	2,020	1,010	1,830	1,40
23	3,560	864	1,070	1,040	1,050	2,100	6,990	4,310	2,060	1,150	1,960	1,38
24	3,170	874	1,060	1,050	1,040	2,340	7,230	4,120	2,040	1,100	2,230	1,30
25	2,880	890	1,060	1,050	1,030	2,450	7,500	3,960	2,110	1,100	2,450	1,22
26	2,650	920	1,060	1,050	1,020	2,500	7,380	3,770	2,020	1,160	2,400	1,20
27	2,470	962	1,070	1,050	1,000	2,550	7,100	3,580	1,820	1,240	2,260	1,18
28	2,340	1,020	1,070	1,060	1,010	2,600	7,300	3,400	1,730	1,310	2,040	1,17
29	2,220	1,080	1,060	1,060	------	2,740	8,600	3,160	1,640	1,290	1,880	1,20
30	2,160	1,140	1,090	1,060	------	2,980	9,350	3,110	1,590	1,210	1,730	1,18
31	2,110	------	1,120	1,060	------	4,600	------	3,040	------	1,170	1,660	------
TOTAL	74,600	41,060	37,790	33,670	29,120	52,220	307,800	162,870	71,950	43,070	54,390	44,63
MEAN	2,406	1,369	1,219	1,086	1,040	1,685	10,260	5,254	2,398	1,389	1,755	1,48
AC-FT	148,000	81,440	74,960	66,780	57,760	103,600	610,500	323,000	142,700	85,430	107,900	88,52

CALENDAR YEAR 1965 MAX 18,700 MIN 600 MEAN 2,135 AC-FT 1,546M
WATER YEAR 1965-66 MAX 19,900 MIN 858 MEAN 2,611 AC-FT 1,891M

Note.--No gage-height record Nov. 20 to Dec. 22.

5-0825. Red River of the North at Grand Forks, N. Dak.

Location.--Lat 47°56'34", long 97°03'10", in SW¼NE¼ sec.33, T.152 N., R.50 W., on left bank on second floor of old sewage plant in Grand Forks, 2.3 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 1966. 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. Nov. 3, 1933, to Apr. 13, 1965, water-stage recorder 0.3 mile upstream at present datum.

Average discharge.--84 years, 2,377 cfs (1,721,000 acre-ft per year).

Extremes.--Maximum discharge during year, 55,000 cfs Apr. 4 (gage height, 45.55 ft); minimum discharge, 1,450 cfs Nov. 21; minimum gage height, 6.98 ft Sept. 28-30.
1882-1966: 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 except those for the winter period, which are fair. Flow regulated by many lakes and reservoirs on tributaries. Records of chemical analyses and water temperatures for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,920	3,280	1,600	2,100	1,800	1,750	37,400	17,000	6,490	4,070	2,730	3,400
2	3,500	3,220	1,600	2,050	1,850	1,750	43,500	17,700	6,320	4,050	2,620	3,200
3	3,860	3,140	1,700	2,000	1,850	1,800	51,000	17,700	6,120	3,950	2,560	3,050
4	3,770	3,090	1,950	2,000	1,850	1,800	54,800	17,300	5,970	3,900	2,600	2,900
5	3,580	3,020	2,200	2,000	1,850	1,800	53,500	16,800	5,910	3,860	2,640	2,870
6	3,550	2,940	2,250	2,000	1,850	1,750	49,500	16,300	5,810	3,710	2,840	2,810
7	3,640	2,900	2,350	2,000	1,850	1,700	46,300	15,400	5,740	3,650	3,110	2,680
8	3,730	2,900	2,350	2,000	1,850	1,550	42,200	14,400	5,720	3,530	3,300	2,580
9	3,770	2,890	2,350	1,950	1,900	1,500	37,600	13,300	5,690	3,490	3,390	2,500
10	3,690	2,860	2,400	1,950	1,900	1,550	33,000	12,300	5,610	3,270	3,450	2,440
11	3,620	2,800	2,400	1,950	1,900	1,600	28,600	11,200	5,550	3,170	3,460	2,380
12	3,510	2,830	2,350	1,950	1,850	1,650	25,000	10,300	5,500	3,190	3,310	2,300
13	3,370	2,850	2,350	1,900	1,850	1,700	22,200	9,700	5,630	3,060	3,230	2,290
14	3,240	2,450	2,350	1,900	1,850	1,800	20,000	9,300	5,810	2,880	3,170	2,260
15	3,140	1,950	2,250	1,900	1,850	1,830	18,400	9,000	5,780	2,700	3,170	2,240
16	3,060	1,700	2,150	1,900	1,800	1,980	16,800	8,800	5,630	2,610	3,480	2,200
17	3,120	1,700	2,050	1,850	1,800	2,180	15,700	8,760	5,420	2,550	3,800	2,190
18	3,110	1,650	2,050	1,850	1,800	3,850	14,400	8,750	5,190	2,530	3,950	2,180
19	3,410	1,650	2,050	1,850	1,750	6,900	13,800	8,750	4,950	2,500	3,960	2,120
20	4,050	1,600	2,050	1,850	1,750	10,300	13,000	8,540	4,730	2,440	3,850	2,050
21	5,270	1,450	2,100	1,850	1,750	13,200	12,200	8,360	4,540	2,450	3,720	2,020
22	6,200	1,600	2,200	1,800	1,750	16,600	11,400	8,340	4,370	2,560	3,650	1,980
23	6,070	1,750	2,200	1,800	1,750	19,400	10,800	8,410	4,290	2,300	3,550	1,960
24	5,400	1,900	2,250	1,800	1,750	21,700	10,700	8,340	4,290	2,240	3,640	1,920
25	4,800	2,100	2,250	1,800	1,750	23,600	11,500	8,220	4,450	2,210	3,930	1,880
26	4,360	2,300	2,250	1,800	1,750	25,000	12,200	7,950	4,530	2,290	4,310	1,810
27	4,040	2,250	2,250	1,800	1,750	26,300	12,600	7,710	4,430	2,260	4,530	1,790
28	3,790	2,000	2,200	1,750	1,750	27,700	12,900	7,460	4,240	2,360	4,490	1,750
29	3,590	1,750	2,100	1,750		29,000	14,100	7,210	4,070	2,500	4,270	1,750
30	3,460	1,600	2,050	1,750	---------	31,100	15,600	6,900	4,070	2,610	3,980	1,750
31	3,360	---------	2,100	1,800	---------	33,400	---------	6,710	---------	2,750	3,660	---------
Total	119,980	70,120	66,750	58,650	50,750	317,740	760,700	336,910	156,850	91,640	108,350	69,250
Mean	3,870	2,337	2,153	1,892	1,812	10,250	25,360	10,870	5,228	2,956	3,495	2,308
Ac-ft	238,000	139,100	132,400	116,300	100,700	630,200	1,509,000	668,300	311,100	181,800	214,900	137,400

Calendar year 1965: Max 51,500 Min 855 Mean 5,000 Ac-ft 3,620,000
Water year 1965-66: Max 54,800 Min 1,450 Mean 6,048 Ac-ft 4,379,000

5-0875. Middle River at Argyle, Minn.

Location.--Lat 48°20'27", long 96°49'02", in SE¼SW¼ 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 1966.

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.--16 years (1950-66), 39.8 cfs (28,810 acre-ft per year).

Extremes.--Maximum discharge during year, 1,820 cfs Apr. 3 (gage height 16.00 ft, backwater from ice); minimum, 0.5 cfs Sept. 20 (gage height, 0.97 ft).

1945, 1950-66: Maximum discharge, 2,590 cfs Apr. 12, 1965 (gage height 15.29 ft); maximum gage height that of Apr. 3, 1966; no flow at times most years.

Flood of April 1950 reached a stage of 15.25 ft, present datum, from floodmarks (discharge 2,790 cfs).

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	31	41	14	5.2	3.0	1.7	400	435	52	20	47	9.8
2	49	41	13	5.0	2.8	1.7	510	501	44	25	39	8.8
3	68	40	13	5.0	2.7	1.9	1,200	531	37	21	31	7.8
4	76	36	13	4.8	2.6	2.0	1,700	562	31	20	26	7.1
5	70	33	12	4.6	2.5	2.0	1,570	550	30	34	24	6.2
6	65	30	12	4.4	2.4	2.1	1,500	449	30	64	20	6.2
7	67	30	12	4.4	2.3	2.3	1,480	353	27	146	19	6.5
8	66	26	12	4.4	2.3	2.4	1,200	282	27	190	23	6.2
9	72	21	12	4.4	2.2	2.5	1,090	229	30	201	40	6.2
10	71	17	11	4.2	2.1	2.5	925	194	32	182	38	5.8
11	67	16	10	4.2	2.1	2.7	814	168	34	244	42	5.5
12	61	17	9.2	4.2	2.0	2.9	742	142	33	353	44	6.0
13	55	18	8.7	4.2	2.0	3.1	705	127	34	343	38	6.0
14	49	19	8.2	4.2	1.9	3.2	708	121	45	250	32	5.2
15	44	19	7.7	4.0	1.9	3.3	742	111	57	179	28	5.2
16	39	19	7.4	4.0	1.7	3.6	750	112	58	127	26	4.9
17	41	19	7.1	4.0	1.5	5.0	737	150	52	96	26	3.8
18	36	18	6.8	4.0	1.5	7.0	699	196	45	73	25	1.2
19	44	17	6.6	4.0	1.4	20	651	209	37	58	22	.8
20	65	17	6.5	3.8	1.3	80	588	209	31	46	18	.6
21	100	17	6.4	3.8	1.3	140	497	217	26	39	16	.8
22	114	16	6.2	3.8	1.3	200	426	215	22	33	16	1.8
23	111	16	6.1	3.8	1.3	240	397	194	21	30	14	3.3
24	99	16	5.9	3.6	1.4	250	375	170	20	27	14	3.4
25	88	16	5.7	3.6	1.5	250	363	162	21	24	13	3.8
26	77	16	5.6	3.6	1.6	240	366	150	19	31	12	4.1
27	67	15	5.4	3.4	1.6	240	340	128	18	72	12	4.0
28	60	15	5.4	3.4	1.6	250	300	104	20	127	12	3.4
29	54	14	5.3	3.2		270	288	87	25	120	11	4.1
30	49	14	5.3	3.2	-----	300	350	70	22	86	11	3.7
31	44	-----	5.3	3.0	-----	350	-----	60	-----	62	10	-----
Total	1,999	649	264.8	125.4	53.8	2,881.9	22,413	7,188	980	3,323	749	142.2
Mean	64.5	21.6	8.54	4.05	1.92	93.0	747	232	32.7	107	24.2	4.74
Max	114	41	14	5.2	3.0	350	1,700	562	58	353	47	9.8
Min	31	14	5.3	3.0	1.3	1.7	288	60	18	20	10	0.6
Ac-ft	3,960	1,290	525	249	107	5,720	44,460	14,260	1,940	6,590	1,490	282

Cal yr1965:	Total	31,626.8	Mean	86.6	Max	2,410	Min	1.0	Ac-ft	62,730
Wtr yr1966:	Total	40,769.1	Mean	112	Max	1,700	Min	0.6	Ac-ft	80,860

5-0920. 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 of 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 1966 (fragmentary prior to April 1949).

Gage.--Water-stage recorder and concrete control. 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.--17 years (1949-66) 3,546 cfs (2,567,000 acre-ft per year); median of yearly mean discharges, 2,650 cfs (1,920,000 acre-ft per year).

Extremes.--Maximum discharge during year, 67,500 cfs Apr. 8 (gage height, 42.15 ft); minimum, 1,500 cfs Mar.10, 11, 12.

1936-37, 1941-66: 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 the winter period, which are fair. Some regulation by reservoirs on tributaries.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3.150	3.540	1.700	2.160	1.960	1.790	34.200	19.400	7.830	4.340	3.020	3.840
2	3.280	3.430	1.650	2.150	1.940	1.790	39.800	20.200	7.470	4.360	3.040	3.540
3	3.610	3.350	1.650	2.150	1.920	1.790	42.300	20.800	7.200	4.340	2.950	3.300
4	4.070	3.290	1.800	2.110	1.890	1.810	49.500	21.200	6.940	4.300	2.830	3.110
5	4.220	3.180	2.000	2.110	1.860	1.820	54.800	21.400	6.720	4.340	2.770	2.950
6	4.100	3.120	2.100	2.100	1.880	1.790	60.200	21.400	6.570	4.380	2.760	2.880
7	3.950	3.050	2.350	2.100	1.880	1.740	66.100	21.300	6.460	4.380	2.810	2.830
8	3.920	2.980	2.410	2.090	1.860	1.680	64.500	20.800	6.340	4.370	3.020	2.750
9	3.950	2.950	2.460	2.080	1.850	1.550	62.500	20.200	6.280	4.490	3.250	2.660
10	3.960	2.970	2.490	2.080	1.840	1.500	58.500	19.300	6.250	4.500	3.390	2.580
11	3.950	2.920	2.540	2.070	1.840	1.500	55.200	18.100	6.200	4.360	3.490	2.500
12	3.860	2.930	2.580	2.070	1.840	1.500	52.000	16.800	6.150	4.180	3.560	2.450
13	3.750	2.960	2.570	2.070	1.840	1.540	48.300	15.700	6.100	4.220	3.500	2.340
14	3.610	2.980	2.500	2.060	1.800	1.580	44.800	14.600	6.150	4.260	3.400	2.330
15	3.460	2.630	2.460	2.060	1.800	1.600	41.600	13.500	6.260	4.060	3.300	2.290
16	3.320	1.980	2.420	2.060	1.800	1.650	38.200	12.600	6.310	3.710	3.230	2.270
17	3.230	1.800	2.360	2.060	1.800	1.750	35.600	11.700	6.260	3.390	3.350	2.250
18	3.190	1.660	2.270	2.060	1.800	1.800	32.300	11.300	6.090	3.150	3.640	2.240
19	3.250	1.620	2.230	2.060	1.800	2.070	29.700	11.000	5.840	2.970	3.860	2.220
20	3.400	1.600	2.200	2.060	1.780	3.800	27.200	10.700	5.590	2.870	3.940	2.190
21	3.940	1.580	2.230	2.060	1.780	6.600	25.400	10.400	5.290	2.760	3.890	2.120
22	5.000	1.520	2.230	2.060	1.760	8.800	23.900	10.200	5.010	2.700	3.810	2.070
23	6.010	1.680	2.270	2.040	1.760	11.400	22.800	9.930	4.780	2.750	3.700	2.030
24	6.280	1.920	2.300	2.040	1.760	13.600	21.900	9.810	4.620	2.680	3.610	2.000
25	6.010	2.100	2.340	2.030	1.760	16.200	21.200	9.730	4.670	2.570	3.600	1.970
26	5.470	2.180	2.360	2.020	1.770	18.800	20.600	9.640	4.700	2.620	3.780	1.940
27	4.920	2.200	2.360	2.020	1.770	21.200	20.200	9.500	4.840	2.710	4.120	1.880
28	4.490	2.280	2.340	2.000	1.780	23.200	19.800	9.270	4.820	2.680	4.370	1.830
29	4.140	2.280	2.330	2.000	----------	24.800	19.400	8.970	4.660	2.710	4.440	1.800
30	3.880	2.230	2.290	2.000	----------	27.100	19.300	8.610	4.440	2.880	4.340	1.780
31	3.680	----------	2.200	1.980	----------	29.800	----------	8.220	----------	2.970	4.100	----------
otal	127,050	74,910	69,990	64,010	51,120	237,550	1,151,800	446,280	176,840	111,000	108,870	72,940
ean	4,098	2,497	2,258	2,065	1,826	7,663	38,390	14,400	5,895	3,581	3,512	2,431
c-ft	252,000	148,600	138,800	127,000	101,400	471,200	2,285,000	885,200	350,800	220,200	215,900	144,700

alendar year 1965: Max 47,100 Min 850 Mean 5,671 Ac-ft 4,106,000
ater year 1965-66: Max 66,100 Min 1,500 Mean 7,346 Ac-ft 5,341,000

5-0940. 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 70 ft upstream from culvert 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 1966. 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 928.46 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 datum 2.00 ft higher. Nov. 23, 1953, to Oct. 5, 1963, water-stage recorder at same site at datum 2.00 ft higher.

Average discharge.--25 years (1928-36, 1941-43, 1945-47, 1953-66), 80.7 cfs (58,420 acre-ft per year).

Extremes.--Maximum discharge during year, 5,410 cfs Apr. 5 (gage height, 18.23 ft); minimum, 1.3 cfs Sept. 13; minimum gage height, 3.21 ft Nov. 19.
1928-37, 1941-47, 1953-66: Maximum discharge, that of Apr. 5, 1966; no flow at times in 1937, 1941, 1960.

Remarks.--Records good except those for winter months, which are fair. Flow partly regulated since 1937 by Bronson Lake (usable capacity, 3,700 acre-ft).

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	141	7.0	15	12	10	7.4	132	1,600	400	80	15	68
2	217	5.8	15	12	11	7.4	573	1,710	351	86	10	169
3	209	5.4	15	12	11	7.4	1,140	1,850	217	211	5.1	161
4	199	5.8	15	12	11	7.3	3,390	1,820	287	351	4.1	143
5	163	6.6	15	12	11	7.2	5,290	1,660	320	794	8.5	84
6	8.7	15	15	11	11	7.1	4,900	1,360	311	1,300	39	44
7	7.6	46	15	11	11	7.1	4,170	1,110	307	1,210	249	56
8	76	58	15	11	11	7.2	3,550	1,000	233	984	656	82
9	190	55	15	11	11	7.3	2,990	868	207	711	700	85
10	91	53	15	11	11	7.6	2,690	800	287	638	432	98
11	6.6	52	14	11	10	7.7	2,440	814	281	613	400	92
12	6.6	30	14	11	10	7.9	2,220	769	283	358	347	1.9
13	6.6	4.4	14	11	9.4	8.2	2,080	729	331	318	182	1.4
14	31	4.1	14	11	9.0	8.5	2,040	668	390	182	80	1.6
15	94	4.1	14	11	8.6	8.9	2,040	653	320	139	111	1.6
16	75	4.1	14	11	8.0	9.2	2,030	793	233	139	134	2.9
17	135	3.9	14	11	7.6	9.6	1,960	956	241	137	134	15
18	6.2	3.6	14	11	7.3	10	1,900	919	255	123	72	16
19	12	3.6	14	11	7.0	11	1,720	902	257	77	30	15
20	79	3.8	14	11	7.0	11	1,530	950	249	19	37	16
21	237	4.5	13	10	7.0	11	1,300	916	199	6.6	37	16
22	271	6.0	13	10	7.0	11	1,100	783	86	6.6	36	20
23	277	7.0	13	10	7.0	11	1,060	713	99	6.6	36	26
24	226	8.0	13	10	7.0	11	1,040	700	194	6.6	35	16
25	11	9.5	13	10	7.1	10	1,080	569	259	16	27	2.3
26	7.0	13	13	10	7.1	10	994	583	207	42	12	2.7
27	6.6	15	13	10	7.2	10	902	505	171	45	2.5	2.5
28	6.2	15	12	10	7.3	14	820	412	245	55	1.9	3.1
29	17	15	12	10		20	950	508	182	53	3.0	3.4
30	61	15	12	10	-----	30	1,290	353	108	40	11	3.4
31	206	-----	12	10	-----	60	-----	336	-----	23	24	-----
Total	3,080.1	479.2	429	335	249.6	363	59,321	28,309	7,510	8,770.4	3,871.1	1,248.8
Mean	99.4	16.0	13.8	10.8	8.91	11.7	1,977	913	250	283	125	41.6
Max	277	58	15	12	11	60	5,290	1,850	400	1,300	700	169
Min	6.2	3.6	12	10	7.0	7.1	132	336	86	6.6	1.9	1.4
Ac-ft	6,110	950	851	664	495	720	117,700	56,150	14,900	17,400	7,680	2,480

Cal yr 1965: Total 52,787.7 Mean 145 Max 2,760 Min 40 Ac-ft 104,700
Wtr yr 1966: Total 113,966.2 Mean 312 Max 5,290 Min 1.4 Ac-ft 226,000

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

(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 Boundry, 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 1966.

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.--54 years (1912-66) 2,927 cfs (2,121,000 acre-ft per year); median of yearly mean discharges, 2,500 cfs (1,810,000 acre-ft per year).

Extremes.--Maximum discharge during year, 66,800 cfs Apr. 11 (gage height, 89.15 ft); minimum daily, 1,620 cfs Feb. 22-25; minimum gage height, 49.20 ft Sept. 30.
1912-66: 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 the winter period, which are fair. Discharge partially regulated by reservoirs on tributaries.

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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,350	4,300	3,010	2,260	1,680	1,640	25,400	28,900	9,740	5,100	3,210	4,320
2	3,420	4,160	2,890	2,220	1,680	1,640	29,300	28,200	9,160	4,990	3,260	4,270
3	3,540	4,050	2,830	2,190	1,680	1,640	33,100	27,800	8,770	5,440	3,290	4,110
4	3,800	3,920	2,800	2,160	1,680	1,640	35,900	28,000	8,450	5,890	3,260	4,000
5	4,190	3,760	2,800	2,140	1,680	1,640	39,300	28,300	8,140	6,170	3,140	3,910
6	4,420	3,650	2,800	2,110	1,670	1,640	44,000	28,600	7,940	6,460	3,120	3,790
7	4,470	3,570	2,800	2,080	1,670	1,640	49,600	28,700	7,800	6,430	3,120	3,660
8	4,410	3,480	2,830	2,050	1,660	1,640	55,400	28,600	7,650	6,390	3,140	3,500
9	4,350	3,380	2,860	2,020	1,660	1,640	60,400	28,100	7,520	6,570	3,340	3,360
10	4,290	3,310	2,920	1,970	1,660	1,640	64,600	27,400	7,420	6,770	3,780	3,220
11	4,270	3,280	2,950	1,940	1,650	1,650	66,300	26,500	7,300	6,780	4,100	3,120
12	4,300	3,240	2,980	1,900	1,650	1,650	66,000	25,500	7,250	6,520	4,210	3,020
13	4,270	3,180	3,040	1,880	1,650	1,670	65,200	24,200	7,170	6,200	4,200	2,910
14	4,180	3,100	3,040	1,850	1,650	1,700	63,600	22,700	7,120	5,840	4,130	2,790
15	4,060	2,950	3,010	1,830	1,640	1,740	61,100	21,400	7,130	5,520	3,980	2,700
16	3,910	2,920	2,980	1,810	1,640	1,780	58,200	19,900	7,170	5,140	3,800	2,620
17	3,770	2,980	2,920	1,800	1,630	1,840	54,800	18,400	7,160	4,730	3,680	2,550
18	3,680	3,100	2,890	1,780	1,630	1,880	51,500	17,100	7,060	4,330	3,700	2,500
19	3,650	3,240	2,830	1,770	1,630	1,910	48,400	16,000	6,890	3,980	3,880	2,450
20	3,680	3,270	2,770	1,750	1,630	2,180	45,300	15,100	6,680	3,720	4,040	2,420
21	3,790	3,240	2,740	1,740	1,630	2,450	43,100	14,300	6,470	3,490	4,120	2,370
22	4,140	3,180	2,680	1,730	1,620	4,490	40,900	13,700	6,210	3,300	4,110	2,320
23	4,870	3,100	2,660	1,720	1,620	6,920	39,100	13,300	5,920	3,170	4,060	2,260
24	5,810	3,040	2,600	1,710	1,620	8,920	37,400	13,100	5,620	3,140	3,970	2,210
25	6,250	3,040	2,570	1,710	1,620	10,800	35,900	13,100	5,500	3,080	3,870	2,160
26	6,200	3,070	2,510	1,700	1,630	13,800	34,500	13,000	5,440	3,000	3,830	2,140
27	5,900	3,100	2,450	1,690	1,640	16,200	33,400	12,800	5,430	2,970	3,910	2,110
28	5,500	3,130	2,420	1,690	1,640	18,400	32,100	12,200	5,440	3,000	4,090	2,060
29	5,110	3,180	2,360	1,680		20,400	31,000	11,600	5,400	3,010	4,260	2,010
30	4,790	3,180	2,330	1,680	----------	21,400	29,900	10,800	5,260	3,030	4,360	1,960
31	4,560	----------	2,300	1,680	----------	22,900	----------	10,300	----------	3,140	4,360	----------
Total	136,930	100,100	85,570	58,240	46,140	181,080	1,374,700	627,600	210,210	147,300	117,320	86,820
Mean	4,420	3,340	2,760	1,880	1,650	5,840	45,820	20,250	7,010	4,750	3,780	2,890
Ac-ft	271,600	198,500	169,700	115,500	91,520	359,200	2,727,000	1,245,000	416,900	292,200	232,700	172,200

Calendar year 1965: Max 46,100 Min 875 Mean 6,420 Ac-ft 4,644,000
Water year 1965-66: Max 66,300 Min 1,620 Mean 8,690 Ac-ft 6,292,000

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 1966.

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

Average discharge.--20 years, 143 cfs (103,500 acre-ft per year).

Extremes.--Maximum discharge during year, 4,750 cfs Apr. 3 (gage-height, 23.37 ft, backwater from ice); minimum daily, 6.0 cfs Feb 20-26.

1946-66: Maximum discharge, that of Apr. 3, 1966; 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 no gage-height record and those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	286	171	44	29	13	6.2	1,140	1,130	160	83	20	67
2	297	154	45	28	12	6.2	2,200	1,150	144	81	18	70
3	278	139	45	28	12	6.2	4,500	1,200	128	135	17	64
4	245	128	45	28	12	6.2	4,580	1,220	112	103	15	56
5	210	128	45	27	11	6.2	3,960	1,150	93	266	15	49
6	187	120	46	27	11	6.3	3,120	1,040	100	372	24	49
7	176	114	46	26	11	6.4	2,510	948	110	395	28	44
8	171	107	45	26	11	6.4	2,240	856	126	348	59	41
9	182	64	45	26	10	6.5	2,060	750	120	278	103	37
10	182	70	45	25	10	6.6	1,920	650	111	293	137	36
11	179	78	45	25	9.8	6.7	1,910	555	103	356	142	32
12	168	72	44	24	9.3	6.8	1,840	462	113	360	116	31
13	154	68	44	24	9.0	6.9	1,870	380	142	320	103	30
14	144	64	43	23	8.5	7.0	2,010	320	176	256	122	29
15	133	60	42	22	8.0	7.2	2,160	344	195	207	148	30
16	120	58	41	22	7.6	7.4	2,330	569	176	166	168	36
17	111	56	40	21	7.3	7.8	2,380	690	151	135	166	36
18	148	53	39	20	6.8	8.2	2,290	728	124	107	154	36
19	249	51	38	19	6.5	9.0	2,110	746	101	87	142	36
20	391	49	37	19	6.2	10	1,830	790	87	69	126	33
21	484	47	36	18	6.0	12	1,600	790	80	56	114	30
22	487	46	36	17	6.0	14	1,430	714	72	51	107	27
23	414	46	35	16	6.0	26	1,320	622	85	49	101	25
24	344	45	34	15	6.0	83	1,300	545	96	46	128	24
25	293	45	34	15	6.0	250	1,250	478	148	39	151	23
26	249	44	33	14	6.0	268	1,150	395	184	37	174	23
27	218	44	32	14	6.2	264	1,050	328	198	35	171	20
28	198	43	31	14	6.2	252	984	274	168	31	144	20
29	182	43	31	13		266	956	234	142	28	116	20
30	171	43	30	13	---------	314	1,050	206	111	24	94	20
31	182	---------	30	13	---------	580	---------	182	---------	22	78	---------
Total	7,233	2,250	1,226	651	240.4	2,469.2	61,050	20,446	3,856	4,835	3,201	1,074
Mean	233	75.0	39.5	21.0	8.59	79.7	2,035	660	129	156	103	35.8
Ac-ft	14,350	4,460	2,430	1,290	477	4,900	121,100	40,550	7,650	9,590	6,350	2,130

Calendar year 1965: Max 4,600 Min 2.5 Mean 229 Ac-ft 166,000
Water year 1965-66: Max 4,580 Min 6.0 Mean 297 Ac-ft 215,300

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 northeast 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 1966 (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 at same site and datum.

Average discharge.--27 years (1928-29, 1940-66), 61.3 cfs (44,380 acre-ft per year).

Extremes.--Maximum discharge during year, 932 cfs Apr. 18 (gage height, 11.74 ft); maximum gage height, 12.65 ft Apr. 3 (backwater from ice) minimum discharge, 2.4 cfs Feb. 23 (gage height, 2.50 ft).
1928-66: 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 periods of no gage-height record and those for winter months, which are poor.
Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

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

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	232	107	34	20	4.8	2.9	560	389	88	80	10	15
2	199	100	34	19	4.6	2.8	800	437	82	76	9.7	51
3	177	99	34	18	4.6	2.9	790	476	62	82	8.8	52
4	155	93	34	17	4.5	3.0	770	616	52	100	6.6	44
5	140	86	34	16	4.5	3.1	760	773	53	115	6.2	39
6	130	81	33	15	4.5	3.1	740	801	86	90	5.8	38
7	148	78	33	14	4.5	3.1	710	760	78	80	6.4	35
8	196	72	33	13	4.6	3.2	661	637	66	60	14	31
9	188	66	33	13	5.2	3.3	558	532	54	65	16	24
10	174	62	33	12	5.4	3.4	533	462	45	70	11	18
11	157	58	32	12	5.2	3.6	520	398	87	60	7.9	16
12	141	54	32	11	5.2	3.9	564	344	316	50	7.7	15
13	127	52	31	11	5.0	3.8	633	305	266	42	16	14
14	119	50	31	11	4.8	4.1	764	276	232	35	25	11
15	111	48	29	10	4.6	4.5	888	308	205	30	19	11
16	104	48	29	10	4.3	5.5	921	449	180	26	44	9.4
17	144	48	28	9.8	4.2	7.0	921	471	160	21	62	8.2
18	208	48	28	9.2	3.9	9.0	919	494	125	17	40	7.4
19	238	50	27	8.7	3.4	14	863	500	90	15	24	5.8
20	289	50	27	8.1	3.0	45	721	490	75	14	16	5.6
21	259	48	26	7.4	2.8	65	611	441	70	15	12	4.8
22	244	46	26	6.7	2.6	72	560	387	75	30	10	4.5
23	224	44	25	6.2	2.5	76	505	341	80	25	9.1	5.4
24	197	42	25	5.8	2.5	76	488	316	90	23	9.7	4.5
25	179	40	24	5.7	2.6	73	472	288	105	19	7.7	3.9
26	161	38	23	5.5	2.6	70	440	255	140	16	7.9	3.7
27	146	37	23	5.4	2.6	70	390	213	120	13	6.6	3.6
28	132	36	22	5.2	2.8	75	307	177	105	11	5.0	2.9
29	124	35	22	5.2		125	270	148	90	10	4.0	2.8
30	117	35	21	5.0	----------	240	356	123	80	8.8	3.4	2.9
31	113	----------	20	4.8	----------	360	----------	103	----------	9.1	3.2	----------
Total	5,273	1,751	886	320.7	111.8	1,433.2	18,995	12,710	3,357	1,307.9	434.7	489.4
Mean	170	58.4	28.6	10.3	3.99	46.2	633	410	112	42.2	14.0	16.3
Ac-ft	10,460	3,470	1,760	636	222	2,840	37,680	25,210	6,660	2,590	862	971

Calendar year 1965: Max 1,200 Min 1.0 Mean 125 Ac-ft 90,860
Water year 1965-66: Max 921 Min 2.5 Mean 129 Ac-ft 93,360

Note.--No gage-height record June 15 to July 19.

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

Location.--Lat 48°54'22", long 95°49'55", in SW¼SW¼ sec.28, T.163 N., R.40 W., on upstream bridge piling on left bank at Roseau Lake, 3½ miles upstream from Pine Creek, 3¼ miles downstream from Sprague Creek, and 7 miles northwest of Roseau.

Records available.--November 1939 to September 1966 (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, 1,036.42 ft Apr. 19 (from floodmark); minimum observed, 1,020.73 ft Aug. 2.

1939-66: Maximum elevation observed, 1,036.86 ft May 13, 1950; minimum observed, 1,019.75 ft Aug. 16, 1941.

Flood of July 1919 reached an elevation of about 1,034 ft.

Elevation, in feet, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1							29.60	35.28				22.21
2							31.01	35.28			20.73	22.29
3	26.73						32.12	35.17				
4	26.45						32.53	35.04			21.26	22.43
5	26.27						33.64	35.08				
6	26.05						34.55	35.03				22.13
7	25.87						34.70	34.93				
8	26.03						34.89					21.99
9	26.09							34.77	28.45			
10							35.31	34.71			22.73	21.77
11							35.43	34.62				
12							35.54	34.46				21.63
13							35.64	34.29				
14							35.73	34.10		25.41		21.53
15							35.81	33.97				
16							35.96	33.97				
17							36.10	33.83				21.43
18							36.15	33.77				
19							36.29	33.74		23.01		
20							36.26	33.65				21.33
21							36.18	33.45		22.23		
22							36.10	33.43		22.35		21.23
23							36.02	33.42			22.23	
24							35.97	33.29				21.27
25							35.88	33.11				
26							35.76	32.95				21.23
27							35.60	32.77				
28							35.52	32.47				
29							35.43	32.04				21.19
30					----------	27.55	35.40					
31		----------			----------	28.10	----------		----------	21.41	22.14	----------

Note.--Add 1,000.00 ft to obtain elevation above mean sea level.

GPO 803-695-5

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 1966.

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.--38 years, 250 cfs (181,000 acre-ft per year).

Extremes.--Maximum discharge during year, 4,670 cfs Apr. 21 (gage height, 17.17 ft); minimum daily, 9.5 cfs Feb. 22-27; minimum gage height, 1.52 ft Sept. 30.

1928-66: 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 for winter months, which are fair. Hogh flow regulated by natural storage in Roseau Lake.

Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	630	471	137	74	40	10	600	3,340	1,670	177	43	103
2	655	446	134	72	39	10	650	3,250	1,580	195	40	108
3	635	417	132	72	37	10	720	3,250	1,490	410	38	118
4	600	390	130	70	36	10	800	3,180	1,410	523	36	117
5	571	351	128	68	34	10	1,000	3,180	1,320	515	36	105
6	539	304	125	68	32	10	1,450	3,210	1,240	578	37	93
7	523	272	122	66	30	10	2,120	3,180	1,160	576	49	87
8	539	250	120	66	28	11	2,750	3,110	1,090	550	64	80
9	547	202	120	64	26	11	3,120	3,030	1,010	555	105	73
10	534	188	115	64	25	11	3,330	2,940	909	582	140	67
11	512	180	110	62	24	11	3,480	2,890	852	579	154	61
12	486	175	107	62	22	11	3,600	2,780	909	566	150	57
13	455	172	104	60	20	12	3,710	2,690	897	534	139	55
14	421	168	101	60	18	12	3,790	2,610	869	473	135	50
15	383	165	100	58	16	13	3,940	2,580	825	379	159	46
16	343	162	97	58	14	14	4,130	2,490	768	290	198	43
17	368	160	95	58	13	16	4,180	2,470	694	223	237	43
18	490	158	93	56	12	19	4,410	2,440	602	175	238	42
19	584	158	92	56	11	24	4,620	2,420	525	138	201	41
20	719	155	90	54	11	32	4,580	2,400	456	111	169	40
21	770	155	88	54	10	45	4,620	2,380	388	93	144	36
22	770	155	86	52	9.5	56	4,480	2,360	345	98	129	33
23	753	155	84	50	9.5	72	4,320	2,280	311	104	118	30
24	711	152	84	50	9.5	90	4,080	2,230	296	93	116	28
25	687	150	82	48	9.5	110	4,060	2,190	348	84	132	27
26	657	150	80	47	9.5	140	4,200	2,140	431	75	148	26
27	619	148	80	46	9.5	170	4,120	2,070	424	68	158	25
28	578	145	78	45	10	230	3,390	1,990	362	61	152	24
29	541	142	76	44		310	3,420	1,920	287	54	132	24
30	510	140	76	43	----------	430	3,340	1,840	226	49	107	23
31	485	----------	74	41	----------	520	----------	1,760	----------	46	95	----------
Total	17,615	6,436	3,140	1,788	565.0	2,440	97,010	80,600	23,694	8,954	3,799	1,705
Mean	568	215	101	57.7	20.2	78.7	3,234	2,600	790	289	123	56.8
Ac-ft	34,940	12,770	6,230	3,550	1,120	4,840	192,400	159,900	47,000	17,760	7,540	3,380

Calendar year 1965: Max 3,740 Min 7.5 Mean 539 Ac-ft 390,100
Water year 1965-66: Max 4,620 Min 9.5 Mean 679 Ac-ft 491,400

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 1966 (incomplete).

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

Extremes.--Maximum elevation during year, 1,032.35 ft Apr. 21; minimum recorded, 1,018.50 ft Aug. 6. 1928-66: Maximum elevation, 1,032.65 ft May 13, 1950; minimum recorded, 1,017.42 ft Aug. 30, 1961. Maximum elevation known, about 1,034 ft in 1896.

Mean elevation, in feet, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	23.12						26.21	31.58	28.31	20.94	18.79	
2	23.30							31.53	28.02	20.98	18.69	
3	23.23						28.07	31.49	27.72	22.46	18.65	
4	23.04						28.52	31.46	27.45	23.51	18.58	
5	22.88						29.32	31.41	27.21	23.50	18.54	
6	22.69						29.99	31.40	26.92	23.81	18.54	
7	22.56						30.79	31.39	26.62	23.87	18.73	
8	22.64						31.28	31.32	26.36	23.74	19.09	
9	22.68						31.41	31.26	26.04	23.74	19.75	
10	22.63						31.51	31.16	25.67	23.90	20.32	
11	22.51						31.59	31.09	25.41	23.91	20.60	
12	22.35						31.66	30.95	25.60	23.84	20.61	
13	22.16						31.74	30.82	25.59	23.67	20.49	
14	21.95						31.86	30.69	25.46	23.34	20.38	
15	21.70						31.93	30.63	25.27	22.76	20.63	
16	21.40						32.01	30.48	25.01	22.08	21.06	
17	21.45						32.06	30.42	24.66	21.47	21.47	
18	22.22						32.11	30.32	24.23	20.95	21.54	
19	22.83						32.23	30.27	23.79	20.51	21.26	
20	23.57						32.27	30.22	23.36	20.14	20.90	
21	23.83						32.31	30.16	22.88	19.85	20.61	
22	23.86						32.29	30.06	22.51	19.84	20.41	
23	23.81						32.24	29.97	22.20	19.97	20.25	
24	23.65						32.15	29.84	22.02	19.84	20.14	
25	23.50						32.12	29.74	22.34	19.72	20.29	
26	23.36						32.14	29.62	22.93	19.55	20.52	
27	23.15						32.15	29.48	22.96	19.40	20.68	
28	22.91						31.81	29.30	22.60	19.26	20.67	
29	22.67						31.67	29.08	22.04	19.09	20.47	
30							31.62	28.85	21.47	18.95	20.14	
31						25.07		28.59		18.86	20.04	

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 1966 (incomplete, discontinued).

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, 1,024.47 ft about Apr. 27, from floodmark; minimum recorded, 1,015.31 ft about Sept. 28.
1932-66: Maximum elevation, 1,024.64 ft May 15, 1950; minimum recorded, 1,014.74 ft Aug. 8, 1933.
Flood of July 1919 reached an elevation of about 1,024 ft.

Mean elevation, in feet, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1									23.57	18.43	16.44	
2									23.50	18.26	16.39	
3									23.43	18.84	16.32	
4									23.37	19.81	16.19	
5									23.31		16.10	
6									23.24		15.81	
7									23.15		15.66	
8									23.06		15.81	
9									22.96		16.10	
10									22.83		16.64	
11									22.74		16.98	
12									22.65		17.10	
13									22.58		17.08	
14									22.50		16.95	
15									22.39		16.94	
16									22.26		17.24	
17									22.11		17.57	
18								23.98	21.90		17.84	
19								23.98	21.62	17.82	17.80	
20								23.96	21.24	17.50		
21								23.94	20.74	17.30		
22								23.90	20.20	17.22		
23								23.89	19.74	17.26		
24								23.86	19.39	17.25		
25								23.85	19.52	17.12		
26								23.83	19.79	17.03	16.89	
27								23.80	19.88	16.89	17.05	
28								23.77	19.75	16.78	17.11	
29	20.40							23.73	19.38	16.66	17.02	
30								23.68	18.91	16.55	16.79	
31								23.64		16.50	16.89	

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

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 1966 (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, 3,120 cfs Apr. 28 (gage height, 10.34 ft); minimum daily recorded, 43 cfs Sept. 27.
1917, 1920-66: 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 fair. Occasionally, at high stages, there is some natural diversion of flow above station to headwaters of Two Rivers. Station not operated during winter period.

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

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	544	570					510	3,050	2,090	411	140	370
2	662	562					630	3,060	2,060	497	132	344
3	713	512					775	3,060	2,010	621	118	286
4	730	489					940	3,060	1,950	760	102	264
5	699	458					1,050	3,020	1,940	825	92	222
												190
6	678	420					1,120	2,930	1,920	840	80	190
7	640	370					1,180	2,870	1,860	850	66	156
8	613	328					1,260	2,810	1,820	850	64	132
9	613	310					1,350	2,770	1,770	845	78	113
10	613	285					1,560	2,750	1,720	840	110	97
11	602	270					1,980	2,720	1,690	835	160	86
12	591	260					2,130	2,690	1,640	825	181	80
13	567						2,310	2,650	1,580	810	190	78
14	544						2,470	2,610	1,530	785	171	71
15	520						2,570	2,620	1,470	700	158	62
16	502						2,670	2,630	1,410	610	192	54
17	492						2,740	2,590	1,350	505	229	52
18	507						2,750	2,550	1,270	430	269	50
19	640						2,760	2,510	1,190	342	273	50
20	733						2,770	2,460	1,070	290	237	48
21	806						2,790	2,430	918	264	198	48
22	852						2,830	2,400	772	264	165	48
23	874						2,870	2,380	664	256	145	52
24	886						2,910	2,350	634	260	129	52
25	868						2,920	2,320	667	250	116	50
26	864						2,920	2,290	678	237	123	47
27	855						2,990	2,250	662	214	147	43
28	793						3,110	2,220	613	192	156	46
29	719						3,090	2,180	538	173	152	45
30	659				----------		3,070	2,150	458	154	132	45
31	610	----------			----------		----------	2,120	----------	145	168	----------
Total	20,989						65,025	80,500	39,944	15,880	4,671	3,281
Mean	677						2,168	2,597	1,331	512	151	109
Ac-ft	41,630						129,000	159,700	79,230	31,500	9,260	6,510

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

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 1966 (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, 1,007.10 ft May 17; minimum recorded, 1,003.21 ft Sept. 27.
1933-66: 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.64						6.11	7.07	6.98	4.51	3.72	4.38
2	4.85						6.57	7.07	6.96	4.38	3.70	4.29
3	4.99						6.68	7.07	6.93	4.55	3.65	4.18
4	5.06						6.70	7.07	6.91	4.77	3.60	4.12
5	5.01						6.66	7.06	6.91	5.14	3.57	4.05
6	4.95						6.65	7.06	6.91	5.25	3.55	3.97
7	4.88						6.68	7.06	6.88	5.29	3.47	3.87
8	4.80							7.05	6.87	5.31	3.48	3.80
9	4.80							7.05	6.85	5.38	3.52	3.76
10	4.79							7.05	6.84	5.38	3.67	3.70
11	4.77							7.05	6.81	5.38	3.82	3.65
12	4.75							7.05	6.78	5.34	3.89	3.69
13	4.70							7.05	6.74	5.28	3.90	3.59
14	4.65							7.04	6.69	5.24	3.86	3.53
15	4.61							7.04	6.64	5.12	3.84	3.46
16	4.56							7.06	6.58	4.94	3.92	3.44
17	4.54							7.09	6.51	4.66	4.01	3.41
18	4.72							7.09	6.41	4.39	4.09	3.39
19	5.17							7.09	6.30	4.21	4.12	3.38
20	5.42							7.08	6.12	4.10	4.05	3.36
21	5.52							7.07	5.86	4.06	3.97	3.35
22	5.48							7.07	5.52	4.06	3.87	3.34
23	5.43							7.07	5.21	4.05	3.81	3.32
24	5.12							7.04	4.96	4.05	3.76	3.29
25	4.88							7.04	4.96	4.02	3.72	3.31
26	4.75						7.06	7.03	5.01	3.99	3.77	3.26
27	4.55						7.06	7.02	5.03	3.93	3.82	3.23
28	4.30						7.06	7.00	4.99	3.88	3.86	3.25
29							7.06	7.00	4.85	3.82	3.85	3.24
30							7.06	7.00	4.70	3.77	3.79	3.24
31						5.16		6.98		3.75	3.89	

Note.--Add 1,000.00 ft to obtain elevation above mean sea level.

5-1244.8 Kawishiwi River near Ely, Minn.

(Hydrologic bench-mark station)

Location.--Lat 47°55'22", long 91°32'06", in SE¼ sec.24, T.63 N., R.10 W., on left bank upstream from rapids, 2 miles upstream from South Kawishiwi River, 2¼ miles southwest of Fernberg Lookout Tower and 14 miles east of Ely.

Records available.--June to September 1966.

Gage.--Water-stage recorder. Altitude of gage is 1,450 ft (from topographic map).

Extremes.--Maximum discharge observed during period, 795 cfs June 1 (gage height, 4.97 ft); minimum, 24 cfs Sept. 28, 29 (gage height, 2.71 ft).
Flood in May 1966 reached a stage of 5.12 ft, from floodmark (discharge, 897 cfs).

Remarks.--Records good.
Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1									795	308	90	70
2									788	296	90	68
3									768	278	86	64
4									720	240	84	60
5									670	210	81	58
6									620	197	79	57
7									590	192	78	54
8									571	189	79	53
9									559	187	84	52
10									548	180	85	51
11									532	168	84	50
12									500	152	82	48
13									470	147	79	46
14									453	144	77	45
15									438	143	77	44
16									422	139	76	42
17									417	135	76	41
18									407	134	74	40
19									390	128	72	39
20									375	123	72	38
21									352	120	70	36
22									336	118	76	33
23									338	116	81	32
24									344	113	81	30
25									350	110	81	28
26									348	107	81	27
27									344	103	79	26
28									336	99	78	25
29									331	94	76	25
30					-----				318	91	74	25
31		-----			-----		-----		-----	88	72	-----
Total									14,430	4,849	2,454	1,307
Mean									481	156	79.2	43.6
Max									795	308	90	70
Min									318	88	70	25
Ac-ft									28,620	9,620	4,870	2,590

Cal yr	: Total	Mean	Max	Min	Ac-ft
Wtr yr	: Total	Mean	Max	Min	Ac-ft

5-1270. Kawishiwi River near Winton, Minn.

Location.--Lat 47°56'05", long 91°45'50", in NE¼NW¼ 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 1966. Monthly discharge only for some periods, published in WSP 1308.

Average discharge.--47 years (1905-06, 1915-17, 1918-19, 1923-66), 971 cfs (unadjusted).

Extremes.--Maximum daily discharge during year, 7,600 cfs May 12; minimum daily, 129 cfs Sept. 25.
1905-07, 1912-19, 1923-66: 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, 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,150	1,690	1,020	928	456	434	778	6,820	4,660	895	626	597
2	2,120	1,660	960	928	489	190	778	6,870	4,250	895	529	610
3	2,300	1,630	960	928	456	463	763	6,940	3,850	1,400	529	462
4	2,080	1,630	1,020	928	489	545	703	6,870	3,570	1,640	529	161
5	2,230	1,560	960	895	489	627	596	6,740	2,960	1,780	626	393
6	2,310	1,650	960	895	456	595	659	6,850	2,810	1,830	578	530
7	2,510	1,590	960	924	494	571	734	6,770	2,660	1,620	462	530
8	2,570	1,590	960	924	456	584	702	6,800	2,700	1,330	694	498
9	2,780	1,590	960	827	521	608	703	6,880	2,360	1,250	662	531
10	2,680	1,600	960	891	489	641	761	7,100	2,420	1,340	662	531
11	2,620	1,560	960	891	456	738	821	7,430	2,310	1,200	597	499
12	2,500	1,700	1,020	891	424	673	778	7,600	2,490	1,060	613	499
13	2,450	1,570	1,020	924	456	673	736	7,500	2,440	960	523	531
14	2,340	1,570	1,170	956	559	641	658	7,470	2,370	863	426	531
15	2,270	1,460	1,150	988	543	641	873	7,470	2,370	895	547	466
16	2,150	1,330	1,110	956	606	608	1,070	7,470	2,060	1,020	598	499
17	2,080	1,160	960	924	638	767	1,260	7,120	1,370	928	663	499
18	1,960	1,080	960	924	603	819	1,540	6,760	1,050	928	630	330
19	1,760	991	960	956	667	948	1,830	6,830	924	928	580	499
20	1,760	1,150	960	891	403	948	2,150	6,830	956	813	561	499
21	1,730	1,150	960	860	540	883	2,280	6,990	1,310	797	362	499
22	1,750	1,160	960	834	443	916	2,650	6,970	1,460	795	643	466
23	1,770	1,190	960	834	443	883	3,120	7,130	1,460	740	662	434
24	1,830	1,270	960	733	410	851	3,410	7,170	1,660	760	662	297
25	1,660	1,270	960	682	417	819	4,100	7,170	1,790	780	597	129
26	1,760	1,310	960	586	393	818	4,740	6,840	1,720	781	630	531
27	1,720	1,410	928	521	362	718	5,470	6,580	1,560	717	662	434
28	1,730	1,310	928	553	369	750	5,850	6,350	1,340	716	429	466
29	1,630	1,240	928	521		749	6,440	5,790	1,120	731	597	464
30	1,630	1,050	928	521	----------	714	6,560	5,690	928	590	630	368
31	1,720	----------	928	586	----------	823	----------	5,010	----------	323	597	----------
Total	64,550	42,121	30,390	25,600	13,527	21,638	63,513	212,810	64,928	31,305	18,106	13,783
Mean	2,082	1,404	980	826	483	698	2,117	6,865	2,164	1,010	584	459
≠)	-24	+5	-26	-225	-91	-277	+584	-8	+65	-51	-100	-215
Mean	≠2,058	1,409	954	601	392	421	2,701	6,857	2,229	959	484	244
Max	2,780	1,700	1,170	988	667	948	6,560	7,600	4,660	1,830	694	610
Min	1,630	991	928	521	362	190	596	5,010	924	323	362	129
Cfsm	≠1.72	1.17	0.795	0.501	0.327	0.351	2.25	5.71	1.86	0.799	0.403	0.203
In.	≠1.98	1.31	0.92	0.58	0.34	0.40	2.51	8.48	2.07	0.92	0.47	0.23

Calendar year 1965: Max 5,800 Min 0 Mean 1,299 Mean ≠ 1,325 Cfsm ≠ 1.10 In. ≠ 14.99
Water year 1965-66: Max 7,600 Min 129 Mean 1,650 Mean ≠ 1,620 Cfsm ≠ 1.35 In. ≠ 20.21

≠ 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.

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 1966. 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.--38 years (1925-27, 1930-66), 1,323 cfs.

Extremes.--Maximum discharge during year, 7,770 cfs May 24 (gage height, 4.24 ft); minimum, 481 cfs Sept. 28 (gage height, -0.14 ft).
1924, 1925-27, 1930-66: 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 period 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,500	2,440	1,930	1,560	1,310	1,150	1,220	4,920	6,800	2,240	1,170	860
2	1,640	2,410	1,890	1,560	1,310	1,150	1,240	5,260	6,580	2,150	1,120	850
3	1,770	2,360	1,840	1,550	1,300	1,150	1,240	5,540	6,360	2,210	1,060	850
4	1,890	2,360	1,810	1,550	1,300	1,150	1,220	5,800	6,070	2,150	1,030	810
5	1,970	2,320	1,760	1,540	1,290	1,150	1,210	6,030	5,780	2,080	1,000	780
6	2,080	2,280	1,740	1,540	1,280	1,140	1,210	6,290	5,500	2,030	1,030	760
7	2,150	2,260	1,710	1,540	1,280	1,140	1,200	6,510	5,260	2,030	1,050	741
8	2,280	2,260	1,680	1,530	1,270	1,140	1,200	6,660	5,040	2,030	1,020	722
9	2,440	2,210	1,650	1,530	1,270	1,140	1,190	6,780	4,800	2,080	1,020	712
10	2,520	2,200	1,630	1,530	1,270	1,140	1,190	6,870	4,580	2,040	1,000	703
11	2,600	2,150	1,600	1,520	1,260	1,130	1,190	6,960	4,390	2,000	980	684
12	2,700	2,210	1,630	1,520	1,260	1,130	1,190	7,010	4,260	1,930	970	675
13	2,750	2,210	1,630	1,520	1,250	1,130	1,200	7,100	4,110	1,880	960	665
14	2,800	2,210	1,620	1,510	1,240	1,140	1,210	7,190	3,980	1,820	950	648
15	2,800	2,180	1,640	1,510	1,230	1,140	1,220	7,290	3,860	1,750	930	648
16	2,800	2,240	1,640	1,510	1,230	1,150	1,260	7,410	3,750	1,680	900	631
17	2,790	2,210	1,640	1,500	1,220	1,150	1,320	7,500	3,650	1,620	900	614
18	2,770	2,150	1,630	1,500	1,200	1,160	1,400	7,600	3,480	1,580	910	597
19	2,740	2,090	1,620	1,480	1,190	1,160	1,500	7,620	3,300	1,570	900	580
20	2,800	2,060	1,600	1,470	1,180	1,160	1,700	7,650	3,130	1,520	890	565
21	2,770	2,000	1,590	1,460	1,180	1,160	1,850	7,620	2,960	1,470	880	551
22	2,680	1,950	1,580	1,450	1,170	1,150	2,060	7,600	2,820	1,440	930	544
23	2,600	1,920	1,570	1,430	1,160	1,140	2,320	7,600	2,700	1,410	950	536
24	2,590	1,920	1,570	1,420	1,160	1,140	2,600	7,620	2,630	1,380	930	536
25	2,540	1,900	1,560	1,410	1,150	1,140	2,940	7,600	2,620	1,360	930	522
26	2,510	1,930	1,540	1,380	1,150	1,130	3,290	7,570	2,570	1,330	920	507
27	2,470	1,960	1,540	1,370	1,150	1,130	3,660	7,530	2,570	1,270	920	488
28	2,460	1,970	1,540	1,360	1,150	1,130	4,030	7,450	2,520	1,220	910	494
29	2,410	1,970	1,540	1,340		1,130	4,320	7,330	2,460	1,210	880	507
30	2,410	1,960	1,540	1,330	---------	1,130	4,620	7,170	2,330	1,180	880	500
31	2,440	---------	1,560	1,320	---------	1,150	---------	7,010	---------	1,180	870	---------
Total	75,670	64,290	51,020	45,740	34,410	35,430	57,000	216,090	120,860	52,840	29,790	19,280
Mean	2,441	2,143	1,646	1,475	1,229	1,143	1,900	6,971	4,029	1,705	961	643
Cfsm	1.40	1.23	0.948	0.851	0.707	0.655	1.09	4.01	2.32	0.977	0.552	0.370
In.	1.62	1.37	1.09	0.98	0.74	0.76	1.22	4.62	2.58	1.13	0.64	0.41

Calendar year 1965: Max 6,070 Min 399 Mean 1,734 Cfsm 0.997 In. 13.54
Water year 1965-66: Max 7,650 Min 488 Mean 2,198 Cfsm 1.26 In. 17.16

Note.--No gage-height record Jan. 23 to Mar. 27.

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 1966, in reports of Geological Survey. Monthly discharge only for some periods, published in WSP 1308. August 1921 to September 1966 in reports of Inland Waters Branch, Department of Energy, Mines and 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.--44 years (1922-66), 3,612 cfs.

Extremes.--Maximum discharge during year, 16,400 cfs May 30 (elevation, 1,189.64 ft); minimum, 1,470 cfs Sept. 30 (elevation, 1,182.68 ft).
1921-66: 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 excellent.

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

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,420	7,950	5,860	4,620	3,780	3,060	3,100	8,780	16,300	8,570	3,950	2,380
2	3,600	7,830	5,840	4,590	3,760	3,030	3,120	9,140	16,300	8,380	3,840	2,350
3	3,880	7,600	5,760	4,550	3,710	3,020	3,120	9,380	16,100	8,500	3,730	2,320
4	4,120	7,620	5,710	4,510	3,700	3,060	3,130	9,740	16,100	8,380	3,620	2,230
5	4,350	7,440	5,630	4,480	3,650	3,060	3,160	10,100	16,000	7,950	3,520	2,240
6	4,550	7,350	5,570	4,460	3,620	3,060	3,190	10,600	15,800	7,690	3,520	2,220
7	4,810	7,260	5,520	4,420	3,580	3,060	3,200	11,100	15,500	7,490	3,440	2,180
8	5,110	7,160	5,460	4,410	3,580	3,060	3,220	11,600	15,400	7,350	3,360	2,170
9	5,440	7,050	5,400	4,370	3,620	3,050	3,250	12,000	15,100	7,120	3,310	2,130
10	5,690	6,960	5,340	4,330	3,600	3,050	3,260	12,400	14,800	7,030	3,280	2,120
11	5,900	6,840	5,290	4,320	3,550	3,020	3,300	12,700	14,500	6,890	3,200	2,070
12	6,190	6,820	5,310	4,290	3,520	2,990	3,330	13,000	14,100	6,660	3,140	2,050
13	6,450	6,700	5,310	4,260	3,500	2,980	3,360	13,200	13,800	6,540	3,140	2,020
14	6,680	6,680	5,310	4,230	3,490	2,950	3,410	13,400	13,400	6,390	3,120	1,990
15	6,860	6,610	5,290	4,200	3,460	2,920	3,460	13,700	13,100	6,210	3,070	1,940
16	7,070	6,640	5,250	4,170	3,420	2,890	3,540	13,900	12,800	5,990	3,000	1,890
17	7,190	6,590	5,170	4,140	3,390	2,860	3,710	14,200	12,500	5,820	2,950	1,870
18	7,350	6,570	5,090	4,110	3,360	2,920	3,910	14,500	12,100	5,650	2,860	1,820
19	7,530	6,500	5,050	4,080	3,310	2,990	4,190	14,700	11,800	5,630	2,840	1,810
20	7,850	6,410	4,990	4,050	3,280	3,000	4,500	15,000	11,500	5,460	2,780	1,800
21	8,110	6,340	4,970	4,030	3,240	2,990	4,740	15,200	11,200	5,270	2,720	1,750
22	8,180	6,280	4,950	4,020	3,200	2,990	4,990	15,400	10,900	5,150	2,740	1,710
23	8,240	6,190	4,910	3,980	3,190	2,990	5,290	15,600	10,700	5,050	2,720	1,680
24	8,340	6,150	4,870	3,960	3,160	2,980	5,670	15,700	10,400	4,910	2,670	1,640
25	8,290	6,060	4,830	3,960	3,140	2,980	6,170	15,900	10,100	4,770	2,640	1,600
26	8,290	6,080	4,790	3,950	3,120	2,980	6,640	16,100	9,780	4,680	2,610	1,580
27	8,240	6,040	4,750	3,930	3,100	2,980	7,260	16,200	9,560	4,500	2,570	1,530
28	8,220	6,010	4,700	3,930	3,070	2,980	7,740	16,300	9,260	4,320	2,540	1,530
29	8,110	5,990	4,680	3,930		2,980	8,130	16,300	9,000	4,210	2,480	1,530
30	8,020	5,930	4,680	3,930	-----	2,980	8,520	16,300	8,760	4,070	2,470	1,500
31	7,970	-----	4,640	3,880	-----	3,030	-----	16,300	-----	4,050	2,400	-----
Total	204,050	201,650	160,920	130,090	96,100	92,890	133,610	418,440	386,660	190,680	94,230	57,650
Mean	6,580	6,720	5,190	4,200	3,430	3,000	4,450	13,500	12,900	6,150	3,040	1,920
Max	8,340	7,950	5,860	4,620	3,780	3,060	8,520	16,300	16,300	8,570	3,950	2,380
Min	3,420	5,930	4,640	3,880	3,070	2,860	3,100	8,780	8,760	4,050	2,400	1,500
Cfsm	1.27	1.30	1.00	0.81	0.66	0.58	0.86	2.61	2.50	1.19	0.59	0.37
In.	1.47	1.45	1.16	0.94	0.69	0.67	0.96	3.01	2.78	1.37	0.68	0.42

Cal yr 1965:	Total	1,868,680	Mean	5,120	Max	14,800	Min	1,750	Cfsm	0.99	In.	13.46
Wtr yr 1966:	Total	2,166,970	Mean	5,937	Max	16,300	Min	1,500	Cfsm	1.15	In.	15.60

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 1966 (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, about 1,359.3 ft May 9; minimum, 1,356.89 ft Sept. 28; minimum daily 1,356.92 ft Sept 28.

1913-15, 1941-42, 1946-65: 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).

Remarks.--Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Daily mean elevation, in feet, October 1965 to September 1966

Oct. 31	1,358.03	Feb. 28	1,357.34	June 30	1,357.94
Nov. 30	1,357.93	Mar. 31	1,357.54	July 31	1,357.45
Dec. 26	1,357.80	Apr. 27	1,359.22	Aug. 31	1,357.25
Jan. 31	1,357.52	May 31	1,358.75	Sept. 30	1,356.93

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

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 1966.

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.--44 years, 305 cfs.

Extremes.--Maximum discharge during year, 1,920 cfs Apr. 30 (gage height, 3.93 ft); minimum, 32 cfs Sept. 30, (gage height, 0.01 ft, affected by seiche action).
1911-17, 1928-66: 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	312	574	539	480	294	227	381	1,880	1,200	559	280	203
2	302	574	529	466	292	222	394	1,880	1,180	544	274	198
3	343	524	524	470	290	219	398	1,880	1,110	644	265	196
4	394	554	514	466	288	265	408	1,880	1,090	669	255	172
5	421	529	504	462	286	284	412	1,860	1,070	634	252	161
6	430	519	494	462	286	280	430	1,880	992	594	249	168
7	444	514	494	460	288	280	444	1,900	947	579	246	172
8	457	489	489	458	294	277	462	1,900	935	584	238	166
9	484	499	484	456	312	271	475	1,900	904	589	235	157
10	499	494	480	454	312	268	484	1,900	904	589	235	153
11	484	494	480	452	308	265	499	1,880	880	579	230	148
12	494	494	504	450	308	262	509	1,860	816	544	227	151
13	519	489	509	448	294	262	529	1,840	789	534	243	134
14	519	514	514	444	294	258	569	1,820	762	529	238	120
15	514	514	534	438	291	252	619	1,820	756	504	235	117
16	534	519	534	430	284	249	679	1,770	734	480	230	112
17	524	529	524	421	280	252	767	1,780	719	466	222	108
18	514	524	514	412	274	265	856	1,750	709	426	208	103
19	529	514	509	400	268	291	979	1,720	704	452	210	103
20	564	514	509	386	262	298	1,130	1,710	699	444	208	103
21	604	509	504	374	258	294	1,240	1,700	689	426	201	88
22	589	509	499	362	255	294	1,350	1,680	679	381	212	82
23	534	504	494	354	255	294	1,420	1,600	664	372	227	70
24	594	499	494	348	246	298	1,520	1,540	654	360	230	68
25	559	494	494	338	241	302	1,630	1,490	674	360	227	63
26	569	524	489	328	241	302	1,730	1,460	624	360	230	64
27	564	554	484	320	238	305	1,840	1,400	634	332	230	52
28	584	554	484	314	232	308	1,900	1,350	599	298	232	60
29	574	549	480	308		308	1,900	1,300	589	294	210	50
30	569	549	466	302	---------	316	1,900	1,280	584	288	217	50
31	559	---------	475	300	---------	339	---------	1,240	---------	280	212	---------
Total	15,580	15,620	15,545	12,563	7,771	8,607	27,854	52,850	24,290	14,694	7,208	3,592
Mean	503	521	501	405	278	278	928	1,705	810	474	233	120
Cfsm	1.04	1.08	1.04	0.838	0.576	0.576	1.92	3.53	1.68	0.981	0.482	0.248
In.	1.20	1.20	1.20	0.97	0.60	0.66	2.14	4.07	1.87	1.13	0.56	0.28

Calendar year 1965: Max 1,270 Min 78 Mean 401 Cfsm 0.830 In. 11.27
Water year 1965-66: Max 1,900 Min 50 Mean 565 Cfsm 1.17 In. 15.88

5-1294. Rainy Lake at Fort Frances, Ontario

(International gaging station)

Location.--Lat 48°37'15", long 93°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 1966 in reports of Geological Survey. August 1911 to September 1966 in reports of Inland Waters Branch, Department of Energy, Mines and 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 at Ranier, Minn., at same datum. Supplementary gage in town pumping station, half a mile south, used during winter months.

Extremes.--Maximum elevation during year, 1,109.52 ft June 11; minimum, 1,105.55 ft Mar. 30.
1910-17, 1934-66: 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 1965 to September 1966

Oct. 31	8.17	Feb. 28	6.06	June 30	8.46
Nov. 30	7.74	Mar. 31	5.60	July 31	7.95
Dec. 31	7.63	Apr. 30	7.23	Aug. 31	7.60
Jan. 31	6.86	May 31	9.11	Sept.30	6.53

Note.--Add 1,100 ft to obtain elevation above mean sea level. Elevations other than those shown are available.

5-1305. Sturgeon River near Chisholm, Minn.

Location.--Lat 47°40'25", long 92°54'00", in NE¼NW¼ 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 1966.

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.--24 years, 120 cfs.

Extremes.--Maximum discharge during year, 1,460 cfs about April 21 (gage height, 4.55 ft, from recorded range in stage); minimum,23 cfs July 30, 31, Aug. 1 (gage height, 0.53 ft, from recorded range in stage).
1942-66: 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, 0.08 ft Jan. 28 to Feb. 1, 1963.

Remarks.--Records poor.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	457	168	104	74	50	30	215	900	215	112	23	84
2	619	160	106	73	48	30	275	760	205	100	24	81
3	728	154	108	72	47	31	370	710	195	92	24	79
4	658	148	110	71	46	32	440	715	185	86	25	78
5	526	142	109	71	46	33	460	799	175	96	26	76
6	397	136	108	70	46	34	460	860	165	104	33	75
7	341	130	107	70	46	35	450	850	156	94	66	70
8	341	124	106	69	48	36	450	795	150	80	136	67
9	331	120	104	69	49	38	450	725	142	69	304	65
10	324	118	103	68	50	40	470	640	135	62	345	63
11	307	118	101	68	51	41	540	555	128	55	300	63
12	266	120	99	67	49	43	648	495	123	49	265	62
13	235	136	98	67	45	45	800	445	117	45	235	62
14	210	128	96	66	42	48	940	410	112	41	210	63
15	193	118	94	66	39	51	1,070	390	107	38	185	62
16	178	124	93	66	36	54	1,020	420	103	36	160	60
17	172	124	91	66	32	57	940	500	97	33	140	59
18	165	122	89	66	30	63	960	570	93	32	124	57
19	163	118	87	66	29	72	1,050	620	89	34	112	55
20	233	116	85	66	29	86	1,210	600	85	35	104	54
21	280	116	83	66	29	100	1,400	550	82	33	101	56
22	311	113	82	66	28	110	1,250	495	78	31	115	56
23	311	108	81	66	28	113	1,090	445	76	31	140	55
24	274	104	80	65	28	115	1,020	410	73	30	152	52
25	243	100	79	64	28	116	940	390	72	28	156	50
26	220	96	78	63	28	120	920	360	75	27	140	50
27	204	94	77	62	28	123	930	324	81	26	121	49
28	194	94	76	60	29	130	1,000	294	94	25	107	49
29	184	97	76	58		137	1,220	268	112	24	100	50
30	178	100	75	54	- - - - -	150	1,040	251	118	23	92	50
31	174	- - - - -	74	52	- - - - -	178	- - - - -	233	- - - - -	23	86	- - - - -
Total	9,417	3,646	2,859	2,047	1,084	2,291	24,028	16,779	3,638	1,594	4,151	1,852
Mean	304	122	92.2	66.0	38.7	73.9	801	541	121	51.4	134	61.7
Max	728	168	110	74	51	178	1,400	900	215	112	345	84
Min	163	94	74	52	28	30	215	233	72	23	23	49
Cfsm	1.63	0.652	0.493	0.353	0.207	0.395	4.28	2.89	0.647	0.275	0.717	0.330
In.	1.87	0.73	0.57	0.41	0.22	0.46	4.78	3.34	0.72	0.32	0.83	0.37

Cal yr 1965:	Total	52,474	Mean	144	Max	1,100	Min	12	Cfsm	0.770	In. 10.44
Wtr yr 1966:	Total	73,386	Mean	201	Max	1,400	Min	23	Cfsm	1.07	In. 14.59

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10-3	1200	3.31	738	about 4-29	unkn.	4.27	1,280
about 4-21	unkn.	4.55	1,460	about 5-19	unkn.	3.68	934

Note.--No gage-height record Apr. 13-22 and July 26 to Aug. 3.

5-1310. Dark River near Chisholm, Minn.

Location.--Lat 47°41'27", long 92°49'15", in SW¼SW¼ sec.12, T.60 N., R.20 W., on right bank 50 ft downstream from remains of abandoned highway bridge, 3½ miles upstream from mouth, and 12¼ miles northeast of Chisholm

Drainage area.--50.6 sq mi.

Records available.--August 1942 to September 1961, October 1965 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,316.8 ft above mean sea level, datum of 1929 (surveyed by Topographic Division). Prior to Aug. 24, 1944, staff gage at site 50 ft upstream at same datum.

Average discharge.--20 years, 36.7 cfs.

Extremes.--Maximum discharge during year, 437 cfs Apr. 19 (gage height, 4.78 ft); minimum daily, 6.9 cfs Mar. 2, 3.
1942-61, 1966: Maximum discharge, 1,170 cfs May 7, 1950 (gage height, 7.10 ft); minimum, 0.3 cfs Aug. 3 1956; minimum gage height, 0.87 ft Mar. 22, 23, 1949, Aug. 16, 17, 1961.

Remarks.--Records good.

Cooperation.--Records for 1966 water year computed by U. S. Steel Corporation and reviewed by Geological Surve

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	115	40	21	15	10	7.2	71	172	43	21	12	19
2	138	38	21	15	10	6.9	88	158	39	19	12	17
3	167	37	21	15	10	6.9	91	154	38	45	10	17
4	160	33	21	14	10	7.5	90	167	36	43	10	17
5	142	32	20	14	10	8.1	101	188	36	46	8.7	16
6	111	31	20	14	10	8.4	109	209	36	43	12	16
7	107	30	20	13	10	8.0	107	221	36	39	31	15
8	108	29	20	13	10	8.0	108	216	36	35	53	15
9	101	29	20	13	10	8.0	109	194	35	53	55	14
10	100	28	19	13	10	8.4	115	171	32	46	60	13
11	100	26	19	13	10	8.1	125	149	31	41	59	13
12	93	26	19	13	10	8.4	155	134	30	37	53	13
13	85	26	19	13	10	8.7	176	124	29	34	53	13
14	73	25	19	12	10	9.0	230	115	30	30	55	13
15	65	25	18	12	10	9.0	282	114	28	27	50	12
16	56	25	18	12	10	9.0	334	118	28	24	48	12
17	52	25	18	12	10	9.0	399	121	27	21	44	11
18	48	24	18	12	10	10	421	125	26	21	40	11
19	46	24	18	12	10	11	379	128	24	19	32	11
20	60	24	18	12	10	12	308	132	21	18	30	10
21	66	24	17	11	10	13	262	128	21	16	29	10
22	84	23	17	11	10	15	272	121	19	15	32	9.4
23	100	23	17	11	10	16	292	114	18	14	39	9.0
24	97	23	17	11	10	18	308	107	19	13	41	8.7
25	84	23	17	11	9.0	21	343	93	29	13	41	8.7
26	73	23	16	10	8.1	24	336	84	30	14	40	8.7
27	61	22	16	10	7.2	28	308	75	30	13	36	8.7
28	53	22	16	10	7.2	32	260	65	28	13	32	9.0
29	47	22	15	10		37	210	57	26	11	28	10
30	42	22	15	10	- - - - -	45	187	51	24	10	24	11
31	41	- - - - -	15	10	- - - - -	60	- - - - -	47	- - - - -	9.0	21	- - - - -
Total	2,675	804	565	377	271.5	480.6	6,576	4,052	885	803.0	1,090.7	371.2
Mean	86.3	26.8	18.2	12.2	9.70	15.5	219	131	29.5	25.9	35.2	12.4
Max	167	40	21	15	10	60	421	221	43	53	60	19
Min	41	22	15	10	7.2	6.9	71	47	18	9.0	8.7	8.7
Cfsm	1.71	0.530	0.360	0.241	0.192	0.306	4.33	2.59	0.583	0.512	0.696	0.245
In.	1.97	0.59	0.42	0.28	0.20	0.35	4.83	2.98	0.65	0.59	0.80	0.27

Cal yr	: Total		Mean		Max		Min		Cfsm		In.	
Wtr yr 1966:	Total	18,951.0	Mean	51.9	Max	421	Min	6.9	Cfsm	1.03	In.	13.93

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

Location.--Lat 48°24', long 93°34', in NW¼ 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 1½ 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 1966.

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.--43 years (1911-16, 1928-66), 992 cfs.

Extremes.--Maximum discharge during year, 14,700 cfs Apr. 19 (gage height, 28.33 ft); minimum, 177 cfs Sept. 27, 28 (gage height, 5.66ft).
1909-17, 1928-66: 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 period of backwater from Rainy River and those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,090	1,710	820	630	340	180	2,000	6,700	2,050	463	272	549
2	5,540	1,680	840	620	330	180	2,700	6,290	1,950	452	254	498
3	5,870	1,650	850	620	320	180	3,800	6,290	1,810	1,100	248	452
4	5,380	1,560	860	610	320	180	4,400	6,410	1,730	1,800	240	415
5	4,700	1,470	870	600	320	185	4,800	7,160	1,630	2,180	232	407
6	3,990	1,410	880	590	310	185	5,000	7,960	1,540	2,320	240	388
7	3,500	1,330	890	570	310	185	5,000	8,470	1,460	1,960	261	372
8	3,530	1,300	900	560	300	190	4,900	8,360	1,400	1,570	317	356
9	3,760	1,170	900	540	300	190	4,800	7,650	1,300	1,270	613	342
10	3,820	1,060	880	520	290	195	4,800	6,700	1,230	980	1,100	327
11	3,530	1,060	870	510	290	195	5,000	5,840	1,160	851	1,200	305
12	3,160	1,100	860	510	280	200	5,600	5,140	1,100	768	1,240	292
13	2,790	1,200	850	500	270	200	6,500	4,660	1,050	681	1,200	280
14	2,510	1,140	830	490	260	200	7,600	4,370	1,030	616	1,150	269
15	2,330	1,100	810	480	250	205	9,300	4,210	1,000	558	1,150	259
16	2,110	1,080	790	470	240	215	11,700	4,670	978	510	1,160	250
17	1,930	1,080	770	460	230	235	13,200	5,050	937	463	1,130	238
18	1,830	1,070	760	450	230	280	14,100	5,480	901	434	1,110	230
19	2,240	1,070	740	440	220	440	14,600	5,800	851	415	1,010	226
20	2,460	1,070	730	430	210	660	14,200	5,610	771	382	904	222
21	3,140	1,060	720	420	200	820	11,800	5,160	712	354	796	218
22	3,760	1,050	710	410	190	920	9,370	4,640	675	334	765	211
23	3,750	1,030	700	400	190	1,040	9,280	4,190	630	317	884	205
24	3,410	980	680	400	185	1,050	10,800	4,090	590	305	1,010	194
25	3,040	900	670	390	185	1,050	12,500	4,230	570	312	1,140	191
26	2,710	840	660	380	185	1,040	13,600	3,890	555	301	1,160	184
27	2,430	820	660	370	180	1,020	13,300	3,430	537	292	1,080	180
28	2,180	810	650	360	180	1,020	11,400	2,900	522	283	954	182
29	1,970	810	640	350		1,020	9,000	2,680	498	267	816	187
30	1,830	810	640	350	---------	1,030	7,580	2,420	480	252	693	182
31	1,740	----------	630	350	---------	1,350	----------	2,200	----------	276	610	----------
Total	98,030	34,420	24,060	14,780	7,115	16,040	252,630	162,650	31,647	23,066	24,939	8,611
Mean	3,162	1,147	776	476	254	517	8,421	5,247	1,055	744	804	287
Cfsm	1.83	0.663	0.449	0.275	0.147	0.299	4.87	3.03	0.610	0.430	0.465	0.166
In.	2.11	0.74	0.52	0.32	0.15	0.34	5.43	3.50	0.68	0.50	0.54	0.19

Calendar year 1965: Max 10,800 Min 68 Mean 1,448 Cfsm 0.837 In. 11.36
Water year 1965-66: Max 14,600 Min 180 Mean 1,912 Cfsm 1.11 In. 15.00

Note.--Stage-discharge relation affected by backwater from Rainy River May 19 to July 4.

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 4¾ 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 1966.

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.--38 years (1928-1966), 655 cfs.

Extremes.--Maximum discharge during year, 9,520 cfs Apr. 19 (gage height, 12.60 ft); minimum, 58 cfs Aug. 5 (gage height, 2.77 ft, result of regulation).
1909-12, 1928-66: 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 winter months, which are fair. Some diurnal fluctuation at low flow caused by powerplant a quarter of a mile upstream.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,430	991	430	415	305	175	1,400	4,930	1,800	503	185	546
2	1,700	970	440	415	300	180	2,100	4,790	1,720	486	180	527
3	1,650	942	450	415	290	180	2,600	4,760	1,640	900	176	509
4	1,520	907	460	415	285	185	2,900	4,960	1,570	1,170	168	498
5	1,370	872	470	415	280	190	3,100	5,430	1,500	1,350	153	498
6	1,250	851	490	410	280	190	3,100	5,820	1,440	1,380	193	492
7	1,220	817	500	410	280	190	3,000	5,820	1,360	1,120	342	475
8	1,610	804	500	410	275	195	3,000	5,550	1,300	865	1,110	458
9	2,120	765	500	410	270	200	2,950	5,070	1,240	700	2,120	452
10	2,100	720	500	410	265	205	2,900	4,580	1,170	622	2,550	436
11	1,950	690	495	410	260	215	3,000	4,140	1,110	546	2,160	426
12	1,730	660	490	410	250	220	3,120	3,800	1,060	486	1,650	420
13	1,560	610	480	410	245	220	3,630	3,570	1,030	431	1,400	415
14	1,470	565	475	405	235	220	4,150	3,400	1,010	389	1,480	415
15	1,390	385	470	405	225	225	4,700	3,400	991	359	1,410	410
16	1,300	405	460	400	215	230	6,500	4,000	949	330	1,320	404
17	1,240	460	450	400	205	250	8,290	4,470	907	307	1,210	394
18	1,190	480	450	400	200	320	9,440	4,480	865	270	1,050	389
19	1,170	480	450	395	190	430	9,360	4,290	830	274	879	384
20	1,280	470	440	395	180	600	8,130	4,020	804	256	758	374
21	1,560	470	440	390	180	800	6,500	3,730	778	235	674	364
22	1,680	460	430	385	175	950	5,740	3,480	746	214	739	359
23	1,640	460	430	380	175	1,020	6,110	3,240	706	214	956	354
24	1,520	460	420	375	175	1,040	7,110	3,100	661	210	1,060	349
25	1,400	450	420	365	175	1,060	8,240	2,980	661	201	1,070	344
26	1,280	440	420	360	175	1,050	8,590	2,830	680	201	1,000	344
27	1,170	440	420	350	175	1,030	7,920	2,640	674	193	886	344
28	1,110	430	420	340	175	1,020	6,800	2,440	642	180	765	340
29	1,050	430	415	335		1,000	5,880	2,240	596	185	668	335
30	1,020	430	415	325	---------	1,000	5,320	2,070	558	185	609	326
31	998	----------	415	315	---------	1,070	----------	1,920	----------	185	576	----------
Total	44,678	18,314	14,045	12,075	6,440	15,860	155,580	121,950	30,998	14,947	29,497	12,381
Mean	1,441	610	453	390	230	512	5,186	3,933	1,033	482	952	413
Cfsm	0.987	0.418	0.310	0.267	0.158	0.351	3.55	2.69	0.708	0.330	0.652	0.283
In.	1.14	0.47	0.36	0.31	0.16	0.40	3.96	3.11	0.79	0.38	0.75	0.32

Calendar year 1965: Max 5,890 Min 78 Mean 848 Cfsm 0.581 In. 7.89
Water year 1965-66: Max 9,440 Min 153 Mean 1,306 Cfsm 0.895 In. 12.14

GPO 803-695-6

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 1966. 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.--38 years, 12,260 cfs.

Extremes.--Maximum discharge during year, 53,500 cfs Apr. 27 (gage height, 17.36 ft); minimum, 6,600 cfs Sept. 19 (gage height, 3.55 ft).
1928-66: Maximum discharge, 71,600 cfs May 12, 1950 (gage height, 21.04 ft); minimum daily, 928 cfs Dec. 26, 1929.

Remarks.--Records good except those for winter months, which are fair. 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	17,300	30,400	15,600	15,100	13,500	12,800	21,700	43,400	37,800	27,200	12,000	12,100
2	19,500	30,100	15,600	15,800	13,300	12,900	22,900	42,300	37,400	26,200	11,800	12,000
3	21,400	29,700	15,800	15,700	13,300	12,900	24,200	42,500	37,100	30,900	11,700	12,200
4	20,900	29,600	16,200	15,700	13,300	12,900	25,500	43,100	37,000	31,500	11,400	11,600
5	20,500	29,200	16,100	14,800	13,300	12,700	26,500	43,900	36,900	31,400	10,300	10,400
6	19,500	29,100	14,700	14,900	13,300	12,600	27,300	45,700	36,800	30,600	9,730	7,580
7	18,600	29,000	16,400	15,500	13,300	12,700	27,500	47,000	36,700	27,900	9,570	9,020
8	19,400	28,800	16,200	15,700	13,300	12,700	27,400	47,200	36,700	26,200	10,200	11,300
9	20,000	28,200	15,400	15,700	13,300	12,700	27,300	46,600	36,700	24,900	11,300	11,700
10	20,400	27,100	15,600	15,600	12,600	12,800	27,300	44,900	36,500	24,200	12,600	11,200
11	20,500	26,500	16,200	15,600	12,700	12,800	27,800	43,100	36,400	23,400	13,600	8,570
12	22,200	26,500	16,300	15,600	13,200	12,900	29,100	40,700	36,200	20,100	13,500	7,280
13	22,400	26,300	15,200	15,500	13,300	12,900	30,800	39,200	36,000	17,800	14,300	7,180
14	22,700	25,600	16,200	15,500	13,200	12,900	33,500	39,000	36,000	14,700	15,000	7,180
15	23,600	25,000	16,000	15,500	13,200	12,900	37,700	38,800	35,900	13,700	15,300	7,180
16	24,500	22,100	16,200	15,500	13,100	12,900	42,600	38,700	35,700	13,100	15,400	7,080
17	25,000	20,100	16,000	15,500	12,400	12,000	46,800	33,100	35,500	12,800	15,200	6,980
18	25,200	20,200	16,100	15,300	12,900	11,700	49,800	39,200	35,300	12,700	14,700	6,780
19	27,800	20,000	16,100	15,400	13,000	11,400	52,000	42,400	35,100	12,600	14,500	6,660
20	29,000	20,000	16,000	15,400	13,000	11,800	52,500	43,400	34,800	12,500	14,000	7,760
21	34,000	20,000	16,000	15,400	13,000	12,100	49,800	43,500	34,500	12,400	12,500	8,620
22	36,100	20,000	16,200	15,300	12,900	15,200	45,900	42,800	34,100	12,400	11,000	10,100
23	36,500	20,000	16,000	15,100	13,000	15,900	43,700	41,900	33,700	12,400	12,900	10,600
24	35,800	19,700	16,000	15,300	12,900	16,000	44,800	41,400	33,300	12,300	14,000	10,600
25	34,500	17,100	15,300	15,300	12,900	16,200	48,500	41,400	33,000	12,300	14,500	10,900
26	33,600	15,600	14,100	15,300	12,900	16,100	52,200	41,300	32,700	12,100	14,900	10,600
27	32,700	16,300	14,900	14,500	12,900	16,200	53,000	40,900	32,300	12,100	14,400	10,400
28	32,100	16,200	15,800	13,100	12,800	16,000	51,200	40,000	31,900	12,100	13,300	10,600
29	31,300	16,200	15,800	13,500		16,200	48,500	39,200	31,500	11,800	11,900	10,600
30	30,800	16,000	15,900	13,400	---------	16,800	45,300	38,600	30,500	11,500	12,400	10,400
31	30,600	---------	15,900	13,400	---------	18,200	---------	38,100	---------	11,800	12,100	---------
Total	808,400	700,600	489,800	468,900	365,800	426,800	1,143,100	1,293,300	1,054,000	567,600	400,000	285,170
Mean	26,080	23,350	15,800	15,130	13,060	13,770	38,100	41,720	35,130	18,310	12,900	9,506
Cfsm	1.34	1.20	0.814	0.780	0.673	0.710	1.96	2.15	1.81	0.944	0.665	0.490
In.	1.55	1.34	0.94	0.90	0.70	0.82	2.19	2.48	2.02	1.09	0.77	0.55

Calendar year 1965: Max 37,800 Min 4,120 Mean 17,490 Cfsm 0.901 In. 12.25
Water year 1965-66: Max 53,000 Min 6,660 Mean 21,930 Cfsm 1.13 In. 15.35

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 20 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 1966.

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.--10 years, 332 cfs.

Extremes.--Maximum discharge during year, 5,140 cfs Apr. 17 (gage height, 15.67 ft); minimum, 11 cfs Aug. 5 (gage height, 1.83 ft).

1956-66: 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).

Flood of May 11, 1950 reached a stage of 21.1 ft, from information by local residents and Minnesota Highway Department (discharge, about 8,500 cfs).

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,490	622	275	180	62	37	1,200	2,600	362	63	16	179
2	1,450	584	272	175	61	37	1,700	2,770	305	61	15	242
3	1,330	550	270	170	60	38	2,300	2,900	268	108	14	236
4	1,200	529	270	165	59	40	2,850	2,970	240	219	13	209
5	1,080	504	265	160	58	42	3,150	2,890	221	327	13	202
6	995	464	265	160	57	44	3,300	2,700	244	336	15	186
7	935	428	260	155	57	46	3,300	2,470	270	257	21	170
8	929	413	260	150	56	47	3,200	2,180	246	192	38	150
9	960	347	255	148	56	48	3,150	1,920	214	192	68	128
10	941	305	255	145	55	49	3,120	1,700	189	336	70	115
11	885	325	250	142	54	51	3,220	1,520	178	322	53	102
12	823	270	250	140	52	52	3,400	1,370	214	252	48	94
13	761	235	245	140	49	54	3,780	1,260	319	189	316	90
14	712	275	240	137	46	55	4,120	1,180	347	146	963	108
15	674	315	235	132	43	56	4,520	1,190	311	118	944	117
16	631	340	230	130	40	57	4,890	1,440	257	97	795	103
17	600	360	230	125	38	59	5,110	1,560	214	81	671	88
18	681	360	225	122	36	65	5,030	1,540	187	68	752	79
19	1,040	350	220	120	35	90	4,710	1,490	162	60	712	70
20	1,380	335	220	115	35	140	4,010	1,490	140	52	588	61
21	1,450	315	215	110	35	205	3,440	1,440	121	53	479	55
22	1,380	305	210	106	35	300	3,300	1,330	106	52	449	52
23	1,270	300	205	100	35	340	3,420	1,210	99	41	625	46
24	1,130	295	200	94	35	375	3,570	1,120	100	34	699	44
25	1,010	295	195	90	35	380	3,580	1,010	108	32	631	43
26	913	300	195	85	36	370	3,470	894	114	27	504	40
27	832	305	190	80	36	365	3,220	795	117	24	395	37
28	764	300	190	75	36	360	2,870	702	99	24	308	36
29	715	290	185	70		380	2,650	609	86	23	252	36
30	687	282	185	67	-----	430	2,590	522	74	20	212	40
31	656	-----	180	64	-----	720	-----	437	-----	17	184	-----
Total	30,304	10,898	7,142	3,852	1,292	5,332	102,170	49,209	5,912	3,823	10,863	3,158
Mean	978	363	230	124	43.1	172	3,406	1,587	197	123	350	105
Max	1,490	622	275	180	62	720	5,110	2,970	362	336	963	242
Min	600	235	180	64	35	37	1,200	437	74	17	13	36
Cfsm	1.80	0.669	0.424	0.228	0.079	0.317	6.27	2.92	0.363	0.227	0.645	0.193
In.	2.07	0.75	0.49	0.26	0.09	0.37	7.00	3.37	0.40	0.26	0.74	0.22

Cal yr 1965:	Total	201,584.6	Mean	552	Max	3,880	Min	2.5	Cfsm	1.02	In.	13.81
Wtr yr 1966:	Total	233,955	Mean	641	Max	5,110	Min	13	Cfsm	1.18	In.	16.02

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 1966. 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.--20 years, 41.0 cfs.

Extremes.--Maximum discharge during year, 1,020 cfs Apr. 16 (gage height, 8.45 ft); maximum gage height 9.33 ft Apr. 3 (backwater from ice); minimum daily discharge, 4.7 cfs Feb. 20-26.
1946-1966: Maximum discharge 1,780 cfs Apr. 15, 1965 (gage height 9.95 ft); 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 winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	85	56	20	19	7.5	5.0	140	331	55	18	8.5	31
2	80	50	20	18	7.2	5.0	250	378	48	25	8.1	28
3	75	46	21	18	7.2	5.2	560	390	42	33	8.0	25
4	70	44	22	18	7.2	5.2	730	407	36	60	6.6	24
5	57	39	23	18	7.2	5.2	590	395	35	80	5.8	25
6	49	38	23	18	7.0	5.3	540	372	36	111	15	23
7	48	36	24	17	7.0	5.3	780	335	44	99	18	26
8	46	31	24	17	7.0	5.4	660	279	50	84	56	24
9	48	28	25	17	6.8	5.6	527	235	44	92	105	20
10	49	26	25	16	6.8	5.8	457	196	37	96	112	18
11	49	24	24	16	6.6	6.0	453	175	41	105	91	17
12	48	22	24	16	6.4	6.2	514	140	57	80	57	15
13	44	21	24	15	6.2	6.3	617	130	66	56	54	13
14	41	20	23	15	6.0	6.5	755	125	62	45	84	12
15	36	20	23	14	5.8	6.8	966	143	61	37	137	13
16	36	21	23	14	5.6	7.2	973	166	48	30	136	16
17	56	21	22	13	5.4	7.8	925	233	37	25	129	14
18	59	22	22	13	5.2	9.0	852	242	30	24	124	13
19	102	22	22	12	4.8	11	770	247	25	19	121	12
20	136	21	22	11	4.7	17	675	256	21	18	107	9.6
21	160	21	21	11	4.7	35	572	258	19	16	67	8.5
22	179	21	21	10	4.7	60	500	247	16	14	61	7.8
23	161	21	21	9.5	4.7	82	492	233	19	17	82	5.9
24	140	20	21	9.2	4.7	95	457	204	20	30	124	5.0
25	129	20	20	9.0	4.7	105	436	178	30	36	160	6.2
26	107	20	20	8.6	4.7	92	382	160	37	25	157	7.6
27	94	19	19	8.4	4.8	85	366	132	48	19	104	8.3
28	87	19	19	8.0	4.8	80	337	113	41	18	87	6.2
29	75	19	19	8.0		75	308	87	26	15	65	5.9
30	62	19	19	7.5	---------	80	325	74	22	12	45	5.0
31	60	----------	19	7.5	---------	105	----------	67	----------	11	34	----------
Total	2,468	807	675	411.7	165.4	1,030.8	16,909	6,928	1,153	1,350	2,369.0	445.0
Mean	79.6	26.9	21.8	13.3	5.91	33.3	564	223	38.4	43.5	76.4	14.8
Cfsm	0.724	0.245	0.198	0.121	0.054	0.303	5.13	2.03	0.349	0.395	0.695	0.135
In.	0.83	0.27	0.23	0.14	0.06	0.35	5.72	2.34	0.39	0.46	0.80	0.15

Calendar year 1965: Max 1,530 Min 0.2 Mean 68.1 Cfsm 0.619 In. 8.24
Water year 1965-66: Max 973 Min 4.7 Mean 95.1 Cfsm 0.865 In. 11.74

5-1400. Bulldog Run near Warroad, Minn.

Location.--Lat 48°51'30", long 95°20'20", in SE¼ sec.7, T.162 N., R.36 W., on right bank at downstream side of highway bridge, three-quarters of a mile upstream from mouth and 3 miles south of Warroad.

Drainage area.--14.2 sq mi.

Records available.--March 1946 to November 1951, June to September 1966.

Average discharge.--5 years (1946-51), 4.02 cfs.

Extremes.--Maximum discharge observed during period, 8.9 cfs July 4 (gage height, 3.55 ft); no flow for many days.
1946-51, 1966: Maximum discharge, 420 cfs June 10, 1947 (gage height, 6.91 ft); no flow for many days.

Remarks.--Records fair.

Discharge, in cubic feet per second, June to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1									2.1	.6	0	.2
2									1.6	.6	0	.2
3									1.2	5.9	0	.2
4									1.0	8.9	0	.1
5									1.4	7.4	0	.1
6									1.7	6.9	0	.1
7									1.9	6.5	0	.1
8									1.8	5.6	1.4	.1
9									1.7	4.8	1.2	.1
10									1.4	4.7	.7	0
11									1.1	4.8	.6	0
12									1.9	3.2	.4	0
13									2.1	1.4	.6	0
14									1.9	.8	2.9	0
15									1.7	.4	3.2	0
16									1.3	.4	4.2	0
17									1.2	.3	4.4	0
18									.8	.2	4.3	0
19									.8	.1	2.0	0
20									.6	0	.6	0
21									.5	0	.4	0
22									.4	.1	.4	0
23									.3	.1	.7	0
24									.7	0	1.1	0
25									1.7	0	.9	0
26									2.1	0	.6	0
27									1.6	0	.4	0
28									1.0	0	.3	0
29									.8	0	.2	0
30					- - - - -				.6	0	.1	0
31		- - - - -			- - - - -		- - - - -		- - - - -	0	0	- - - -
Total									38.9	63.7	31.6	1.2
Mean									1.30	2.05	1.02	0.04
Max									2.1	8.9	4.4	0.2
Min									0.3	0	0	0
Cfsm									0.092	0.144	0.072	0.0028
In.									0.10	0.17	0.08	0.003

Cal yr	: Total	Mean	Max	Min	Cfsm	In.
Wtr yr	: Total	Mean	Max	Min	Cfsm	In.

5-1405. East Branch Warroad River near Warroad, Minn.

Location.--Lat 48°51'30" long 95°18'40", in SE¼SE¼ sec.8, T.162 N., R.36 W., near right bank on upstream side of piling of highway bridge, 2 miles upstream from mouth and 3 miles south of Warroad.

Drainage area.--102 sq mi.

Records available.--March 1946 to September 1954, June to September 1966 (fragmentary prior to April 1947).

Gage.--Staff gage read once daily. Altitude of gage is 1,080 ft (from topographic map).

Average discharge.--7 years (1947-54), 21.1 cfs.

Extremes.--Maximum discharge during period, 98 cfs July 7 (gage height, 5.70 ft, from graph based on gage readings); no flow Aug. 3-5.
1946-54, 1966: Maximum discharge, 1,340 cfs June 11, 1947 (gage height 9.36 ft, from floodmark); no flow for many days.

Remarks.--Records fair.

Discharge, in cubic feet per second, June to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1									23	6.1	0.2	9.4
2									18	5.4	.1	8.0
3									13	7.0	0	1.5
4									11	17	0	2.2
5									13	40	0	1.3
6									16	78	.2	1.4
7									20	91	.9	1.4
8									24	53	3.5	1.9
9									19	39	7.2	1.4
10									15	37	8.1	2.0
11									13	41	7.8	2.6
12									28	38	7.5	3.0
13									30	26	6.8	2.5
14									30	15	16	2.2
15									28	14	16	2.4
16									22	10	22	2.5
17									21	8.4	29	2.6
18									22	7.1	21	2.3
19									16	5.0	17	2.3
20									17	4.0	17	2.6
21									14	2.8	11	2.7
22									9.9	2.1	8.2	2.8
23									9.2	2.5	12	2.9
24									12	3.2	36	14
25									14	3.6	41	5.6
26									17	2.5	31	3.0
27									17	1.1	23	3.8
28									13	.7	14	4.3
29									9.7	.4	10	6.3
30					- - - - -				8.3	.3	7.7	5.6
31		- - - - -			- - - - -		- - - - -		- - - - -	.2	6.3	- - - - -
Total									523.1	561.4	380.5	106.5
Mean									17.4	18.1	12.3	3.55
Max									30	91	41	14
Min									8.3	0.2	0	1.3
Cfsm									0.171	0.177	0.121	0.035
In.									0.19	0.20	0.14	0.04

Cal yr	: Total	Mean	Max	Min	Cfsm	In.
Wtr yr	: Total	Mean	Max	Min	Cfsm	In.

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 1966. 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, 676,400 acre-ft June 26, (gage height, 11.42 ft); minimum, 464,100 acre-ft Mar. 16 (gage height, 8.45 ft).

1884-1966: 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 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 1965 to September 1966

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	10.12	573,200	-
Oct. 31	9.65	541,500	-31,700
Nov. 30	9.38	523,600	-17,900
Dec. 31	9.24	515,700	-7,900
Calendar year 1965	-	-	+71,400
Jan. 31	8.93	493,900	-21,800
Feb. 28	8.53	468,100	-25,800
Mar. 31	8.50	466,100	-2,000
Apr. 30	10.00	565,300	+99,200
May 31	11.24	658,500	+93,200
June 30	11.30	664,500	+6,000
July 31	10.85	624,800	-39,700
Aug. 31	10.42	595,000	-29,800
Sept. 30	9.72	547,400	-47,600
Water year 1965-66	-	-	-25,800

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 1966. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Water-stage recorder on headwater and staff gage on tailwater. Tailwater gage 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.--82 years, 503 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 963 cfs Feb. 14-16; minimum daily, 100 cfs Apr. 15-18. 1884-1966: 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	750	830	825	805	894	954	958	108	813	905	900	897
2	750	830	825	810	929	953	958	108	940	905	900	894
3	750	840	825	805	924	956	958	112	940	910	900	894
4	750	825	825	805	926	958	958	110	940	903	903	903
5	750	815	825	805	924	958	960	110	935	910	897	903
6	750	825	825	805	919	958	962	352	940	915	897	894
7	750	825	830	800	924	958	962	540	940	905	897	894
8	750	805	825	800	931	956	962	530	940	900	900	892
9	750	815	825	800	941	958	962	525	940	900	900	892
10	750	820	820	800	951	958	960	520	935	900	900	892
11	750	820	825	795	953	958	962	700	935	900	897	892
12	750	825	825	800	958	958	682	710	935	890	897	892
13	750	845	830	795	960	956	370	800	940	895	897	913
14	750	840	830	795	963	956	126	787	940	895	900	913
15	750	835	830	800	963	953	100	783	935	895	900	908
16	750	840	825	800	963	953	100	796	940	890	900	908
17	750	830	825	800	960	953	100	791	940	885	900	908
18	750	830	825	795	949	956	100	791	940	885	904	908
19	750	825	825	795	948	958	102	801	940	885	900	909
20	750	825	825	795	947	956	104	796	935	922	897	903
21	750	835	825	800	946	958	106	791	930	919	897	908
22	750	830	825	795	945	956	106	791	925	919	897	903
23	750	825	820	795	948	958	106	796	920	919	900	908
24	750	830	825	795	951	956	112	801	920	914	900	900
25	750	825	820	795	951	956	106	801	920	912	894	895
26	750	825	815	795	951	956	102	801	920	904	894	895
27	840	835	815	885	951	953	106	802	920	904	894	900
28	830	830	815	899	953	953	104	801	915	904	894	895
29	825	830	805	888		958	106	802	915	905	897	900
30	825	825	815	884	- - - - -	953	106	802	910	902	894	895
31	835	- - - - -	810	872	- - - - -	953	- - - - -	805	- - - - -	900	897	- - - - -
Total	23,655	24,835	25,505	25,208	26,423	29,634	13,406	19,563	27,838	27,997	27,844	27,008
Mean	763	828	823	813	944	956	447	631	928	903	898	900
Max	840	845	830	899	963	958	962	805	940	922	904	913
Min	750	805	805	795	894	953	100	108	813	885	894	892
Cfsm	0.529	0.574	0.571	0.564	0.655	0.663	0.310	0.438	0.644	0.626	0.623	0.624
In.	0.61	0.64	0.66	0.65	0.68	0.76	0.35	0.50	0.72	0.72	0.72	0.70

Cal yr 1965:	Total	181,506	Mean	497	Max	1,250	Min	50	Cfsm	0.345	In.	4.68
Wtr yr 1966:	Total	298,916	Mean	819	Max	963	Min	100	Cfsm	0.568	In.	7.71

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 1966. 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, 386,800 acre-ft May 20 (gage height, 2.81 ft); minimum, 195,000 acre-ft Feb. 28 (gage height, 1.09 ft).

1884-1966: 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 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.

Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

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 1965 to September 1966

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	1.75	251,900	-
Oct. 31	1.57	230,100	-21,800
Nov. 30	1.40	208,300	-21,800
Dec. 31	1.36	202,300	-6,000
Calendar year 1965	-	-	0
Jan. 31	1.28	192,600	-9,700
Feb. 28	1.09	171,400	-21,200
Mar. 31	1.35	202,300	+30,900
Apr. 30	2.48	345,100	+142,800
May 31	2.73	376,900	+31,800
June 30	2.48	345,100	-31,800
July 31	2.14	301,500	-43,600
Aug. 31	2.15	303,500	+2,000
Sept. 30	1.70	246,000	-57,500
Water year 1965-66	-	-	-5,900

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 1966. 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.--82 years, 344 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 967 cfs June 26; minimum daily, 79 cfs Apr. 19.
1884-1966: 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; five discharge measurements made and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	825	798	750	738	815	833	312	88	771	871	775	793
2	868	787	750	754	793	807	272	93	905	849	813	779
3	841	825	762	758	820	789	276	95	905	854	818	779
4	798	787	754	754	820	855	284	92	870	838	808	793
5	787	798	765	754	820	887	291	97	865	864	803	789
6	793	767	762	754	829	901	282	299	905	875	818	752
7	825	751	742	746	842	869	280	512	921	897	835	746
8	863	772	750	738	842	851	284	515	865	865	829	746
9	825	761	746	735	878	864	269	512	893	939	835	733
10	830	747	738	735	911	855	269	518	888	944	824	725
11	841	747	738	725	911	864	255	688	873	912	824	715
12	820	767	754	719	897	869	105	695	920	907	818	715
13	798	798	769	725	892	864	109	835	904	886	824	725
14	803	711	777	725	878	807	112	830	878	870	846	702
15	798	726	777	725	878	474	117	791	847	859	846	711
16	767	747	769	719	869	274	119	915	908	892	855	715
17	793	767	769	719	860	247	122	792	897	892	846	702
18	803	705	769	719	849	265	133	810	886	871	840	697
19	798	705	758	719	838	288	79	818	892	845	803	691
20	825	722	765	725	829	263	88	818	871	876	784	682
21	820	737	765	725	824	271	88	796	844	876	779	769
22	847	747	769	719	820	272	90	796	886	866	793	755
23	820	738	765	719	820	284	95	814	908	824	829	740
24	830	727	782	711	811	275	103	891	892	818	829	735
25	847	738	773	700	824	269	105	832	908	813	835	721
26	841	738	750	704	816	272	102	814	967	808	813	716
27	815	769	742	704	811	275	101	801	908	835	803	735
28	798	765	746	687	816	275	121	779	897	835	803	716
29	820	754	746	721		280	126	775	881	813	813	716
30	798	750	754	714	-----	280	88	771	881	813	789	706
31	820	-----	758	710	-----	284	-----	775	-----	808	784	-----
Total	25,357	22,651	23,514	22,500	23,613	16,763	5,077	19,657	26,636	26,715	25,314	21,999
Mean	818	755	759	726	843	541	169	634	888	862	817	733
Max	868	825	782	758	911	901	312	915	967	944	855	793
Min	767	705	738	687	793	247	79	88	771	808	775	682
Cfsm	0.703	0.649	0.653	0.624	0.725	0.465	0.145	0.545	0.764	0.741	0.702	0.630
In.	0.81	0.72	0.75	0.72	0.76	0.54	0.16	0.63	0.85	0.85	0.81	0.70

Cal yr 1965: Total	226,153	Mean	620	Max	1,060	Min	47	Cfsm	0.533	In.	7.23
Wtr yr 1966: Total	259,796	Mean	712	Max	967	Min	79	Cfsm	0.612	In.	8.31

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 U. S. Highway 169, 4 miles south of Grand Rapids.

Drainage area.--3,265 sq mi.

Records available.--April 1884 to September 1966. 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, 92,230 acre-ft May 1 (gage height, 11.46 ft); minimum, 29,160 acre-ft Mar. 17 (gage height, 6.86 ft).

1884-1966: Maximum contents, 121,400 acre-ft 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 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 1965 to September 1966

	Gage height (feet)	Contents (acre-ft)	Change in contents (acre-feet)
Sept. 30	9.52	64,460	-
Oct. 31	8.97	56,730	-7,730
Nov. 30	8.22	46,800	-9,930
Dec. 31	8.26	47,200	+400
Calendar year 1965	-	-	-5,960
Jan. 31	8.18	46,210	-990
Feb. 28	7.36	35,500	-10,710
Mar. 31	7.33	35,100	-400
Apr. 30	11.39	91,240	+56,140
May 31	10.41	77,360	-13,880
June 30	9.24	60,500	-16,860
July 31	9.04	57,720	-2,780
Aug. 31	9.13	58,900	+1,180
Sept. 30	8.98	56,930	-1,970
Water year 1965-66	-	-	-7,530

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.25 W., in super-calendar room of Blandin Paper Mill in Grand Rapids, 400 ft upstream from bridge on U. S. Highway 169, 2.5 miles upstream from Prairie River, and at mile 1,182 above Ohio River.

Drainage area.--3,370 sq mi, approximately.

Records available.--October 1883 to September 1966. Monthly discharge only for some periods, published in WSP 1308. Published as "at Pokegama Dam near Grand Rapids" 1942-44.

Gage.--Digital 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. Jan. 17, 1951, to July 11, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--83 years, 1,124 cfs.

Extremes.--Maximum discharge during year, 3,590 cfs Apr. 16 (gage height, 10.06 ft, backwater from Prairie River); maximum gage height, 10.57 ft Apr. 18 (backwater from Prairie River); minimum daily discharge 1,320 cfs Apr. 29.

1883-1966: 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.--Records fair. Flow completely regulated by Pokegama Lake (see preceding page). Backwater from Prairie River occurs at times in most years. Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Cooperation.--Records furnished by Corps of Engineers, 1883-1944, 1959-64.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,530	2,370	1,790	2,010	2,300	1,800	2,610	2,230	2,690	2,240	1,900	2,200
2	2,610	2,350	1,800	1,990	2,260	1,810	2,770	2,620	2,670	2,220	1,900	2,210
3	2,640	2,350	1,800	1,980	2,230	1,820	3,000	2,860	2,820	2,220	1,900	2,190
4	2,650	2,340	1,820	1,970	2,190	1,840	3,140	2,630	2,670	2,210	1,870	2,200
5	2,660	2,340	1,840	1,960	2,150	1,860	3,260	2,550	2,640	2,160	1,910	2,130
6	2,620	2,330	1,820	2,000	2,120	1,800	3,280	2,530	2,590	2,120	1,950	2,180
7	2,640	2,320	1,910	2,020	2,100	1,800	3,320	2,550	2,520	2,120	2,100	2,140
8	2,710	2,300	1,950	2,000	2,080	2,040	3,230	2,610	2,400	2,130	2,340	2,110
9	2,720	2,280	1,920	1,980	2,100	2,030	3,420	2,550	2,360	2,170	2,350	2,060
10	2,770	2,270	1,900	1,960	2,130	1,990	3,340	2,510	2,330	2,200	2,320	2,070
11	2,780	2,250	1,910	1,920	2,200	1,960	3,350	2,380	2,520	2,170	2,300	2,080
12	2,720	2,250	1,950	1,900	2,190	2,000	3,400	2,360	2,420	2,150	2,300	2,090
13	2,610	2,260	1,990	1,920	2,110	2,020	3,410	2,550	2,380	2,100	2,330	2,000
14	2,610	2,260	1,990	1,890	2,060	2,040	3,360	2,500	2,380	1,990	2,380	2,000
15	2,770	2,250	2,000	1,850	2,000	2,070	3,470	2,510	2,340	1,920	2,420	2,030
16	2,760	2,240	1,990	1,840	1,960	2,100	3,510	2,520	2,430	1,740	2,450	2,110
17	2,650	2,230	1,980	1,850	1,900	2,140	3,340	2,580	2,610	1,790	2,510	2,000
18	2,600	2,200	1,970	1,900	1,860	2,190	2,900	2,820	2,470	1,780	2,440	2,040
19	2,550	2,200	1,960	1,900	1,820	2,230	1,920	2,820	2,530	1,780	2,420	1,980
20	2,510	2,140	1,940	1,900	1,780	2,280	1,640	2,740	2,380	1,790	2,380	2,040
21	2,520	2,130	1,930	1,900	1,760	2,330	1,560	2,750	2,290	1,800	2,350	1,930
22	2,540	2,170	1,930	1,900	1,750	2,370	1,680	2,740	2,320	1,800	2,350	1,790
23	2,540	2,180	1,930	1,860	1,760	2,340	1,540	2,740	2,220	1,800	2,370	1,810
24	2,540	2,150	1,920	1,810	1,770	2,310	1,490	2,820	2,280	1,800	2,390	1,810
25	2,510	2,120	1,910	1,800	1,850	2,280	1,330	2,990	2,350	1,830	2,350	1,830
26	2,500	2,070	1,880	1,790	1,850	2,290	1,330	2,940	2,320	1,870	2,320	1,860
27	2,480	2,000	1,850	1,780	1,840	2,320	1,340	2,920	2,250	1,920	2,290	1,810
28	2,460	1,890	1,870	1,740	1,810	2,380	1,340	2,920	2,250	1,860	2,290	1,890
29	2,430	1,830	1,920	1,740		2,430	1,320	2,900	2,260	1,860	2,250	1,880
30	2,410	1,800	2,000	1,800	- - - - -	2,520	1,390	2,810	2,250	1,860	2,190	1,830
31	2,390	- - - - -	2,020	2,020	- - - - -	2,630	- - - - -	2,740	- - - - -	1,870	2,260	- - - - -
Total	80,430	65,870	59,390	58,880	55,930	66,020	75,990	82,690	72,940	61,270	69,880	60,300
Mean	2,595	2,196	1,916	1,899	1,998	2,130	2,533	2,667	2,431	1,976	2,254	2,010
Max	2,780	2,370	2,020	2,020	2,300	2,630	3,510	2,990	2,820	2,240	2,510	2,210
Min	2,390	1,800	1,790	1,740	1,750	1,800	1,320	2,230	2,220	1,740	1,870	1,790
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Cal yr 1965: Total 609,009 Mean 1,669 Max 2,650 Min 530 Ac-ft -
Wtr yr 1966: Total 809,590 Mean 2,218 Max 3,510 Min 1,320 Ac-ft -

Note.--No gage-height record Oct. 19 to Dec. 5, Feb. 8 to Mar. 13.

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 1963 to September 1966.

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 discharge during year, 238 cfs Apr. 18 (gage height, 4.10 ft); minimum, 0.9 cfs Sept. 27 (gage height, 1.66 ft).
1963-66: Maximum discharge, 265 cfs Apr. 19, 1965 (gage height 4.29 ft); minimum, that of Sept. 27, 1966.

Remarks.--Records good. Flow affected by natural storage in lakes above station. One hundred discharge measurements were made during the year. Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Cooperation.--Ninety discharge measurements furnished by M. A. Hanna Mining Co.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	242	21	18	16	7.6	8.6	106	76	19	21	13	12
2	249	22	18	16	7.6	7.9	135	83	19	22	19	11
3	141	20	17	15	7.6	8.2	150	98	21	20	15	10
4	78	18	17	15	7.6	8.2	153	124	19	16	12	10
5	51	14	17	14	7.6	9.4	135	144	20	14	12	9.7
6	44	15	16	14	7.9	9.8	113	135	26	12	17	9.4
7	41	16	16	13	8.2	10	101	105	25	12	48	9.0
8	49	17	17	13	9.0	9.8	83	81	21	11	123	8.7
9	55	15	17	12	11	9.8	80	62	18	12	131	8.4
10	54	14	16	11	12	9.8	94	54	17	14	86	8.0
11	46	14	16	11	12	9.8	110	54	18	13	54	8.0
12	40	20	21	10	12	9.4	136	56	22	11	36	6.2
13	37	27	27	10	13	9.8	178	52	21	11	30	5.7
14	34	26	28	10	14	11	203	52	18	10	47	6.8
15	31	25	26	10	14	13	180	62	16	10	53	6.0
16	29	23	26	10	13	17	186	105	16	9.7	42	4.6
17	27	20	26	10	12	29	214	106	16	9.7	31	7.4
18	28	22	24	10	12	51	234	100	15	21	24	5.7
19	28	21	22	9.8	11	48	196	84	13	53	21	5.2
20	41	19	22	9.8	11	48	150	75	13	36	18	5.2
21	61	18	22	9.8	11	57	138	67	13	22	19	4.9
22	61	18	21	9.8	11	63	156	58	13	18	22	3.0
23	58	17	20	9.0	11	60	204	54	14	15	29	2.0
24	54	17	20	9.0	10	54	195	59	17	14	30	1.6
25	48	17	19	9.0	10	45	171	54	52	13	27	1.4
26	42	17	18	8.6	9.5	41	143	43	81	13	22	1.4
27	38	16	18	8.6	9.3	37	112	34	54	12	19	1.0
28	30	17	17	8.2	9.0	35	95	29	34	12	16	1.6
29	23	18	17	7.9		36	92	26	25	10	14	2.0
30	20	18	17	7.9	-----	47	82	24	21	9.4	13	1.6
31	19	-----	17	7.9	-----	69	-----	22	-----	8.7	12	-----
Total	1,799	562	613	335.3	290.9	881.5	4,325	2,178	697	485.5	1,055	177.5
Mean	58.0	18.7	19.8	10.8	10.4	28.4	144	70.3	23.2	15.7	34.0	5.92
Max	249	27	28	16	14	69	234	144	81	53	131	12
Min	19	14	16	7.9	7.6	7.9	80	22	13	8.7	12	1.0
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Cal yr 1965: Total 11,694.2 Mean 32.0 Max 258 Min 5.1 Ac-ft -
Wtr yr 1966: Total 13,399.7 Mean 36.7 Max 234 Min 1.0 Ac-ft -

5-2168.6 Swan River near Calumet, Minn.

Location.--Lat 47°17'20", long 93°13'54", in SW¼ sec.35, T.56 N., R.23 W., on left bank 1.0 mile downstream from Snowball Creek, 2.1 miles downstream from bridge on U. S. Highway 65 at outlet of Swan Lake and 3.1 miles southeast of Calumet.

Records available.--January 1964 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,331.19 ft (revised) above mean sea level, datum of 1929 (Hanna Mining Company bench mark). Prior to June 5, 1964, reference point at same site and datum.

Extremes.--Maximum discharge during year, 540 cfs Apr. 19 (gage height 5.01 ft); minimum, 3.0 cfs Sept. 26, 27 (result of weir construction); minimum gage height, 1.64 ft July 31.
1964-66: Maximum discharge, that of Apr. 19, 1966; maximum gage height, 5.07 ft Apr. 22, 1965 (backwater from temporary foot bridge); minimum discharge, that of Sept. 26, 27, 1966.

Remarks.--Records good. Flow affected by natural storage in Swan Lake.

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

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	188	86	62	65	30	24	155	367	94	85	22	38
2	275	81	60	63	30	24	185	339	94	79	20	36
3	324	74	60	65	29	25	226	328	96	76	20	33
4	329	72	59	62	29	26	264	318	96	70	20	27
5	324	65	57	60	28	29	293	326	94	56	20	26
6	297	64	57	57	27	31	314	337	89	50	26	32
7	276	61	56	56	27	32	322	331	84	46	38	33
8	266	56	55	54	28	35	322	322	86	44	49	32
9	257	54	54	54	32	35	318	301	81	43	60	31
10	239	53	54	52	33	34	316	282	75	44	70	31
11	219	50	55	50	34	35	318	260	74	44	75	29
12	201	55	61	50	34	35	328	240	73	41	74	29
13	188	57	64	50	34	35	354	221	70	39	79	30
14	174	60	69	50	34	35	391	210	69	36	83	19
15	160	61	75	49	34	36	425	217	69	32	83	4.8
16	157	59	76	47	34	38	455	222	65	29	78	4.6
17	150	59	76	46	33	43	473	240	61	28	75	4.6
18	145	59	76	46	33	53	504	244	56	26	72	4.4
19	140	59	75	45	32	67	528	246	50	26	68	4.4
20	141	59	74	43	31	76	530	246	50	26	68	4.4
21	146	57	74	41	29	83	515	242	47	24	65	3.9
22	152	54	73	40	28	93	504	231	43	24	64	4.2
23	152	54	74	39	27	100	509	221	40	23	62	3.9
24	150	57	74	38	26	104	511	210	47	22	60	3.9
25	145	56	72	38	25	107	515	194	73	21	58	3.7
26	136	65	70	37	24	107	515	179	89	22	56	3.5
27	128	67	68	35	24	106	502	167	99	20	53	3.2
28	119	66	66	33	24	103	459	153	100	20	48	3.5
29	108	65	65	33		101	429	136	99	19	44	3.7
30	100	64	65	31	- - - - -	104	395	120	93	18	42	3.7
31	89	- - - - -	65	30	- - - - -	125	- - - - -	106	- - - - -	17	40	- - - - -
Total	5,875	1,849	2,041	1,459	843	1,881	11,875	7,556	2,256	1,150	1,692	490.4
Mean	190	61.6	65.8	47.1	30.1	60.7	396	244	75.2	37.1	54.6	16.3
Max	329	86	76	65	34	125	530	367	100	85	83	38
Min	89	50	54	30	24	24	155	106	40	17	20	3.2
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Cal yr 1965: Total 32,522 Mean 89.1 Max 531 Min 12 Ac-ft -
Wtr yr 1966: Total 38,967.4 Mean 107 Max 530 Min 3.2 Ac-ft -

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, 3¾ miles northwest of Swan River, and 22 miles upstream from mouth.

Drainage area.--254 sq mi.

Records available.--October 1953 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 1,259.80 ft above mean sea level (Minnesota State Highway Department bench mark).

Average discharge.--13 years, 132 cfs.

Extremes.--Maximum discharge during year, 936 cfs Apr. 24 (gage height, 8.84 ft); minimum, 42 cfs Sept. 26 (gage height, 2.36 ft, from recorded range in stage), caused by dam construction upstream at outlet of Swan Lake.

1953-66: Maximum discharge, 1,080 cfs Apr. 17, 1965; maximum gage height, 9.53 ft Apr. 16, 1965; 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 period of no gage-height record and those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	478	197	130	132	80	58	320	769	235	221	74	119
2	572	184	130	130	77	58	430	745	238	197	76	115
3	641	174	128	130	75	60	510	728	295	180	70	110
4	657	163	126	128	74	62	545	703	282	171	66	104
5	633	153	125	125	72	64	590	678	255	161	66	102
6	600	147	122	122	72	68	630	649	252	151	76	100
7	581	140	122	120	72	73	675	623	236	132	123	98
8	577	137	120	118	70	75	700	596	206	120	206	96
9	579	131	120	115	70	78	720	568	186	125	234	95
10	586	120	120	115	72	80	725	545	174	143	219	87
11	579	110	120	112	74	82	687	526	162	154	197	83
12	559	120	125	110	77	85	643	504	195	168	182	82
13	529	135	135	110	77	88	637	478	224	158	182	80
14	492	150	146	108	78	90	645	451	208	143	221	80
15	452	152	150	105	78	98	661	443	194	132	247	77
16	411	155	152	105	76	105	674	478	185	122	240	70
17	374	148	155	105	76	114	700	498	184	112	219	60
18	352	140	158	102	75	125	747	508	175	111	196	51
19	329	136	158	100	74	140	802	500	169	106	177	48
20	324	132	156	100	72	152	848	478	157	95	165	46
21	328	128	154	98	70	165	864	457	148	88	171	45
22	323	125	152	98	68	182	891	436	146	83	182	44
23	308	122	150	96	65	200	924	420	141	82	194	44
24	289	118	150	95	62	210	932	418	142	81	190	43
25	275	121	148	93	60	205	916	410	245	79	173	43
26	264	130	147	92	58	195	888	390	400	77	158	42
27	252	133	145	90	58	190	865	359	429	74	147	43
28	237	132	142	90	58	185	839	322	382	73	138	48
29	224	130	140	87		190	815	289	307	68	139	54
30	213	130	137	84	-----	200	794	269	253	67	135	57
31	203	-----	134	82	-----	230	-----	244	-----	68	125	-----
Total	13,221	4,193	4,297	3,297	1,990	3,907	21,617	15,482	6,805	3,742	4,988	2,166
Mean	426	140	139	106	71.1	126	720	499	429	121	161	72.2
Max	657	197	158	132	80	230	932	769	382	221	247	119
Min	203	110	120	82	58	58	320	244	141	67	66	42
Cfsm	1.68	.551	.547	.417	.280	.496	2.83	1.96	.894	.476	.634	.284
In.	1.94	0.61	0.63	0.48	0.29	0.57	3.16	2.27	1.00	0.55	0.73	0.32

Cal yr1965:	Total	72,292	Mean	198	Max	1,060	Min	39	Cfsm	0.780	In.	10.58
Wtr yr1966:	Total	85,705	Mean	235	Max	932	Min	42	Cfsm	0.925	In.	12.55

Note.--No gage-height record Jan. 25 to Mar. 13.

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 1966. 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, 100,800 acre-ft Apr. 27 (gage height, 13.43 ft); minimum, 25,790 acre-ft Mar. 1 (gage height, 5.82 ft).
1895-1966: 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 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 1965 to September 1966

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	9.10	53,550	-
Oct. 31	9.06	53,160	-390
Nov. 30	9.13	53,750	+590
Dec. 31	8.71	49,790	-3,960
Calendar year 1965	-	-	+5,760
Jan. 31	7.02	35,100	-14,690
Feb. 28	5.84	25,980	-9,120
Mar. 31	9.10	53,550	+27,570
Apr. 30	13.37	99,970	+46,420
May 31	9.89	61,090	-38,880
June 30	9.10	53,550	-7,540
July 31	9.00	52,560	-990
Aug. 31	9.09	53,360	+800
Sept. 30	8.52	48,000	-5,360
Water year 1965-66	-	-	-5,550

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 1966. 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.--71 years (1895-1966), 206 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,580 cfs May 14; minimum daily, 4 cfs June 14-24, July 19-25, Sept. 6-8.
1893-1966: 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 1965to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	307	1,020	275	535	370	100	425	1,540	1,390	300	190	310
2	365	995	270	515	350	105	315	1,550	1,230	315	190	310
3	345	485	270	500	315	105	360	1,530	1,200	130	190	315
4	550	535	270	490	285	100	360	1,450	1,170	132	190	315
5	560	595	260	495	275	95	280	1,360	1,130	132	115	315
6	560	81	260	485	265	95	275	1,370	705	134	115	4
7	575	290	260	450	255	102	375	1,340	43	138	110	4
8	575	162	390	420	250	125	509	1,400	51	140	582	4
9	770	168	390	415	245	100	584	1,510	54	215	775	201
10	700	171	385	420	235	60	624	1,470	56	330	745	204
11	680	171	390	420	220	60	864	1,550	59	685	735	207
12	680	171	390	415	210	60	1,040	1,540	61	665	735	207
13	680	171	390	420	215	85	934	1,560	61	665	730	204
14	685	215	390	435	225	108	928	1,580	4	170	705	204
15	685	305	510	445	225	150	934	1,520	4	180	690	204
16	710	305	510	445	235	146	964	1,430	4	185	675	206
17	360	305	550	445	250	115	992	1,360	4	185	675	206
18	572	310	550	445	250	50	882	1,330	4	76	670	206
19	750	310	550	445	245	95	824	1,270	4	4	670	206
20	760	305	550	440	240	115	890	1,230	4	4	670	105
21	780	310	550	435	245	140	917	1,230	4	4	665	106
22	810	310	550	430	245	130	1,080	1,370	4	4	660	106
23	860	315	540	425	240	100	1,110	1,340	4	4	660	106
24	915	315	525	415	225	155	1,150	1,320	4	4	665	106
25	950	315	525	410	205	275	1,160	1,320	281	4	675	109
26	965	315	510	415	185	385	1,210	1,320	531	75	680	109
27	990	280	510	395	170	440	1,270	1,300	605	365	275	109
28	1,020	280	535	390	95	475	1,360	1,260	610	364	290	109
29	1,040	285	565	385		500	1,420	1,210	615	190	300	109
30	1,020	280	575	380	-----	500	1,450	1,220	625	185	305	108
31	995	-----	560	370	-----	475	-----	1,220	-----	185	305	-----
Total	22,214	10,075	13,755	13,530	6,770	5,546	25,486	43,000	10,521	6,169	15,637	5,014
Mean	717	336	444	436	242	179	850	1,387	351	199	504	167
Max	1,040	1,020	575	535	370	500	1,450	1,580	1,390	685	775	315
Min	307	81	260	370	95	50	275	1,210	4	4	110	4
Cfsm	1.70	0.798	1.05	1.04	0.575	0.425	2.02	3.29	0.834	0.473	1.20	0.397
In.	1.96	0.89	1.22	1.20	0.60	0.49	2.25	3.80	0.93	0.54	1.38	0.44

Cal yr 1965: Total 162,018 Mean 444 Max 2,780 Min 0 Cfsm 1.05 In. 14.31
Wtr yr 1966: Total 177,717 Mean 487 Max 1,580 Min 4 Cfsm 1.16 In. 15.70

GPO 803-695-7

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, 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 1966.

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.--36 years, 1,915 cfs.

Extremes.--Maximum discharge during year, 8,380 cfs Apr. 26 (gage height, 15.79 ft); minimum, 1,940 cfs July 25 (gage height, 5.44 ft).
1930-66: 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 winter months, which are fair. Flow regulated by powerplants and Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p. 78,80,82,87).

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4.470	4.380	2.820	2.910	2.570	2.480	4.970	7.970	5.380	3.180	2.260	3.190
2	4.940	4.270	2.820	2.930	2.610	2.480	5.160	7.900	5.270	3.020	2.290	3.140
3	5.020	3.930	2.840	2.960	2.680	2.500	5.450	7.870	5.180	2.850	2.260	3.060
4	5.060	3.810	2.870	2.960	2.750	2.550	5.810	7.870	5.080	2.820	2.210	3.020
5	5.010	3.700	2.940	2.940	2.760	2.580	6.400	7.870	4.980	2.830	2.120	2.950
6	4.970	3.360	3.020	2.960	2.760	2.610	6.710	7.810	4.610	2.750	2.240	2.670
7	4.960	3.290	3.070	2.990	2.740	2.650	6.770	7.710	4.030	2.610	2.540	2.590
8	4.970	3.210	3.100	3.000	2.710	2.750	6.750	7.540	3.820	2.510	3.280	2.610
9	4.970	3.140	3.090	3.000	2.670	2.780	6.780	7.360	3.680	2.810	3.650	2.710
10	4.960	3.090	3.050	2.980	2.650	2.800	6.860	7.170	3.510	3.000	3.740	2.670
11	4.980	3.050	3.040	2.960	2.640	2.800	7.050	7.010	3.330	3.160	3.760	2.610
12	5.010	3.010	3.020	2.940	2.620	2.810	7.300	6.820	3.240	3.140	3.760	2.590
13	5.030	3.000	3.000	2.900	2.610	2.810	7.430	6.670	3.240	3.030	3.800	2.620
14	5.040	2.980	3.000	2.870	2.610	2.820	7.540	6.500	3.190	2.640	3.940	2.650
15	4.980	2.990	2.990	2.860	2.600	2.820	7.590	6.430	3.150	2.530	4.050	2.620
16	4.870	3.020	2.980	2.840	2.580	2.830	7.620	6.470	3.080	2.420	4.080	2.580
17	4.630	3.040	2.960	2.810	2.550	2.850	7.690	6.500	3.010	2.310	4.070	2.570
18	4.800	3.030	2.930	2.800	2.540	2.950	7.770	6.530	2.980	2.140	4.040	2.570
19	4.980	3.010	2.910	2.770	2.540	3.010	7.890	6.510	2.990	2.020	4.020	2.500
20	5.020	3.000	2.900	2.750	2.520	3.080	8.090	6.480	2.940	1.980	4.020	2.380
21	5.040	2.980	2.900	2.730	2.500	3.150	8.160	6.460	2.850	1.970	4.070	2.360
22	5.000	2.940	2.920	2.720	2.500	3.270	8.230	6.400	2.770	1.970	4.090	2.340
23	4.930	2.910	2.960	2.710	2.500	3.500	8.280	6.320	2.690	1.960	4.060	2.280
24	4.880	2.900	2.980	2.690	2.490	3.710	8.340	6.210	2.710	1.950	4.010	2.190
25	4.840	2.880	3.000	2.680	2.490	4.030	8.340	6.110	3.140	1.950	3.950	2.150
26	4.760	2.870	3.000	2.680	2.490	4.250	8.350	6.030	3.610	2.170	3.850	2.140
27	4.680	2.850	2.970	2.640	2.480	4.210	8.320	5.940	3.730	2.410	3.560	2.140
28	4.590	2.830	2.940	2.620	2.480	4.250	8.250	5.860	3.670	2.410	3.450	2.140
29	4.520	2.810	2.910	2.600		4.300	8.160	5.740	3.570	2.260	3.370	2.140
30	4.480	2.810	2.900	2.580	- - - - -	4.450	8.050	5.630	3.460	2.190	3.300	2.170
31	4.430	- - - - -	2.900	2.570	- - - - -	4.650	- - - - -	5.510	- - - - -	2.180	3.250	- - - - -
Total	150.820	95.090	91.730	87.350	72.640	98.730	220.110	209.200	108.890	77.170	107.090	76.350
Mean	4,865	3,170	2,959	2,818	2,594	3,185	7,337	6,748	3,630	2,489	3,455	2,545
Max	5,060	4,380	3,100	3,000	2,760	4,650	8,350	7,970	5,380	3,180	4,090	3,190
Min	4,430	2,810	2,820	2,570	2,480	2,480	4,970	5,510	2,690	1,950	2,120	2,140
Cfsm	0.961	0.626	0.585	0.557	0.513	0.629	1.45	1.33	0.717	0.492	0.683	0.503
In.	1.11	0.70	0.67	0.64	0.53	0.73	1.62	1.54	0.80	0.57	0.79	0.56

Cal yr1965: Total 1,115,510 Mean 3,056 Max 7,290 Min 1,110 Cfsm 0.604 In. 8.20
Wtr yr1966: Total 1,395,170 Mean 3,822 Max 8,350 Min 1,950 Cfsm 0.755 In.10.25

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 a 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 1966.

Gage.--Water-stage recorder. Datum of gage is 1,185.41 ft above mean sea level, datum of 1929 (levels by Corp 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. Diversion channel: Wire-weight gage. Datum of gage is 1,185.02 ft above mean sea level, datum of 1929. Apr. 9, 1955, to Apr. 10, 1956, staff gage at site 4 miles downstream and at different datum. Apr. 11, 1956, to Sept. 6, 1960, staff gage at same site and datum.

Average discharge.--21 years, 2,881 cfs.

Extremes.--Maximum discharge during year, 12,600 cfs Apr. 29, 30; minimum, 2,320 cfs July 25. River gage: Maximum discharge during year, 6,920 cfs Apr. 28 (gage height, 13.60 ft); minimum, 2,220 cfs July 25 (gage height, 3.00 ft). Diversion gage: Maximum discharge during year, 5,690 cfs Apr. 29 (gage height, 13.77 ft); minimum 53 cfs Sept. 29.

1945-66: 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 winter months, which are fair. Slight regulation by powerplants and by Winnibigoshish, Leech, Pokegama, and Sandy Lakes (see p.). 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,520	5,350	3,190	3,700	3,190	3,040	6,590	12,400	6,740	4,310	2,760	3,940
2	6,470	5,250	3,220	3,720	3,200	3,040	7,350	12,300	6,590	4,110	2,800	3,820
3	6,790	5,130	3,310	3,740	3,240	3,060	8,220	12,100	6,480	3,810	2,860	3,680
4	6,850	4,840	3,380	3,760	3,280	3,060	9,000	11,800	6,260	3,490	2,860	3,530
5	6,940	4,620	3,460	3,760	3,320	3,100	9,800	11,600	6,060	3,500	2,810	3,420
6	7,010	4,490	3,540	3,760	3,380	3,190	10,500	11,400	5,900	3,420	2,760	3,320
7	7,060	4,220	3,640	3,750	3,420	3,260	11,200	11,000	5,570	3,320	2,950	3,140
8	7,090	4,030	3,700	3,760	3,430	3,340	11,400	10,800	5,060	3,160	3,300	2,990
9	7,090	3,890	3,730	3,760	3,410	3,400	11,200	10,400	4,740	3,100	3,940	2,880
10	7,110	3,800	3,760	3,750	3,380	3,450	10,900	10,100	4,520	3,320	4,290	3,000
11	7,090	3,590	3,750	3,720	3,340	3,480	10,600	9,730	4,350	3,620	4,460	2,980
12	7,000	3,540	3,740	3,690	3,300	3,490	10,500	9,390	4,150	3,790	4,560	2,920
13	6,870	3,460	3,720	3,660	3,270	3,500	10,500	9,080	3,990	3,810	4,570	2,870
14	6,750	3,370	3,710	3,620	3,240	3,520	10,500	8,810	3,900	3,670	4,700	2,880
15	6,660	3,360	3,720	3,590	3,200	3,530	10,500	8,700	3,850	3,380	4,850	2,880
16	6,450	3,380	3,720	3,560	3,180	3,580	10,500	8,920	3,800	3,170	4,960	2,930
17	6,260	3,410	3,720	3,540	3,140	3,640	10,600	8,950	3,700	3,010	4,970	2,900
18	6,390	3,420	3,690	3,520	3,110	3,700	10,700	8,930	3,580	2,840	4,900	2,870
19	6,680	3,420	3,700	3,500	3,090	3,760	10,900	8,900	3,560	2,660	4,760	2,850
20	6,840	3,400	3,680	3,460	3,070	3,900	11,200	8,970	3,520	2,510	4,720	2,790
21	6,840	3,370	3,680	3,420	3,050	3,990	11,600	8,960	3,470	2,410	4,910	2,700
22	6,740	3,340	3,690	3,380	3,040	4,140	11,800	8,950	3,370	2,400	5,070	2,640
23	6,570	3,320	3,710	3,370	3,030	4,330	12,000	8,920	3,310	2,370	5,130	2,610
24	6,390	3,280	3,730	3,350	3,030	4,500	12,100	8,810	3,280	2,330	5,110	2,560
25	6,280	3,260	3,780	3,290	3,040	4,690	12,200	8,660	3,380	2,320	5,010	2,480
26	6,170	3,230	3,810	3,250	3,040	4,960	12,300	8,440	3,890	2,600	4,900	2,420
27	6,030	3,210	3,770	3,200	3,040	5,140	12,400	8,200	4,380	2,830	4,760	2,400
28	5,870	3,200	3,740	3,200	3,040	5,310	12,500	7,930	4,600	3,000	4,510	2,400
29	5,720	3,180	3,710	3,180		5,510	12,600	7,660	4,560	2,990	4,320	2,410
30	5,550	3,180	3,680	3,170	- - - - -	5,730	12,600	7,370	4,440	2,900	4,180	2,420
31	5,460	- - - - -	3,670	3,160	- - - - -	6,050	- - - - -	7,000	- - - - -	2,760	4,040	- - - - -
Total	202,540	112,540	113,050	109,290	89,500	122,390	324,760	295,180	135,000	96,910	130,720	87,630
Mean	6,534	3,751	3,647	3,525	3,196	3,948	10,825	9,522	4,500	3,126	4,217	2,921
Max	7,110	5,350	3,810	3,760	3,430	6,050	12,600	12,400	6,740	4,310	5,130	3,940
Min	5,460	3,180	3,190	3,160	3,030	3,040	6,590	7,000	3,280	2,320	2,760	2,330
Cfsm	1.06	0.611	0.594	0.574	0.521	0.643	1.76	1.55	0.733	0.509	0.687	0.476
In.	1.23	0.68	0.68	0.66	0.54	0.74	1.97	1.79	0.82	0.59	0.79	0.53

Cal yr1965: Total 1,536,810 Mean 4,210 Max 13,300 Min 1,350 Cfsm 0.686 In. 9.31
Wtr yr1966: Total 1,819,510 Mean 4,985 Max 12,600 Min 2,320 Cfsm 0.812 In. 11.02

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 1966. 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, 102,000 acre-ft June 30 (gage height, 13.26 ft); minimum, 68,330 acre-ft Mar. 15 (gage height, 10.74 ft).
1886-1966: 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 between gage heights 10.00 ft and 18.5 ft (maximum allowable range) is 118,710 acre-ft of which 53,280 acre-ft 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 1965 to September 1966

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	13.24	101,600	-
Oct. 31	12.94	97,590	-4,010
Nov. 30	12.44	90,840	-6,750
Dec. 31	12.08	85,880	-4,960
Calendar year 1965	-	-	+3,370
Jan. 31	11.50	78,150	-7,730
Feb. 28	10.85	69,820	-8,330
Mar. 31	11.17	73,980	+4,160
Apr. 30	13.06	99,170	+25,190
May 31	12.78	95,400	-3,770
June 30	13.26	102,000	+6,600
July 31	12.80	95,600	-6,400
Aug. 31	12.83	96,000	+400
Sept. 30	12.52	91,830	-4,170
Water year 1965-66	-	-	-9,770

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 1966. 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. 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.--80 years, 211 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 1,510 cfs Apr. 30; minimum daily, 110 cfs June 22, 23. 1886-1966: Maximum daily discharge, 2,250 cfs in June 1896 (does not include flow bypassing dam throug crevasse); no flow at times.

Remarks.--Discharge computed principally on basis of modified weir formula, the head being obtained from twic 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; two discharge measurements mad and records reviewed by Geological Survey.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	800	300	336	420	420	400	670	1,500	410	390	205	325
2	800	320	425	420	410	395	702	1,500	403	395	290	325
3	800	320	425	420	410	400	765	1,500	370	395	290	325
4	863	315	425	420	410	400	770	1,500	370	395	290	315
5	1,180	371	425	420	410	405	853	1,480	370	479	290	315
6	1,180	515	425	420	410	405	1,020	1,410	370	620	290	283
7	1,180	515	425	420	410	405	1,020	1,060	370	615	326	160
8	1,150	510	425	420	410	400	1,020	1,070	370	620	415	160
9	1,150	505	425	420	410	400	1,020	1,070	370	615	415	180
10	1,150	510	425	420	410	395	1,020	1,070	356	615	415	260
11	1,130	500	425	420	410	395	1,020	1,060	315	615	415	260
12	1,130	505	425	420	405	395	1,020	1,060	315	620	415	260
13	1,050	500	425	420	405	395	1,020	1,060	310	547	415	260
14	840	500	425	420	405	395	1,020	1,060	310	440	415	255
15	766	500	425	415	405	395	1,010	1,060	310	433	437	255
16	585	500	425	420	405	395	1,010	1,040	290	275	510	255
17	585	500	425	420	405	400	1,020	810	205	275	510	255
18	585	500	425	420	405	395	943	810	205	270	510	255
19	585	495	425	420	405	395	710	795	200	239	510	255
20	585	495	425	415	405	395	695	805	200	160	510	255
21	585	490	425	415	405	395	705	800	155	154	625	255
22	585	490	425	420	405	395	705	805	110	130	625	255
23	580	300	425	420	405	395	705	805	110	130	625	250
24	580	300	425	420	405	400	705	822	125	130	625	250
25	534	300	425	420	405	480	705	1,060	186	130	556	250
26	410	300	425	415	400	670	710	1,060	265	140	440	219
27	410	300	425	415	400	670	835	1,000	265	170	440	145
28	410	300	425	420	395	670	1,090	810	295	170	440	145
29	400	300	425	420		670	1,200	565	385	165	435	145
30	290	300	420	420	-----	670	1,510	520	390	165	417	145
31	290	-----	420	420	-----	670	-----	410	-----	170	325	-----
Total	23,168	12,556	13,076	12,995	11,385	14,045	27,198	31,377	8,705	10,667	13,426	7,272
Mean	747	419	422	419	407	453	907	1,012	290	344	433	242
Max	1,180	515	425	420	420	670	1,510	1,500	410	620	625	325
Min	290	300	336	415	395	395	670	410	110	130	205	145
Cfsm	1.33	0.746	0.751	0.746	0.724	0.806	1.61	1.80	0.516	0.612	0.770	0.431
In.	1.53	0.83	0.87	0.86	0.75	0.93	1.80	2.08	0.58	0.71	0.89	0.48

Cal yr 1965: Total 176,267 Mean 483 Max 1,400 Min 90 Cfsm 0.859 In. 11.66
Wtr yr 1966: Total 185,870 Mean 509 Max 1,510 Min 110 Cfsm 0.906 In. 12.30

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 mile upstream from Pelican Lake and 6 miles east of town of Pequot Lakes.

Records available.--April 1938 to September 1966 (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, 4.28 ft May 23; minimum observed, 3.56 ft Oct. 25, 29. 1938-66: Maximum gage height observed, that of May 23, 1966; 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.
Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Gage height, in feet, October 1965 to September 1966

Oct. 29	3.56	May 31	4.18	July 29	3.92
Apr. 23	4.16	June 30	4.12	Aug. 31	3.90
				Sept.30	3.60

Note.--Gage readings other than those shown are available.

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 1966 (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.--27 years (1939-66), 463 cfs.

Extremes.--Maximum discharge during year, 2,640 cfs Apr. 2 (gage height, 5.75 ft); maximum gage height, 7.29 ft Apr. 1 (backwater from ice); minimum discharge, 120 cfs about Nov. 14 (gage height, 2.33 ft, result of freezeup).

1910-14, 1930-66: Maximum discharge, 2,890 cfs Apr. 13, 1965; 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 winter months, which are fair. Flow affected by natural storage in many lakes.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	850	514	435	480	450	470	2,030	1,740	844	550	688	824
2	824	520	440	475	455	475	2,200	1,800	792	502	720	824
3	766	526	440	475	455	480	1,900	1,820	734	478	714	812
4	727	520	450	470	455	480	1,860	1,760	701	460	694	798
5	694	520	460	470	460	480	1,840	1,670	688	636	675	779
6	682	508	470	470	460	480	1,780	1,600	682	598	675	760
7	668	478	470	470	465	485	1,740	1,530	656	580	694	727
8	656	454	475	470	465	490	1,680	1,480	636	568	694	694
9	656	436	480	465	470	495	1,580	1,430	610	538	682	668
10	636	430	480	465	475	500	1,500	1,390	592	520	682	656
11	598	420	485	465	475	510	1,440	1,360	586	520	668	630
12	580	405	485	465	475	515	1,400	1,350	580	514	649	610
13	568	360	490	465	475	520	1,370	1,330	574	490	720	604
14	568	280	490	465	475	530	1,330	1,320	568	490	798	610
15	562	320	490	460	470	540	1,330	1,320	556	466	805	592
16	568	410	490	460	460	550	1,330	1,320	532	442	792	562
17	574	460	490	460	455	650	1,370	1,280	520	424	772	550
18	574	480	490	460	450	760	1,460	1,230	508	408	760	538
19	580	480	485	460	445	820	1,440	1,210	502	380	760	526
20	610	470	485	460	440	850	1,370	1,190	484	353	812	520
21	598	460	485	460	430	880	1,410	1,150	472	342	926	514
22	580	455	485	460	430	900	1,590	1,130	466	336	978	496
23	580	450	485	455	430	940	1,700	1,100	448	353	992	478
24	574	450	485	455	440	950	1,720	1,100	442	358	985	466
25	568	445	485	455	445	970	1,660	1,060	642	397	955	448
26	568	440	480	455	450	1,000	1,710	1,040	682	490	912	436
27	568	440	480	455	455	1,050	1,700	1,010	656	550	898	408
28	556	435	480	450	460	1,150	1,740	992	662	562	884	402
29	532	435	480	450		1,320	1,790	940	662	586	870	402
30	514	435	480	450	---------	1,520	1,750	905	610	604	850	402
31	502	----------	480	450	---------	1,760	----------	884	----------	610	838	----------
Total	19,081	13,436	14,785	14,325	12,770	23,520	48,720	40,441	18,087	15,105	24,542	17,736
Mean	616	448	477	462	456	759	1,624	1,305	603	487	792	591
Cfsm	0.610	0.444	0.472	0.457	0.451	0.751	1.61	1.29	0.597	0.482	0.784	0.585
In.	0.70	0.49	0.54	0.53	0.47	0.87	1.79	1.49	0.67	0.56	0.90	0.65

Calendar year 1965: Max 2,600 Min 257 Mean 626 Cfsm 0.620 In. 8.39
Water year 1965-66: Max 2,200 Min 280 Mean 719 Cfsm 0.712 In. 9.66

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 1966. 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, 61,090 acre-ft Apr. 29, 30 (gage height, 6.25 ft); minimum, 45,620 acre-ft Feb. 28 (gage height, 5.06 ft).
1911-66: 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 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 1965 to September 1966

	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30	6.28	61,490	-
Oct. 31	6.01	57,920	-3,570
Nov. 30	5.80	55,140	-2,780
Dec. 31	5.82	55,340	+200
Calendar year 1965	-	-	+2,580
Jan. 31	5.42	50,180	-5,160
Feb. 28	5.06	45,620	-4,560
Mar. 31	5.76	54,740	+9,120
Apr. 30	6.25	61,090	+6,350
May 31	5.99	57,720	-3,370
June 30	6.09	58,910	+1,190
July 31	6.04	58,310	-600
Aug. 31	6.03	58,120	-190
Sept. 30	5.73	54,350	-3,770
Water year 1965-66	-	-	-7,140

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 1966. 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.--55 years, 103 cfs, unadjusted.

Extremes.--Maximum daily discharge during year, 610 cfs Apr. 30; minimum daily, 20 cfs July 21, 22.
1911-66: Maximum daily discharge, 1,120 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).
Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	364	182	150	160	228	174	520	605	65	313	120	110
2	384	180	150	162	225	174	525	605	66	180	243	64
3	382	182	151	163	221	180	530	600	69	179	231	64
4	376	177	150	163	218	188	540	600	71	176	168	65
5	376	174	151	162	214	199	600	600	73	210	108	63
6	376	174	150	160	211	198	600	604	130	325	108	59
7	461	170	150	160	209	195	600	574	129	313	111	21
8	456	170	149	160	209	193	600	449	126	247	112	21
9	443	166	149	160	214	191	600	440	126	177	108	58
10	435	163	149	159	216	190	600	334	67	111	106	57
11	428	160	149	157	212	188	600	187	66	118	105	57
12	418	170	154	160	211	187	600	188	69	118	101	57
13	327	171	160	159	209	184	600	193	71	114	68	57
14	252	165	161	157	208	184	590	196	71	112	110	58
15	250	160	161	296	204	182	590	220	123	60	132	56
16	245	165	160	292	204	180	590	301	120	22	166	54
17	182	160	159	288	203	185	590	366	119	22	166	53
18	185	159	159	283	200	201	590	370	67	23	106	53
19	188	157	159	279	198	218	540	388	67	23	103	53
20	193	157	160	276	195	225	540	366	69	21	108	53
21	193	156	160	272	191	235	540	362	69	20	174	53
22	195	156	159	265	190	249	540	356	65	20	177	51
23	195	157	159	261	187	265	550	283	65	21	176	50
24	190	154	161	256	185	274	550	281	118	23	174	92
25	190	154	161	252	184	430	550	278	300	25	174	90
26	191	160	162	249	180	433	550	278	349	69	114	88
27	120	153	160	242	179	433	600	274	343	69	114	86
28	120	146	160	237	177	433	605	270	339	69	112	85
29	119	150	160	237		433	605	265	331	67	112	85
30	188	151	160	233	---------	433	610	188	317	65	112	83
31	185	---------	160	230	---------	451	---------	188	---------	64	110	---------
Total	8,607	4,899	4,843	6,690	5,682	7,885	17,245	11,209	4,060	3,376	4,129	1,896
Mean	278	163	156	216	203	254	575	362	135	109	133	63.2
Cfsm	0.969	0.568	0.544	0.753	0.707	0.885	2.00	1.26	0.470	0.380	0.463	0.220
In.	1.12	0.63	0.63	0.87	0.74	1.02	2.23	1.45	0.53	0.44	0.54	0.25

Calendar year 1965: Max 850 Min 19 Mean 221 Cfsm 0.770 In. 10.46
Water year 1965-66: Max 610 Min 20 Mean 221 Cfsm 0.770 In. 10.43

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 1966.

Average discharge.--42 years, 4,086 cfs.

Extremes.--Maximum daily discharge during year, 25,300 cfs Apr. 30, May 1; minimum daily, 3,000 cfs Nov. 28. 1924-66: Maximum daily discharge, 37,700 Apr. 16, 1965; minimum daily, 254 cfs Nov. 25, 1936.

Remarks.--Records fair. Discharge computed on basis of powerplant records. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see p.

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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	11.600	9.370	4.550	6.700	4.710	4.130	21.100	25.300	12.200	7.670	5.150	7.340
2	13.900	9.230	5.300	6.940	4.710	4.100	21.600	25.300	10.400	7.200	5.200	6.660
3	14.900	9.120	6.140	6.160	4.700	4.200	22.700	25.300	10.600	6.590	5.830	5.990
4	15.100	8.800	5.560	5.240	4.710	4.190	23.700	24.800	9.760	6.230	4.310	6.220
5	15.800	8.440	5.850	6.180	4.710	4.100	24.400	24.100	9.330	6.660	4.900	5.490
6	15.300	8.940	5.630	6.560	4.710	3.870	24.700	23.400	9.420	6.310	5.140	6.090
7	15.300	9.120	5.680	6.440	4.710	3.660	24.200	22.400	8.700	6.910	5.350	5.800
8	15.000	8.100	6.080	6.200	4.710	3.930	23.600	21.700	8.730	6.100	5.050	5.250
9	14.900	7.110	6.110	6.110	5.140	4.160	22.800	20.900	7.830	6.400	5.180	5.140
10	14.500	6.790	6.160	6.110	5.440	3.930	22.300	19.900	7.370	6.370	5.980	4.230
11	14.400	6.810	6.560	5.920	5.210	4.640	21.900	19.200	6.960	6.760	6.830	4.730
12	10.500	6.920	6.540	5.680	5.630	4.980	21.300	18.900	7.000	6.100	6.990	4.940
13	13.900	6.340	6.570	5.680	5.680	5.570	20.300	17.500	6.480	6.250	7.080	5.020
14	13.400	6.480	6.290	5.680	5.810	6.440	20.400	17.000	6.380	6.470	8.250	4.570
15	13.200	6.240	6.860	5.680	6.110	7.850	20.400	16.900	5.800	6.420	7.280	4.660
16	12.100	6.970	6.760	5.520	6.110	9.720	20.000	16.800	6.380	5.480	7.220	4.600
17	12.100	6.860	5.390	5.370	6.110	12.300	20.000	17.100	5.920	5.160	7.480	4.780
18	12.500	6.680	6.140	5.660	5.100	16.000	20.000	17.200	5.800	4.950	7.180	4.430
19	12.800	6.230	6.400	5.680	5.290	17.400	20.600	17.200	5.190	4.500	7.740	4.390
20	13.000	6.560	6.430	5.680	5.090	20.300	21.300	16.600	5.180	3.960	7.840	5.590
21	13.000	6.740	6.560	5.680	4.620	22.300	21.300	16.700	5.210	4.060	9.170	4.080
22	12.800	7.270	6.370	5.680	5.260	24.900	21.600	15.900	4.940	3.600	9.540	3.870
23	13.000	7.100	6.960	5.440	4.030	24.500	21.700	16.200	5.310	3.800	8.410	4.600
24	12.200	5.340	6.520	5.210	4.220	23.200	22.100	16.300	5.380	3.790	9.690	4.440
25	12.100	6.250	6.190	5.210	4.230	23.000	22.500	15.900	6.620	3.820	10.000	4.670
26	11.000	5.660	6.270	5.170	4.230	21.400	22.800	15.500	6.190	3.960	9.540	3.950
27	11.200	3.860	5.430	5.170	4.230	20.800	22.900	14.900	7.180	4.530	9.170	3.640
28	10.800	3.000	4.720	5.210	4.180	19.500	23.700	14.400	7.990	4.590	9.820	3.620
29	10.500	3.190	4.920	5.210		18.500	24.900	13.900	8.080	5.190	8.300	3.720
30	10.100	3.330	4.960	5.210	------	18.600	25.300	13.300	7.560	5.090	7.280	3.510
31	9.860	------	6.960	4.710	------	18.800	------	12.900	------	4.710	7.680	------
Total	400.760	202.850	186.860	177.090	139.390	380.970	666.100	573.400	219.890	169.630	224.580	146.020
Mean	12,930	6,762	6,028	5,713	4,978	12,290	22,200	18,500	7,330	5,472	7,245	4,867
Cfsm	1.11	0.583	0.520	0.492	0.429	1.06	1.91	1.59	0.632	0.472	0.625	0.420
In.	1.28	0.65	0.60	0.57	0.45	1.22	2.14	1.84	0.70	0.54	0.72	0.47

Calendar year 1965: Max 37,700 Min 2,230 Mean 8,456 Cfsm 0.729 In. 9.90
Water year 1965-66: Max 25,300 Min 3.000 Mean 9,560 Cfsm 0.824 In. 11.18

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 northwest 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 1966. 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.--36 years (1909-12, 1930-31, 1934-66), 252 cfs.

Extremes.--Maximum discharge during year, 2,610 cfs Mar. 19 (gage height, 5.77 ft); maximum gage height, 5.89 ft Feb. 13 (backwater from ice); minimum discharge, 70 cfs Sept. 23, 26 (gage height, 1.07 ft).
1909-13, 1929-66: Maximum discharge, 9,100 cfs Apr. 13, 1965 (gage height, 10.68 ft); minimum, 0.3 cfs Nov. 25, 1936.

Remarks.--Records good except those for winter months, which are fair. Flow regulated by powerplants and reservoirs above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	480	484	290	225	200	575	1,510	805	394	263	110	140
2	492	469	295	225	200	570	1,370	800	394	237	106	152
3	516	465	300	220	200	565	1,270	691	397	214	103	145
4	520	443	310	220	200	560	1,210	303	400	186	99	138
5	516	433	310	220	200	560	1,140	371	387	177	92	129
6	536	413	305	220	200	570	1,080	426	380	175	98	117
7	548	397	305	220	205	580	1,020	447	352	160	99	110
8	552	394	303	215	210	600	975	473	318	147	89	104
9	516	380	295	215	260	620	930	496	298	145	87	101
10	492	362	283	215	450	660	890	520	286	140	86	99
11	492	358	283	215	700	730	855	516	272	154	83	94
12	476	384	321	215	880	820	805	528	269	186	79	91
13	458	380	368	210	950	1,000	361	580	257	205	87	92
14	447	365	390	210	930	1,200	400	985	248	208	94	91
15	430	358	360	210	920	1,450	473	940	234	199	92	87
16	420	350	355	210	900	1,750	520	895	225	196	96	86
17	423	325	345	210	860	2,050	576	820	219	191	92	83
18	436	315	330	210	830	2,280	616	776	214	183	91	79
19	433	310	320	210	800	2,340	696	736	211	172	87	78
20	458	310	300	210	750	2,280	1,180	552	208	160	104	76
21	443	318	280	210	710	2,310	1,120	199	214	152	147	78
22	458	327	270	210	680	2,320	1,050	248	231	150	162	76
23	465	334	260	210	660	2,300	995	346	274	145	170	75
24	465	324	255	210	640	2,190	950	417	343	138	164	78
25	480	324	250	210	620	2,000	910	430	362	136	162	76
26	492	330	245	205	600	1,800	820	433	349	132	162	72
27	504	310	240	205	580	1,700	810	426	321	125	160	76
28	504	215	235	200	580	1,650	890	423	321	121	152	76
29	516	270	230	200		1,600	840	420	303	116	150	79
30	508	280	230	200	-----	1,580	825	410	283	110	145	79
31	512	-----	225	200	-----	1,570	-----	400	-----	104	138	-----
Total	14,988	10,727	9,088	6,565	15,915	42,780	27,087	16,812	8,964	5,127	3,586	2,857
Mean	483	358	293	212	568	1,380	903	542	299	165	116	95.2
Max	552	484	390	225	950	2,340	1,510	985	400	263	170	152
Min	420	215	225	200	200	560	361	199	208	104	79	72
Cfsm	0.522	0.387	0.317	0.229	0.614	1.49	0.976	0.586	0.323	0.178	0.125	0.103
In.	0.60	0.43	0.37	0.26	0.64	1.72	1.09	0.68	0.36	0.21	0.14	0.11

Cal yr 1965:	Total	208,297	Mean	571	Max	7,940	Min	40	Cfsm	0.617	In. 8.37
Wtr yr 1966:	Total	164,496	Mean	451	Max	2,340	Min	72	Cfsm	0.488	In. 6.61

5-2747. St. Francis River at Santiago, Minn.

Location.--Lat 45°32'30", long 93°48'50", in NE¼ sec.10, T.35 N., R.28 W., on the right bank, 0.2 mile east of Santiago and 0.4 mile upstream from bridge on county road.

Records available.--June 1965 to September 1966.

Gage.--Water-stage recorder.

Extremes.--Maximum discharge during year, 1,300 cfs Feb. 10 (gage height, 10.83 ft, backwater from ice); minimum, 0.1 cfs July 10; minimum gage height, 3.35 ft July 3, 4.

1965-66: Maximum discharge, that of Feb. 10, 1966; minimum, that of July 10, 1966; minimum gage height, 3.35 ft July 3, 4, 1966.

Flood of Apr. 14, 1965 reached a stage of 12.17 ft, backwater from ice (discharge, 2,940 cfs).

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	442	18	10	11	6.8	7.5	57	68	12	1.9	3.0	7.6
2	398	17	10	10	6.8	10	60	54	11	1.5	2.8	14
3	323	16	10	10	6.8	15	53	44	14	1.2	2.8	12
4	230	15	10	9.6	6.8	25	46	38	19	1.1	2.8	11
5	162	14	10	9.4	6.8	40	40	33	58	1.1	3.0	9.8
6	118	14	9.8	9.2	6.8	55	36	28	79	1.7	4.0	8.3
7	93	14	9.8	9.0	7.5	60	31	26	57	.5	6.6	7.6
8	78	13	9.8	8.8	30	65	29	23	35	.2	6.0	6.9
9	63	13	9.8	8.6	200	70	27	20	24	.2	5.3	6.6
10	49	13	10	8.4	1,000	90	26	19	20	.3	5.0	6.3
11	40	13	10	8.2	500	200	24	19	17	22	5.0	6.3
12	34	17	15	8.1	250	400	23	21	15	234	5.0	6.0
13	29	30	150	8.0	100	550	22	23	13	364	6.6	5.6
14	27	30	140	7.8	50	600	22	25	13	221	8.0	5.6
15	25	30	100	7.7	40	565	24	33	12	129	7.6	5.3
16	22	26	60	7.6	30	510	28	187	11	74	6.6	5.3
17	22	16	40	7.5	22	447	35	273	9.8	35	6.0	5.3
18	28	15	30	7.4	18	430	75	230	8.3	19	5.3	5.3
19	35	14	25	7.3	15	360	126	187	7.6	12	6.3	5.0
20	52	14	20	7.3	13	258	263	130	6.9	7.6	6.9	4.6
21	68	13	18	7.2	11	234	310	90	6.6	5.3	18	5.0
22	68	13	17	7.2	9.5	215	212	65	6.3	4.0	25	4.6
23	57	12	16	7.1	8.4	183	136	57	5.3	3.0	22	4.3
24	44	12	15	7.1	7.8	122	100	55	5.3	2.8	18	4.3
25	36	11	14	7.0	7.4	80	79	49	4.6	2.2	15	4.3
26	31	11	13	7.0	7.1	60	64	38	3.7	2.2	12	4.3
27	27	11	13	7.0	7.0	45	53	28	3.7	2.2	10	4.3
28	24	11	12	6.9	7.0	42	59	23	3.7	2.2	8.7	5.0
29	22	10	12	6.9		40	78	18	3.7	1.5	7.6	5.0
30	21	10	11	6.9	----------	42	77	16	2.4	1.4	7.3	5.0
31	20	----------	11	6.9	----------	48	----------	13	----------	1.4	6.9	----------
Total	2,688	466	841.2	248.1	2,381.5	5,868.5	2,215	1,933	487.9	1,155.5	255.1	190.5
Mean	86.7	15.5	27.1	8.00	85.1	189	73.8	62.4	16.3	37.3	8.23	6.35
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1965: Max - Min - Mean - Ac-ft -
Water year 1965-66: Max 1,000 Min 0.2 Mean 51.3 Ac-ft -

5-2749. St. Francis River near Big Lake, Minn.

Location.--Lat 45°23'07", long 93°44'02", in NW¼NW¼ sec.5, T.33 N., R.27 W., on right bank 3.6 miles north of Big Lake and 4 miles upstream from mouth.

Records available.--May 1965 to September 1966.

Gage.--Water-stage recorder. Altitude of gage is 925 ft (from topographic map).

Extremes.--Maximum discharge during year, 952 cfs Mar. 18 (gage height, 9.44 ft); maximum gage height, 10.15 ft about Feb. 14 (from floodmark, backwater from ice); minimum discharge, 47 cfs Sept. 23, 24 (gage height, 4.94 ft).

1965-66: Maximum discharge, that of Mar. 18, 1966; maximum gage height, that of Feb. 14, 1966; minimum discharge, that of Sept. 23, 24, 1966.

Flood of Apr. 16, 1965 reached a stage of 11.34 ft, from floodmarks (discharge 2,700 cfs).

Remarks.--Records good except those for winter months or no gage-height record, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	159	118	80	90	58	80	272	252	159	60	79	72
2	160	115	80	86	58	78	257	240	146	58	77	81
3	160	111	79	84	57	76	243	227	138	56	72	79
4	164	107	79	82	57	78	227	215	137	54	67	72
5	169	104	78	80	57	85	212	206	140	52	63	68
6	179	100	78	78	57	100	207	196	145	50	61	67
7	197	98	77	76	58	120	209	189	154	56	68	64
8	227	97	77	74	60	150	207	181	160	52	68	61
9	271	95	78	72	65	180	197	170	162	51	64	59
10	292	92	78	70	80	220	188	161	170	55	62	58
11	296	90	80	69	100	280	178	155	160	96	61	57
12	286	95	80	68	170	350	170	149	154	158	60	56
13	268	105	82	67	300	450	161	145	145	176	63	54
14	238	102	90	66	650	700	154	142	140	160	69	53
15	216	100	110	65	600	820	152	143	130	156	68	53
16	201	104	140	64	400	900	151	147	120	161	65	50
17	188	104	170	63	300	920	151	148	108	170	63	49
18	178	95	190	62	260	944	153	147	98	184	62	49
19	167	92	200	62	220	848	158	147	91	200	60	49
20	159	90	180	61	200	784	166	148	85	216	63	49
21	148	89	170	61	170	676	171	156	86	224	85	50
22	140	88	160	60	150	610	174	172	84	220	92	49
23	135	87	150	60	130	545	180	194	77	207	88	48
24	130	86	140	60	120	462	187	214	73	189	86	48
25	127	85	130	60	110	419	208	227	72	162	85	49
26	125	84	120	59	100	394	245	233	71	136	86	49
27	125	83	110	59	90	374	273	227	69	117	85	49
28	125	82	105	59	85	350	281	218	72	104	84	50
29	124	81	100	59		330	274	206	68	92	80	52
30	123	80	96	58	----------	310	266	192	63	84	77	53
31	121	----------	92	58	----------	286	----------	176	----------	76	74	----------
Total	5,598	2,859	3,479	2,092	4,762	12,919	6,072	5,723	3,477	3,832	2,237	1,697
Mean	181	95.3	112	67.5	170	417	202	185	116	124	72.2	56.6
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1965: Max - Min - Mean - Ac-ft -
Water year 1965-66: Max 944 Min 48 Mean 150 Ac-ft -

Note.--No gage-height record Feb. 12-23.

5-2750. Elk River near Big Lake, Minn.

Location (revised).--Lat 45°20'02", long 93°40'00", in NE¼SW¼ 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 1966.

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.--38 years (1911-17, 1934-66), 249 cfs.

Extremes.--Maximum discharge during year, 2,090 cfs Mar. 15 (gage height, 5.80 ft); maximum gage height, 6.45 ft Mar. 14 (backwater from ice); minimum discharge, 122 cfs Sept. 23, 24 (gage height, 0.98 ft).
1911-17, 1931-66: Maximum discharge, 7,360 cfs Apr. 16, 1965 (gage height, 10.86 ft); minimum, 3.6 cfs July 31, 1934.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	523	340	295	260	174	450	603	561	337	166	198	188
2	603	329	298	250	175	485	568	546	318	160	198	213
3	652	314	300	240	177	540	542	519	325	152	188	213
4	736	302	302	230	179	600	511	489	337	146	177	205
5	804	299	305	220	181	740	481	466	378	149	174	188
6	823	287	308	215	183	720	466	439	401	149	166	177
7	823	283	310	208	187	720	462	416	424	146	180	174
8	812	280	310	200	200	740	454	397	485	156	180	166
9	804	272	310	195	220	798	435	375	553	160	177	156
10	793	268	311	190	240	880	416	359	527	160	174	152
11	755	265	314	187	260	960	401	356	470	272	166	152
12	709	299	330	182	315	1,080	378	352	413	511	163	152
13	660	329	375	180	370	1,200	367	344	363	587	170	146
14	606	302	450	178	500	1,400	359	344	329	675	191	146
15	553	325	510	175	750	1,920	363	359	302	701	191	142
16	515	340	620	174	790	1,970	356	382	280	755	188	138
17	489	314	655	172	780	2,020	363	409	257	781	180	135
18	466	325	655	171	700	2,010	378	447	242	743	177	132
19	447	337	630	170	600	1,940	413	519	231	660	170	132
20	447	325	598	170	510	1,870	481	561	220	572	177	132
21	439	318	542	170	440	1,720	523	561	220	523	242	135
22	447	310	527	170	380	1,550	549	557	220	492	268	128
23	447	295	511	170	365	1,410	599	584	205	458	272	125
24	435	291	500	170	355	1,130	633	603	194	416	276	122
25	420	287	455	170	355	1,160	622	584	191	367	272	125
26	405	302	415	170	365	1,020	614	565	188	318	261	125
27	397	280	355	170	375	933	625	538	184	280	246	125
28	390	280	335	170	405	827	637	504	191	257	231	125
29	378	290	310	171		755	614	462	188	235	216	132
30	367	292	290	172	---------	690	587	416	177	216	205	132
31	352	----------	275	173	---------	644	----------	371	----------	198	191	----------
Total	17,497	9,080	12,701	5,843	10,531	34,882	14,800	14,385	9,150	11,561	6,265	4,513
Mean	564	303	410	188	376	1,130	493	464	305	373	202	150
Cfsm	0.917	0.493	0.667	0.306	0.611	1.84	0.802	0.754	0.496	0.606	0.328	0.244
In.	1.06	0.55	0.77	0.35	0.64	2.11	0.89	0.87	0.55	0.70	0.38	0.27

Calendar year 1965: Max 7,170 Min 63 Mean 475 Cfsm 0.772 In. 10.49
Water year 1965-66 Max 2,020 Min 122 Mean 414 Cfsm 0.673 In. 9.14

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 1966.

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.--17 years, 49.6 cfs.

Extremes.--Maximum discharge during year, 206 cfs May 27 (gage height, 4.65 ft); maximum gage height, 4.79 ft Mar. 5 (backwater from ice); minimum discharge, 3.8 cfs Sept. 30 (2.03 ft).
1949-66: 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, Dec. 8, 1963, Feb. 10-21, 1965.

Remarks.--Records good except those for winter months, which are fair. Flow affected by natural storage and some regulation from lakes above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	55	74	75	69	57	58	158	122	185	82	22	16
2	53	70	77	68	57	59	152	129	179	76	19	18
3	45	84	79	67	56	60	161	123	175	72	16	17
4	38	96	80	67	56	62	164	124	171	67	16	20
5	34	101	82	66	55	63	162	127	166	66	17	20
6	34	102	82	66	54	65	148	116	165	66	16	16
7	33	99	83	66	54	67	142	113	162	60	16	14
8	31	98	84	66	56	71	152	112	151	60	16	13
9	24	93	84	66	60	75	151	110	140	52	15	13
10	23	90	84	66	62	83	148	122	132	49	14	12
11	23	86	87	65	66	95	146	132	125	50	14	11
12	19	82	88	65	68	105	152	142	125	65	12	11
13	17	78	91	65	67	115	157	153	124	62	15	11
14	16	82	93	64	65	118	160	158	122	57	18	11
15	17	83	93	64	63	124	156	161	116	50	17	8.4
16	18	80	92	64	60	124	157	144	108	46	15	8.0
17	27	79	90	64	59	129	157	134	101	44	14	8.0
18	36	77	88	63	58	135	151	119	96	43	14	7.2
19	56	75	86	63	57	132	162	108	92	40	12	6.8
20	84	73	84	62	56	125	170	96	88	34	17	6.8
21	95	72	82	62	56	124	158	112	110	31	25	7.2
22	96	71	80	61	56	127	151	130	109	29	24	6.5
23	101	71	78	61	56	135	148	158	103	27	21	6.0
24	102	70	77	61	56	117	158	155	99	25	19	5.0
25	106	70	76	60	56	148	150	171	90	25	17	4.8
26	99	69	75	60	56	145	153	198	88	23	16	4.3
27	93	69	74	59	57	131	134	205	89	22	16	4.8
28	90	70	73	59	58	129	146	205	92	20	17	4.8
29	88	72	72	58		155	124	201	88	17	17	5.0
30	80	72	71	58	-----	162	122	196	86	15	16	4.3
31	82	-----	70	57	-----	163	-----	191	-----	14	15	-----
Total	1,715	2,408	2,530	1,962	1,637	3,401	4,550	4,467	3,677	1,389	518	300.9
Mean	55.3	80.3	81.6	63.3	58.5	110	152	144	123	44.8	16.7	10.0
Max	106	102	93	69	68	163	170	205	185	82	25	20
Min	16	69	70	57	54	58	122	96	86	14	12	4.3
Cfsm	0.309	0.449	0.456	0.354	0.327	0.615	0.849	0.804	0.687	0.250	0.093	0.056
In.	0.36	0.50	0.53	0.41	0.34	0.71	0.95	0.93	0.76	0.29	0.11	0.06

Cal yr1965:	Total	29,494.4	Mean	80.8	Max	341	Min	0	Cfsm	0.451	In. 6.13
Wtr yr1966:	Total	28,554.9	Mean	78.2	Max	205	Min	4.3	Cfsm	0.437	In. 5.93

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 downstream 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 1966. 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.--32 years, 229 cfs.

Extremes.--Maximum discharge during year, 2,520 cfs Mar. 17 (gage height, 9.00 ft); maximum gage height, 10.60 ft Feb. 16 (backwater from ice); minimum discharge, 9.8 cfs Sept. 26 (gage height, 0.88 ft).
1934-66: Maximum discharge, 16,100 cfs Apr. 13, 1965 (gage height, 19.23 ft, from floodmark); no flow at times.

Remarks.--Records good except those for winter periods, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	672	167	115	98	52	580	829	527	219	393	28	54
2	672	150	113	97	52	590	784	504	202	364	24	49
3	662	151	111	96	51	600	704	480	196	337	21	42
4	636	139	108	94	51	640	632	444	213	296	19	42
5	599	134	108	92	50	670	589	422	223	245	18	40
6	589	139	107	90	50	740	552	389	211	216	17	38
7	571	134	107	85	50	800	532	361	199	198	25	34
8	536	129	107	75	50	860	502	334	177	177	40	34
9	469	126	106	70	51	940	483	298	165	159	30	26
10	398	123	106	64	69	1,050	462	285	124	141	30	26
11	340	121	107	62	150	1,150	444	280	109	121	38	25
12	298	147	112	60	365	1,250	435	289	93	95	36	21
13	243	150	140	60	536	1,400	427	312	84	103	36	21
14	238	147	230	59	930	1,600	414	348	76	108	38	22
15	222	135	365	58	1,000	1,720	414	362	70	111	50	18
16	212	129	380	58	990	2,250	412	373	63	114	67	18
17	207	122	370	58	950	2,490	412	404	59	131	67	16
18	214	119	335	58	910	2,240	444	423	53	128	64	14
19	212	123	305	58	870	2,030	460	435	49	112	67	13
20	243	159	260	58	850	1,800	545	423	47	103	64	13
21	250	148	210	57	810	1,700	615	402	49	87	60	12
22	233	142	180	56	760	1,550	628	371	60	78	67	12
23	238	110	162	56	730	1,300	662	348	192	70	74	23
24	219	110	145	56	700	854	662	355	346	63	126	16
25	216	118	125	56	660	738	650	350	418	56	134	11
26	204	125	118	55	650	635	618	342	532	48	122	98
27	194	124	114	54	620	648	569	341	582	46	103	14
28	187	123	110	54	600	665	567	314	552	38	88	15
29	179	120	107	53		742	558	280	464	36	80	16
30	172	118	104	52	---------	836	541	260	422	30	70	16
31	167	----------	100	52	---------	888	----------	240	----------	26	63	----------
Total	10,492	3,982	5,167	2,051	13,607	35,956	16,546	11,296	6,249	4,230	1,766	710.8
Mean	338	133	167	66.2	486	1,160	552	364	208	136	57.0	23.7
Cfsm	0.289	0.114	0.143	0.057	0.415	0.991	0.472	0.311	0.178	0.116	0.049	0.020
In.	0.33	0.13	0.16	0.07	0.43	1.14	0.53	0.36	0.20	0.13	0.06	0.02

Calendar year 1965: Max 15,900 Min 1.1 Mean 724 Cfsm 0.619 In. 8.39
Water year 1965-66: Max 2,490 Min 9.8 Mean 307 Cfsm 0.262 In. 3.56

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 1966. 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.--41 years (1909-17, 1930-31, 1934-66), 580 cfs.

Extremes.--Maximum discharge during year, 4,210 cfs Mar. 18 (gage height 7.94 ft); maximum gage height, 9.02 ft Mar. 15 (backwater from ice); minimum discharge, 88 cfs Sept. 27, 28 (gage height, 1.95 ft).
1909-17, 1929-66: Maximum discharge, 22,400 cfs Apr. 16, 1965 (gage height, 19.27 ft, from floodmark); minimum, 1.8 cfs Nov. 15, 1936 (gage height, 1.05 ft), caused by ice jam upstream.

Remarks.--Records good except those for the winter periods, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,130	656	390	575	210	1,380	2,770	1,600	921	892	176	193
2	1,340	638	410	560	210	1,380	2,700	1,570	885	842	168	217
3	1,400	626	420	550	210	1,410	2,580	1,520	856	800	155	232
4	1,420	608	430	540	215	1,500	2,460	1,470	849	807	152	226
5	1,400	585	430	530	220	1,580	2,350	1,420	892	681	148	214
6	1,370	580	425	520	230	1,660	2,260	1,360	892	620	140	196
7	1,360	585	420	510	240	1,780	2,170	1,300	863	585	157	184
8	1,310	574	410	500	300	1,900	2,070	1,250	828	541	157	168
9	1,240	557	414	480	500	2,050	1,990	1,180	780	510	162	152
10	1,150	552	419	470	750	2,290	1,900	1,120	726	465	155	136
11	1,070	541	456	460	820	2,500	1,800	1,100	668	432	152	134
12	974	574	510	440	900	2,700	1,730	1,110	638	406	152	130
13	935	614	590	425	1,200	2,900	1,670	1,110	596	397	160	130
14	885	626	720	411	1,650	3,050	1,620	1,140	546	419	145	138
15	842	602	950	400	1,950	3,300	1,580	1,170	510	437	176	136
16	807	614	1,090	380	2,050	3,700	1,540	1,190	480	437	184	117
17	793	580	1,140	365	2,000	4,000	1,500	1,250	446	424	199	117
18	780	546	1,130	350	1,900	4,180	1,500	1,290	428	414	196	111
19	780	552	1,090	335	1,850	4,170	1,530	1,300	388	380	184	107
20	828	557	960	320	1,780	4,090	1,590	1,300	367	350	184	105
21	856	563	870	315	1,700	3,970	1,660	1,280	358	322	211	101
22	842	541	810	295	1,650	3,800	1,710	1,220	362	296	232	99
23	828	504	750	275	1,550	3,650	1,740	1,180	410	272	260	95
24	807	490	720	265	1,500	3,500	1,780	1,150	638	253	304	101
25	780	480	690	255	1,480	3,300	1,780	1,120	821	238	330	99
26	773	460	660	240	1,400	3,150	1,740	1,110	942	223	322	93
27	753	330	640	230	1,380	3,000	1,700	1,110	1,020	217	289	88
28	726	420	620	225	1,370	2,850	1,680	1,080	1,050	208	266	90
29	707	440	600	220		2,730	1,640	1,030	1,000	196	238	93
30	681	420	590	215	---------	2,770	1,630	994	942	182	223	93
31	681	----------	580	210	---------	2,800	----------	957	----------	170	202	----------
Total	30,248	16,415	20,334	11,866	31,215	87,040	56,370	37,981	21,102	13,416	6,179	4,095
Mean	976	547	656	383	1,115	2,808	1,879	1,225	703	433	199	136
Cfsm	0.387	0.217	0.260	0.152	0.442	1.11	0.746	0.486	0.279	0.172	0.079	0.054
In.	0.45	0.24	0.30	0.18	0.46	1.28	0.83	0.56	0.31	0.20	0.09	0.06

Calendar year1965: Max 22,100 Min 20 Mean 1,628 Cfsm 0.646 In. 8.77
Watar year1965-66: Max 4,180 Min 88 Mean 921 Cfsm 0.365 In. 4.96

GPO 803-695-8

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 northeast of Garrison.

Records available.--June 1931 to September 1966. 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, 1,253.33 ft July 10 (affected by wind action); maximum daily recorded, 1,252.59 ft July 5; minimum recorded, 1,251.42 ft Sept. 29 (affected by wind action).
1931-66: 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.

Daily mean elevation, in feet, October 1965 to September 1966

Oct. 19 ..... 1251.77	Feb. 25 ..... 1251.68	June 30 ..... 1252.52
Nov. 14 ..... 1251.62	Mar. 30 ..... 1252.16	July 31 ..... 1252.37
Dec. 31 ..... 1251.76	Apr. 29 ..... 1252.47	Aug. 31 ..... 1252.29
Jan. 28 ..... 1251.82	May 31 ..... 1252.38	Sept. 30 ..... 1251.75

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

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 15¾ 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 1966.

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.--34 years (1930-31, 1933-66), 548 cfs.

Extremes.--Maximum discharge during year, 5,720 cfs Mar. 22 (gage height, 8.30 ft); minimum daily, 397 cfs Sept. 29, 30; minimum gage height, 3.00 ft Nov. 27.
1929-66: Maximum discharge, 10,100 cfs Apr. 20, 1965 (gage height, 11.57 ft); minimum, 29 cfs Aug. 18, 1934 (gage height, 1.91 ft).

Remarks.--Records good except those for winter periods, which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	950	666	485	620	455	630	1,880	1,670	1,080	580	439	459
2	1,200	640	495	630	455	645	1,790	1,590	1,010	557	444	485
3	1,500	610	490	630	455	700	1,760	1,560	980	540	434	485
4	1,750	590	485	625	455	880	1,830	1,520	980	523	434	485
5	2,000	565	475	615	455	1,100	1,870	1,450	1,020	545	449	464
6	2,100	552	470	595	460	1,120	1,920	1,390	1,060	551	444	454
7	2,150	546	460	570	465	1,120	1,920	1,330	1,110	551	444	444
8	2,050	534	450	550	480	1,170	1,850	1,250	1,220	545	449	439
9	1,900	508	439	545	515	1,320	1,730	1,180	1,290	523	454	434
10	1,700	502	433	535	600	1,520	1,610	1,130	1,350	528	454	434
11	1,500	490	467	530	750	1,660	1,490	1,100	1,390	598	439	434
12	1,350	515	612	525	900	1,750	1,380	1,060	1,340	801	429	434
13	1,170	565	794	515	1,150	1,900	1,300	1,040	1,230	903	434	434
14	1,030	598	880	510	1,500	2,100	1,240	1,020	1,100	959	449	439
15	938	612	950	505	1,690	2,450	1,210	1,030	995	959	449	439
16	858	632	1,020	500	1,650	2,850	1,190	1,070	924	917	449	434
17	802	625	1,040	495	1,520	3,500	1,200	1,140	868	827	449	434
18	763	598	1,060	485	1,310	4,190	1,250	1,190	814	756	439	429
19	735	585	1,040	475	1,120	4,840	1,380	1,300	768	691	429	429
20	794	605	1,030	470	940	5,200	1,520	1,450	742	629	429	429
21	898	578	840	465	840	5,500	1,630	1,620	716	569	474	424
22	986	592	755	460	780	5,600	1,770	1,790	685	540	517	424
23	1,040	585	730	455	680	5,400	1,940	1,900	666	523	551	420
24	1,050	565	730	455	640	4,400	2,170	1,920	653	512	574	415
25	1,030	546	735	455	635	4,400	2,370	1,840	660	490	574	415
26	970	560	740	455	625	3,900	2,480	1,700	635	479	574	406
27	898	495	700	455	620	3,540	2,320	1,580	623	469	569	402
28	818	440	620	455	620	3,120	2,150	1,460	616	464	545	402
29	763	460	590	455		2,700	1,970	1,350	610	459	517	397
30	735	475	590	455	--------	2,370	1,810	1,260	592	444	496	397
31	700	--------	610	455	--------	2,080	--------	1,170	--------	429	464	--------
Total	37,128	16,834	21,215	15,945	22,765	83,655	51,930	43,060	27,727	18,861	14,695	13,020
Mean	1,198	561	684	514	813	2,699	1,731	1,389	924	608	474	434
Cfsm	0.881	0.412	0.503	0.378	0.598	1.98	1.27	1.02	0.679	0.447	0.349	0.319
In.	1.02	0.46	0.58	0.44	0.62	2.29	1.42	1.18	0.76	0.52	0.40	0.36

Calendar year 1965: Max 9,900 Min 110 Mean 910 Cfsm 0.669 In. 9.09
Water year 1965-66: Max 5,600 Min 397 Mean 1,005 Cfsm 0.739 In. 10.03

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 1966. 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.--35 years, 7,053 cfs.

Extremes.--Maximum discharge during year, 46,700 cfs Mar. 18 (gage height, 12.53 ft); minimum daily, 3,710 cfs Nov. 29; minimum gage height, 2.43 ft Nov. 29.

1931-66: Maximum discharge, 91,000 cfs Apr. 17, 1965 (gage height, 19.53 ft); minimum, 586 cfs Sept. 13, 1934 (gage height, 0.37 ft).

Remarks.--Records good. Flow slightly regulated by six reservoirs on headwaters; total usable capacity, 1,640,600 acre-ft. Diurnal regulation caused by powerplant above station. Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	14,600	13,200	4,370	7,210	6,440	7,570	28,100	30,500	16,600	10,300	6,620	9,370
2	17,500	12,600	5,600	9,770	6,260	7,670	28,900	30,400	16,300	10,800	6,980	9,650
3	20,100	12,800	8,430	8,200	6,100	7,780	29,500	30,300	14,700	9,510	6,810	8,700
4	21,400	12,200	8,430	7,620	6,230	10,100	30,400	29,500	14,900	9,340	6,840	7,930
5	22,300	11,600	8,530	7,400	6,080	10,900	31,100	28,500	14,500	8,920	6,660	7,980
6	23,000	11,700	7,640	6,840	5,810	10,800	31,000	27,500	13,800	9,320	6,060	7,790
7	23,000	11,100	7,390	6,860	5,960	10,700	31,200	26,800	13,600	8,570	6,500	7,770
8	22,900	12,400	8,930	5,900	6,190	10,700	31,000	25,700	13,200	9,340	7,510	7,530
9	22,300	11,100	8,610	6,680	8,910	10,600	30,000	24,900	13,400	8,240	6,700	6,970
10	21,300	10,000	8,530	7,260	12,300	11,700	29,000	23,900	12,200	9,000	6,490	6,750
11	20,500	9,710	8,910	7,020	13,800	12,600	28,000	23,000	12,000	9,500	7,360	6,290
12	19,800	9,690	10,500	7,200	13,900	14,600	27,100	22,600	11,700	10,300	8,550	5,870
13	19,100	10,300	11,100	7,120	13,900	14,900	26,000	21,700	11,200	9,880	8,560	6,730
14	18,300	9,440	10,900	7,630	14,300	17,200	24,700	21,200	10,500	10,000	8,740	6,430
15	17,700	9,600	9,280	7,320	14,600	20,500	24,700	21,500	9,940	10,100	9,850	6,180
16	17,100	9,780	9,540	7,190	14,500	24,200	24,300	21,400	9,420	9,830	9,310	6,080
17	16,300	9,940	9,760	7,060	14,300	27,900	24,200	21,500	9,390	9,230	8,860	6,200
18	16,400	9,260	9,140	7,180	14,300	37,500	24,400	21,900	8,830	8,280	9,220	6,130
19	16,700	9,950	8,550	7,220	13,100	35,200	24,900	21,900	8,800	8,100	9,260	5,960
20	17,200	9,020	9,790	7,140	11,800	36,500	26,000	22,000	8,080	7,440	9,470	5,840
21	17,500	9,440	9,790	7,180	10,700	39,100	27,400	21,700	8,080	6,960	10,400	6,360
22	17,600	9,760	9,990	7,140	9,800	41,000	27,800	21,200	7,950	6,670	11,200	6,030
23	17,400	10,100	10,000	7,040	9,320	42,200	28,300	21,400	7,380	6,260	11,500	5,620
24	17,400	9,740	11,400	6,920	8,730	37,100	28,700	22,100	8,030	5,880	10,500	5,380
25	16,600	8,390	10,100	6,610	7,790	35,500	29,200	21,500	8,470	5,700	11,600	5,430
26	16,500	9,380	8,630	6,570	8,180	35,600	29,700	21,100	9,600	5,810	11,500	6,020
27	15,300	7,420	7,350	6,710	7,770	34,600	29,800	20,100	9,620	5,430	11,600	5,690
28	15,300	4,280	6,560	6,180	7,460	32,900	30,200	19,500	10,600	6,130	11,100	5,100
29	14,400	3,710	7,080	6,340	------	30,800	30,300	18,600	11,000	6,390	11,700	5,200
30	14,400	4,600	8,980	6,320	------	29,100	30,400	17,900	10,800	6,370	10,400	5,130
31	13,800	------	8,270	6,460	------	28,100	------	17,300	------	6,480	9,290	------
TOTAL	563,700	292,210	272,080	219,290	278,530	725,620	846,300	719,100	334,590	254,080	277,140	198,110
MEAN	18,180	9,740	8,777	7,074	9,948	23,410	28,210	23,200	11,150	8,196	8,940	6,604
CFSM	.952	.510	.460	.370	.521	1.23	1.48	1.21	.584	.429	.468	.346
IN	1.10	.57	.53	.43	.54	1.41	1.65	1.40	.65	.49	.54	.39

CALENDAR YEAR 1965 MAX 90,300 MIN 2,900 MEAN 13,730 CFSM .719 INCHES 9.76
WATER YEAR 1965-66 MAX 42,200 MIN 3,710 MEAN 13,650 CFSM .715 INCHES 9.70

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 1966.

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 4½ 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.--27 years, 47.8 cfs (34,600 acre-ft per year).

Extremes.--Maximum discharge during year, 1,410 cfs Mar. 18 (gage height, 7.16 ft); maximum gage height, 11.82 ft Mar. 13, from floodmark (backwater from ice); minimum daily discharge, 0.5 cfs July 26, Aug. 4, 5, Sept. 21; minimum gage height, 1.99 ft Aug. 3, 4, Sept. 21.
1939-66: 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 winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	32	6.6	3.4	3.2	1.3	2.1	180	131	16	3.6	1.1	1.9
2	26	6.6	3.4	3.2	1.3	3.1	173	131	16	3.4	1.0	1.7
3	18	6.8	3.4	3.2	1.3	5.4	140	129	14	3.1	.6	1.5
4	13	6.4	3.4	3.2	1.3	7.0	116	120	12	3.0	.5	1.5
5	11	6.4	3.4	3.2	1.3	20	104	106	12	2.7	.5	1.2
6	8.8	6.1	3.4	3.2	1.3	62	94	91	11	2.5	.8	1.2
7	9.2	6.1	3.4	2.9	1.3	62	82	85	11	2.4	1.4	1.2
8	9.9	6.1	3.4	2.5	1.3	60	78	76	11	2.2	1.1	1.0
9	9.9	6.1	3.4	2.3	1.3	50	73	68	9.5	2.1	.9	.9
10	9.5	6.1	3.4	2.0	1.3	49	66	64	8.5	2.0	.8	1.0
11	8.5	5.9	3.4	1.9	1.3	52	66	66	7.6	1.8	.6	1.1
12	7.4	5.8	3.4	1.8	1.3	95	64	78	7.4	1.7	.6	.9
13	7.4	5.7	3.4	1.7	1.3	171	61	104	6.8	1.6	1.9	1.0
14	7.9	5.6	3.4	1.6	1.3	270	66	112	5.8	1.5	1.9	1.1
15	7.6	5.5	3.3	1.6	1.3	700	66	120	5.4	1.4	2.6	.8
16	6.8	5.4	3.3	1.6	1.3	1,050	65	116	5.6	1.3	1.6	.8
17	6.8	5.3	3.3	1.5	1.3	1,090	72	102	5.6	1.2	1.0	.8
18	7.6	5.2	3.3	1.5	1.3	1,300	89	87	5.4	1.1	.7	.7
19	7.9	5.1	3.3	1.5	1.3	824	98	77	5.2	1.0	.8	.6
20	8.2	4.9	3.3	1.5	1.3	586	60	68	4.8	.9	4.4	.6
21	7.9	4.8	3.3	1.4	1.3	509	74	60	4.3	.8	7.9	.5
22	7.6	4.6	3.3	1.4	1.3	430	98	52	4.3	.7	12	.6
23	7.6	4.5	3.3	1.4	1.3	281	112	46	4.1	.7	19	.8
24	7.1	4.3	3.3	1.4	1.3	142	129	41	3.7	.7	13	.8
25	7.1	4.2	3.3	1.4	1.4	230	125	37	3.9	.6	8.5	.8
26	7.4	3.8	3.3	1.4	1.4	216	110	34	3.7	.5	6.8	.8
27	6.8	3.6	3.3	1.4	1.5	208	104	30	3.5	.6	5.2	.8
28	6.8	3.5	3.3	1.3	1.6	178	112	27	3.5	.7	4.3	.8
29	6.8	3.4	3.2	1.3		183	131	24	3.9	.6	3.3	1.0
30	6.6	3.4	3.2	1.3	----------	190	133	20	3.9	.6	2.7	1.1
31	6.6	----------	3.2	1.3	----------	178	----------	18	----------	.6	2.2	----------
Total	301.7	157.8	103.4	60.1	37.1	9,203.6	2,941	2,320	219.4	47.6	109.7	29.5
Mean	9.73	5.26	3.34	1.94	1.32	297	98.0	74.8	7.31	1.54	3.54	0.98
Cfsm	0.022	0.012	0.0075	0.0043	0.0030	0.664	0.219	0.167	0.016	0.0034	0.0079	0.0022
In.	0.03	0.01	0.009	0.005	0.003	0.77	0.24	0.19	0.18	0.004	0.009	0.002
Ac-ft	598	313	205	119	74	18,260	5,830	4,600	435	94	218	58

Calendar year 1965:	Max	1,740	Min	0.2	Mean	66.6	Cfsm	0.149	In.	2.02	Ac-ft	48,220
Water year 1965-66:	Max	1,300	Min	0.5	Mean	42.6	Cfsm	0.095	In.	1.45	Ac-ft	30,800

Peak discharge (base, 450 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-18	0300	7.16	1,410				

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 1966. 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.--35 years (1931-66), 45.8 cfs (33,160 acre-ft per year).

Extremes.--Maximum discharge during year, 2,600 cfs Mar. 14 (gage height, 9.42 ft); maximum gage height, 9.97 ft Mar. 13 (backwater from ice); minimum discharge 1.4 cfs July 12 (gage height, 1.74 ft).
1910-12, 1931-66: 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 winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	26	6.4	5.6	3.6	3.7	20	78	96	29	5.8	6.9	8.2
2	24	6.1	5.6	3.6	3.9	28	78	86	27	5.1	7.5	8.2
3	18	5.8	5.6	3.5	4.1	164	73	81	25	4.5	7.8	7.5
4	14	6.1	5.6	3.5	4.4	161	63	73	23	4.2	8.2	6.6
5	11	6.4	5.6	3.4	4.6	150	58	66	23	4.3	8.2	6.9
6	9.4	6.4	5.5	3.4	5.0	135	54	60	22	4.2	9.1	6.6
7	8.5	6.4	5.5	3.4	5.4	84	50	55	20	4.0	14	6.6
8	8.2	6.4	5.4	3.4	6.0	88	48	53	18	3.7	14	7.2
9	7.8	6.4	5.4	3.4	6.8	110	47	49	16	3.1	14	7.2
10	7.2	6.4	5.4	3.4	12	150	47	47	15	3.2	14	6.9
11	9.4	6.4	5.3	3.4	24	230	49	51	13	2.4	14	5.4
12	7.5	6.4	5.3	3.4	23	454	49	61	12	2.2	15	5.6
13	7.2	6.3	5.2	3.4	22	1,190	48	74	11	3.8	18	5.6
14	6.9	6.2	5.2	3.4	22	2,120	46	83	11	4.5	19	5.1
15	7.2	6.2	5.1	3.4	21	1,550	47	100	11	4.9	21	4.2
16	7.5	6.2	5.0	3.4	20	989	48	118	11	4.9	17	3.4
17	16	6.1	4.9	3.4	19	790	54	135	10	4.5	19	2.7
18	14	6.0	4.9	3.4	17	1,040	62	97	9.4	3.8	18	2.1
19	10	6.0	4.8	3.4	16	665	66	78	9.4	3.1	17	2.4
20	9.4	5.9	4.7	3.4	15	255	60	68	9.1	3.4	32	2.4
21	8.8	5.9	4.6	3.4	14	191	53	62	7.8	3.4	50	2.2
22	8.2	5.8	4.5	3.4	13	191	63	56	7.5	4.0	50	2.0
23	7.8	5.8	4.4	3.4	12	83	82	52	7.2	4.2	46	2.1
24	7.2	5.8	4.3	3.4	12	60	103	48	6.9	4.3	31	2.8
25	7.2	5.7	4.2	3.4	11	75	103	44	6.6	4.3	23	3.2
26	7.2	5.6	4.1	3.4	12	69	88	40	6.1	5.8	18	3.4
27	7.8	5.6	4.0	3.4	13	70	79	38	6.1	6.1	15	3.7
28	6.6	5.6	3.9	3.4	16	67	87	35	6.6	6.4	13	4.0
29	6.6	5.6	3.8	3.4		63	103	33	5.6	6.1	10	4.9
30	6.6	5.6	3.7	3.5	----------	70	106	32	5.6	6.1	9.1	5.4
31	6.4	----------	3.7	3.6	----------	78	----------	30	----------	5.8	8.5	----------
Total	309.6	181.5	150.8	106.3	357.9	11,390	1,992	2,001	390.9	136.1	567.3	144.5
Mean	9.99	6.05	4.86	3.43	12.8	367	66.4	64.5	13.0	4.39	18.3	4.82
Cfsm	0.026	0.016	0.012	0.0088	0.033	0.943	0.171	0.166	0.033	0.011	0.047	0.0012
In.	0.03	0.02	0.01	0.01	0.03	1.09	0.19	0.19	0.037	0.01	0.05	0.01
Ac-ft	614	360	299	211	710	22,590	3,950	3,970	775	270	1,130	287

Calendar year 1965	Max	1,680	Min	1.9	Mean	55.7	Cfsm	0.143	In.	1.94	Ac-ft	40,300
Water year 1965-66	Max	2,120	Min	2.0	Mean	48.6	Cfsm	0.125	In.	1.69	Ac-ft	35,160

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-14	1630	9.42	2,600	3-18	1130	6.77	1,120

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 powerplant 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 1966.

Gage.--Wire-weight gage read once a day. Datum of gage is 957.69 ft above mean sea level, datum of 1929. Prior to Sept. 17, 1947, staff gage at site ½ mile south at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site ½ 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, 9.99 ft Mar. 19; minimum, 6.00 ft Dec. 19, Aug. 23, 31.
1937-66: 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 gage and two 2½-foot gates with lowest sill at elevation 958.40 ft (all elevations are referred to datum of 1929). 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.

Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Gage height, in feet, October 1965 to September 1966

Oct. 31	6.60	Feb. 28	6.56	June 30	6.92
Nov. 30	6.25	Mar. 31	9.00	July 31	6.86
Dec. 31	6.64	Apr. 30	7.85	Aug. 31	6.00
Jan. 31	6.58	May 31	7.20	Sept. 30	6.27

Note.--Gage-height record other than that 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 1966.

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.--28 years, 116 cfs (83,980 acre-ft per year).

Extremes.--Maximum discharge during year, 1,250 cfs Mar. 18 (gage height, 9.86 ft); minimum, 1.8 cfs Sept. 30 (gage height, 1.16 ft).
1938-66: Maximum discharge, 3,060 cfs Apr. 13, 1952 (gage height, 12.92 ft); no flow Dec. 13, 1940.

Remarks.--Records fair. Flow affected by natural storage in Big Stone Lake (see preceding page).

Discharge, in cubic feet per second, water year October 1965to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	52	23	19	42	39	41	973	290	97	88	12	36
2	57	28	19	45	39	43	852	238	104	85	12	42
3	36	56	19	47	38	47	856	265	71	89	9.8	13
4	29	23	20	50	38	92	840	291	33	78	11	28
5	37	29	20	50	38	85	806	315	54	76	12	42
6	53	30	20	50	38	80	786	291	49	67	11	26
7	162	28	21	50	38	78	656	273	40	56	10	14
8	51	48	22	50	37	78	648	289	38	53	14	13
9	22	25	23	50	37	80	592	262	37	52	34	15
10	30	25	24	50	37	86	532	224	23	44	13	14
11	44	17	26	50	37	95	520	236	24	43	12	12
12	25	43	29	49	37	152	490	255	24	48	12	12
13	19	38	31	48	37	285	473	253	32	40	15	21
14	24	14	34	48	37	490	483	233	17	41	12	20
15	16	17	36	47	37	700	436	275	14	43	10	18
16	17	77	37	47	38	880	404	256	14	49	10	16
17	24	25	38	46	38	1,160	469	277	12	35	13	16
18	36	20	38	46	39	1,200	439	282	11	30	18	16
19	32	20	38	45	39	1,220	496	277	11	28	33	9.4
20	50	20	38	44	39	1,170	403	245	14	19	44	8.4
21	29	20	38	43	38	1,140	362	229	12	17	49	13
22	27	20	37	43	38	1,140	369	193	10	19	55	16
23	42	20	36	43	38	1,110	337	258	29	20	54	7.6
24	18	21	35	42	38	1,030	324	226	69	13	37	6.2
25	29	15	35	42	38	960	304	212	73	14	23	7.1
26	21	18	35	41	38	906	252	208	72	14	19	6.2
27	19	21	35	40	39	876	233	214	65	14	13	7.1
28	13	22	36	40	40	878	233	165	86	17	14	8.0
29	15	20	37	40		958	257	130	41	12	17	16
30	25	19	39	39	----------	970	254	126	64	14	14	7.6
31	41	----------	40	39	----------	976	----------	120	----------	11	15	----------
Total	1,095	802	955	1,406	1,064	19,006	15,079	7,408	1,240	1,229	627.8	486.6
Mean	35.3	26.7	30.8	45.4	38.0	613	503	239	41.3	39.6	20.3	16.2
Ac-ft	2,170	1,590	1,890	2,790	2,110	37,700	29,910	14,690	2,460	2,440	1,250	965

Calendar year 1965: Max 997 Min 0.7 Mean 158 Ac-ft 114,400
Water year 1965-66: Max 1,220 Min 6.2 Mean 138 Ac-ft 99,960

5-2930. Yellow Bank River near Odessa, Minn.

Location.--Lat 45°13'35", long 96°21'12", in SE¼SE¼ sec.1, T.120 N., R.46 W., on left bank 150 ft downstream from highway bridge, 2½ miles southwest of Odessa, and 4½ miles upstream from mouth.

Drainage area.--398 sq mi.

Records available.--October 1939 to September 1966.

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.--27 years, 56.4 cfs (40,830 acre-ft per year).

Extremes.--Maximum discharge during year, 1,400 cfs Mar. 15 (gage height, 13.60 ft, from floodmark, backwater from ice); minimum, 1.8 cfs Sept. 24, 25, 26, 27, 28; minimum gage height, 1.89 ft Aug. 6.
1939-66: 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, Feb. 11 to Mar. 9, 1965.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	32	12	8.1	5.3	5.3	18	94	129	35	11	3.7	7.0
2	33	11	8.1	5.2	5.3	24	90	114	34	10	3.5	7.6
3	44	10	8.1	5.1	5.3	38	83	106	33	9.9	3.5	7.0
4	35	9.8	8.0	5.1	5.4	47	78	98	31	9.8	3.3	6.4
5	30	11	8.0	5.0	5.6	37	74	86	31	8.9	3.3	6.4
6	28	11	8.0	5.0	5.9	34	69	79	30	8.9	4.2	5.9
7	25	9.8	8.0	5.0	6.3	30	67	74	30	8.6	4.2	5.6
8	20	9.8	7.9	5.0	7.0	27	64	69	29	7.6	3.7	5.1
9	19	9.6	7.9	5.0	9.4	33	63	63	30	7.0	4.4	5.1
10	18	9.5	7.8	5.0	12	50	60	60	28	7.0	4.4	4.6
11	16	9.4	7.7	5.0	17	120	60	64	27	6.7	4.4	4.4
12	14	9.2	7.6	5.0	23	250	59	74	25	6.7	4.4	3.9
13	13	9.0	7.5	5.0	25	500	59	83	23	7.0	5.4	3.9
14	12	8.9	7.5	5.0	25	990	57	99	21	7.6	5.9	4.2
15	12	8.8	7.4	5.0	24	1,330	57	129	20	7.3	6.7	3.9
16	11	8.9	7.4	5.0	23	1,190	57	148	19	6.4	6.7	3.5
17	12	8.9	7.3	5.0	22	930	64	148	18	5.6	6.4	3.3
18	15	8.9	7.2	5.0	21	809	71	136	17	5.1	5.9	2.9
19	17	8.9	7.1	5.0	19	608	75	118	16	5.9	5.6	2.5
20	17	8.9	7.0	5.1	18	369	77	106	16	5.6	13	2.0
21	16	8.9	6.8	5.1	17	300	77	94	15	4.8	19	2.5
22	19	8.9	6.7	5.1	16	259	86	85	14	4.6	18	2.3
23	18	8.9	6.6	5.1	15	174	100	78	14	4.4	13	2.3
24	19	8.9	6.5	5.1	15	148	114	70	14	4.4	14	1.9
25	16	8.8	6.3	5.2	14	142	132	63	14	3.9	16	1.9
26	16	8.7	6.2	5.2	14	140	117	58	13	3.9	13	1.9
27	15	8.6	6.0	5.2	14	134	104	50	14	3.9	11	1.9
28	14	8.4	5.9	5.2	15	124	107	47	14	3.9	9.9	1.9
29	13	8.3	5.7	5.2		117	116	43	13	3.5	9.2	2.3
30	12	8.2	5.5	5.2	----------	114	128	40	12	3.5	8.2	2.1
31	11	----------	5.4	5.3	----------	103	----------	35	----------	3.5	7.3	----------
Total	592	279.9	221.2	157.7	404.5	9,189	2,459	2,646	650	196.9	241.2	116.2
Mean	19.1	9.33	7.14	5.09	14.4	296	82.0	85.4	21.7	6.35	7.78	3.87
Cfsm	0.048	0.023	0.018	0.013	0.036	0.744	0.206	0.215	0.055	0.016	0.020	0.0097
In.	0.06	0.03	0.02	0.01	0.04	0.86	0.23	0.25	0.06	0.02	0.02	0.01
Ac-ft	1,170	555	439	313	802	18,230	4,880	5,250	1,290	391	478	230

Calendar year 1965: Max 3,330 Min 0 Mean 83.3 Cfsm 0.209 In. 2.84 Ac-ft 60,340
Water year 1965-66: Max 1,330 Min 1.9 Mean 47.0 Cfsm 0.118 In. 1.60 Ac-ft 34,020

Peak discharge (base, 300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-15	Unknown	13.60	1,400				

Note.--No gage-height record Mar. 12-15.

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 1966. 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.--31 years (1935-66), 98.6 cfs (71,380 acre-ft per year).

Extremes.--Maximum discharge during year, 1,660 cfs Mar. 17 (gage height, 8.41 ft); minimum, 27 cfs Feb. 2 (gage height, 4.51 ft).
1931-66: 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 winter months, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	310	195	133	94	45	66	564	416	188	98	60	98
2	333	192	123	91	43	76	540	411	184	92	83	92
3	296	188	123	92	43	93	511	397	195	89	82	87
4	274	184	125	92	42	118	492	374	199	85	71	83
5	265	180	128	91	42	95	468	361	199	92	67	80
6	269	180	128	92	43	85	449	347	192	89	73	78
7	265	173	128	93	45	78	416	338	192	89	70	75
8	269	169	128	91	48	82	379	324	184	83	75	70
9	278	169	128	87	52	87	351	305	177	80	78	65
10	274	169	133	84	62	96	351	296	169	75	71	64
11	265	169	132	80	120	170	351	296	156	73	67	64
12	243	169	133	78	171	320	338	310	153	80	65	64
13	234	177	134	77	155	590	324	328	148	92	68	65
14	230	108	130	76	105	850	305	328	145	89	70	64
15	225	118	123	73	85	1,070	296	324	148	83	80	61
16	217	104	120	72	75	1,340	278	324	148	78	83	61
17	221	91	118	72	72	1,550	283	319	133	75	80	60
18	292	102	115	71	72	1,480	292	301	123	71	75	58
19	315	118	115	68	71	1,370	296	292	117	68	71	57
20	315	130	113	67	69	1,230	287	283	115	67	100	55
21	296	120	112	66	69	1,100	283	269	110	67	133	54
22	274	112	112	65	68	1,100	310	247	105	65	195	53
23	265	108	111	64	67	924	347	239	100	62	148	53
24	252	95	110	62	66	679	370	239	105	60	125	55
25	243	81	105	58	66	603	370	234	110	57	115	54
26	239	67	100	56	64	684	365	221	107	55	110	53
27	225	55	90	52	63	855	356	217	133	65	105	52
28	225	80	79	49	64	816	361	208	133	73	100	52
29	212	110	84	48		713	411	199	117	67	96	51
30	208	130	90	47	----------	641	425	195	110	62	94	52
31	199	----------	93	46	----------	598	----------	192	----------	58	89	----------
Total	8,028	4,043	3,596	2,254	1,987	19,559	11,169	9,134	4,395	2,339	2,799	1,930
Mean	259	135	116	72.7	71.0	631	372	295	146	75.5	90.3	64.3
Cfsm	0.286	0.149	0.128	0.080	0.078	0.697	0.411	0.326	0.161	0.083	0.100	0.071
In.	0.33	0.17	0.15	0.09	0.08	0.80	0.46	0.38	0.18	0.10	0.12	0.08
Ac-ft	1,590	8,020	7,130	4,470	3,940	38,790	22,150	18,120	8,720	4,640	5,550	3,830

Calendar year 1965:	Max	2,170	Min	5.0	Mean	249	Cfsm	0.275	In.	3.73	Ac-ft	179,900
Water year 1965-66:	Max	1,550	Min	42	Mean	195	Cfsm	0.215	In.	2.93	Ac-ft	141,300

Peak discharge (base, 200 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10- 2	0900	5.83	338	4-30	0200	6.01	430
10-19	2300	5.81	324	6-27	1000	5.42	208
3-17	2200	8.41	1,660	8-22	0900	5.42	208
3-27	1500	6.87	894				

5-3000. Lac qui Parle River near Lac qui Parle, Minn.

Location.--Lat 45°00', long 95°55', in SW¼SW¼ 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 1966 (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.--35 years (1912-13, 1931-32, 1933-66), 117 cfs (84,700 acre-ft per year).

Extremes.--Maximum discharge during year, 7,700 cfs Mar. 16 (gage height, 15.37 ft, from floodmark); no flow Sept. 24, 25.
1910-14, 1931-66: Maximum discharge, 11,100 cfs Apr. 6, 1952 (gage height, 18.18 ft); maximum gage height, 19.37 ft Apr. 9, 1965, from floodmark, backwater from ice; no flow at times in several years.

Remarks.--Records good except those for winter months or backwater from beaver dam, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	107	42	18	17	16	82	281	286	96	25	4.9	4.0
2	122	40	18	17	16	87	265	261	92	20	4.0	5.6
3	157	39	18	16	16	94	249	239	86	13	3.1	5.3
4	155	37	18	16	16	162	215	213	84	10	2.9	4.9
5	133	36	18	16	16	162	192	194	80	13	2.8	4.0
6	114	36	18	16	16	158	170	188	74	12	2.8	3.6
7	102	36	18	16	16	150	155	174	70	10	4.2	3.4
8	93	36	18	16	20	147	181	159	63	12	6.5	3.3
9	87	34	18	16	37	149	178	146	60	13	2.8	3.1
10	81	35	18	16	75	160	168	135	53	22	3.0	2.9
11	74	35	19	16	110	310	157	137	50	19	3.4	2.8
12	67	34	19	16	130	600	155	148	46	19	3.3	2.8
13	64	34	19	16	154	1,250	152	183	44	19	3.6	2.7
14	60	33	20	16	154	2,450	152	246	39	17	3.6	3.0
15	55	32	20	16	140	4,430	155	308	37	15	3.1	2.6
16	54	31	20	16	112	7,200	152	319	33	14	5.3	2.1
17	54	30	20	16	100	3,600	152	300	31	14	4.5	1.6
18	58	29	21	16	85	2,260	157	271	29	12	4.2	1.3
19	58	29	20	16	80	1,810	174	251	28	15	4.2	1.2
20	59	28	20	16	79	1,390	188	229	26	15	5.7	.7
21	68	27	20	16	79	1,090	174	208	27	10	19	.6
22	70	26	20	16	78	877	192	188	27	8.4	12	.4
23	66	25	20	16	78	652	217	174	23	7.4	8.9	.1
24	63	23	19	16	78	398	253	157	22	6.1	5.3	0
25	58	22	19	16	78	457	268	144	22	5.3	5.3	0
26	55	21	19	16	79	486	249	135	20	6.5	7.9	.1
27	52	20	18	16	79	445	229	127	22	6.1	6.2	.2
28	50	20	18	16	80	366	234	119	22	5.3	4.6	.3
29	48	19	18	16		336	261	114	22	5.7	3.6	.4
30	46	19	17	16	----------	322	289	107	44	6.1	3.3	.9
31	44	----------	17	16	----------	300	----------	102	----------	5.3	3.0	----------
Total	2,374	908	583	498	2,017	32,380	6,014	5,962	1,372	381.2	157.0	63.9
Mean	76.6	30.3	18.8	16.1	72.0	1,045	200	192	457	12.3	5.06	2.13
Cfsm	0.078	0.031	0.019	0.016	0.073	1.06	0.203	0.195	0.465	0.013	0.0051	0.0022
In.	0.09	0.03	0.02	0.02	0.08	1.23	0.23	0.23	0.52	0.01	0.006	0.002
Ac-ft	4,710	1,800	1,160	988	4,000	64,220	11,930	11,830	2,720	756	311	127

Calendar year 1965:	Max	7,200	Min	0.5	Mean	248	Cfsm	0.252	In.	3.42	Ac-ft	179,500
Water year 1965-66	Max	7,200	Min	0	Mean	144	Cfsm	0.146	In.	1.99	Ac-ft	104,500

Note.--Backwater from beaver dam Aug. 11 to Sept. 30.

5-3010. Minnesota River near Lac qui Parle, Minn.

Location.--Lat 45°01'17", long 95°52'05", in NW¼NE¼ 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 1966.

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.--24 years, 646 cfs (467,700 acre-ft per year).

Extremes.--Maximum discharge during year, 5,770 cfs Mar. 21 (gage height, 34.08 ft); minimum, 9.1 cfs Sept. 29 (gage height, 20.37 ft).
1942-66: 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 winter months, 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	367	400	290	165	325	160	3,740	1,660	414	104	58	41
2	362	395	240	165	325	160	3,520	1,700	385	105	58	37
3	347	388	170	170	320	165	3,420	1,770	380	104	58	36
4	347	383	170	175	315	170	3,320	1,770	382	105	52	36
5	395	381	170	175	305	200	3,200	1,760	389	108	41	37
6	997	376	170	180	290	300	3,120	1,720	389	107	40	38
7	1,620	376	170	190	280	350	3,040	1,660	380	105	41	40
8	1,360	376	170	190	264	370	3,000	1,630	380	105	38	40
9	788	376	170	180	222	400	2,920	1,510	382	105	38	40
10	474	374	170	185	241	600	2,840	1,140	382	105	38	40
11	466	327	170	180	260	760	2,760	899	380	104	40	40
12	429	281	170	180	285	980	2,690	933	371	105	41	40
13	429	279	170	180	300	1,200	2,540	951	371	105	41	40
14	427	281	170	180	320	1,500	2,500	959	367	104	41	40
15	369	277	165	180	350	1,780	2,390	995	360	102	41	37
16	283	256	165	180	380	1,900	2,260	1,010	358	104	42	37
17	279	203	165	170	400	3,000	2,210	1,170	356	104	38	37
18	277	290	160	170	405	4,000	2,060	1,300	358	104	40	37
19	279	273	160	170	400	5,000	1,950	1,360	356	102	41	37
20	277	266	160	170	385	5,400	1,730	1,390	311	100	40	37
21	362	266	160	165	320	5,740	1,540	1,370	179	102	41	37
22	436	262	160	160	240	5,730	1,510	1,340	105	100	41	37
23	439	262	160	160	180	5,690	1,510	1,440	105	100	41	38
24	434	260	160	155	165	5,350	1,520	1,470	102	100	41	38
25	434	258	160	170	165	4,860	1,520	1,390	100	102	42	38
26	434	258	160	200	160	4,650	1,470	1,220	100	72	42	37
27	434	260	170	270	160	4,420	1,300	1,100	104	56	42	38
28	434	290	170	275	160	4,280	1,260	935	104	56	41	38
29	424	315	170	310		4,160	1,380	925	104	58	41	31
30	405	300	165	315	-----	4,030	1,600	863	104	58	40	50
31	400	-----	165	320	-----	3,900	-----	582	-----	56	40	-----
Total	15,208	9,289	5,345	6,035	7,922	81,205	69,820	39,922	8,558	2,947	1,319	1,149
Mean	491	310	172	195	283	2,620	2,327	1,288	285	95.1	42.5	38.3
Max	1,620	400	290	320	405	5,740	3,740	1,770	414	108	58	50
Min	277	203	160	155	160	160	1,260	582	100	56	38	31
Ac-ft	30,160	18,420	16,520	11,970	15,710	161,100	138,500	79,180	16,970	5,845	2,616	2,279

Cal yr 1965: Total 390,705 Mean 1,070 Max 10,600 Min 27 Ac-ft 775,000
Wtr yr 1966: Total 248,719 Mean 681 Max 5,740 Min 31 Ac-ft 493,300

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 1966.

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.--29 years, 247 cfs (178,800 acre-ft per year).

Extremes.--Maximum discharge during year, 4,820 cfs Mar. 17 (gage height, 9.49 ft); maximum gage height, 10.54 ft Mar. 15 (backwater from ice); minimum discharge, 76 cfs Sept. 24 (gage height, 1.70 ft).
1937-66: 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 winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Flow regulated by several small lakes above gage.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	402	381	190	115	120	250	1,380	1,210	631	246	99	146
2	446	381	195	115	120	400	1,340	1,190	604	231	121	146
3	432	370	195	115	125	600	1,320	1,160	588	216	128	154
4	432	362	195	115	125	850	1,280	1,140	562	202	121	146
5	432	362	200	115	125	1,000	1,240	1,100	546	210	108	133
6	428	358	200	115	130	850	1,220	1,070	530	199	108	126
7	410	350	200	115	130	750	1,180	1,040	494	187	99	121
8	398	343	200	115	135	650	1,170	1,010	470	176	114	119
9	402	332	200	115	140	700	1,140	978	437	165	101	114
10	402	329	200	115	200	750	1,120	956	419	160	101	110
11	393	326	210	115	300	1,000	1,110	962	398	154	97	108
12	402	322	220	115	260	1,500	1,100	968	381	160	93	101
13	385	312	240	115	240	2,000	1,070	1,010	358	173	99	104
14	373	277	250	115	220	2,500	1,060	1,020	343	179	110	106
15	362	252	245	120	210	2,200	1,040	1,010	336	168	110	101
16	350	220	240	120	200	3,650	1,030	1,010	332	157	114	104
17	350	190	210	120	190	4,490	1,030	995	326	143	116	101
18	398	185	190	120	185	3,420	1,060	956	309	138	114	97
19	432	180	170	120	180	2,650	1,080	934	293	128	104	91
20	432	180	160	120	175	2,270	1,080	918	283	121	121	90
21	423	180	150	120	170	2,260	1,150	907	277	116	176	86
22	419	180	140	120	170	2,150	1,200	890	274	110	237	83
23	406	180	140	120	165	1,860	1,200	874	264	110	246	81
24	402	185	130	120	165	1,240	1,180	852	261	106	222	78
25	393	185	130	120	160	1,500	1,150	841	249	104	202	78
26	389	185	130	120	160	1,570	1,130	809	252	108	187	78
27	389	190	120	120	160	1,540	1,120	782	268	146	179	79
28	393	190	120	120	180	1,500	1,190	749	362	121	168	79
29	393	190	120	120		1,510	1,240	722	312	110	162	79
30	389	190	120	120	-----	1,510	1,230	695	280	104	157	79
31	385	-----	115	120	-----	1,460	-----	668	-----	93	152	-----
Total	12,442	7,867	5,525	3,650	4,840	50,580	34,840	29,426	11,439	4,741	4,266	3,118
Mean	401	262	178	118	173	1,632	1,161	949	381	153	138	104
Max	446	381	250	120	300	4,490	1,380	1,210	631	246	246	154
Min	350	180	115	115	120	250	1,030	668	249	93	93	78
Cfsm	0.214	0.140	0.095	0.063	0.093	0.873	0.621	0.507	0.204	0.082	0.074	0.056
In.	0.25	0.16	0.11	0.07	0.10	1.01	0.69	0.59	0.23	0.09	0.08	0.06
Ac-ft	24,680	15,600	10,960	7,240	9,600	100,300	69,100	58,370	22,690	9,400	8,460	6,180

Cal yr 1965:	Total	187,739.9	Mean	514	Max	6,270	Min	2.9	Cfsm	0.275	In.	3.73	Ac-ft	372,400
Wtr yr 1966:	Total	172,734	Mean	473	Max	4,490	Min	78	Cfsm	0.253	In.	3.44	Ac-ft	342,600

Peak discharge (base, 400 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10- 2	0700	2.96	460	4-29	0100	4.26	1,250
10-20	0300	2.91	437	5-15	0200	3.88	1,030
3-17	0730	9.49	4,820				

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 1966. 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.--45 years (1909-17, 1929-66), 645 cfs (467,000 acre-ft per year).

Extremes.--Maximum discharge during year, 8,280 cfs Mar. 24 (gage height, 14.98 ft); minimum, 120 cfs Sept. 30 (gage height, 2.21 ft).
1909-66: 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 periods of no gage-height record and those for winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Flow regulated by Big Stone Lake since Apr. 17, 1937, Lac qui Parle Lake since January 1938 and Marsh Lake since Nov. 1, 1939.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	836	825	560	380	460	430	5.200	2.790	1.180	429	168	193
2	859	822	580	380	460	580	5.180	2.840	1.080	390	180	191
3	825	820	540	380	450	760	5.040	2.890	1.020	370	190	186
4	794	811	510	380	450	1.040	4.800	2.940	1.000	350	195	188
5	786	803	480	380	440	1.200	4.720	2.980	985	340	178	182
6	938	800	460	380	430	1.280	4.590	3.000	960	345	158	174
7	1.750	797	435	375	430	1.230	4.250	3.010	940	355	152	167
8	1.750	789	420	387	420	1.220	3.910	3.000	900	359	150	164
9	1.310	786	420	385	450	1.380	3.950	2.970	880	340	158	159
10	880	792	410	385	480	1.600	4.000	2.840	828	320	150	154
11	831	764	415	380	560	1.870	4.020	2.380	820	310	148	153
12	803	700	420	380	600	2.120	4.000	2.180	800	295	148	150
13	792	680	440	380	580	2.400	3.900	1.900	770	300	146	144
14	780	635	440	380	560	2.750	3.800	1.920	750	315	156	150
15	764	592	445	380	575	3.300	3.700	1.960	740	325	158	150
16	678	582	450	380	610	3.400	3.580	1.980	740	315	160	148
17	649	541	445	380	640	4.000	3.500	2.020	736	305	164	148
18	644	524	430	370	660	5.050	3.420	2.060	719	300	160	145
19	671	529	415	370	660	6.320	3.340	2.080	700	290	158	144
20	698	540	395	365	640	6.790	3.050	2.180	670	280	150	139
21	711	580	380	365	600	7.240	3.060	2.240	600	270	180	136
22	750	570	380	365	470	7.500	3.050	2.310	500	265	232	129
23	789	540	375	365	390	7.660	3.020	2.370	430	260	277	127
24	822	540	375	365	340	8.070	3.000	2.420	425	256	277	129
25	825	540	375	365	330	7.240	2.980	2.460	405	251	258	129
26	822	520	380	360	320	6.700	2.960	2.150	370	253	239	127
27	820	520	380	360	320	6.400	2.890	1.870	380	215	226	129
28	820	530	380	375	350	5.200	2.800	1.780	420	222	222	130
29	822	540	380	410		5.190	2.740	1.700	485	215	207	127
30	822	540	380	430	- - - - -	5.120	2.740	1.620	455	198	210	125
31	825	- - - - -	380	450	- - - - -	5.110	- - - - -	1.450	- - - - -	180	196	- - - - -
Total	26.866	19.552	13.275	11.787	13.675	120.150	111.190	72.290	21.688	9.218	5.751	4.517
Mean	867	652	428	380	488	3,876	3,706	2,332	723	297	186	151
Max	1,750	825	580	450	660	8,070	5,200	3,010	1,180	429	277	193
Min	644	520	375	360	320	430	2,740	1,450	370	180	146	125
Ac-ft	53,290	38,780	26,330	23,380	27,120	238,300	220,500	143,400	43,020	18,280	11,410	8,960

Cal yr1965 : Total 546,554 Mean 1,497 Max 12,600 Min 39 Ac-ft 1,084,000
Wtr yr1966: Total 429,959 Mean 1,178 Max 8,070 Min 125 Ac-ft 852,800

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 downstream side of bridge on State Highway 68, 0.5 mile northwest of Minneota, and 6 miles upstream from confluence with North Branch Yellow Medicine River.

Drainage area.--111 sq mi, approximately.

Records available.--April 1960 to September 1966. Monthly and daily discharge for the period Apr. 1, 1960 to June 30, 1960, published in WSP 1914.

Gage.--Wire-weight gage read once daily. Datum of gage is 1,150.00 ft above mean level, datum of 1929. Prior to Mar. 21, 1963, staff gage at same site and datum.

Average discharge.--6 years, 23.7 cfs (17,160 acre-ft per year).

Extremes.--Maximum discharge during year, 900 cfs Mar. 10 (gage height, 9.80 ft, backwater from ice); no flow at times.
1960-66: Maximum discharge, 1,830 cfs Apr. 6, 1960 (gage height, 11.10 ft); no flow at times.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	16	2.0	2.1	2.0	1.8	63	15	18	3.1	.82	.01	1.4
2	8.6	2.0	2.1	2.0	1.8	80	13	16	3.2	.61	.01	14
3	5.1	2.2	2.1	1.9	1.8	108	14	12	2.9	.47	.01	7.3
4	3.8	2.1	2.0	1.9	1.9	95	13	13	2.5	.33	0	4.8
5	2.8	2.3	2.0	1.9	1.9	89	13	13	2.8	.13	0	2.2
6	2.7	2.1	2.0	1.9	2.1	81	13	13	3.9	.19	0	1.4
7	2.4	4.2	2.0	1.9	4.3	76	12	10	2.8	.04	.01	.82
8	2.1	2.6	2.0	1.9	47	72	11	9.0	2.3	.02	.01	.54
9	1.7	2.4	2.0	1.8	300	260	10	8.2	2.3	.02	0	.40
10	1.7	2.4	2.1	1.8	340	740	9.0	7.7	2.0	.01	0	.61
11	1.7	2.4	2.3	1.8	120	580	11	9.7	1.8	0	0	.40
12	1.8	2.8	3.3	1.8	92	500	11	13	1.6	.07	0	.40
13	1.9	2.7	4.5	1.8	82	460	10	16	1.5	8.1	0	.26
14	1.9	2.6	2.8	1.8	68	360	10	17	1.4	13	.01	.54
15	2.2	2.7	2.3	1.8	60	250	9.7	16	1.4	4.6	3.3	.26
16	2.3	2.9	2.1	1.8	56	161	10	14	1.2	2.0	6.0	.26
17	2.3	2.7	2.1	1.8	51	94	12	13	.75	1.4	1.3	.08
18	2.4	2.3	2.1	1.8	47	69	12	12	1.2	.96	.33	.03
19	2.7	2.4	2.0	1.8	42	49	13	11	.96	.61	.03	.02
20	2.9	2.4	2.0	1.8	40	41	23	9.5	.68	.47	2.3	.02
21	3.2	2.4	2.0	1.7	38	31	15	8.2	.89	.19	24	.02
22	3.8	2.3	2.0	1.7	37	26	20	7.9	1.1	.13	14	.02
23	3.8	2.3	2.0	1.7	36	14	19	7.3	.96	.26	5.7	.02
24	1.7	2.3	2.0	1.7	36	10	19	6.1	.68	.13	3.6	.02
25	2.2	2.3	2.0	1.7	37	21	17	6.2	.68	.13	1.6	.02
26	2.2	2.3	2.0	1.7	39	19	16	5.7	.68	.08	.61	.03
27	2.2	2.3	2.0	1.7	45	16	16	5.0	.54	.02	.47	.13
28	2.3	2.3	2.0	1.7	52	10	22	4.2	1.4	.13	.19	.33
29	2.3	2.2	2.0	1.7		16	20	4.1	1.9	.02	.02	.75
30	2.3	2.1	2.0	1.7	----------	15	21	3.6	1.2	.02	0	2.1
31	2.1	----------	2.0	1.8	----------	16	----------	3.5	----------	.01	0	----------
Total	97.1	73.0	67.9	55.8	1,680.6	4,422	429.7	312.9	50.32	34.97	63.51	39.18
Mean	3.13	2.43	2.19	1.80	60.0	143	14.3	10.1	1.68	1.13	2.05	1.31
Ac-ft	193	145	135	111	3,330	8,770	852	621	100	69	130	78

Calendar year 1965: Max 900 Min 0 Mean 31.4 Ac-ft 22,760
Water year 1965-66: Max 740 Min 0 Mean 20.1 Ac-ft 14,540

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 1966. 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.--30 years (1935-38, 1939-66), 102 cfs (73,840 acre-ft per year).

Extremes.--Maximum discharge during year, 1,600 cfs Mar. 16 (gage height, 6.78 ft, backwater from ice); minimum, 2.5 cfs Sept. 22; minimum gage height, 2.12 ft Aug. 5, 6, 14.

1931-38, 1939-66: 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 winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	69	15	12	13	10	87	139	162	49	10	4.3	7.7
2	90	15	12	12	10	100	130	152	48	10	4.3	8.3
3	90	15	12	12	9	150	120	130	45	8.3	4.0	7.2
4	74	14	12	12	9	240	111	120	42	7.7	3.7	5.8
5	60	14	12	12	9	230	106	111	41	7.2	3.7	5.0
6	52	14	12	12	9	210	100	100	39	7.7	3.7	5.4
7	46	14	12	12	9	190	95	95	35	6.7	4.3	6.2
8	39	14	13	12	10	180	90	87	33	9.0	4.3	9.0
9	34	14	13	12	58	178	85	78	32	8.3	4.3	7.7
10	33	14	13	12	100	220	85	76	30	7.7	4.3	6.7
11	31	14	13	12	175	280	85	83	29	6.7	4.0	6.2
12	30	14	13	12	360	340	83	80	29	6.7	3.7	5.0
13	29	14	13	12	290	450	78	87	24	7.7	4.3	5.0
14	28	14	14	12	240	600	76	114	22	13	5.0	4.0
15	27	14	14	12	185	870	74	142	21	11	10	4.0
16	26	13	14	12	160	1,340	74	145	21	12	9.6	3.7
17	25	12	14	12	135	1,310	76	139	18	42	9.0	3.5
18	24	13	14	12	115	986	76	123	17	29	7.2	3.5
19	24	13	14	12	104	808	90	114	15	21	10	3.1
20	23	13	14	12	96	658	106	106	15	16	12	2.9
21	23	13	14	12	87	540	114	98	16	11	21	2.9
22	23	13	14	11	82	442	117	90	15	9.0	17	2.8
23	22	13	13	11	77	352	130	98	13	7.7	16	3.1
24	20	14	13	11	75	188	152	90	12	6.7	16	3.1
25	19	14	13	11	74	200	145	80	14	6.2	21	3.1
26	18	14	13	11	74	210	136	78	14	7.7	19	3.5
27	17	13	13	10	76	240	129	72	17	7.2	15	3.3
28	16	13	13	10	80	205	129	63	15	6.2	12	3.5
29	15	13	13	10		192	136	59	15	5.4	9.0	4.6
30	15	13	13	10	----------	168	162	57	12	4.6	7.2	4.3
31	15	----------	13	10	----------	155	----------	52	----------	4.3	6.7	----------
Total	1,057	410	405	358	2,718	12,319	3,229	3,081	748	323.7	275.6	144.1
Mean	34.1	13.7	13.1	11.5	97.1	397	108	99.4	24.9	10.4	8.89	4.80
Cfsm	0.052	0.021	0.020	0.018	0.149	0.608	0.165	0.152	0.038	0.016	0.014	0.0074
In.	0.06	0.02	0.02	0.02	0.15	0.70	0.18	0.18	0.04	0.02	0.02	0.008
Ac-ft	2,100	813	803	710	5,390	24,430	6,400	6,110	1,480	642	547	286

Calendar year 1965: Max 6,140 Min 2.8 Mean 204 Cfsm 0.312 In. 4.24 Ac-ft 147,600
Water year 1965-66: Max 1,340 Min 2.8 Mean 68.7 Cfsm 0.105 In. 1.43 Ac-ft 49,720

Peak discharge (base, 300 cfs, revised)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
2-12	1100	4.62	414	3-16	1630	6.78	1,600

5-3150. Redwood River at Marshall, Minn.

Location.--Lat 44°27'05", long 95°47'13", in SE¼NW¼ 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 1966. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Wire-weight gage read twice daily. Datum of gage is 1,144.88 ft above mean sea level, datum of 1929. Prior to July 12, 1966, chain gage at same site and datum. Staff gage on diversion channel. Datum of gage is 1,100.00 ft above mean sea level, datum of 1929 (levels by Corps of Engineers).

Average discharge.--26 years, 47.9 cfs (34,680 acre-ft per year).

Extremes.--Maximum discharge during year, 445 cfs Mar. 13. River channel: Maximum discharge during year, 244 cfs Mar. 15; maximum gage height, 5.54 ft Mar. 15 (backwater from ice); minimum discharge, 0.36 cfs July 10. Diversion channel: maximum discharge during year, 258 cfs Mar. 13 (gage height, 74.02 ft, backwater from ice); no flow on many days.

1940-66: 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 fair. Water diverted at medium and high stages into diversion channel 3 miles above station, bypasses station and returns to river 1 mile below station. Diversion began Mar. 18, 1964. These records include flow in diversion channel. Unknown amount of natural diversion into Cottonwood River basin at extremely high stages.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	24	6.1	2.6	2.5	2.1	69	41	46	9.8	2.8	1.4	4.0
2	19	5.2	2.7	2.4	2.1	115	34	46	9.3	2.1	1.0	5.6
3	12	5.6	2.8	2.4	2.2	250	34	39	8.8	1.4	.85	4.4
4	10	5.6	2.8	2.4	2.2	231	26	36	9.3	1.0	.85	4.0
5	9.6	4.4	3.0	2.4	2.2	214	26	33	10	.85	.85	3.4
6	10	4.8	3.2	2.4	2.3	199	24	18	9.3	.78	3.4	3.4
7	10	3.4	3.4	2.3	2.6	200	20	8.8	7.9	.62	1.6	3.1
8	8.1	3.4	3.6	2.3	5.0	208	20	22	7.4	.62	2.8	2.8
9	8.5	3.7	3.7	2.3	22	221	20	20	7.4	.50	2.5	2.8
10	8.9	3.1	3.9	2.2	33	253	24	22	8.3	.36	2.3	2.5
11	7.9	3.4	4.1	2.2	31	298	20	29	8.3	.5	1.6	2.0
12	7.9	3.4	4.2	2.2	37	349	19	32	7.4	.58	2.0	2.0
13	8.3	3.4	4.2	2.2	44	405	20	39	6.5	15	2.1	2.0
14	7.4	4.0	4.4	2.2	52	405	20	39	7.4	32	2.1	2.0
15	6.5	4.0	4.6	2.2	56	371	22	41	8.3	22	9.1	2.5
16	7.9	4.0	4.6	2.2	54	282	24	37	8.3	15	9.8	3.1
17	8.8	3.7	4.6	2.2	53	180	33	37	7.0	11	9.8	3.1
18	7.9	3.7	4.5	2.1	51	160	26	30	6.5	15	5.2	3.1
19	7.9	3.4	4.2	2.1	50	140	30	29	7.0	17	6.1	3.1
20	8.8	3.1	3.7	2.1	49	120	36	25	7.0	22	9.8	2.5
21	7.9	4.0	3.3	2.1	48	114	36	22	7.9	15	11	2.5
22	7.4	3.4	3.0	2.0	47	104	42	20	7.0	3.1	11	2.1
23	6.5	3.4	3.0	2.0	46	96	41	22	6.1	2.5	9.3	2.0
24	7.4	3.1	2.9	2.0	45	84	38	22	6.5	2.0	7.9	2.3
25	6.1	2.9	2.8	1.9	45	70	41	20	7.0	2.0	5.6	2.5
26	6.5	2.8	2.7	1.9	46	58	46	20	6.5	1.8	4.8	2.8
27	7.0	2.7	2.6	1.9	50	49	44	17	6.1	2.3	4.0	2.8
28	5.6	2.7	2.6	1.9	55	50	49	13	6.5	2.3	4.2	2.8
29	6.1	2.7	2.6	2.0		47	58	9.3	4.8	2.0	4.4	3.1
30	7.0	2.6	2.5	2.0	----------	42	52	9.8	3.4	1.2	4.4	3.1
31	6.1	---------	2.5	2.1	----------	41	----------	9.8	----------	1.3	2.5	
Total	273.0	111.7	105.3	67.1	934.7	5,425	966	813.7	223.0	196.61	144.25	87.4
Mean	8.81	3.72	3.40	2.16	33.4	175	32.2	26.2	7.43	6.34	4.65	2.91
Cfsm	0.029	0.012	0.011	0.0070	0.109	0.570	0.105	0.085	0.024	0.021	0.015	0.0095
In.	0.03	0.01	0.01	0.008	0.11	0.66	0.12	0.10	0.03	0.02	0.02	0.01
Ac-ft	541	222	209	133	1,850	10,760	1,920	1,610	442	390	286	173

Calendar year 1965: Max 1,880 Min 1.5 Mean 71.8 Cfsm 0.234 In. 3.18 Ac-ft 52,020
Water year 1965-66: Max 405 Min 0.36 Mean 25.6 Cfsm 0.083 In. 1.13 Ac-ft 18,540

GPO 803-695-8

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 1966.

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.--32 years (1911-12, 1935-66), 99.3 cfs (71,890 acre-feet per year).

Extremes.--Maximum discharge during year, 1,380 cfs Mar. 15 (gage height, 11.51 ft, backwater from ice); minimum, 1.8 cfs Aug. 6 (gage height, 1.32 ft).
1909-14, 1930-66: 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 winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood and Cottonwood River basins during extreme floods.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	113	18	18	15	5.8	114	103	118	46	9.3	2.8	5.6
2	113	18	18	14	5.9	145	97	108	41	8.4	2.6	6.4
3	97	17	18	13	5.9	185	91	99	39	7.2	2.2	7.6
4	78	17	19	12	6.0	260	84	91	35	6.4	2.0	12
5	64	18	20	11	6.1	230	74	87	31	5.6	2.0	12
6	53	18	21	10	6.3	210	66	78	35	5.2	2.6	9.3
7	43	19	22	9.0	6.5	200	63	74	38	4.4	4.0	8.4
8	39	19	22	8.3	9.0	190	58	63	35	5.2	3.4	7.2
9	32	19	23	7.6	31	215	54	60	29	3.7	4.0	6.0
10	30	18	24	7.4	44	275	52	60	28	3.4	3.7	5.2
11	27	21	25	7.0	47	350	52	63	23	2.8	3.1	5.6
12	27	28	26	6.9	56	490	52	72	21	2.0	2.8	5.2
13	25	23	27	6.8	64	590	53	80	20	3.4	3.1	4.8
14	25	22	28	6.6	74	710	54	89	19	6.4	3.1	4.8
15	24	23	29	6.6	80	1,120	57	95	17	7.6	19	4.8
16	21	25	30	6.5	88	1,000	60	95	16	14	23	4.4
17	20	27	30	6.4	91	760	63	89	16	12	29	3.7
18	21	25	29	6.4	98	568	69	83	15	9.3	20	3.7
19	23	25	28	6.4	92	415	81	74	13	7.2	15	4.0
20	26	25	27	6.2	85	325	103	69	13	5.6	8.4	4.0
21	24	24	26	6.2	80	281	115	67	12	4.8	15	4.0
22	24	24	25	6.2	74	245	108	65	11	4.0	27	4.4
23	22	23	24	6.2	66	153	110	74	10	3.4	33	4.4
24	22	23	23	6.2	66	90	112	78	11	3.1	29	4.8
25	21	23	22	6.2	67	110	110	69	10	2.6	23	5.2
26	21	22	21	6.1	71	132	105	67	9.8	12	15	4.8
27	20	21	20	6.0	78	151	105	63	9.8	11	13	5.6
28	18	19	20	5.9	95	133	110	60	9.8	6.8	10	6.4
29	18	18	19	5.8		125	118	54	9.8	4.4	8.4	6.8
30	18	17	18	5.7	----------	115	118	51	10	3.7	6.8	7.2
31	18	----------	16	5.8	----------	110	----------	47	----------	3.1	5.6	----------
Total	1,127	639	718	239.4	1,498.5	9,997	2,497	2,342	633.2	188.0	341.6	178.3
Mean	36.4	21.3	23.2	7.72	53.5	322	83.2	75.5	21.1	6.06	11.0	5.94
Cfsm	0.052	0.031	0.033	0.011	0.077	0.462	0.119	0.108	0.030	0.0087	0.016	0.0085
In.	0.06	0.03	0.04	0.01	0.08	0.53	0.13	0.12	0.03	0.01	0.02	0.01
Ac-ft	2,240	1,270	1,420	475	2,970	19,830	4,950	4,650	1,260	373	678	354

Calendar year 1965: Max 6,600 Min 1.3 Mean 191 Cfsm 0.274 In. 3.71 Ac-ft 137,900
Water year 1965-66: Max 1,120 Min 2.0 Mean 55.9 Cfsm 0.080 In. 1.09 Ac-ft 40,460

Peak discharge (base, 150 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
3-15	1600	11.51	1,380				

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 1966 (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 2¼ miles upstream at datum 11.41 ft higher. Aug. 23, 1938, to June 25, 1948, staff gage at present site and datum.

Average discharge.--32 years (1911-13, 1935-37, 1938-66), 257 cfs (186,100 acre-ft per year).

Extremes.--Maximum discharge during year, 2,190 cfs Mar. 13 (gage height, 9.87 ft, backwater from ice); maximum gage height, 13.56 ft Feb. 10 or 11 (backwater from ice); minimum discharge, 10 cfs Aug. 6, minimum gage height, 2.84 ft Nov. 27.

1909-13, 1931-66: Maximum discharge, 26,000 cfs Apr. 8, 1965 (gage height, 20.86 ft, from floodmark, back water from ice); minimum observed, 0.5 cfs Nov. 27, 1952; minimum gage height, 0.72 ft Nov. 20, 1964.

Remarks.--Records good except those for winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Some regulation by dam at Cottonwood Lake and several other small lakes above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	832	147	124	119	58	490	683	335	143	54	24	22
2	704	145	135	116	58	520	492	318	139	48	21	31
3	524	140	145	114	59	650	421	322	137	43	18	36
4	390	138	150	93	59	980	371	275	139	38	17	52
5	319	132	150	83	60	1,600	335	259	139	44	16	44
6	271	132	150	74	61	1,450	315	244	147	41	19	37
7	239	133	150	69	64	1,380	292	227	137	34	34	37
8	213	130	150	64	68	1,320	280	213	129	48	28	34
9	189	128	150	59	90	1,260	266	200	119	114	31	33
10	174	128	150	57	380	1,500	257	190	114	83	28	31
11	160	135	160	54	470	1,800	261	196	120	57	24	41
12	147	145	175	54	510	1,960	268	215	107	44	21	37
13	140	150	205	54	550	2,140	278	263	102	59	28	32
14	136	152	220	54	600	2,080	273	325	93	85	24	51
15	135	155	220	54	630	1,740	268	371	91	119	38	44
16	135	154	215	54	680	1,460	266	382	85	110	28	46
17	135	150	210	54	740	1,210	263	376	81	90	37	48
18	135	149	200	54	770	1,010	266	354	76	69	38	41
19	138	149	190	54	730	845	300	320	76	52	34	36
20	182	148	180	54	670	675	455	300	73	43	40	36
21	223	148	175	54	650	565	550	266	105	36	48	32
22	198	147	175	55	620	489	530	244	88	31	43	30
23	187	146	170	55	590	428	479	232	85	27	44	28
24	170	145	165	56	570	265	428	227	81	24	38	30
25	162	144	155	56	540	208	394	223	76	23	31	30
26	160	130	145	56	520	259	357	213	66	23	28	32
27	158	98	135	56	500	280	330	198	83	23	25	33
28	157	105	130	57	480	328	340	184	81	43	24	33
29	155	110	125	57		509	348	168	69	43	24	33
30	150	114	125	57	---------	764	346	158	59	30	23	32
31	148	---------	120	57	---------	804	---------	148	---------	24	20	---------
Total	7,166	4,127	5,049	2,004	11,777	30,969	10,712	7,946	3,040	1,602	896	1,082
Mean	231	138	163	64.6	421	999	357	256	101	51.7	28.9	36.1
Cfsm	0.180	0.108	0.127	0.050	0.329	0.780	0.279	0.200	0.079	0.040	0.023	0.028
In.	0.21	0.12	0.15	0.06	0.34	0.90	0.31	0.23	0.09	0.05	0.03	0.03
Ac-ft	14,210	8,190	10,010	3,970	23,360	61,430	21,250	15,760	6,030	3,180	1,780	2,150

Calendar year 1965:	Max	23,000	Min	12	Mean	710	Cfsm	0.555	In.	7.53	Ac-ft	514,300
Water year 1965-66:	Max	2,140	Min	16	Mean	237	Cfsm	0.185	In.	2.51	Ac-ft	171,300

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 1966. 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.--15 years, 35.2 cfs (25,480 acre-ft per year).

Extremes.--Maximum discharge during year, 268 cfs Apr. 3 (gage height, 7.70 ft); no flow on many days.
1951-66: Maximum discharge, 1,320 cfs Apr. 7, 1951 (gage height, 10.68 ft, from graph based on gage readings); maximum gage height, 11.70 ft Apr. 7, 1965; no flow on many days.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	159	27	22	25	9.0	40	175	70	25	16	9.2	0.1
2	177	25	22	23	9.0	40	238	66	22	13	8.0	.4
3	185	23	21	21	9.0	39	265	60	19	11	5.4	.5
4	182	22	20	19	9.0	38	265	55	16	9.6	4.0	.4
5	175	21	19	18	9.0	38	250	50	15	7.6	3.1	.4
6	163	19	19	16	9.2	36	233	44	18	6.7	2.1	.3
7	154	19	18	15	9.4	36	216	42	19	5.4	36	.2
8	147	19	18	14	9.6	36	207	37	19	4.2	4.4	0
9	139	19	18	13	10	36	184	34	20	3.7	4.2	0
10	130	18	17	12	31	36	170	31	20	3.0	3.7	0
11	121	18	18	11	37	36	162	31	17	2.2	3.1	0
12	112	18	19	11	40	37	153	31	15	2.0	2.5	0
13	102	19	22	10	43	38	144	37	12	10	1.9	0
14	94	19	28	9.6	46	38	137	43	11	52	1.5	0
15	86	18	45	9.3	48	39	135	47	10	76	2.1	0
16	79	17	45	9.0	49	40	130	52	8.9	100	2.6	0
17	72	22	44	8.7	51	42	124	53	7.8	104	2.2	0
18	64	15	42	8.5	51	44	120	53	6.3	102	2.0	0
19	59	15	40	8.2	51	45	120	53	4.6	95	2.0	0
20	58	15	38	8.2	50	47	120	52	3.6	86	1.8	0
21	57	15	36	8.2	49	48	118	49	32	72	2.0	0
22	56	15	35	8.2	48	50	113	47	19	65	2.2	0
23	53	14	34	8.2	47	55	107	44	26	54	2.2	0
24	52	14	32	8.3	46	62	102	42	35	44	1.9	0
25	48	13	31	8.4	45	66	98	42	36	38	1.4	0
26	44	14	30	8.6	44	66	95	40	29	33	.9	0
27	41	15	29	8.8	43	66	89	39	25	29	.7	0
28	37	17	28	8.8	42	65	80	36	24	25	.6	0
29	34	21	27	8.9		63	76	33	20	21	.5	0
30	31	22	26	8.9	-----	76	72	31	18	16	.3	0
31	28	-----	25	8.9	-----	110	-----	28	-----	11	.2	-----
Total	2,939	548	868	363.7	944.2	1,508	4,498	1,372	553.2	1,117.4	82.3	2.3
Mean	94.8	18.3	28.0	11.7	33.7	48.6	150	44.3	18.4	36.0	2.65	0.077
Max	185	27	45	25	51	110	265	70	36	104	9.2	0.5
Min	28	13	17	8.2	9.0	36	72	28	3.6	2.0	0.2	0
Cfsm	0.718	0.139	0.212	0.089	0.255	0.368	1.14	0.336	0.139	0.273	0.020	0.00058
In.	0.83	0.16	0.24	0.10	0.27	0.42	1.27	0.39	0.16	0.31	0.02	0.0006

Cal yr 1965:	Total	34,409.5	Mean	94.3	Max	1,240	Min	0	Cfsm	0.714	In. 9.69
Wtr yr 1966:	Total	14,796.1	Mean	40.5	Max	265	Min	0	Cfsm	0.307	In. 4.17

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 7¾ 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 1966. Published as "at Rapidan Mills" 1909-10.

Gage.--Digital 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 and Nov. 15, 1939 to June 1, 1964 graphic water-stage recorder at present site and datum.

Average discharge.--23 years (1939-45, 1949-66), 795 cfs (575,600 acre-ft per year).

Extremes.--Maximum discharge during year, 4,760 cfs Apr. 2 (gage height, 6.16 ft); minimum, 11 cfs Sept. 23 (gage height, 1.06 ft).
1909-10, 1939-45, 1949-66: Maximum discharge, 43,100 cfs Apr. 9, 1965 (gage height, 21.36 ft, from floodmark); minimum 6.9 cfs Oct. 12, 1955 (gage height, 1.04 ft).

Remarks.--Records good. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Flow regulated by Rapidan Reservoir (capacity, 2,980 acre-ft). Rapidan Reservoir gates destroyed during April 1965 flood and not replaced during 1966. Capacity reduced to an undetermined figure.

Discharge, in cubic feet per second, water year October 1965 to September 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	2,630	675	376	461	105	325	4,340	1,170	521	2,850	298	10
2	3,150	636	414	449	100	410	4,700	1,120	495	2,270	260	14
3	3,280	604	408	405	100	612	4,560	1,050	554	1,690	238	13
4	3,110	590	386	300	100	1,010	4,220	1,010	592	1,380	204	18
5	2,760	578	408	334	100	1,240	3,510	952	599	1,200	196	16
6	2,410	545	403	297	100	1,220	2,920	895	592	1,030	181	13
7	2,130	533	376	270	100	1,010	2,580	858	547	895	200	13
8	1,910	527	398	250	200	820	2,310	805	508	1,090	188	10
9	1,720	515	381	260	540	725	2,060	768	483	858	192	10
10	1,540	503	403	240	1,000	768	1,890	718	471	718	196	9
11	1,360	491	467	220	1,500	978	1,780	690	465	632	177	11
12	1,230	497	616	210	1,650	1,050	1,750	704	459	586	158	10
13	1,140	491	616	200	1,800	1,270	1,810	790	459	927	158	9
14	1,060	497	571	190	1,700	1,310	1,830	978	453	1,160	127	10
15	999	473	578	190	1,450	1,360	1,770	1,270	430	1,200	196	10
16	941	479	630	185	1,050	1,100	1,690	1,340	396	1,370	173	10
17	885	467	571	175	880	1,060	1,620	1,290	348	1,370	169	12
18	840	455	552	180	790	1,010	1,600	1,210	343	1,110	162	9
19	818	455	521	175	800	978	1,580	1,130	327	880	181	10
20	810	449	558	165	750	910	1,560	1,050	317	739	173	10
21	825	455	545	160	600	835	1,640	978	534	638	177	9
22	925	455	630	155	560	790	1,660	895	2,090	547	181	10
23	974	443	662	150	480	782	1,580	842	3,440	489	238	7
24	941	437	630	145	410	534	1,500	805	3,760	441	238	5
25	893	437	509	140	360	424	1,420	775	4,070	408	208	8
26	840	437	461	135	330	441	1,350	760	3,840	380	177	8
27	803	305	200	130	320	424	1,270	739	3,110	343	144	7
28	761	166	200	125	320	424	1,220	704	3,050	332	162	9
29	727	238	333	120	------	638	1,200	651	3,110	413	117	9
30	701	365	425	115	------	1,340	1,190	599	3,040	435	123	7
31	694	------	515	110	------	2,810	------	554	------	364	111	------
TOTAL	43,807	14,198	14,743	6,641	18,195	28,608	64,110	28,100	39,403	28,745	5,703	3,19
MEAN	1,413	473	476	214	650	923	2,137	906	1,313	927	184	10
CFSM	.582	.195	.196	.088	.268	.380	.879	.373	.540	.382	.076	.04
IN	.67	.22	.23	.10	.28	.44	.98	.43	.60	.44	.09	.0
AC-FT	86,890	28,160	29,240	13,170	36,090	56,740	127,200	55,740	78,150	57,010	11,310	6,33

CALENDAR YEAR 1965	MAX	42,500	MIN	18	MEAN	1,952	CFSM	.803	INCHES	10.90	AC-FT	144,300
WATER YEAR 1965-66	MAX	4,700	MIN	57	MEAN	809	CFSM	.333	INCHES	4.52	AC-FT	586,000

5-3205. Le Sueur River near Rapidan, Minn.

Location.--Lat 44°06'40", long 94°02'28", in SW¼ 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 1966.

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.--23 years, 372 cfs (269,300 acre-ft per year).

Extremes.--Maximum discharge during year, 2,950 cfs Apr. 2 (gage height, 8.21 ft); maximum gage height, 8.55 ft (from floodmark, backwater from ice); minimum discharge, 11 cfs Sept. 23, 24 (gage height, 1.82 ft).
1939-45, 1949-66: Maximum discharge, 24,700 cfs Apr. 8, 1965 (gage height, 22.10 ft, from floodmark); maximum gage height, 22.72 ft May 22, 1960 (from floodmark); minimum daily discharge, 1.6 cfs Feb. 9-25, 1959; minimum gage height, 1.59 ft Nov. 20, 1965.

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

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2,090	355	280	220	76	330	2,750	602	261	459	72	28
2	1,960	343	300	230	75	350	2,940	593	254	379	67	33
3	1,740	331	290	150	74	460	2,830	580	278	319	62	34
4	1,500	316	300	160	74	800	2,470	547	301	272	58	36
5	1,280	316	300	140	74	900	2,160	515	367	246	54	36
6	1,100	310	300	110	74	840	1,850	483	499	221	57	35
7	985	298	300	105	76	800	1,550	459	479	203	67	34
8	886	286	300	105	94	700	1,350	436	436	331	68	31
9	804	275	305	100	170	510	1,200	410	400	278	64	28
10	737	272	310	100	1,050	600	1,080	379	364	264	60	24
11	660	261	320	95	900	660	1,010	370	349	322	56	23
12	588	272	350	94	850	780	990	392	325	286	57	22
13	535	275	650	94	700	820	971	447	301	355	57	21
14	491	272	640	93	600	900	953	539	270	421	56	21
15	459	261	640	92	485	980	935	629	256	376	73	20
16	432	272	560	90	460	800	912	660	241	652	68	19
17	414	248	580	89	450	746	904	642	226	724	55	18
18	392	236	540	88	430	746	899	620	214	563	46	16
19	386	251	520	86	430	750	881	575	205	410	48	13
20	414	254	540	85	440	782	876	539	199	319	50	13
21	499	256	480	84	420	742	863	499	210	254	54	12
22	555	248	490	83	400	678	845	467	228	194	57	12
23	555	236	500	82	380	616	814	428	214	168	54	11
24	519	246	410	81	360	328	773	396	246	144	52	11
25	487	248	290	80	340	421	732	373	243	127	48	12
26	455	248	250	79	330	425	710	367	216	113	44	12
27	421	247	210	78	320	515	674	352	252	104	40	14
28	396	247	300	77	320	584	647	334	555	93	38	14
29	379	249	410	77		737	624	313	527	88	36	14
30	373	260	360	77	------	1,340	611	292	503	81	34	15
31	367	------	300	76	------	2,180	------	275	------	75	31	------
Total	22,859	8,189	12,325	3,200	10,452	22,820	36,804	14,513	9,419	8,841	1,683	632
Mean	737	273	398	103	373	736	1,227	468	314	285	54.3	21.1
Cfsm	0.670	0.248	0.362	0.094	0.339	0.669	1.12	0.425	0.285	0.259	0.049	0.019
In.	0.77	0.28	0.42	0.11	0.35	0.77	1.24	0.49	0.32	0.30	0.06	0.02

Calendar year 1965: Max 23,400 Min 36 Mean 993 Cfsm 0.903 In. 12.26
Water year 1965-66: Max 2,940 Min 11 Mean 416 Cfsm 0.378 In. 5.13

Peak discharge (base, 1,300 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10- 1	0600	6.74	2,120	4- 2	1430	8.21	2,950
2-10	1400	6.82	1,420				

Note.--No gage-height record July 28 to Sept. 18.

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 upstream from Mississippi River.

Drainage area.--14,900 sq mi, approximately.

Records available.--May 1903 to September 1966 (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.--Digital 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.--45 years (1905, 1910-17, 1929-66), 2,503 cfs (1,813,000 acre-ft per year).

Extremes.--Maximum discharge during year, 15,400 cfs Apr. 2 (gage height, 14.44 ft); minimum, 275 cfs Sept. 25 (gage height, 2.66 ft).

1903-66: Maximum discharge, 94,100 cfs Apr. 10, 1965 (gage height, 29.09 ft); 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 winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Some diurnal fluctuation at low and medium stages caused by powerplants on Blue Earth River.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	6,530	2,330	1,150	1,170	930	2,500	14,200	5,660	3,190	4,100	802	59
2	7,810	2,260	1,240	1,160	930	2,520	15,300	5,540	3,020	3,500	726	66
3	7,970	2,220	1,360	1,150	940	2,600	14,800	5,430	2,930	2,860	656	60
4	7,840	2,170	1,420	1,120	940	2,700	13,900	5,310	2,840	2,460	597	63
5	7,270	2,130	1,480	1,100	940	2,950	12,700	5,250	2,760	2,240	583	66
6	6,440	2,110	1,490	1,080	960	3,900	11,700	5,130	2,820	2,010	573	64
7	5,690	2,070	1,490	1,030	980	4,300	10,900	5,020	2,690	1,810	608	57
8	5,080	2,080	1,490	990	1,050	4,600	10,200	4,900	2,560	1,970	686	51
9	4,600	2,020	1,490	970	1,380	4,800	9,600	4,750	2,470	2,070	600	49
10	4,420	1,990	1,500	935	2,200	4,900	9,080	4,570	2,320	2,110	567	48
11	4,330	1,950	1,510	930	4,900	5,020	8,720	4,490	2,280	2,000	553	46
12	4,040	1,990	1,700	922	5,200	5,200	8,410	4,540	2,240	1,840	527	48
13	3,670	2,020	2,010	922	5,100	5,600	8,230	4,630	2,150	2,210	528	44
14	3,330	2,010	2,150	922	4,800	6,200	8,090	4,750	2,070	2,620	498	49
15	3,110	2,000	2,280	922	4,600	6,800	7,920	5,080	1,990	2,660	719	46
16	2,960	2,020	2,130	930	4,300	7,050	7,670	5,290	1,930	2,890	644	43
17	2,810	1,890	2,090	930	3,900	7,180	7,460	5,290	1,830	2,970	658	41
18	2,720	1,820	2,060	930	3,650	7,300	7,400	5,180	1,750	2,560	734	43
19	2,630	1,810	2,040	930	3,300	7,500	7,270	5,020	1,670	2,130	746	42
20	2,670	1,800	2,010	930	2,950	7,800	7,270	4,820	1,670	1,920	708	40
21	2,790	1,780	1,990	930	2,650	8,200	7,320	4,630	2,250	1,560	718	39
22	2,890	1,760	1,950	930	2,540	9,100	7,340	4,440	3,310	1,420	779	37
23	2,950	1,730	1,910	930	2,480	10,200	7,290	4,360	5,050	1,280	727	36
24	2,830	1,770	1,870	930	2,480	9,400	7,150	4,300	5,440	1,160	738	33
25	2,780	1,740	1,800	930	2,480	9,400	6,890	4,300	5,550	1,080	736	32
26	2,710	1,700	1,600	930	2,480	8,750	6,580	4,380	5,220	1,010	716	34
27	2,620	1,220	1,280	930	2,480	8,730	6,210	4,420	4,470	942	732	33
28	2,520	1,020	1,220	930	2,500	9,030	6,030	4,290	4,690	875	691	33
29	2,440	1,050	1,200	930	------	8,970	5,890	4,030	4,610	906	743	34
30	2,410	1,070	1,190	930	------	10,100	5,830	3,750	4,400	960	636	35
31	2,390	------	1,180	930	------	12,200	------	3,440	------	879	607	------
TOTAL	125,250	55,530	51,280	30,203	74,040	205,500	267,350	146,990	92,170	61,002	20,536	13,84
MEAN	4,040	1,851	1,654	974	2,644	6,629	8,912	4,742	3,072	1,968	662	46
CFSM	.271	.124	.111	.065	.177	.445	.598	.318	.206	.132	.044	.03
IN	.31	.14	.13	.08	.18	.51	.67	.37	.23	.15	.05	.0
AC-FT	248,400	110,100	101,700	59,910	146,900	407,600	530,300	291,600	182,800	121,000	40,730	27,46

Calendar year 1965:	Max	92,700	Min	175	Mean	6,941	Cfsm	0.466	In.	6.32	Ac-ft	5,025,000
Water year 1965-66:	Max	15,300	Min	326	Mean	3,133	Cfsm	0.210	In.	2.85	Ac-ft	2,269,000

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 1966.

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 2¾ miles upstream at same datum read twice daily.

Average discharge.--32 years, 3,174 cfs (2,298,000 acre-ft per year).

Extremes.--Maximum discharge during year, 16,200 cfs Apr. 6; maximum gage height, 19.39 ft Mar. 14 (backwater from ice); minimum discharge, 540 cfs Sept. 30 (gage height, 3.64 ft).
1934-66: Maximum discharge, 117,000 cfs Apr. 11, 1965; maximum gage height, 34.37 ft Apr. 12, 1965 (backwater from Mississippi River); minimum discharge, 79 cfs Nov. 17, 1955; minimum gage height, 2.66 ft Nov. 22, 1935.

Remarks.--Records good except those for winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report.

Cooperation.--Auxiliary gage readings furnished by Corps of Engineers.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	7.680	2.940	2.080	2.300	1.000	3.400	12.700	7.060	4.410	5.250	1.330	1.050
2	9.220	2.890	2.100	2.150	1.000	3.400	13.700	6.960	4.180	4.900	1.330	1.050
3	9.860	2.840	2.120	2.000	1.000	3.600	14.700	6.780	3.950	4.420	1.280	1.050
4	9.880	2.750	2.150	1.860	1.010	3.800	15.500	6.700	3.800	3.640	1.250	1.040
5	9.640	2.700	2.140	1.600	1.040	5.000	15.900	6.540	3.740	3.170	1.210	1.040
6	9.120	2.660	2.120	1.450	1.100	5.250	16.000	6.410	3.680	2.850	1.160	1.040
7	8.320	2.620	2.110	1.300	1.200	5.500	15.400	6.270	3.580	2.560	1.120	1.040
8	7.630	2.580	2.110	1.200	1.400	5.800	14.300	6.150	3.510	2.340	1.090	1.040
9	6.720	2.550	2.100	1.100	2.000	6.200	13.100	6.040	3.360	2.180	1.080	1.040
10	6.250	2.520	2.100	1.050	3.500	6.500	12.000	5.880	3.220	2.240	1.080	1.030
11	5.560	2.480	2.100	1.030	6.500	7.100	11.100	5.760	3.100	2.310	1.070	1.030
12	5.310	2.470	2.200	1.020	6.600	7.800	10.400	5.810	3.020	2.320	1.030	1.010
13	5.010	2.510	3.000	1.000	6.500	8.700	9.850	5.920	2.800	2.310	1.010	989
14	4.630	2.530	3.700	1.000	6.200	10.000	9.480	6.020	2.700	2.310	1.010	901
15	4.290	2.540	3.550	1.000	6.000	11.500	9.050	6.180	2.600	2.660	1.010	818
16	3.970	2.550	3.200	1.000	5.600	10.100	8.940	6.350	2.400	2.810	1.010	746
17	3.670	2.520	3.100	1.000	5.200	9.740	8.730	6.510	2.300	2.820	1.020	674
18	3.550	2.450	3.000	1.000	5.000	9.490	8.670	6.610	2.210	2.860	1.030	617
19	3.420	2.400	2.900	1.000	4.500	9.630	8.500	6.510	2.130	2.870	1.040	584
20	3.460	2.350	2.800	1.000	4.000	9.720	8.580	6.280	2.070	2.750	1.050	584
21	3.480	2.340	2.800	1.000	3.700	9.990	8.570	6.030	2.010	2.510	1.050	584
22	3.480	2.280	2.700	1.000	3.500	10.400	8.610	5.770	2.300	2.230	1.050	573
23	3.520	2.250	2.700	1.000	3.300	10.500	8.560	5.620	4.380	2.000	1.050	562
24	3.560	2.220	2.650	1.000	3.200	10.800	8.410	5.490	6.040	1.800	1.050	551
25	3.530	2.180	2.600	1.000	3.200	10.700	8.430	5.380	6.500	1.670	1.050	551
26	3.440	2.140	2.550	1.000	3.200	9.990	7.960	5.240	6.440	1.560	1.050	562
27	3.360	2.100	2.500	1.000	3.200	9.750	7.740	5.300	6.090	1.480	1.050	551
28	3.250	2.050	2.500	1.000	3.300	9.830	7.520	5.290	5.500	1.420	1.050	551
29	3.160	2.040	2.500	1.000		10.100	7.270	5.170	5.470	1.370	1.050	551
30	3.070	2.030	2.480	1.000	----------	10.700	7.170	4.970	5.520	1.330	1.050	551
31	3.000	----------	2.400	1.000	----------	11.700	----------	4.670	----------	1.330	1.050	----------
Total	164.040	73.480	79.060	37.060	96.950	256.690	316.840	185.670	113.010	78.270	33.760	23.960
Mean	5,292	2,449	2,550	1,195	3,462	8,280	10,561	5,989	3,767	2,525	1,089	799
Cfsm	0.327	0.151	0.157	0.074	0.214	0.511	0.652	0.370	0.233	0.156	0.067	0.049
In.	0.38	0.17	0.18	0.09	0.22	0.59	0.73	0.43	0.26	0.18	0.08	0.06
Ac-ft	325,400	145,700	156,800	73,510	192,300	509,100	628,400	368,300	224,200	155,200	66,960	47,520

Calendar year 1965: Max 112,000 Min 372 Mean 7,782 Cfsm 0.480 In. 6.52 Ac-ft 5,634,000
Water year 1965-66: Max 16,000 Min 551 Mean 3,997 Cfsm 0.247 In. 3.35 Ac-ft 2,893,000

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 1963 to September 1966.

Gage.--Digital 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. May 16, 1963, to Dec. 13, 1965, graphic water-stage recorder at present site and datum.

Extremes.--Maximum daily discharge during year, 80 cfs Feb. 10; minimum daily, 5.7 cfs Jan. 31 to Feb. 3. 1963-66: Maximum discharge, 535 cfs Apr. 8, 1965 (gage height 4.32 ft); minimum daily, 1.2 cfs Feb. 24, 1965; minimum gage height, 1.33 ft Aug. 15, 16, 1965.

Remarks.--Records good except those for winter months, which are fair and those for periods of no gage-height record, which are poor.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	67	11	6.2	9.4	5.7	30	40	15	11	12	8.5	16
2	65	11	6.1	8.4	5.7	40	35	15	13	11	7.7	41
3	66	12	5.9	8.0	5.7	50	30	14	13	14	7.4	37
4	62	11	5.8	7.8	5.8	55	25	14	39	16	6.5	24
5	54	10	5.8	7.6	5.9	60	22	15	42	13	6.3	12
6	43	9.4	7.4	7.4	6.3	55	19	14	48	10	9.1	10
7	43	9.1	11	7.3	6.7	50	18	13	51	10	13	9.7
8	39	8.8	11	7.2	48	40	18	12	44	10	16	9.1
9	34	8.5	11	7.0	67	30	18	11	29	9.4	12	8.5
10	31	8.2	12	6.8	80	25	18	11	20	9.1	9.4	8.2
11	27	8.8	30	6.7	79	20	18	19	18	12	9.1	8.6
12	24	16	40	6.6	70	15	18	19	22	10	8.5	7.8
13	22	17	38	6.7	63	14	17	23	20	16	19	8.2
14	22	16	26	6.8	59	13	17	19	18	13	26	8.8
15	20	15	13	6.9	56	13	17	22	17	12	69	8.0
16	18	13	17	7.0	51	13	16	26	13	10	68	8.0
17	18	12	13	7.0	43	13	17	23	11	8.8	55	7.1
18	17	11	12	7.0	37	13	24	25	11	10	27	6.9
19	18	10	11	6.8	32	14	22	21	10	8.2	16	6.9
20	20	9.6	12	6.3	29	14	22	20	10	7.7	14	6.9
21	22	9.0	12	6.3	26	14	18	18	12	7.4	18	7.0
22	22	8.7	12	6.3	23	14	18	18	9.1	7.7	16	6.8
23	17	8.3	18	6.8	22	14	17	17	18	7.2	12	6.7
24	16	8.0	20	6.5	21	15	16	17	11	6.8	11	6.4
25	16	7.6	14	6.3	21	17	17	15	10	6.5	10	6.4
26	13	7.3	13	6.3	22	20	17	14	10	6.8	10	6.5
27	13	7.1	9.2	6.3	23	50	18	13	22	7.0	8.8	6.5
28	12	6.8	9.8	6.3	25	70	18	12	13	7.0	8.5	7.9
29	13	6.6	11	5.9	------	75	17	12	14	6.8	8.8	6.8
30	12	6.4	13	5.8	------	65	19	11	12	7.0	7.9	6.4
31	12	------	14	5.7	------	55	------	12	------	6.5	7.7	------
TOTAL	878	303.2	440.2	213.2	938.8	986	606	510	591.1	298.9	526.2	320.1
MEAN	28.3	10.1	14.2	6.88	33.5	31.8	20.2	16.5	19.7	9.64	17.0	10.7

CALENDAR YEAR	1965	MAX	430	MIN	1.2	MEAN	30.7
WATER YEAR	1965-66	MAX	80	MIN	5.7	MEAN	18.1

Note.--No gage-height record Jan. 30 to Feb. 10, Feb. 21 to Apr. 5.

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 1966 (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.--68 years (1894-95, 1896-97, 1900-1966), 10,080 cfs (adjusted for diversion).

Extremes.--Maximum discharge during year, 49,400 cfs Mar. 23 (gage height, 11.63 ft); minimum daily, 5,700 cfs Sept. 25.

1892-1966: Maximum discharge 171,000 cfs Apr. 16, 1965 (gage height, 26.01 ft, from floodmark); minimum daily, 632 cfs Aug. 26, 1934.

Maximum stage known since at least 1851, that of Apr. 16, 1965. Flood of Apr. 11, 1870 reached a stage of 19.4 ft and the flood of Apr. 29, 1881 reached a stage of 19.7 ft (107,000 cfs), determined by Corps of Engineers.

Remarks.--Records good. Records of water temperatures for the water year 1966 are published in Part 2 of this report. Slight regulation except during extreme floods by reservoirs on headwaters and by powerplants. Beginning July 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	20,000	17,400	7,210	10,600	8,390	12,000	40,400	37,500	21,900	17,100	7,960	10,900
2	23,300	16,900	8,150	12,300	8,270	12,400	41,100	37,500	22,000	18,400	8,340	11,300
3	26,500	16,700	10,300	11,200	7,690	13,100	42,000	37,100	20,500	15,700	8,220	10,200
4	29,100	15,900	10,800	10,800	7,830	15,100	42,900	36,600	20,700	15,500	7,490	9,120
5	30,100	15,400	10,800	10,500	7,680	16,300	44,200	35,500	20,400	14,100	8,760	9,320
6	30,900	15,500	10,300	9,360	7,620	17,400	44,700	34,600	19,900	14,100	7,680	9,620
7	31,100	14,900	9,950	8,940	7,710	17,300	45,200	33,800	18,900	12,600	7,110	8,680
8	30,300	16,200	11,000	7,990	9,020	17,200	45,200	32,800	19,100	12,900	9,500	9,020
9	29,000	14,000	10,900	8,490	11,600	17,600	44,600	31,800	18,300	12,000	8,760	8,210
10	27,500	12,800	10,700	9,580	15,000	18,700	43,300	30,600	17,100	12,300	6,990	7,740
11	26,100	12,200	11,000	9,120	18,200	20,100	41,900	29,800	16,500	13,200	8,430	7,430
12	25,100	12,300	12,000	9,120	21,600	22,400	40,400	29,100	16,400	13,300	10,300	6,750
13	24,400	13,000	12,600	9,220	21,900	23,900	38,900	28,400	15,700	13,700	11,200	7,380
14	23,500	12,400	13,100	9,500	22,300	24,900	37,000	27,700	14,400	13,600	11,000	7,600
15	22,600	12,100	13,200	9,380	22,500	31,600	35,900	28,000	13,800	13,400	12,300	7,166
16	22,000	12,600	12,800	9,380	22,200	34,000	35,200	28,000	13,300	13,900	12,100	7,010
17	21,100	12,900	12,900	9,080	21,300	35,900	34,700	28,100	13,000	13,600	10,400	6,930
18	20,600	11,900	12,400	9,020	20,900	42,600	34,600	28,500	12,200	12,700	10,400	6,770
19	20,600	12,500	11,200	9,240	20,000	42,800	34,600	28,900	12,400	12,200	11,400	6,780
20	21,100	11,800	12,200	9,140	17,900	43,800	35,100	28,600	11,600	10,600	11,800	6,600
21	21,000	11,900	12,500	9,200	16,700	45,500	36,300	28,600	11,400	10,100	12,900	6,540
22	21,200	12,300	12,500	9,060	15,500	47,200	36,900	27,600	10,800	9,040	13,400	7,110
23	21,100	12,400	12,500	8,810	14,700	49,000	37,300	27,300	10,100	8,640	14,300	6,000
24	21,500	12,000	13,100	8,740	14,400	48,200	37,500	27,200	12,100	7,340	12,700	6,510
25	20,900	11,200	12,300	8,810	13,100	45,800	37,800	27,100	15,600	7,230	14,100	5,700
26	20,500	11,800	12,600	8,600	12,500	45,800	38,300	26,700	17,700	7,170	13,800	6,430
27	19,700	10,300	11,200	8,570	12,600	44,800	38,400	25,700	18,500	6,420	14,100	6,510
28	19,800	7,430	9,890	8,420	12,400	43,900	38,100	25,000	18,400	6,970	13,400	5,730
29	19,000	6,250	10,500	8,260		42,500	37,800	24,400	18,400	7,190	14,100	6,030
30	18,300	7,380	11,900	8,380	----------	41,200	37,600	23,500	17,800	7,800	13,200	5,750
31	17,700	----------	11,800	8,000	----------	40,700	----------	22,800	----------	7,070	10,500	----------
Total	725,600	382,360	354,300	286,810	411,510	973,700	1,177,900	918,800	488,900	359,870	336,640	226,836
Mean	23,410	12,740	11,430	9,250	14,700	31,410	39,260	29,640	16,300	11,610	10,860	7,560
(/)	+295	+304	+293	+266	+316	+324	+284	+294	+355	+363	+360	+325
Mean /	23,700	13,040	11,720	9,516	15,020	31,730	39,540	29,930	16,660	11,970	11,220	7,885
Cfsm /	0.644	0.354	0.318	0.259	0.408	0.862	1.07	0.813	0.453	0.325	0.305	0.214
In. /	0.74	0.40	0.37	0.30	0.42	0.99	1.19	0.94	0.51	0.37	0.35	0.24

Calendar year	1965:	Max	171,000	Min	3,410	Mean	22,380	Mean /	22,700	Cfsm /	0.617	In /	8.37
Water year	1965-66:	Max	49,000	Min	5,700	Mean	18,200	Mean /	18,520	Cfsm /	0.503	In /	6.82

/ Diversion, equivalent in cubic feet per second, through sewage-disposal plant.
/ Adjusted for diversion.
Note.--Stage-fall discharge relation affected by indefinite slope June 9 to Sept. 30.

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 1966.

Gage.--Water-stage recorder. Altitude of gage is 1,105 ft (from topographic map).

Average discharge.--7 years, 18.9 cfs (revised).

Extremes.--Maximum discharge during year, 636 cfs June 4 (gage height, 7.27 ft); minimum, 1.1 cfs July 25 (gage height, 2.11 ft).
1959-66: Maximum discharge, 813 cfs (revised) Apr. 18, 1965 (gage height 8.42 ft); minimum, 0.1 cfs Aug. 3, 1960, July 9, 1961, Aug. 8, Sept. 1, 1963, July 24, 25, 26, 1964.

Remarks.--Records good except those for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	143	18	14	12	3.9	5.2	249	84	4.3	18	7.2	14
2	135	17	15	12	3.9	5.2	272	77	4.3	14	10	13
3	93	16	15	11	3.6	5.0	265	68	10	18	8.2	11
4	70	15	15	11	3.4	4.8	263	58	290	19	6.0	9.7
5	57	14	16	11	3.1	4.7	250	49	388	46	5.0	9.0
6	49	13	16	11	3.1	4.5	210	42	243	45	19	8.2
7	46	13	16	11	3.1	4.4	180	35	172	33	95	7.2
8	46	12	16	10	3.6	4.4	165	29	108	23	336	6.2
9	44	12	16	10	9.0	4.5	130	24	68	22	294	6.0
10	40	11	16	10	17	4.6	90	20	46	23	170	5.6
11	35	10	17	10	20	6.2	98	19	31	19	92	5.0
12	30	24	16	10	22	8.2	112	19	33	17	55	4.6
13	26	44	15	10	23	11	122	19	29	15	44	5.0
14	22	41	14	10	21	16	118	20	20	13	62	6.8
15	20	32	14	10	19	25	105	24	14	9.7	73	5.0
16	18	26	13	10	16	41	91	36	11	7.2	65	4.3
17	17	21	12	10	14	89	86	51	7.6	6.0	47	3.6
18	44	18	12	10	11	128	92	77	6.0	4.8	35	3.0
19	70	16	12	10	8.5	82	118	94	4.6	3.6	23	2.8
20	149	15	12	9.6	6.5	124	210	79	3.8	3.0	23	2.8
21	145	15	11	9.2	5.6	166	214	59	2.4	2.4	85	2.6
22	105	16	11	9.2	5.2	155	152	46	1.8	2.1	116	2.4
23	82	16	11	9.2	5.0	140	114	36	1.5	1.7	110	2.4
24	64	16	11	8.8	4.8	125	88	29	26	1.5	78	2.2
25	53	16	11	8.4	4.7	105	71	23	65	1.2	55	2.2
26	44	16	11	7.6	4.7	80	66	18	188	5.6	38	2.4
27	36	16	11	6.5	4.8	68	69	14	140	9.3	26	2.0
28	28	15	11	6.5	5.0	58	90	10	69	7.9	19	2.1
29	25	15	11	6.2		55	95	7.9	41	5.4	15	2.4
30	22	14	11	5.9	- - - - -	95	95	6.6	24	3.6	14	2.6
31	21	- - - - -	12	4.5	- - - - -	188	- - - - -	4.8	- - - - -	2.4	14	- - - - -
Total	1,779	543	414	290.6	254.5	1,812.7	4,280	1,178.3	2,052.3	402.4	2,039.4	156.1
Mean	57.4	18.1	13.4	9.37	9.09	58.5	143	38.0	68.4	13.0	65.8	5.20
Max	149	44	17	12	23	188	272	94	388	46	336	14
Min	17	10	11	4.5	3.1	4.4	66	4.8	1.5	1.2	5.0	2.0
Ac-ft	-	-	-	-	-	-	-	-	-	-	-	-

Cal yr 1965: Total	13,552.5	Mean	37.1	Max	932	Min	0.5	Ac-ft	-
Wtr yr 1966: Total	15,202.3	Mean	41.7	Max	388	Min	1.2	Ac-ft	-

5-3385. Snake River near Pine City, Minn.

ocation.--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.

rainage area.--958 sq mi.

ecords available.--June 1913 to September 1917, July 1951 to September 1966.

age.--Digital 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 and Oct. 29, 1951 to May 10, 1966, graphic water-stage recorder at present site and datum.

verage discharge.--19 years, 559 cfs.

xtremes.--Maximum discharge during year, 6,050 cfs Mar. 21 (gage height, 7.43 ft); minimum, 69 cfs July 26 (gage height, 2.96 ft).

1913-17, 1951-66: Maximum discharge, 11,500 cfs April 18, 1965 (gage height, 9.56 ft); 5.5 cfs Oct. 1, 1964 (gage height, 2.57 ft).

A discharge measurement of 12,500 cfs was made May 9, 1950.

emarks.--Records good except those for winter months, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	1,540	613	400	527	261	207	2,170	1,910	631	213	362	292
2	2,130	570	400	518	261	201	2,260	1,860	552	196	341	299
3	2,360	552	407	518	261	218	2,460	1,760	527	190	320	267
4	2,450	494	400	502	254	392	2,680	1,630	478	153	306	254
5	2,430	470	400	462	254	570	2,870	1,550	486	196	299	224
6	2,340	438	378	438	254	685	2,930	1,380	649	178	285	184
7	2,150	422	362	438	248	742	2,880	1,200	907	162	306	173
8	1,920	415	355	408	242	732	2,760	1,070	1,120	167	273	162
9	1,620	362	348	378	292	704	2,530	966	1,310	207	254	153
10	1,400	348	341	355	604	790	2,290	858	1,370	190	230	148
11	1,220	341	334	334	956	1,070	2,060	752	1,290	230	213	139
12	1,050	362	462	320	1,190	1,440	1,850	714	1,160	248	196	134
13	907	378	604	313	1,270	1,730	1,700	685	986	213	207	139
14	809	415	704	312	1,250	2,050	1,570	667	819	184	224	120
15	704	438	917	306	1,160	2,460	1,480	704	667	162	213	112
16	631	454	1,010	313	1,110	2,960	1,410	770	578	158	218	108
17	595	454	1,050	306	976	3,670	1,370	848	502	148	224	112
18	578	462	1,050	299	799	4,830	1,350	1,050	438	144	213	125
19	595	462	1,020	292	649	5,180	1,400	1,310	392	108	184	116
20	770	470	936	292	561	5,680	1,590	1,570	341	97	184	108
21	946	462	887	285	486	6,000	1,820	1,760	299	100	279	112
22	1,150	438	848	279	415	5,940	2,130	1,840	279	93	313	104
23	1,260	422	828	279	334	5,700	2,430	1,900	254	93	378	97
24	1,240	408	790	279	299	5,060	2,660	1,810	230	89	454	89
25	1,190	400	742	279	273	4,830	2,680	1,660	242	93	510	89
26	1,090	392	676	273	248	4,300	2,540	1,500	236	78	518	89
27	976	378	595	273	230	3,760	2,430	1,320	236	85	494	89
28	877	355	561	267	224	3,220	2,340	1,160	261	89	462	85
29	809	362	527	267	------	2,720	2,060	1,010	248	167	408	104
30	732	392	518	267	------	2,390	2,010	858	230	267	341	81
31	685	------	527	267	------	2,180	------	742	------	313	299	------
TOTAL	39,154	12,929	19,377	10,646	15,361	82,411	64,710	38,814	17,718	5,011	9,508	4,308
MEAN	1,263	431	625	343	549	2,658	2,157	1,252	591	162	307	144
CFSM	1.32	.450	.652	.358	.573	2.77	2.25	1.31	.617	.169	.321	.150
IN	1.52	.50	.75	.41	.60	3.20	2.51	1.51	.69	.19	.37	.17

CALENDAR YEAR 1965 MAX 11,300 MIN 51 MEAN 965 CFSM 1.01 INCHES 13.68
WATER YEAR 1965-66 MAX 6,000 MIN 78 MEAN 877 CFSM .915 INCHES 12.42

5-3400.5 Sunrise River near Lindstrom, Minn.

Location.--Lat 45°27'00", long 92°53'10", in SW¼NE¼ sec.7, T.34 N., R.20 W., on left bank 20 ft downstream from highway bridge and 4.5 miles northwest of Lindstrom.

Records available.--July 1965 to September 1966. Records for January 1949 to July 1965 at site 6.5 miles upstream, published as "near Stacy", records not equivalent owing to increased drainage area and Minnesota Game and Fish reservoir between sites.

Gage.--Water-stage recorder. Altitude of gage is 850 ft (from topographic map).

Extremes.--Maximum discharge during year, 361 cfs Mar. 19 (gage height, 6.03 ft); maximum gage height, 6.44 ft Mar. 13 (backwater from ice); minimum discharge, 16 cfs June 30, July 1, 2 (gage height, 2.27 ft).
1965-66: Maximum discharge, that of Mar. 19, 1966; minimum, 7.9 cfs Sept. 11, 1965 (gage height, 2.07 ft).

Remarks.--Records good except those for winter months, which are fair. Some regulation by Minnesota Game and Fish Wildlife Refuge ponds above the station. 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.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	29	74	144	142	81	135	74	155	101	16	23	27
2	24	72	147	135	81	135	60	152	101	16	22	40
3	24	70	148	130	82	140	48	148	101	19	22	34
4	29	69	144	122	83	160	44	145	102	24	20	32
5	40	67	138	115	85	195	38	142	103	32	20	30
6	56	65	136	104	86	210	35	138	104	28	20	28
7	77	64	167	95	89	210	33	133	99	25	21	27
8	118	64	172	90	90	205	33	129	93	24	20	26
9	154	62	197	88	110	200	39	125	90	24	20	25
10	161	61	210	86	160	215	53	124	87	24	19	24
11	156	60	235	85	200	230	69	124	92	32	19	22
12	147	64	275	84	215	250	84	120	102	44	19	22
13	136	67	292	82	228	275	98	121	93	37	23	22
14	127	64	297	82	220	295	111	121	90	36	27	25
15	118	65	290	82	205	320	122	124	88	34	25	22
16	109	66	286	82	195	338	133	128	86	34	24	22
17	104	65	266	82	180	341	144	126	84	35	24	22
18	100	64	226	82	175	352	155	125	82	34	22	20
19	96	64	215	82	165	357	160	124	79	32	22	20
20	107	64	212	82	160	349	172	123	75	31	23	20
21	102	64	215	82	155	349	172	120	72	30	37	20
22	98	65	205	82	150	349	171	122	70	30	33	19
23	94	65	192	82	145	347	192	126	66	30	32	18
24	90	67	175	81	145	330	190	125	65	29	31	18
25	88	70	168	81	140	320	177	122	65	28	30	18
26	86	78	161	80	135	300	165	120	60	27	29	17
27	84	85	158	79	135	265	162	116	58	27	28	17
28	82	84	152	78	135	225	164	113	56	28	27	17
29	81	87	151	78		180	161	110	40	29	26	18
30	79	122	150	78	---------	130	159	108	17	28	24	17
31	76	----------	150	78	---------	95	----------	105	----------	27	24	----------
Total	2,872	2,098	6,074	2,811	4,030	7,802	3,418	3,914	2,421	894	756	689
Mean	92.6	69.9	196	90.7	144	252	114	126	80.7	28.8	24.4	23.0
Cfsm	-	-	-	-	-	-	-	-	-	-	-	-
In.	-	-	-	-	-	-	-	-	-	-	-	-

Calendar year 1965: Max - Min - Mean - Cfsm - In. -
Water year 1965-66: Max 357 Min 16 Mean 104 Cfsm - In. -

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 1966 in reports of Geological Survey. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Crois Falls."

Gage.--Digital 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. Mar. 16, 1940, to Nov. 30, 1963, graphic water-stage recorder at present site and datum.

Average discharge.--64 years, 4,057 cfs.

Extremes.--Maximum discharge during year, 35,600 cfs Mar. 18 (gage height, 16.53 ft); minimum daily, 1,680 cfs Sept. 27.
1902-66: Maximum discharge 54,900 cfs May 8, 1950 (gage height, 25.19 ft); minimum daily, 75 cfs July 17, 1910.

Remarks.--Records good except Jan. 25 to Mar. 2, 4-11, which are fair. Flow regulated by powerplant upstream.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9.510	4.370	3.350	4.790	2.400	2.900	13.800	10.600	3.880	2.910	3.030	3.080
2	12.900	3.920	3.880	5.100	2.350	3.000	15.100	10.200	3.210	2.640	2.580	3.150
3	15.000	3.960	3.810	4.750	2.350	3.180	16.100	9.730	3.160	2.560	3.230	2.520
4	14.000	3.760	4.070	4.470	2.300	4.500	16.500	9.440	3.440	2.390	3.090	3.220
5	12.000	3.570	4.010	4.340	2.250	5.000	16.700	7.920	3.680	2.900	2.640	2.850
6	10.200	3.080	4.430	4.230	2.300	4.900	16.600	7.920	6.780	2.600	2.810	3.030
7	8.600	3.210	3.810	3.850	2.400	4.900	15.800	6.710	9.320	3.710	2.650	2.470
8	8.200	3.130	4.100	4.270	2.800	4.900	14.500	6.120	9.240	3.690	3.330	2.880
9	7.500	3.250	3.960	3.880	4.000	5.050	13.500	5.430	8.450	3.130	4.190	2.570
10	8.200	3.000	3.950	3.670	6.200	5.600	12.300	5.090	7.440	3.340	4.880	2.280
11	8.000	3.040	4.060	3.500	7.200	6.600	12.000	4.700	6.350	3.210	4.870	2.150
12	7.200	3.370	4.720	3.400	7.400	8.300	11.200	4.760	5.400	3.600	3.960	2.610
13	6.700	3.530	6.120	3.350	7.200	9.070	10.900	4.690	5.000	3.340	4.240	2.150
14	6.100	3.580	7.760	3.300	7.000	10.100	10.300	4.600	4.810	2.960	4.160	2.470
15	5.500	3.970	8.250	3.250	6.800	11.100	10.500	4.550	3.680	3.100	3.430	2.130
16	4.800	3.920	8.480	3.200	6.300	12.800	10.300	4.590	3.770	2.470	3.560	2.550
17	4.700	3.750	8.450	3.150	5.600	16.300	10.100	4.540	3.410	2.510	4.120	2.230
18	4.400	3.620	8.310	3.100	5.200	21.200	9.950	5.410	2.690	2.950	3.980	2.170
19	4.300	4.050	7.270	3.050	4.700	23.400	10.100	7.910	3.000	2.050	3.880	2.560
20	5.440	4.050	7.220	3.060	4.200	26.900	11.100	8.730	2.880	2.070	3.400	2.380
21	7.220	3.920	7.110	3.020	3.800	27.300	12.700	8.590	2.860	2.070	3.680	3.220
22	8.360	3.630	6.890	2.800	3.600	26.000	14.300	8.310	2.440	2.170	4.190	2.060
23	8.390	3.680	7.370	2.800	3.400	24.800	14.100	8.050	2.810	2.190	5.790	1.850
24	7.730	3.720	6.890	3.100	3.100	21.800	13.100	7.330	2.300	2.050	6.720	1.860
25	6.780	3.700	6.270	2.880	2.950	18.800	12.200	6.760	2.100	2.320	6.620	1.860
26	6.140	3.590	5.370	2.750	2.900	17.600	11.300	6.250	3.300	1.990	6.110	1.770
27	5.630	3.260	4.720	2.650	2.900	16.900	10.600	5.760	3.070	1.980	5.550	1.680
28	5.240	1.830	4.030	2.600	2.900	13.700	10.300	5.080	3.580	1.990	4.890	1.860
29	4.840	2.750	3.950	2.550		11.700	10.700	4.660	3.530	2.160	4.370	1.950
30	4.610	2.870	4.730	2.500	---------	11.800	10.900	4.330	3.170	2.790	4.120	2.040
31	4.370	----------	4.750	2.450	---------	12.600	----------	4.240	----------	2.440	3.410	----------
Total	232.560	105.080	172.090	105.810	116.500	392.700	377.550	203.000	128.750	82.280	127.480	71.600
Mean	7,502	3,503	5,551	3,413	4,161	12,670	12,590	6,548	4,292	2,654	4,112	2,387
Cfsm	1.27	.591	.936	.576	.702	2.14	2.12	1.10	.724	.448	.693	.403
In.	1.46	.66	1.08	.66	.73	2.46	2.37	1.27	.81	.52	.80	.45

Calendar year 1965: Max 45,100 Min 1,390 Mean 6,001 Cfsm 1.01 In. 13.75
Water year 1965-66: Max 27,300 Min 1,680 Mean 5,796 Cfsm .977 In. 13.27

Note.--No gage-height record Jan. 25 to Mar. 11.

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 1966.

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.--38 years, 15,303 cfs.

Extremes.--Maximum discharge during year, 74;800 cfs Mar. 23 (gage height, 83.79 ft)· minimum daily, 6,400 cfs Nov. 29; minimum gage height, 74.46 ft Sept. 5.
1928-66: Maximum discharge 228,000 Apr. 18, 1965 (gage height, 93.11 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	25.100	23.600	10.700	13.300	11.300	16.000	55.400	50.000	29.400	21.400	11.300	14.600
2	32.000	22.600	11.400	16.300	10.900	15.600	55.800	49.900	23.400	20.800	11.800	15.600
3	36.000	22.200	16.700	16.500	10.900	20.100	57.600	49.600	23.500	20.100	11.700	15.500
4	41.100	21.800	16.900	17.300	10.900	25.900	53.300	48.800	29.200	18.700	11.900	14.100
5	43.500	21.500	17.800	17.100	10.700	25.800	60.200	48.600	28.800	16.600	11.900	11.700
6	44.300	21.300	16.200	15.500	10.800	28.600	61.100	46.900	29.000	15.800	11.300	10.100
7	45.100	20.500	15.500	12.500	10.700	27.100	61.400	45.100	29.400	15.100	11.400	11.100
8	44.300	20.200	17.100	14.100	13.700	26.800	61.400	43.600	28.800	14.800	10.400	11.900
9	42.100	20.100	16.800	13.600	19.600	25.100	60.700	42.100	27.900	15.500	10.300	12.500
10	40.400	20.000	17.300	13.900	26.600	26.000	59.400	40.900	27.600	15.500	10.700	12.400
11	39.000	19.500	17.300	14.100	32.200	27.000	57.700	39.200	26.800	16.000	11.200	11.800
12	37.300	18.900	19.600	14.100	40.000	30.100	56.200	38.100	25.700	16.800	13.400	10.100
13	35.800	19.100	21.500	13.800	37.000	31.800	54.300	37.000	24.000	17.600	15.400	9.800
14	34.500	19.400	23.200	14.100	35.900	34.100	52.400	36.400	22.000	17.800	16.900	10.700
15	33.400	20.900	26.000	14.000	30.500	38.100	50.300	35.300	20.700	17.600	17.000	10.200
16	31.600	21.300	23.400	14.000	31.300	43.200	49.000	35.400	19.400	17.300	17.200	9.690
17	30.400	21.200	23.300	13.100	28.800	47.600	48.000	35.400	17.900	17.000	15.900	10.200
18	29.000	21.200	22.300	13.500	26.400	53.600	47.500	35.600	16.600	16.400	14.300	10.500
19	28.000	21.000	19.300	13.500	27.000	60.700	47.000	36.100	15.000	15.000	14.200	9.950
20	28.100	21.400	18.700	13.500	24.900	64.800	46.800	37.200	14.600	13.400	15.100	9.690
21	28.600	21.100	19.300	13.400	23.500	69.300	47.300	38.200	14.000	12.000	15.600	9.790
22	29.200	20.100	22.300	13.100	21.500	72.300	49.100	38.500	14.000	11.900	17.000	10.600
23	30.400	19.900	23.800	13.500	19.300	74.000	51.100	38.200	14.100	11.800	18.200	10.100
24	30.600	20.500	24.300	13.200	20.900	72.600	52.000	38.000	15.300	11.700	18.400	9.500
25	31.200	21.300	23.600	13.100	18.400	70.300	52.000	37.200	17.300	10.600	18.400	9.400
26	30.700	20.000	19.300	11.700	16.100	67.000	51.600	36.800	20.300	9.910	19.700	7.850
27	29.300	16.400	13.500	12.300	14.500	64.400	51.400	36.200	21.000	9.140	19.900	7.720
28	28.000	13.200	14.800	12.000	14.500	62.400	51.400	34.600	21.700	7.940	19.700	8.290
29	27.000	6.400	15.800	11.700		59.900	50.900	33.400	21.800	8.930	19.300	7.020
30	25.800	9.000	18.900	11.400	---------	57.300	50.800	32.000	21.600	10.100	18.500	7.340
31	24.800	---------	18.600	10.400	---------	56.100	---------	31.000	---------	11.200	16.200	---------
Total	1,036,600	585,600	585,200	428,600	598,800	1,393,600	1,608,100	1,225,300	670,800	454,420	464,200	319,740
Mean	33,440	19,520	18,880	13,830	21,390	44,950	53,600	39,530	22,360	14,660	14,970	10,660
Cfsm	0.746	0.436	0.421	0.309	0.477	1.00	1.20	0.882	0.499	0.327	0.334	0.238
In.	0.86	0.49	0.49	0.36	0.50	1.16	1.33	1.02	0.56	0.38	0.39	0.27

Calendar year 1965: Max 226,000 Min 5,400 Mean 31,140 Cfsm 0.695 In. 9.43
Water year 1965-66: Max 74,000 Min 6,400 Mean 25,670 Cfsm 0.573 In. 7.78

5-3538. Straight River near Faribault, Minn.

Location.--Lat 44°15'29", long 93°13'51", in W½SE¼ sec.9, T.109 N., R.20 W., on right bank 15 ft downstream from highway bridge, 2.8 miles upstream from Falls Creek and 3.2 miles southeast of Faribault.

Records available.--October 1965 to September 1966.

Gage.--Water-stage recorder. Altitude of gage is 1,035 ft (from topographic map).

Extremes.--Maximum discharge during year, 2,300 cfs Feb. 9 (gage height, 9.06 ft from floodmark, backwater from ice); minimum daily, 22 cfs Sept. 21, 22; minimum gage height, 3.88 ft Aug. 30.

Remarks.--Records good except for winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,290	104	110	75	40	150	1,840	224	73	92	34	34
2	1,110	102	111	70	40	230	1,630	210	71	75	38	151
3	924	102	109	64	40	650	1,230	188	71	67	36	85
4	774	97	102	68	40	1,900	982	173	189	61	36	59
5	646	94	96	70	40	1,520	786	167	359	63	35	46
6	545	94	93	65	40	912	640	155	564	75	35	38
7	467	92	93	61	41	590	530	149	400	67	53	35
8	413	92	95	59	46	500	472	143	287	61	46	32
9	368	87	95	58	1,350	400	426	135	220	55	43	31
10	323	87	93	59	980	431	395	129	182	50	43	30
11	292	61	110	56	820	476	377	132	161	46	42	29
12	264	94	150	54	700	449	372	155	164	44	40	28
13	240	123	310	52	596	395	346	199	138	56	39	26
14	224	118	300	52	341	350	318	228	121	73	39	26
15	210	112	255	50	273	323	323	244	107	75	44	26
16	196	112	220	49	224	318	354	240	99	67	46	25
17	179	93	200	48	205	336	368	220	89	57	40	24
18	167	94	180	47	195	550	350	206	82	50	37	23
19	161	99	170	45	180	565	350	192	73	46	36	23
20	158	94	170	44	170	440	377	179	69	40	36	23
21	149	92	140	43	160	377	377	170	67	38	42	22
22	143	92	130	43	170	354	336	155	63	37	42	22
23	140	92	130	45	150	232	287	149	59	37	39	23
24	132	92	130	45	140	150	264	143	57	36	38	23
25	126	92	100	45	140	165	264	140	59	36	37	27
26	123	100	86	43	130	179	240	129	54	35	36	26
27	118	107	83	43	130	206	224	115	52	35	34	26
28	115	110	80	43	120	260	224	104	126	34	33	26
29	110	112	79	42		359	216	94	140	34	32	26
30	107	110	87	42	-----	651	228	85	115	33	32	27
31	104	-----	92	41	-----	1,320	-----	77	-----	33	33	-----
Total	10,318	2,950	4,199	1,621	7,501	15,738	15,126	5,029	4,311	1,608	1,196	1,042
Mean	333	98.3	135	52.3	268	508	504	162	144	51.9	38.6	34.7
Max	1,290	123	310	75	1,350	1,900	1,840	244	564	92	53	151
Min	104	61	79	41	40	150	216	77	52	33	32	22
Cfsm												
In.												

Cal yr	: Total		Mean		Max		Min		Cfsm		In.	
Wtr yr 1966:	Total	70,639	Mean	194	Max	1,900	Min	22	Cfsm		In.	

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 1966.

Gage.--Digital 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.--37 years (1911-13, 1931-66), 479 cfs.

Extremes.--Maximum discharge during year, 20,800 cfs Feb 10 (gage height, 13.93 ft from floodmark, backwater from ice); minimum, 78 cfs July 31, Aug. 1, Sept. 18, 19, 26 (gage height, 1.40 ft).

1909-14, 1930-66: Maximum discharge, 36,100 cfs Apr. 8, 1965 (gage height, 14.01 ft); minimum, 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 winter months, which are fair. Records of chemical analyses for the water year 1966 are published in Part 2 of this report. Diurnal fluctuation caused by powerplants above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	1,950	298	435	350	400	700	2,980	725	358	310	146	16
2	1,980	401	414	300	450	700	2,980	454	372	274	146	26
3	1,740	396	395	320	420	1,000	2,710	760	442	190	146	11
4	1,560	398	341	370	450	7,070	2,280	760	341	184	146	9
5	1,400	424	284	370	430	4,830	2,040	745	327	271	148	25
6	1,300	379	295	370	280	2,790	1,840	538	488	260	93	24
7	1,210	213	333	370	350	2,010	1,640	474	740	240	86	21
8	1,110	284	386	300	1,000	1,740	1,490	352	710	179	190	21
9	992	395	410	300	3,000	1,560	1,360	386	610	110	202	20
10	879	391	394	350	7,250	1,560	1,260	532	533	90	168	9
11	802	394	383	450	3,000	1,500	1,200	551	446	234	165	8
12	753	385	502	450	2,200	1,430	1,140	542	446	288	163	15
13	735	295	830	450	1,850	1,330	1,120	528	383	313	95	16
14	730	291	815	450	1,420	1,230	1,090	454	390	288	85	16
15	719	295	825	400	1,190	1,190	1,110	410	434	234	334	16
16	714	344	810	300	1,000	1,160	1,140	730	450	146	274	16
17	553	349	800	470	800	1,140	1,100	725	372	95	234	9
18	561	486	800	480	700	1,310	1,100	720	310	208	211	8
19	568	430	551	500	650	1,440	1,090	720	123	196	171	14
20	561	308	434	500	400	1,350	1,090	715	299	184	99	15
21	548	351	600	450	700	1,230	998	454	366	187	97	16
22	548	271	605	300	700	1,160	524	313	341	153	214	16
23	491	267	680	300	700	1,080	564	358	264	92	220	16
24	447	345	695	400	700	976	402	474	237	83	208	9
25	342	262	350	450	600	835	450	470	116	165	165	8
26	460	322	300	450	350	845	790	450	101	182	182	14
27	456	392	350	450	350	835	785	430	220	163	97	16
28	461	427	420	470	600	825	785	327	268	160	83	16
29	440	475	430	350	------	878	592	220	268	158	153	16
30	365	441	442	300	------	1,020	780	220	264	92	158	12
31	236	------	442	350	------	1,680	------	320	------	80	160	------
TOTAL	25,611	10,709	15,751	12,120	31,940	48,404	38,430	15,857	11,019	5,809	5,039	4,65
MEAN	826	357	508	391	1,141	1,561	1,281	512	367	187	163	15
CFSM	.626	.271	.385	.296	.864	1.18	.971	.388	.278	.142	.124	.11
IN	.72	.30	.44	.34	.90	1.36	1.08	.45	.31	.16	.14	.1

CALENDAR YEAR 1965	MAX	28,700	MIN	90	MEAN	1,263	CFSM	.957	INCHES	12.99
WATER YEAR 1965-66	MAX	7,250	MIN	80	MEAN	617	CFSM	.467	INCHES	6.35

GPO 803-695-10

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 2½ miles downstream from Silver Lake Dam.

Drainage area.--304 sq mi.

Records available.--January 1952 to September 1966.

Gage.--Water-stage recorder. Datum of gage is 949.56 ft above mean sea level, datum of 1929.

Average discharge.--14 years, 115 cfs.

Extremes.--Maximum discharge during year, 7,510 cfs Mar. 4 (gage height, 14.94 ft from floodmark); minimum, 15 cfs Sept. 24 (gage height, 1.74 ft).

1952-66: Maximum discharge, 19,600 Mar. 1, 1965 (gage height, 19.12 ft from floodmark); minimum, 8.4 cfs Dec. 7, 1955.

Flood of July 21, 1951 reached a stage of about 17.5 ft, from information by sewage plant superintendent. This is the highest known stage outside the period of record since at least 1908.

Remarks.--Records good. Slight regulation at times from Silver Lake and at very low flows from sewage-plant effluent.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	942	69	77	87	40	78	774	118	70	55	42	37
2	706	69	75	90	40	105	323	118	78	50	36	59
3	470	70	75	74	41	258	255	118	77	47	33	37
4	329	66	74	85	40	4,460	222	105	74	46	32	32
5	272	66	73	90	39	493	195	106	160	57	33	31
6	230	70	73	82	38	232	178	101	524	56	58	31
7	210	89	66	73	42	180	163	97	198	49	74	30
8	188	75	73	69	348	172	153	94	147	47	48	29
9	159	67	71	67	3,930	153	143	93	129	49	39	26
10	131	65	70	66	918	153	133	91	110	45	36	26
11	118	62	137	62	356	155	129	96	107	46	36	23
12	107	134	686	61	252	288	127	107	153	62	34	26
13	102	112	946	61	220	178	131	135	200	168	34	24
14	99	100	532	62	116	110	127	143	119	155	36	24
15	98	91	252	62	108	102	165	125	86	103	40	24
16	94	86	225	60	100	100	208	114	74	77	37	24
17	92	75	178	59	89	104	157	124	70	61	36	23
18	92	74	143	59	85	155	147	120	65	57	33	22
19	89	71	105	56	82	155	149	104	59	52	33	22
20	95	70	133	54	76	99	155	97	65	47	31	24
21	94	68	113	53	73	94	145	92	62	46	39	24
22	92	70	107	52	70	108	131	86	59	43	34	24
23	86	58	134	49	70	153	127	100	54	43	33	22
24	82	59	139	49	69	97	122	98	54	41	32	22
25	82	65	99	48	71	95	120	91	56	42	32	24
26	79	92	94	46	69	99	120	86	56	41	31	24
27	76	91	86	46	69	98	120	81	94	40	30	27
28	74	80	88	45	75	99	120	74	66	38	26	29
29	74	84	96	42		108	119	72	60	36	29	30
30	74	84	105	39	-----	220	119	71	60	34	28	26
31	70	-----	110	42	-----	540	-----	71	-----	33	33	-----
Total	5,506	2,332	5,235	1,890	7,526	9,441	5,277	3,128	3,186	1,766	1,128	826
Mean	178	77.7	169	61.0	269	305	176	101	106	57.0	36.4	27.5
Max	942	134	946	90	3,930	4,460	774	143	524	168	74	59
Min	70	58	66	39	38	78	119	71	54	33	26	22
Cfsm	0.586	0.256	0.556	0.201	0.885	1.00	0.579	0.332	0.349	0.188	0.120	0.090
In.	0.67	0.29	0.64	0.23	0.92	1.15	0.65	0.38	0.39	0.22	0.14	0.10

Cal yr 1965:	Total	88,183	Mean	242	Max	10,900	Min	22	Cfsm	0.796	In. 10.79
Wtr yr 1966:	Total	47,241	Mean	129	Max	4,460	Min	22	Cfsm	0.424	In. 5.78

Peak discharge (base, 1,000 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
12-12	1830	5.84	1,020	3-4	1700	14.94	7,510
2- 9	1230	13.93	6,260	4-1	0600	7.41	1,050

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 1966. Monthly discharge only for some periods, published in WSP 1308.

Gage.--Digital 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. Nov. 11, 1933 to May 28, 1964, graphic water-stage recorder at present site and datum.

Average discharge.--44 years (1909-17, 1930-66), 475 cfs.

Extremes.--Maximum discharge during year, 15,000 cfs Feb. 9 (gage height, 21.47 ft); minimum, 56 cfs Jan. 3 (gage height, 6.30 ft).

1909-17, 1929-66: Maximum discharge, 35,900 cfs July 22, 1951 (gage height, 30.80 ft, from floodmark); minimum, 27 cfs Jan. 12, 1935; minimum gage height, 6.06 ft Feb. 23, 1964, result of freezeup.

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 winter months, which are fair. Diurnal fluctuation caused by power-plant above station.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	1,460	183	261	200	267	380	2,620	183	182	228	117	151
2	1,180	303	345	84	229	386	2,940	447	330	165	134	423
3	988	308	375	164	225	1,140	1,730	526	235	110	137	233
4	878	308	217	270	219	10,100	1,300	532	152	103	124	125
5	845	285	130	370	156	3,960	1,110	400	218	176	144	102
6	611	238	249	300	97	1,370	973	469	1,080	222	118	176
7	575	127	355	228	95	959	897	197	734	208	78	204
8	581	234	360	800	312	912	872	137	781	241	102	211
9	308	391	207	259	11,200	875	858	233	354	149	153	179
10	172	440	308	400	8,290	880	845	194	370	91	154	92
11	355	402	186	500	1,860	857	844	275	455	182	193	82
12	545	386	345	180	1,140	385	619	294	275	332	162	170
13	523	261	749	195	994	540	599	542	341	158	139	307
14	523	145	916	397	923	492	592	273	343	318	82	120
15	512	391	839	176	545	602	615	168	344	475	106	84
16	257	402	611	107	408	602	663	463	459	203	186	78
17	145	265	593	102	557	593	555	450	294	97	204	99
18	298	257	587	210	569	767	617	408	170	293	140	74
19	201	380	273	218	250	443	851	479	134	171	107	103
20	316	245	321	215	150	512	898	565	373	164	111	99
21	312	132	417	216	273	608	864	259	320	94	85	120
22	316	257	289	214	413	840	833	151	261	195	134	109
23	253	370	475	95	360	856	334	454	212	142	166	119
24	135	253	570	94	500	811	388	229	217	83	110	119
25	186	277	260	183	520	810	478	271	126	186	182	75
26	303	452	104	192	238	804	566	272	117	137	209	73
27	312	210	230	206	137	794	570	449	261	80	101	95
28	312	92	394	236	413	793	570	234	333	175	77	98
29	312	186	388	300	------	797	550	134	267	140	181	127
30	245	316	357	96	------	817	266	258	216	95	119	129
31	130	------	355	90	------	1,430	------	269	------	75	84	------
TOTAL	14,089	8,496	12,066	7,297	31,340	36,115	26,417	10,215	9,954	5,488	4,139	4,176
MEAN	454	283	389	235	1,119	1,165	881	330	332	177	134	139
CFSM	.402	.250	.344	.208	.990	1.03	.780	.292	.294	.157	.119	.123
IN	.46	.28	.40	.24	1.03	1.19	.87	.34	.33	.18	.14	.14

CALENDAR YEAR 1965	MAX	23,100	MIN	67	MEAN	866	CFSM	.766	INCHES	10.40
WATER YEAR 1965-66	MAX	11,200	MIN	73	MEAN	465	CFSM	.412	INCHES	5.59

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 1966.

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.--27 years, 27.3 cfs.

Extremes.--Maximum discharge during year, 3,880 cfs Feb. 9 (gage height, 8.95 ft, from floodmark); minimum, 9.3 cfs Sept. 12 (gage height, 2.14 ft); minimum gage height, 0.40 ft Jan. 31 (backwater from ice).
1939-66: Maximum discharge, 5,460 cfs Aug. 31, 1947 (gage height, 10.61 ft); minimum, 3.8 cfs Mar. 24, 1940; minimum gage height, 0.23 ft Mar. 12, 1965.

Remarks.--Records fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	64	14	17	22	10	20	98	24	14	15	12	9.9
2	51	14	17	23	11	46	67	22	14	15	12	11
3	43	14	18	16	11	201	52	22	14	14	12	10
4	37	14	17	17	11	936	47	21	21	14	12	9.8
5	35	14	18	17	11	78	43	20	23	17	11	9.8
6	32	14	16	15	11	50	41	19	20	18	12	9.8
7	32	22	15	13	11	41	40	19	20	18	14	9.6
8	30	19	16	14	300	37	37	19	18	17	12	9.6
9	28	18	17	15	1,640	28	35	18	17	18	12	9.6
10	26	16	17	13	102	26	32	18	16	18	11	9.6
11	24	15	22	13	32	24	32	19	16	19	11	9.5
12	22	27	67	13	29	22	30	21	19	17	11	9.5
13	21	35	79	13	25	21	27	23	19	17	11	9.5
14	20	26	49	13	21	18	26	24	19	17	11	9.8
15	19	23	37	12	19	18	26	22	19	17	11	9.6
16	18	22	35	12	22	18	28	20	20	16	11	9.6
17	18	19	31	12	19	18	27	20	17	16	10	9.6
18	17	16	29	12	18	26	27	19	17	15	10	9.5
19	17	19	26	12	18	26	28	19	16	15	10	9.5
20	21	19	25	12	18	22	32	18	17	15	11	9.5
21	23	19	26	12	17	19	32	17	21	15	12	9.5
22	20	18	26	11	16	22	27	17	16	14	11	9.5
23	19	18	29	11	15	45	26	17	13	14	11	9.5
24	18	18	31	11	14	26	24	17	12	13	10	9.6
25	18	18	25	11	14	17	24	16	11	14	10	96
26	17	20	21	11	14	23	24	15	12	14	10	9.8
27	17	21	19	11	14	24	24	14	12	14	9.9	9.9
28	16	20	18	11	14	23	24	14	12	14	9.9	9.9
29	16	19	19	11		26	23	14	13	13	9.9	10
30	16	17	21	10	-----	44	23	14	14	13	10	9.9
31	15	-----	22	10	-----	93	-----	14	-----	12	9.9	-----
Total	770	568	825	409	2,457	2,038	1,026	576	492	478	340.6	291.5
Mean	24.8	18.9	26.6	13.2	87.8	65.7	34.2	18.6	16.4	15.4	11.0	9.7
Max	64	35	79	23	1,640	936	98	24	23	19	14	11
Min	15	14	15	10	10	17	23	14	11	12	9.9	9.5
Cfsm	0.323	0.246	0.346	0.172	1.14	0.855	0.445	0.242	0.214	0.201	0.143	0.126
In.	0.37	0.28	0.40	0.20	1.19	0.99	0.50	0.28	0.24	0.23	0.16	0.14

Cal yr 1965: Total 14,805.9 Mean 40.6 Max 1,500 Min 9.1 Cfsm 0.529 In. 7.16
Wtr yr 1966: Total 10,271.1 Mean 28.1 Max 1,640 Min 9.5 Cfsm 0.366 In. 4.98

Peak discharge (base, 400 cfs, revised)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
2-9	Unkn	8.95	3,880	3-4	Unkn	6.90	2,080

Note.--No gage-height record Feb. 8-14.

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 1966. 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.--38 years, 24,810 cfs.

Extremes.--Maximum discharge during year, 105,400 cfs Mar. 26 (gage height, 12.14 ft); minimum daily, 11,200 cfs July 31; minimum gage height, 4.95 ft Sept. 7.
1928-66: Maximum discharge, 268,000 cfs Apr. 19, 1965 (gage height, 20.77 ft, from floodmark); minimum, 2,250 cfs Dec. 29, 1933 (gage height, -1.18 ft); minimum gage height, -3.38 ft Aug. 31, 1934.

Remarks.--Records good. Records of chemical analyses for the water year 1965 are published in Part 2 of this report. 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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	33,400	28,500	18,000	35,400	17,600	27,300	80,200	65,200	38,000	24,800	11,700	21,400
2	35,400	29,700	18,200	34,600	17,700	27,400	78,800	64,100	37,200	24,300	12,400	23,100
3	36,000	27,200	23,400	27,300	17,700	29,600	78,500	63,200	36,900	23,300	16,300	25,700
4	40,900	25,000	25,600	18,800	17,700	43,100	78,700	63,600	35,400	26,800	18,300	22,300
5	44,700	25,500	25,800	15,100	17,700	49,200	81,400	62,600	37,200	20,900	19,000	22,200
6	44,100	26,500	25,200	17,000	17,700	52,200	84,800	62,200	37,100	20,200	17,000	16,700
7	48,900	26,800	25,000	18,500	17,600	53,100	85,500	62,400	34,800	18,800	18,000	13,700
8	51,500	25,900	24,200	23,100	20,100	52,200	83,800	61,900	34,700	18,400	17,900	14,500
9	51,300	22,600	22,400	29,700	32,200	51,500	81,800	59,800	37,200	19,200	15,500	15,300
10	50,700	23,500	23,000	30,800	47,000	52,000	79,800	55,400	37,900	20,600	14,900	15,900
11	51,200	23,800	25,000	30,700	52,700	46,500	78,400	53,100	37,600	21,900	15,000	15,400
12	50,600	25,500	28,000	28,200	53,000	47,900	76,200	52,800	36,400	21,600	17,300	14,800
13	48,900	24,600	30,500	23,000	54,700	47,000	73,900	52,400	36,300	23,400	18,900	13,900
14	49,100	21,700	33,800	23,300	54,000	45,600	71,800	51,200	34,600	23,900	16,800	14,800
15	48,400	21,000	40,600	23,500	54,000	46,000	71,400	47,400	32,600	22,600	18,300	15,100
16	47,300	21,300	42,800	23,700	53,500	51,000	69,300	46,100	30,200	21,600	23,800	13,000
17	43,400	23,000	45,200	23,700	50,500	52,200	66,200	45,500	26,700	21,300	23,400	13,000
18	40,300	23,700	48,200	23,500	47,200	56,500	64,500	45,600	25,800	20,500	21,900	13,000
19	37,500	24,900	45,000	23,400	42,700	59,500	63,200	45,500	23,700	19,700	21,700	12,900
20	38,200	24,700	42,300	23,200	41,400	62,600	62,500	45,300	21,400	19,200	21,900	13,700
21	37,900	24,300	45,200	21,800	37,900	67,400	61,400	45,100	19,500	17,300	22,100	15,700
22	36,500	25,200	44,100	21,800	36,100	81,000	60,900	45,600	21,300	17,000	22,800	16,800
23	35,700	25,400	41,900	21,900	36,100	97,900	62,400	44,900	20,600	14,700	23,300	15,200
24	36,100	24,600	41,200	20,000	36,000	104,000	63,800	46,200	19,700	14,000	23,500	12,600
25	33,000	24,400	39,100	18,900	36,300	104,600	64,200	46,200	21,100	14,100	22,500	12,900
26	33,600	25,200	35,300	18,900	35,800	105,000	64,700	46,200	21,000	13,400	24,600	12,600
27	34,900	24,300	28,100	19,200	32,400	100,400	64,400	46,200	23,100	13,600	25,400	11,400
28	34,800	24,000	25,500	19,100	27,600	95,500	63,900	46,000	24,200	13,500	25,700	11,400
29	33,500	18,600	22,400	19,100		90,600	64,700	45,100	24,700	12,300	25,600	12,000
30	31,700	16,700	30,100	19,100	---------	86,300	65,200	41,400	24,600	12,100	25,200	12,000
31	28,100	----------	33,100	17,900	---------	82,200	----------	39,600	----------	11,200	22,400	----------
Total	1,267,600	728,100	998,200	714,200	1,004,900	1,967,300	2,146,300	1,597,800	891,500	586,200	623,100	463,000
Mean	40,890	24,270	32,200	23,040	35,890	63,460	71,540	51,540	29,720	18,910	20,100	15,400
Cfsm	0.691	0.410	0.544	0.389	0.606	1.07	1.21	0.871	0.502	0.319	0.340	0.260
In.	0.80	0.46	0.63	0.45	0.63	1.24	1.35	1.00	0.56	0.37	0.39	0.29

Calendar year 1965: Max 264,000 Min 9,700 Mean 43,650 Cfsm 0.737 In. 10.01
Water year 1965-66: Max 105,000 Min 11,200 Mean 35,580 Cfsm 0.601 In. 8.16

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, 1¼ 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 1966. Published as North Branch Root River near Lanesboro, 1910-17.

Gage. Digital 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. Aug. 2, 1940 to May 19, 1966, graphic water-stage recorder at present site and datum.

Average discharge.--31 years (1911-14, 1915-17, 1940-66), 319 cfs.

Extremes.--Maximum discharge during year, 16,200 cfs Feb. 9 (gage height, 13.90 ft, from floodmark); minimum, 84 cfs Sept. 24 (gage height, 1.24 ft).
1910-17, 1940-66: Maximum discharge, 22,100 cfs Mar. 29, 1962 (gage height, 16.11 ft); maximum gage height, 17.83 ft Mar. 1, 1965, from floodmark, backwater from ice; minimum discharge, 29 cfs Aug. 27, 1949 (gage height, 1.08 ft).

Remarks.--Records good except those for winter months or no gage-height record, which are fair. Diurnal fluctuation at times during medium and low flow caused by powerplant above station.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	2,000	194	162	170	131	150	3,230	263	159	197	101	100
2	1,220	191	160	150	131	230	1,620	250	160	173	103	107
3	820	188	159	130	130	450	938	238	163	176	100	126
4	658	183	158	128	130	10,100	735	225	224	165	98	113
5	570	180	157	126	130	2,560	618	219	261	155	97	106
6	506	175	156	128	130	700	540	210	287	157	181	102
7	470	175	154	128	140	450	488	201	317	151	673	99
8	434	172	152	129	4,000	400	447	198	246	141	241	95
9	394	167	150	129	11,200	358	417	194	216	145	172	93
10	360	164	150	130	3,600	325	392	188	201	140	155	92
11	339	164	150	132	900	303	379	191	196	133	142	92
12	317	194	370	134	450	465	362	207	632	130	133	91
13	301	265	1,050	136	300	596	352	219	478	134	129	90
14	286	240	852	138	200	421	345	232	325	282	128	90
15	277	223	570	138	180	348	335	228	260	221	127	89
16	268	218	400	138	160	319	341	225	232	172	124	89
17	257	210	350	138	150	322	389	225	213	150	121	87
18	248	196	320	136	148	372	389	222	206	135	116	87
19	242	191	300	136	142	469	365	210	192	125	111	87
20	257	188	270	136	138	439	372	201	182	117	110	86
21	265	191	240	136	136	348	372	193	256	113	114	87
22	245	186	220	136	134	328	365	184	315	110	113	86
23	240	186	200	135	132	582	335	195	270	110	111	86
24	237	183	185	135	132	636	309	206	206	109	108	87
25	226	183	170	134	131	443	297	200	192	107	106	90
26	218	175	160	134	131	399	287	190	191	105	104	92
27	213	170	150	133	130	365	281	182	181	152	102	92
28	207	168	145	133	132	352	278	175	217	114	100	96
29	204	165	140	132	------	352	269	167	245	104	98	98
30	202	163	160	132	------	417	269	163	243	100	96	97
31	202	------	200	131	------	2,450	------	160	------	99	103	------
TOTAL	12,683	5,648	8,160	4,181	23,548	26,449	16,116	6,361	7,466	4,422	4,317	2,832
MEAN	409	188	263	135	841	853	537	205	249	143	139	94.4
CFSM	.665	.306	.428	.220	1.37	1.39	.873	.333	.405	.233	.226	.154
IN	.77	.34	.49	.25	1.42	1.60	.97	.38	.45	.27	.26	.17

CALENDAR YEAR 1965 MAX 11,400 MIN 79 MEAN 504 CFSM .820 INCHES 11.12
WATER YEAR 1965-66 MAX 11,200 MIN 86 MEAN 335 CFSM .545 INCHES 7.39

Peak discharge (base, 3,500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
2-9	0200	13.90	16,200	4-1	1400	7.14	3,700
3-4	1300	12.29	12,000				

Note.--No gage-height record Feb. 8-10.

5-3845. Rush Creek near Rushford, Minn.

Location.--Lat 43°50'00", long 91°46'40", on line between secs. 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 1966.

Gage.--Wire-weight 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; June 14, 1950, to Aug. 26, 1964, chai gage at present site and datum; 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.--24 years, 54.2 cfs.

Extremes.--Maximum discharge during year, 7,490 cfs Feb. 9 (gage height, 10.20 ft, from graph based on gage readings); minimum daily, 30 cfs Sept. 23, 26; minimum gage height, 0.94 ft May 28.

1942-66: 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, 0.93 ft June 16, 17, 18, 1965.

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 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	52	37	36	39	38	45	43	36	40	34	33	33
2	48	37	36	38	38	50	43	35	37	34	33	36
3	46	37	37	39	38	116	43	36	37	40	32	33
4	44	36	36	35	39	442	41	35	93	36	32	33
5	44	36	36	34	40	84	41	35	46	37	32	33
6	42	36	36	35	42	53	41	35	46	36	32	33
7	42	49	36	36	46	48	40	35	41	35	41	33
8	42	37	36	37	85	44	40	35	41	35	35	33
9	41	37	36	37	3,280	42	38	35	39	36	34	33
10	40	37	36	37	187	42	38	35	39	35	34	32
11	40	36	41	37	85	41	38	37	40	44	34	32
12	40	40	58	36	69	41	37	38	59	36	33	32
13	40	40	51	36	54	40	37	38	45	56	33	32
14	40	38	44	36	48	38	37	36	41	54	34	32
15	40	38	44	36	45	39	37	35	41	38	34	32
16	39	38	43	38	43	39	37	36	41	35	34	32
17	38	37	42	40	42	38	37	37	39	34	33	32
18	38	37	41	41	42	41	37	36	37	34	33	32
19	38	37	40	41	42	41	37	35	37	34	32	31
20	40	37	41	39	42	40	40	35	37	32	32	31
21	39	37	41	38	42	40	37	35	37	33	35	31
22	37	36	41	37	42	46	37	34	37	33	34	31
23	37	36	74	37	42	76	37	43	36	33	34	30
24	34	36	42	37	42	56	37	35	36	32	33	31
25	36	36	41	38	42	47	36	34	35	32	33	31
26	36	39	41	38	42	44	37	34	36	33	33	30
27	36	40	41	38	42	42	37	35	35	38	33	31
28	37	37	40	38	43	43	37	34	38	33	33	31
29	37	36	40	38		43	37	34	36	33	32	31
30	37	36	40	38	-----	44	37	40	35	33	33	31
31	37	-----	38	38	-----	43	-----	40	-----	32	33	-----
Total	1,237	1,126	1,285	1,162	4,682	1,888	1,151	1,113	1,237	1,120	1,036	958
Mean	39.9	37.5	41.5	37.5	167	60.9	38.4	35.9	41.2	36.1	33.4	31.9
Max	52	49	74	41	3,280	442	43	43	93	56	41	36
Min	34	36	36	34	38	38	36	34	35	32	32	30
Cfsm	0.309	0.291	0.322	0.291	1.29	0.472	0.298	0.278	0.319	0.280	0.259	0.247
In.	0.36	0.32	0.37	0.33	1.35	0.54	0.33	0.32	0.36	0.32	0.30	0.28

Cal yr 1965:	Total	29,869	Mean	81.8	Max	3,770	Min	29	Cfsm	0.634	In. 8.61
Wtr yr 1966:	Total	17,995	Mean	49.3	Max	3,280	Min	30	Cfsm	0.382	In. 5.19

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 1966. 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.--44 years (1909-17, 1930-66), 644 cfs.

Extremes.--Maximum discharge during year, 18,500 cfs Feb. 10 (gage height, 12.94 ft, from floodmark, backwater from ice); minimum daily, 260 cfs Sept. 16-20; minimum gage height observed, 0.99 ft Sept. 21.
1909-17, 1929-66: Maximum discharge, 37,000 cfs Apr. 1, 1952 (gage height, 13.90 ft); maximum gage height, 18.32 ft Mar. 2, 1965 (backwater from ice); minimum discharge, 65 cfs Dec. 26, 1933, Feb. 25, 1935.

Remarks.--Records good except those for periods of no gage-height record and those for winter months, which are fair. Slight diurnal fluctuation at low flows caused by powerplants above station.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	3,630	479	471	420	310	420	3,340	532	377	487	304	275
2	2,750	467	454	410	310	450	2,310	523	373	442	308	280
3	2,050	463	434	390	310	680	1,730	510	373	433	304	315
4	1,680	458	422	380	310	4,800	1,410	500	500	532	304	310
5	1,450	450	410	375	315	5,600	1,240	487	678	433	300	295
6	1,300	446	403	370	325	1,500	1,120	474	555	420	300	290
7	1,180	548	399	360	340	1,100	1,030	464	654	402	649	285
8	1,080	450	392	355	1,500	940	958	460	574	394	769	280
9	1,000	434	395	350	8,800	820	892	446	519	411	492	280
10	930	430	388	350	12,200	740	837	442	482	394	415	275
11	864	426	418	345	2,960	735	793	451	464	460	377	270
12	810	458	553	340	1,910	730	764	460	542	390	356	270
13	765	475	1,200	340	1,550	760	736	469	897	390	335	270
14	731	496	1,450	340	1,080	760	712	478	707	514	327	280
15	707	479	1,080	335	880	730	692	478	598	505	320	265
16	678	458	880	335	840	720	673	469	537	446	316	260
17	645	450	760	335	780	710	678	469	500	411	308	260
18	621	438	680	335	700	720	716	469	478	390	295	260
19	603	426	620	330	600	730	692	456	460	373	290	260
20	598	418	610	330	500	740	688	446	446	352	285	260
21	631	418	600	330	470	750	697	433	451	343	290	261
22	617	414	520	330	450	760	673	428	519	331	295	271
23	594	410	525	325	440	820	659	451	551	331	295	275
24	566	406	530	325	430	980	621	464	505	327	290	280
25	553	410	520	320	420	1,000	598	446	456	320	285	280
26	544	450	470	320	410	943	588	433	474	320	280	275
27	522	442	420	320	410	897	574	420	451	331	280	268
28	505	446	390	315	410	847	555	411	446	343	275	270
29	484	399	400	310		832	551	398	482	320	275	275
30	484	454	430	310	-----	877	551	390	505	308	270	275
31	484	-----	425	310	-----	1,550	-----	381	-----	304	270	-----
Total	30,056	13,398	17,649	10,640	39,960	34,641	28,578	14,138	15,554	12,157	10,459	8,270
Mean	970	447	569	343	1,427	1,117	953	456	518	392	337	276
Max	3,630	548	1,450	420	12,200	5,600	3,340	532	897	532	769	315
Min	484	399	388	310	310	420	551	381	373	304	270	260
Cfsm	0.764	0.352	0.448	0.270	1.12	0.880	0.750	0.359	0.408	0.309	0.265	0.217
In.	0.88	0.39	0.52	0.31	1.17	1.01	0.84	0.41	0.46	0.36	0.31	0.24

Cal yr 1965:	Total	361,993	Mean	992	Max	20,000	Min	210	Cfsm	0.781	In.	10.60
Wtr yr 1966:	Total	235,500	Mean	645	Max	12,200	Min	260	Cfsm	0.508	In.	6.90

Peak discharge (base, 5,000 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
2-10	0500	12.94	18,500	3-4	2300	11.02	12,200

Note.--No gage-height record Feb. 9, 10, Aug. 18 to Sept. 20.

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 1966.

Gage.--Water-stage recorder. Datum of gage is 680.41 ft above mean sea level, datum of 1929.

Average discharge.--13 years, 122 cfs.

Extremes.--Maximum discharge during year, about 2,700 cfs Feb. 9 (gage height, 12.59 ft, from floodmark, backwater from ice); minimum 69 cfs Sept. 11 (gage height, 1.03 ft).
1953-66: 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 winter months, which are fair.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	314	102	97	100	78	80	138	97	86	84	81	78
2	247	99	97	98	76	100	135	94	86	83	81	78
3	213	101	97	110	76	115	129	89	87	85	79	80
4	192	101	96	115	76	660	124	89	92	89	79	78
5	179	99	96	110	75	170	120	88	93	87	79	77
6	168	99	96	94	80	130	117	88	90	87	79	77
7	164	102	96	90	95	115	115	87	89	83	85	77
8	158	99	96	90	650	112	112	87	89	83	84	76
9	147	99	95	90	2,000	110	109	87	90	86	81	76
10	140	98	95	88	550	116	106	87	88	88	80	77
11	133	100	103	88	240	114	106	89	88	103	80	73
12	126	109	148	86	165	136	104	93	91	86	78	74
13	122	109	196	86	135	113	101	95	89	87	78	74
14	122	109	151	86	115	108	101	95	88	94	80	74
15	125	105	139	84	100	106	100	92	87	90	81	74
16	121	98	132	84	95	105	100	92	86	87	81	74
17	114	97	129	84	94	106	100	90	83	84	79	73
18	112	97	123	84	92	121	99	90	86	83	77	73
19	108	93	115	84	90	111	100	90	84	81	77	73
20	111	95	115	82	88	106	105	89	88	81	77	73
21	136	98	110	82	86	104	104	88	95	81	81	73
22	141	88	106	82	84	114	102	88	85	81	82	72
23	127	88	106	82	82	160	102	106	83	81	80	73
24	120	91	110	80	80	150	102	114	81	81	79	73
25	120	91	108	80	80	141	99	105	81	81	78	75
26	114	105	100	80	78	135	101	97	110	108	78	74
27	111	105	98	80	75	128	101	92	95	119	77	74
28	109	102	102	80	70	124	99	88	91	82	77	74
29	107	105	98	80		128	99	88	88	81	77	75
30	109	101	96	80	-----	142	103	88	86	79	76	76
31	105	-----	105	78	-----	149	-----	87	-----	79	87	-----
Total	4,415	2,985	3,451	2,717	5,605	4,309	3,233	2,849	2,655	2,684	2,468	2,248
Mean	142	99.5	111	87.6	200	139	108	91.9	88.5	86.6	79.6	74.9
Max	314	109	196	115	2,000	660	138	114	110	119	87	80
Min	105	88	95	78	70	80	99	87	81	79	76	72
Cfsm	0.516	0.362	0.404	0.319	0.727	0.505	0.393	0.334	0.322	0.315	0.289	0.272
In.	0.60	0.40	0.47	0.37	0.76	0.58	0.44	0.39	0.36	0.36	0.33	0.30

Cal yr 1965: Total	65,813	Mean	180	Max	3,900	Min	69	Cfsm	0.655	In.	8.90
Wtr yr 1966: Total	39,619	Mean	109	Max	2,000	Min	70	Cfsm	0.396	In.	5.36

Peak discharge (base, 900 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
2-9	Unkn	12.59	about 2,700	3-4	1030	7.31	979

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 1966.

Gage.--Digital 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. October 1914 to May 18, 1964, graphic water-stage recorder at present site and datum.

Average discharge.--27 years, 171 cfs.

Extremes.--Maximum discharge during year, 3,740 cfs Feb. 9 (gage height, 10.10 ft, from floodmark); minimum, 36 cfs Sept. 24; minimum gage height, 2.23 ft Feb. 2, 5.
1909-14, 1944-66: Maximum discharge, 9,530 cfs Mar. 29, 1962; maximum gage height, 18.87 ft Mar. 1, 1965 (from floodmark, backwater from ice); no flow for several days in 1911.

Remarks.--Records good except those for period of backwater from aquatic growth, which are fair.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1965 TO SEPTEMBER 1966

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1	1,390	109	124	97	57	93	3,140	173	76	138	63	54
2	873	109	124	97	51	112	1,320	164	74	110	57	88
3	561	109	119	86	51	233	681	156	78	96	54	61
4	408	106	114	97	51	2,360	482	145	72	89	54	52
5	335	106	112	95	51	1,270	374	148	69	97	53	48
6	288	102	102	89	51	330	310	142	78	106	98	47
7	267	102	104	82	54	258	273	134	82	105	135	47
8	246	106	106	80	318	215	252	134	82	103	121	47
9	226	102	97	78	3,090	187	234	132	86	109	86	46
10	212	102	104	80	2,230	187	223	129	76	96	71	46
11	201	104	142	72	563	215	234	132	100	95	64	44
12	187	140	372	72	264	602	249	159	97	103	60	46
13	176	137	641	71	212	496	234	187	88	145	59	47
14	170	132	440	72	159	300	218	192	94	283	61	48
15	164	132	261	71	145	237	276	190	77	245	88	45
16	153	134	218	69	116	232	482	184	69	166	65	45
17	148	109	198	69	106	249	380	170	64	120	63	44
18	148	116	170	67	97	321	300	167	61	99	61	42
19	145	104	148	65	89	338	294	162	58	83	61	43
20	156	109	153	62	82	249	349	153	71	70	57	41
21	170	109	137	62	84	204	346	142	106	64	57	42
22	164	112	134	60	76	209	270	129	134	62	60	40
23	148	109	137	67	76	223	234	160	97	60	59	40
24	137	100	134	63	76	114	218	157	84	58	58	38
25	132	104	109	58	78	159	201	147	86	59	58	40
26	129	114	109	57	78	156	201	129	89	60	56	40
27	124	117	102	58	76	164	192	116	103	60	53	42
28	122	124	106	63	82	178	192	100	177	59	50	43
29	119	128	104	60	------	234	181	91	213	56	54	44
30	114	124	112	59	------	654	184	84	170	54	55	42
31	114	------	119	58	------	2,180	------	80	------	52	54	------
TOTAL	7,927	3,411	5,152	2,236	8,463	12,959	12,524	4,488	2,811	3,102	2,045	1,392
MEAN	256	114	166	72.1	302	418	417	145	93.7	100	66.0	46.4
CFSM	.602	.268	.391	.170	.711	.984	.981	.341	.221	.235	.155	.109
IN	.69	.30	.45	.20	.74	1.13	1.10	.39	.25	.27	.18	.12

CALENDAR YEAR 1965	MAX	7,920	MIN	47	MEAN	338	CFSM	.795	INCHES	10.81		
WATER YEAR 1965-66	MAX	3,140	MIN	38	MEAN	182	CFSM	.428	INCHES	5.82		

Peak discharge (base, 1,400 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
2- 9	1200	10.10	3,740	4- 1	0530	9.91	3,620
3- 4	1400	8.82	2,940				

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 storage room of city powerplant in Jackson.

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

Records available.--May 1909 to December 1913, August 1930 to September 1966 (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. Oct. 27, 1942 to Dec. 15, 1965, water-stage recorder 200 ft downstream at same datum.

Average discharge.--31 years (1935-66), 269 cfs.

Extremes.--Maximum discharge during year, 1,130 cfs Feb. 10 (gage height, 8.37 ft, backwater from ice); maximum gage height, 8.96 ft Feb. 9, (backwater from ice); minimum discharge, 1.2 cfs Aug. 6 (gage height, 2.74 ft).

1909-13, 1930-66: Maximum discharge 9,530 cfs Apr. 9, 1965; maximum gage height, 18.62 ft Apr. 6, 1965, (from floodmark, backwater from ice); no flow at times.

Remarks.--Records good except those for winter months, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes.

Discharge, in cubic feet per second, water year October 1965 to September 1966

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	732	172	93	107	26	441	824	362	120	82	3.0	16
2	534	170	100	100	26	462	633	353	111	65	2.2	67
3	412	165	108	89	26	485	524	351	109	56	2.0	59
4	384	165	116	75	26	480	493	340	104	55	2.2	38
5	356	165	125	58	26	465	447	318	97	48	1.8	30
6	329	145	135	44	30	430	429	297	96	48	11	28
7	300	145	140	45	60	404	424	279	89	45	34	22
8	276	145	143	46	200	453	387	268	84	36	24	20
9	251	143	150	46	600	560	370	254	80	32	17	18
10	228	138	155	45	1,100	593	356	244	76	28	15	16
11	228	138	170	43	1,080	584	356	244	72	22	13	24
12	185	145	180	43	640	564	359	256	82	22	11	35
13	205	205	185	45	500	564	367	271	76	33	15	27
14	205	136	177	46	440	633	364	286	76	45	15	58
15	185	136	102	46	380	811	359	254	71	38	21	76
16	185	136	105	45	390	709	351	254	72	29	16	68
17	185	77	120	43	390	680	340	264	66	24	16	48
18	185	120	135	40	400	673	332	254	72	21	13	39
19	195	111	138	38	405	626	332	244	72	18	9.2	29
20	214	128	132	38	410	521	384	240	120	14	19	25
21	230	128	130	38	410	409	435	216	338	13	32	25
22	221	145	130	37	410	401	426	193	603	11	33	30
23	215	136	131	35	410	279	421	203	316	10	24	34
24	208	142	134	33	410	75	401	203	230	9.2	18	33
25	200	138	93	32	410	101	390	197	179	7.8	12	31
26	195	100	58	30	410	121	362	181	147	20	8.2	30
27	188	57	58	28	415	187	364	165	140	13	6.4	28
28	180	76	68	27	429	210	373	153	128	12	6.4	25
29	175	84	95	26		429	398	136	111	8.7	12	26
30	175	89	108	26	------	699	384	131	101	6.0	14	28
31	175	------	108	26	------	917	------	126	------	4.4	13	------
Total	7,936	3,980	3,822	1,420	10,459	14,966	12,385	7,537	4,038	876.1	439.4	1,033
Mean	256	133	123	45.8	374	483	413	243	135	28.3	14.2	34.4
Cfsm	0.210	0.109	0.101	0.038	0.307	0.396	0.339	0.199	0.111	0.023	0.012	0.028
In.	0.24	0.12	0.12	0.04	0.32	0.46	0.38	0.23	0.12	0.03	0.01	0.03

Calendar year 1965: Max 9,100 Min 16 Mean 608 Cfsm 0.498 In. 6.76
Water year 1965-66: Max 1,100 Min 1.8 Mean 189 Cfsm 0.155 In. 2.10

Peak discharge (base, 500 cfs)

Date	Time	Gage height	Discharge	Date	Time	Gage height	Discharge
10- 1	0400	6.37	788	3-31	1800	6.87	954
2-10	2300	8.37	1,130	6-22	0300	5.78	593
3-15	1300	6.65	880				

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 flood-flow 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 1966

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, 1956-66	10-26-65	29.0
					12- 8-65	36.4
					1- 8-66	31.2
					3- 8-66	37.4
					5- 2-66	83.0
					5-23-66	46.3
					6-20-66	41.0
					7-25-66	30.0
					8-22-66	51.7
					9-19-66	31.5

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)	Discharge (cfs)
		Streams tributary to Lake Superior					
4-0113.7	Little Devil Track River near Grand Marais, Minn.	NW¼ sec.9, T.61 N., R.1 E., at culvert on County Highway 12, 1½ miles above mouth, and 2½ miles north of Grand Marais.	-	1961-66	5-5-66	17.21	129
4-0113.9	Little Devil Track River tributary near Grand Marais, Minn.	SE¼SE¼ sec.4, T.61 N., R.1 E., at culvert on County Highway 55, 0.2 mile above mouth, and 2.8 miles north of Grand Marais.	0.47	1966	5-5-66	a10.88	(✗)
4-0131	Lake Superior tributary near Taconite Harbor, Minn.	SW¼SE¼ sec.20, T.58 N., R.5 W., at culvert on U.S. Highway 61, 0.2 mile above mouth, and 3.7 miles southwest of Taconite Harbor.	1.56	1964-66	4-15-66	a7.69	33
4-0132	Caribou River near Little Marais, Minn.	NW¼SE¼ 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	1961-66	4-19-66	13.34	548
4-0151.5	Crow Creek near Silver Creek, Minn.	SW¼SW¼ 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	1960-66	4-13-60 4-20-61 5-23-62 4-2-63 5-23-64 4-19-65 8-8-66	9.56 11.08 8.47 a9.20 9.30 a9.29 9.13	49 121 21 19 41 23 37
4-0152	Encampment River tributary at Silver Creek, Minn.	NE¼SE¼ 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	1960-66	8-8-66	7.77	47
4-0152.5	Silver Creek tributary near Two Harbors, Minn.	SW¼NE¼ sec.16, T.53 N., R.10 W., at culvert on County Highway 3, 1.0 mile above mouth, and 4.5 miles northeast of Two Harbors.	3.72	1966	10-18-65	4.47	(✗)
4-0153	Little Stewart River near Two Harbors, Minn.	SE¼NE¼ 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	1960-66	10-18-65	10.28	108
4-0153.6	Lake Superior tributary at French River, Minn.	SW¼SE¼ sec.18, T.51 N., R.12 W., at culvert on U.S. Highway 61, 0.35 mile above mouth, and 0.7 mile west of French River.	1.41	1964-66	10-18-65	18.27	69
4-0153.7	Talmadge River at Duluth, Minn.	SE¼NE¼ sec.24, T.51 N., R.13 W., at culvert on U.S. Highway 61, 0.6 mile above mouth, and 0.5 mile northeast of Duluth city limits.	5.79	1964-66	10-18-65	12.61	(✗)
4-0154	Miller Creek at Duluth, Minn.	SE¼NE¼ 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	1960-66	10-18-65	b15.92	150
4-0177	McKinley Lake tributary at McKinley, Minn.	SW¼NE¼ sec.18, T.58 N., R.16 W., at culvert on State Highway 135 at west edge of McKinley.	-	1960-66	4-20-66	8.18	13
4-0188	East Two River tributary at Virginia, Minn.	NE¼NE¼ 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	1959-66	4-19-65 4-20-66	6.74 5.57	54 41
4-0241.1	Rock Creek tributary near Blackhoof, Minn.	NE¼SE¼ 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.	-	1961-66	6-25-66	13.50	28
4-0242	South Fork Nemadji River near Holyoke, Minn.	SE¼SE¼ sec.6, T.46 N., R.16 W., at culvert on State Highway 23, 1.7 miles below Clear Creek, and 2.0 miles northwest of Holyoke.	-	1961-66	6-25-66	14.8	1,220

✗ Discharge not determined.
a Backwater from ice.
b Affected by shifting control.

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					
5-0476	West Branch Mustinka River near Graceville, Minn.	NW¼NW¼ sec.22, T.125 N., R.46 W., at culverts on county highway, 4.1 miles north of Graceville.	-	1964-66	3-18-66	9.41	(✓)
5-0477	West Branch Mustinka River tributary near Graceville, Minn.	NE¼NW¼ sec.28, T.125 N., R.45 W., at culvert on county highway, 0.6 mile northeast of Graceville.	-	1964-66	4-17-66	7.53	(✓)
5-0492	Eighteenmile Creek near Wheaton, Minn.	On west quarter of line between secs. 24 and 25, T.127 N., R.47 W., at culvert on County Highway 67, 1.4 miles above mouth, and 2.0 miles southwest of Wheaton.	-	1965-66	3-3-66	a9.85	(✓)
5-0608	Buffalo River near Callaway, Minn.	SW¼SW¼ sec.17, T.141 N., R.41 W., at culvert on U.S. Highway 59, 2.7 miles north of Callaway.	49.9	1960-66	5-23-66	11.87	238
5-0614	Hay Creek above Downer, Minn.	NW¼NW¼ sec.30, T.138 N., R.45 W., at culvert on county road, 3.1 miles east of Downer.	5.81	1961-66	6-5-66	6.64	53
5-0622.8	Wild Rice River tributary near Bagley, Minn.	SW¼NW¼ sec.21, T.146 N., R.37 W., at culvert on State Highway 92, 5.0 miles south of Bagley.	3.34	1961-66	4-1-66	a11.37	60
5-0624.7	Marsh River tributary near Mahnomen, Minn.	SE¼SW¼ sec.36, T.145 N., R.43 W., at culvert on State Highway 31, a quarter mile above mouth, and 5¼ miles west of Mahnomen.	6.57	1961-66	4-2-66	a13.43	205
5-0627	Wild Rice River tributary near Twin Valley, Minn.	SW¼SE¼ sec.12, T.144 N., R.45 W., at culvert on State Highway 31, 1¼ miles above mouth, and 4¼ miles northwest of Twin Valley.	2.25	1961-66	3-16-66	15.70	91
5-0628	Coon Creek near Twin Valley, Minn.	NE¼NE¼ sec.26, T.144 N., R.45 W., at bridge on County Highway 28, 1.1 miles above mouth, and 4.0 miles west of Twin Valley.	32.1	1962-66	3-17-66	a13.52	630
5-0632	South Branch Wild Rice River near Ogema, Minn.	SE¼SE¼ sec.11, T.142 N., R.42 W., at culvert on county highway, 2 miles northwest of Ogema.	6.50	1963-66	3-16-66	a9.49	57
5-0736	South Branch Battle River at Northome, Minn.	NE¼ 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.	3.19	1960-66	4-16-66	b14.21	40
5-0737.5	South Branch Cormorant River tributary near Blackduck, Minn.	NW¼NW¼ sec.32, T.150 N., R.30 W., at culvert on County Highway 304, 3 miles above mouth, and 3¼ miles north of Blackduck.	4.45	1960-66	4-16-66	13.53	78
5-0738	Perry Creek near Shooks, Minn.	NW¼SW¼ sec.30, T.151 N., R.30 W., at culvert on State Highway 72, 5 miles west of Shooks.	2.41	1960-66	4-16-66	7.45	64
5-0766	Red Lake River tributary near Thief River Falls, Minn.	SW¼SE¼ 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.	-	1962-66	3-20-66	a10.60	39
5-0781	Lost River at Gonvick, Minn.	NE¼NE¼ 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.	30.9	1960-66	5-15-66	8.24	167
5-0781.8	Lost River tributary near Clearbrook, Minn.	NW¼ sec.13, T.148 N., R.38 W., at culvert on county highway, 3½ miles south of Clearbrook.	1.79	1960-66	5-15-66	8.54	33
5-0782	Lost River tributary at Clearbrook, Minn.	SW¼NW¼ sec.29, T.149 N., R.37 W., at culvert on county highway at north edge of Clearbrook, three-quarters of a mile above mouth.	3.05	1960-66	8-13-66	9.84	44
5-0784	Clearwater River tributary near Plummer, Minn.	SE¼SE¼ sec.22, T.151 N., R.43 W., at culvert on county highway, 1¼ miles above mouth, and 5½ miles southwest of Plummer.	1.17	1961-66	4-27-66	8.27	85
		Lake of the Woods basin					
5-1283	Pike River near Gilbert, Minn.	NE¼SW¼ sec.22, T.58 N., R.17 W., at culvert on State Highway 135, 1.1 miles west of Gilbert.	-	1966	4-15-66	7.13	(✓)

✓ Discharge not determined.
a Backwater from ice.
b Affected by shifting control.

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)
		Lake of the Woods basin--continued					
5-1287	Pike River tributary near Wahlsten, Minn.	SW¼SW¼ 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.	-	1961-66	4-15-66	a8.91	25
5-1297.1	Johnson Creek near Britt, Minn.	NW¼NE¼ 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.	-	1961-64, 1966	4-15-66	c9.19	35
5-1303	Boriin Creek near Chisholm, Minn.	SE¼SE¼ 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	1959-66	4-16-66	12.26	149
		Split Hand Creek basin					
5-2150	Smith Creek near Hill City, Minn.	SE¼NW¼ sec.13, T.53 N., R.26 W., at culvert on U.S. Highway 169, 6½ miles north of Hill City.	5.06	1961-66	8-7-66	5.67	(✓)
		Swan River basin					
5-2167	O'Brien Creek near Nashwauk, Minn.	NE¼NE¼ 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.	-	1959-66	4-19-66	c8.99	103
5-2168.3	Hay Creek near Pengilly, Minn.	SW¼NE¼ sec.26, T.56 N., R.22 W., at culvert on Duluth, Missabe and Iron Range railroad, 1.9 miles above Hay Lake, and 5.0 miles southeast of Pengilly.	-	1964-66	10-1-65	9.93	272
5-2169.8	Swan River tributary at Warba, Minn.	NW¼ 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.	2.36	1961-66	4-19-66	5.69	33
		Bluff Creek basin					
5-2177	Bluff Creek near Jacobson, Minn.	SW¼NW¼ sec.8, T.52 N., R.23 W., at culvert on State Highway 34, 1¼ miles west of Jacobson.	2.95	1961-66	10-1-65	8.33	59
		Crow Wing River basin					
5-2441	Kitten Creek near Sebeka, Minn.	SE¼SE¼ sec.15, T.137 N., R.35 W., at culvert on county highway, 3¼ miles above mouth, and 3¼ miles north of Sebeka.	9.34	1961-66	4-3-66	10.36	(✓)
5-2442	Cat River near Nimrod, Minn.	SW¼SW¼ sec.36, T.137 N., R.34 W., at bridge on State Highway 227, 2½ miles west of Nimrod, and 3 miles above mouth.	44.3	1961-66	4-3-66	7.44	336
		Platte River basin					
5-2678	Big Mink Creek tributary near Lastrup, Minn.	NW¼SW¼ 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.	-	1961-66	3-15-66	a10.47	(✓)
5-2679	Hillman Creek near Pierz, Minn.	NE¼SE¼ sec.9, T.40 N., R.30 W., at bridge on county highway, 1.1 miles above mouth, and 1.5 miles east of Pierz.	52.6	1964-66	3-17-66	14.06	795
		Sauk River basin					
5-2703	Sauk River tributary at Spring Hill, Minn.	SW¼NE¼ sec.27, T.124 N., R.33 W., at culvert on State Highway 4, 1.0 mile east of Spring Hill, and 2.7 miles above mouth.	6.42	1960-66	6-21-66	11.54	(✓)
5-2703.1	Sauk River tributary near St. Martin, Minn.	SE¼ sec.19, T.124 N., R.32 W., at culvert on county highway, 4½ miles northwest of St. Martin.	.23	1960, 1962-66	6-21-66	7.80	19

✓ Discharge not determined.
a Backwater from ice.
c Backwater from beaver dam.

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)
		Johnson Creek basin					
5-2718	Johnson Creek tributary at Luxemburg, Minn.	NW¼NE¼ sec.30, T.123 N., R.28 W., at culverts on State Highway 15, 0.8 mile south of Luxemburg.	2.77	1965-66	3-11-66	a8.35	(✓)
5-2720	Johnson Creek tributary near St. Augusta, Minn.	NE¼SE¼ sec.21, T.123 N., R.28 W., at culverts on county highway, 0.7 mile above mouth, and 3.1 miles southwest of St. Augusta.	-	1964-66	3-11-66	a8.45	108
5-2723	Johnson Creek near St. Augusta, Minn.	NW¼SW¼ sec.13, T.123 N., R.28 W., at bridge on County Highway 7, 1.0 mile south of St. Augusta, and 3.3 miles above mouth.	-	1964-66	3-11-66	a14.84	430
		Otsego Creek basin					
5-2737	Otsego Creek near Otsego, Minn.	SW¼NE¼ sec.13, T.121 N., R.24 W., at culvert on County Highway 39, 1.3 miles above mouth, and 1.9 miles west of Otsego.	-	1964-66	3-11-66	8.86	303
		Elk River basin					
5-2742	Stony Brook tributary near Foley, Minn.	NW¼ sec.2, T.36 N., R.29 W., at culvert on State Highway 25, a quarter mile above mouth, and 1½ miles south of Foley.	3.11	1960-66	3-11-66	a9.07	51
		Crow River basin					
5-2761	North Fork Crow River tributary near Paynesville, Minn.	NW¼ sec.12, T.122 N., R.33 W., at culvert on county highway, 1 mile above mouth, and 3 miles west of Paynesville.	.58	1960-66	6-21-66	19.41	68
5-2783.5	Fountain Creek near Montrose, Minn.	NE¼NW¼ sec.22, T.118 N., R.26 W., at culvert on County Highway 30, 3.3 miles southwest of Montrose.	6.73	1962-66	3-4-66	a7.20	(✓)
5-2787	Otter Creek near Lester Prairie, Minn.	SE¼SE¼ 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.	-	1961-66	3-4-66	a8.37	106
5-2787.5	Otter Creek tributary near Lester Prairie, Minn.	SE¼SE¼ 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.	-	1962-66	3-4-66	a10.09	41
5-2788.5	Buffalo Creek tributary near Brownton, Minn.	NE¼SE¼ 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 Brownton.	9.45	1961-66	3-4-66	a14.33	36
5-2790.3	South Fork Crow River tributary near Mayer, Minn.	NW¼NE¼ 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.	-	1962-66	3-4-66	a5.95	82
5-2803	School Lake Creek tributary near St. Michael, Minn.	NW¼SE¼ sec.15, T.120 N., R.24 W., at culvert on county highway, 0.2 mile above mouth, and 1.5 miles southwest of St. Michael.	2.04	1964-66	3-4-66	a11.03	(✓)
		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.	-	1961-66	3-31-66	a9.56	10
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 6¾ miles south of Onamia.	7.21	1960-66	6-4-66	15.40	123
5-2846.2	Rum River tributary near Onamia, Minn.	E½ sec.14, T.40 N., R.27 W., at culvert on U.S. Highway 169, a quarter mile above mouth, and 7¾ miles south of Onamia.	1.84	1960-66	6-4-66	9.21	74
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.	1.26	1961-66	3-15-66	a7.45	48

✓ Discharge not determined.
a 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)	Discharge (cfs)
		Minnesota River basin					
5-2991	Lazarus Creek tributary near Canby, Minn.	N½ sec.6, T.114 N., R.45 W., at culvert on State Highway 68, 3 miles west of Canby, and 3¼ miles above mouth.	3.4	1960-66	3-10-66	a11.44	(≠)
5-3012	Minnesota River tributary near Montevideo, Minn.	SW¼SE¼ sec.16, T.117 N., R.41 W., at culvert on U.S. Highway 212, 1 mile above mouth, and 3¾ miles west of Montevideo.	0.54	1960-66	3-3-66	a8.64	1.2
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.	.13	1962-66	10-18-65	7.29	(≠)
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.	4.03	1962-66	3-12-66	a8.69	(≠)
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	1959-66	3-11-66	a14.15	79
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.	15.2	1960-66	3-10-66	a14.28	(≠)
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, 1½ miles above mouth, and 4½ miles northwest of Wilno.	.33	1960-66	7-13-66	8.80	21
5-3113	North Branch Yellow Medicine River tributary near Porter, Minn.	E½ sec.16, T.113 N., R.45 W., at culvert on U.S. Highway 75, 6¼ miles southwest of Porter.	1.46	1960-66	3-10-66	a15.76	(≠)
5-3138	Chetomba Creek tributary near Blomkest, Minn.	SW¼SW¼ sec.35, T.118 N., R.35 W., at culvert on U.S. Highway 71, 2¾ miles northwest of Blomkest.	.79	1959-66	3-11-66	a9.92	(≠)
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.	5.90	1959-66	3-14-66	a14.66	142
5-3152	Prairie Ravine near Marshall, Minn.	SE¼NE¼ sec.20, T.112 N., R.41 W., at culvert on U.S. Highway 59, 2.7 miles north of Marshall.	-	1959-64≠ 1965-66	3-14-66	a7.48	44
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, 5½ miles northwest of Olivia.	9.71	1959-66	3-11-66	a6.65	32
5-3166.9	Spring Creek tributary near Sleepy Eye, Minn.	NW¼ sec.25, T.111 N., R.33 W., at culvert on county highway, 0.1 mile above mouth, and 7½ miles north of Sleepy Eye.	-	1966	3-3-66	a5.49	(≠)
5-3167	Spring Creek near Sleepy Eye, Minn.	NE¼SE¼ sec.24, T.111 N., R.33 W., at culvert on county highway, 3¾ miles above mouth, and 7½ miles north of Sleepy Eye.	30.0	1959-66	3-3-66	a11.56	170
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.	.50	1959-66	3-23-66	5.31	18
5-3168.5	Meadow Creek tributary near Marshall, Minn.	E½ sec.34, T.111 N., R.41 W., at culvert on U.S. Highway 59, 1¼ miles above mouth, and 4½ miles south of Marshall.	-	1961-66	3-14-66	a14.78	(≠)
5-3169	Dry Creek near Jeffers, Minn.	NE¼NE¼ sec.31, T.108 N., R.36 W., at culvert on County Highway 10, 4½ miles north of Jeffers.	3.24	1961-66	3-3-66	a6.00	83
5-3169.2	Cottonwood River tributary near Sanborn, Minn.	NW¼NW¼ sec.12, T.108 N., R.36 W., at culvert on U.S. Highway 71, 2.4 miles south of Sanborn.	-	1966	4-19-66	6.06	(≠)
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.	-	1959-66	3-31-66	6.23	(≠)
5-3181	East Branch Blue Earth River tributary near Blue Earth, Minn.	W½SE¼ 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.	-	1960-66	6-21-66	d6.51	217
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, 1¾ miles northwest of Delft.	13.1	1960-66	6-21-66	15.45	61

≠ Discharge not determined.
≠ Operated as a continuous-record gaging station.
a Backwater from ice.
d Backwater from debris.

GPO 803-695-11

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					
5-3202	Le Sueur 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	1959-66	2-9-66	a21.09	16
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	1959-66	2-9-66	a14.93	71
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 3¼ miles west of Mapleton.	5.75	1959-66	3-23-66	16.73	96
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	1959-66	6-28-66	13.72	144
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.	0.21	1961-66	2-9-66	4.81	(✗)
5-3301.5	Sand Creek tributary near Montgomery, Minn.	NE¼ sec.18, T.111 N., R.22 W., at culvert on State Highway 21, 3½ miles east of Montgomery.	0.29	1961-66	2-9-66	a9.14	15
5-3302	Rice Lake tributary near Montgomery, Minn.	N½ sec.13, T.111 N., R.23 W., at culvert on State Highway 21, 1¼ miles above Rice Lake, and 2½ miles east of Montgomery.	2.49	1960-66	2-9-66	6.66	33
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	1960-66	3-4-66	a11.54	325
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	1960-66	3-4-66	11.22	163
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	1960-66	4-1-66	13.46	(✗)
		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 miles west of Moose Lake.	-	1960-66	10-20-65	8.58	64
5-3365.5	Wolf Creek tributary near Sandstone, Minn.	NE¼SE¼ sec.33, T.43 N., R.20 W., at culvert on U.S. Highway 61, 0.2 mile above mouth, and 2.2 miles north of Sandstone.	-	1960-66	4-4-66	17.06	86
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.	-	1960-66	4-4-66	8.74	(✗)
5-3382	Mission Creek near Hinckley, Minn.	SW¼SW¼ sec.25, T.41 N., R.21 W., at culvert on U.S. Highway 23, 1.2 miles south of Hinckley.	-	1960-66	4-4-66	a15.38	(✗)
		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.	14.3	1960-66	3-4-66	21.28	310
		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.	-	1960-66	3-4-66	a16.28	40
5-3528	Turtle Creek tributary near Steele Center, Minn.	NW¼NW¼ sec.11, T.106 N., R.20 W., at culvert on township road, 1½ miles above mouth, and 1½ miles northeast of Steele Center.	-	1960-66	3-4-66	6.32	(✗)

✗ Discharge not determined.
a 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)	Discharge (cfs)
		Cannon River basin--continued					
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.	2.02	1960-66	3-3-66	a15.49	264
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.	20.2	1960-66	3-4-66	5.63	519
5-3551.8	Cannon River tributary near Miesville, Minn.	SW¼SW¼ sec.9, T.113 N., R.17 W., at culvert on State Highway 50, 2.9 miles west of Miesville.	.086	1960-66	3-31-66	14.42	(≠)
5-3552.3	Cannon River tributary near Welch, Minn.	SW¼SW¼ 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.	-	1960-66	3-31-66	9.15	27
		Zumbro River basin					
5-3733.5	Zumbro River tributary near South Troy, Minn.	SE¼NE¼ 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.	0.16	1962-66	3-4-66	a8.36	(≠)
5-3737	North Fork Zumbro River tributary near Wanamingo, Minn.	SE¼SE¼ sec.32, T.110 N., R.17 W., at culvert on County Highway 1, 3¼ miles above mouth, and 4¼ miles southwest of Wanamingo.	9.36	1960-66	5-31-60 3-27-61 8-31-62 5-12-63 3-3-66	12.11 10.29 10.86 10.00 a11.60	765 331 457 271 490
5-3739	Trout Brook tributary near Goodhue, Minn.	SE¼ 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	1960-66	3-3-66	8.83	(≠)
5-3744	Long Creek near Potsdam, Minn.	At quarter corner on north line of sec.8, T.108 N., R.12 W., at culvert on county highway, 2.6 miles northeast of Potsdam.	-	1966	3-4-66	17.45	(≠)
		East Indian Creek basin					
5-3758	East Indian Creek tributary No. 1 near Weaver, Minn.	NW¼SE¼ 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	1962-66	8-7-66	10.65	(≠)
		Garvin Brook basin					
5-3782.9	Straight Valley Creek near Altura, Minn.	SW¼SE¼ sec.3, T.107 N., R.9 W., at culvert on State Highway 248, 2.4 miles above mouth, and 3.1 miles northeast of Altura.	-	1966	3-4-66	11.49	(≠)
5-3783	Straight Valley Creek near Rollingstone, Minn.	SE¼NE¼ 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	1959-66	3-4-66	13.01	(≠)
		Jethro Creek basin					
5-3791	Jethro Creek at Homer, Minn.	SE¼SE¼ sec.32, T.107 N., R.6 W., at culvert on U.S. Highway 61, 0.1 mile above mouth, and 0.1 mile northwest of Homer.	-	1966	8-7-66	13.42	(≠)
		Root River basin					
5-3836	North Branch Root River tributary near Stewartville, Minn.	Near center sec.36, T.105 N., R.14 W., at culvert on State Highway 30, 2.0 miles east of Stewartville, and 2.3 miles above mouth.	.73	1958, 1959-64≠ 1965-66	6-4-58 3-3-66	12.47 a6.64	297 25
5-3837	Mill Creek tributary near Chatfield, Minn.	SW¼NW¼ 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	1959-66	3-3-66	a13.14	(≠)
5-3837.2	Mill Creek near Chatfield, Minn.	SE¼NW¼ 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	1962-66	3-3-66	14.39	(≠)

≠ Discharge not determined.
≠ Operated as a continuous-record gaging station.
a 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)	Discharge (cfs)
		Root River basin--continued					
5-3838.5	Bear Creek near Grand Meadow, Minn.	NE¼SE¼ sec.14, T.103 N., R.15 W., at bridge on county highway, 1½ miles northwest of Grand Meadow, and 4 miles above North Fork Bear Creek.	13.6	1962-66	3-3-66	a18.89	785
5-3841	Trout Creek tributary near Lanesboro, Minn.	SW¼ 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	1959-66	3-3-66	12.82	74
5-3841.5	Root River tributary near Whalan, Minn.	SW¼ sec.17, T.103 N., R.9 W., at culvert on private road, 1¼ miles southwest of Whalan.	.30	1959-66	7-13-66	7.65	27
5-3842	Whalan Creek near Whalan, Minn.	SE¼ sec.21, T.103 N., R.9 W., at bridge on county highway, 1¾ miles southeast of Whalan, and 2¼ miles above mouth.	7.85	1959-66	2-9-66	a15.43	247
5-3843	Big Springs Creek near Arendahl, Minn.	NE¼SE¼ sec.7, T.104 N., R.9 W., at culvert on State Highway 250, 2.0 miles west of Arendahl.	.14	1959-66	3-31-66	8.99	19
5-3844	Pine Creek near Arendahl, Minn.	SE¼NE¼ 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	1959-66	3-4-66	12.30	590
		Iowa River basin					
5-4570.8	Rose Creek tributary near Dexter, Minn.	SE¼SW¼ sec.22, T.103 N., R.16 W., at culvert on county highway, 1¾ miles above mouth, and 2¼ miles southwest of Dexter.	1.20	1962-66	3-31-66	9.08	(✗)
5-4589.5	Shell Rock River tributary near Albert Lea, Minn.	SW¼SE¼ 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.	-	1960-66	3-31-66	17.90	(✗)
		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 30, 2¼ miles west of Slayton, and 2¾ miles above mouth.	2.67	1961-66	5-17-61 3-28-62 7-27-63 4-13-64 5-9-65 3-3-66	16.74 a21.22 17.04 16.80 18.48 a18.66	51 211 61 53 128 87
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-quarter mile above mouth, and 1½ miles west of Slayton.	.97	1961-66	3-3-66	a18.71	(✗)
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	1960-66	6-21-66	13.76	395
5-4758	West Fork Des Moines River tributary near Jackson, Minn.	NW¼SE¼ sec.27, T.103 N., R.35 W., at culvert on county highway, three-quarter mile above mouth, and 5½ miles north of Jackson.	1.42	1960-66	3-28-66	14.46	41
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 5¾ miles east of Lakefield.	4.52	1960-66	3-28-66	a6.98	90
5-4760.1	Nelson Creek at Jackson, Minn.	NW¼NW¼ sec.25, T.102 N., R.35 W., in flume spillway at intersection of U.S. Highways 16 and 71 at south edge of Jackson.	6.8	1959, 1964-66	3-14-66	a16.06	(✗)
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.	-	1960-66	3-28-66	c9.33	245
5-4769	East Fork Des Moines River tributary near Dunnell.	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	1960-66	3-28-66	b11.92	150

✗ Discharge not determined.
a Backwater from ice.
b Affected by shifting control.
c Backwater from beaver dam.

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)
		Big Sioux River basin					
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	1959-66	2-9-66	a10.22	82
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	1959-66	2-9-66	a7.82	(✓)
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.	.20	1959-66	2-9-66	a13.68	(✓)
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.	.18	1959-66	2-9-66	a18.23	56
6-4832.1	North Branch Kanaranzi Creek tributary near Wilmont, Minn.	SW¼NW¼ sec.15, T.103 N., R.42 W., at culvert on County Highway 15, 3½ miles southwest of Wilmont and 3¾ miles above mouth.	-	1966	8-14-66	4.89	(✓)
		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	1959-66	3-14-66	a7.52	25
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.	-	1962-66	3-14-66	a8.33	(✓)

✓ Discharge not determined.
a Backwater from ice.

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 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Streams tributary to Lake Superior				
St. Louis River	Lake Superior	NW¼SE¼ sec.22, T.58 N., R.15 W., 400 ft upstream from Partridge River, ½ mile upstream from bridge on County Highway 100 and 1½ miles south of Aurora, Minn.	-	-	1-18-66	*37.0
		Red River of the North basin				
Mustinka River	Bois de Sioux River	On line between secs.11 and 14, T.128 N., R.43 W., about 6.7 miles southwest of town of Elbow Lake, Minn.	-	1964-65	11- 2-65	34.7
Mustinka River	Bois de Sioux River	On line between secs.28 and 29, T.128 N., R.43 W., at bridge on County Highway 9, 5 miles northeast of Herman, Minn.	-	-	11- 2-65	36
Twelve Mile Creek	Mustinka River	On line between secs.27 and 28, T.126 N., R.45 W., ½ mile above West Fork, 5 miles east and 1½ miles south of Dumont, Minn.	-	1964-65	11- 4-65	a1.6
West Fork Twelve Mile Creek	Twelve Mile Creek	On line between secs.28 and 33, T.126 N., R.45 W., 1 mile above mouth, 4 miles east and 2 miles south of Dumont, Minn.	-	1964-65	11- 4-65	0
Twelve Mile Creek	Mustinka River	On line between secs.30 and 31, T.127 N., R.45 W., 0.1 mile above mouth, 5¼ miles east and 2 miles south of Wheaton, Minn.	-	1964-65	11- 5-65	2.62
West Branch Mustinka River	Mustinka River	On line between secs.30 and 31, T.127 N., R.45 W., ¼ mile above mouth of Twelve Mile Creek, 5¼ miles east and 2 miles south of Wheaton, Minn.	-	1964-65	11- 5-65	.82
Mustinka River	Bois de Sioux River	SW¼ sec.8, T.127 N., R.46 W., on U.S. Highway 75, 1.2 miles north of Wheaton, Minn., 8 miles above mouth.	834	1916,17 1919-24≠ 1931-58≠ 1964-65	11- 2-65 3-22-66	48.3 796
Drainage Ditch	Rabbit River	On line between secs.7 and 12, T.130 N., R.45 and 46 W., ¼ mile above Rabbit River and ½ mile southeast of Campbell, Minn.	-	1964-65	11- 5-65	3.74
South Fork Rabbit River	Rabbit River	On line between secs.18 and 19, T.130 N., R.45 W., 2 miles above mouth and 2.2 miles southeast of Campbell, Minn.	-	1964-65	11- 5-65	.36
Rabbit River	Bois de Sioux River	SE¼SE¼ sec.2, T.130 N., R.46 W., at Campbell, Minn., 1 mile below South Fork.	266	1942-51≠ 1964-65	11- 2-65	12.8
Otter Tail River	Red River of the North	NW¼NE¼ sec.1, T.136 N., R.39 W., at outlet of Little Pine Lake, 2.2 miles northeast of Perham, Minn.	-	1933, 1964-65	8- 4-66 9-19-66	*157 *179
Toad River	Otter Tail River	S½NW¼ sec.29, T.137 N., R.38 W., at County Highway 13, 1 mile above Pine Lake, and 4½ miles northeast of Perham, Minn.	-	1964-65	8- 4-66 9-19-66	*50.9 *21.2
Whiskey Creek	Red River of the North	On line between secs.13 and 24, T.134 N., R.48 W., at County Highway 20, 1.7 miles southeast of Kent, Minn.	-	1964-65	8- 5-66 9-20-66	*44.2 1.10
Wolverton Creek	Red River of the North	On line between secs.21 and 22, T.137 N., R.48 W., ¼ mile northeast of Comstock, Minn.	-	1964-65	8- 5-66 9-20-66	*7.03 *.65

* Base flow.
≠ Operated as a continuous-record gaging station.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Red River of the North basin--continued				
South Branch Buffalo River	Buffalo River	On line between secs.23 and 26, T.137 N., R.47 W., 3 miles above mouth, at County Highway 2, 7.4 miles west of Barnsville, Minn. (Published as Deerhorn Creek in 1964-65).	-	1964-65	8- 4-66 9-20-66	*36.3 *.42
Whiskey Creek	South Branch Buffalo River	On line between secs.22 and 27, T.138 N., R.47 W., at County Highway 65, 3 miles southeast of Sabin, Minn. (Published as Stony Creek in 1964).	-	1964-65	8- 4-66 9-20-66	*.66 0
Wild Rice River	Red River of the North	On line between secs.8 and 9, T.145 N., R.39 W., at County Highway 4, 1 mile below Lambert Lake Creek and 5½ miles northwest of town of Roy Lake, Minn.	-	1964-65	8- 4-66 9-21-66	*22.0 *10.8
White Earth River	Wild Rice River	On line between secs.6 and 1, T.144 N., R.41 and 42 W., at County Highway bridge about 1 mile above Wild Rice River and 1½ miles east of Mahnomen, Minn.	-	1964-65	8- 4-66 9-21-66	*7.81 *3.46
Wild Rice River	Red River of the North	On line between secs.1 and 12, T.144 N., R.42 W., at County Highway 25, ¼ mile below White Earth River and ½ mile east of Mahnomen, Minn.	-	1964-65	8- 4-66 9-21-66	*103 *36.7
Marsh Creek	Wild Rice River	On line between secs.6 and 31; T.144 and 145 N., R.42 W., at State Highway 31, 3.6 miles west of Mahnomen, Minn.	-	1964-65	9-21-66	0
Wild Rice River Tributary	Wild Rice River	SW¼ sec.16, T.144 N., R.44 W., at footbridge in park at Heiberg, ¼ mile above mouth, and 1½ miles northwest of Twin Valley, Minn.	-	1964-65	8- 4-66 9-21-66	.59 *.07
Wild Rice River	Red River of the North	On line between sec.13, T.144 N., R.46 W., and sec.18, T.144 N., R.45 W., at bridge on County Highway 24, 0.3 mile south of County Highway 31, and 3.2 miles southeast of Ada, Minn.	-	1945-51, 1965	3-17-66	995
South Branch Wild Rice River	Wild Rice River	On line between secs.28 and 33, T.142 N., R.42 W., 3½ miles southwest of Ogema, Minn.	-	1964-65	8- 4-66 9-20-66	*2.07 *.13
South Branch Wild Rice River	Wild Rice River	On line between secs.8 and 9, T.142 N., R.45 W., at bridge on County Road 63, 5½ miles northeast of Felton, Minn.	-	1959-65	11- 4-65 3-24-66 9-20-66	7.75 522 2.85
South Branch Wild Rice River	Wild Rice River	In NW¼ sec.24, T.143 N., R.47 W., at highway bridge half a mile downstream from channel fork, 3½ miles upstream from Wild Rice River, and 3¾ miles northwest of Borup.	254	1944-49≠	9-20-66	2.6
State Ditch No. 45	Wild Rice River	On line between secs.15 and 16, T.141 N., R.46 W., at culvert on State Highway 9, 3 miles south of Felton, Minn.	-	1959-65	3-24-66 9-20-66	9.10 2.30
Sandhill River	Red River of the North	At intersection of secs.15, 16, 21, and 22, T.147 N., R.44 W., 1 mile northeast of Fertile, Minn.	-	1964-65	8- 3-66 9-20-66	*13.0 *3.02
Drainage Ditch	Sandhill River	On line between secs. 27 and 28, T.148 N., R.48 W., at bridge on county road, 1½ miles east of Climax, Minn.	-	-	4- 2-66	893
Tamarack River	Upper Red Lake	Sec.8, T.154 N., R.30 W., at Washkish, Minn.	-	1961, 1964-65	8- 2-66 9-21-66	*7.22 209
Shotley Brook	Upper Red Lake	On line between secs.11 and 14, T.153 N., R.31 W., at County Highway 23, 2 miles above mouth and 3.2 miles northeast of Shotley, Minn.	-	1964-65	8- 2-66 8- 4-66 9-21-66 9-23-66	*1.00 a*.9 *2.17 *1.80

* Base flow.
≠ Operated as a continuous-record gaging station.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Red River of the North basin--continued				
South Branch Battle River	Battle River	E½ sec.31, T.152 N., R.30 W., at State Highway 72, 3.4 miles west of Kelliher, Minn.	-	1964-65	8- 2-66 8- 4-66 9-21-66 9-23-66	*3.81 a*4.2 *3.74 *2.77
Cormorant River	Blackduck River	On line between secs.7 and 12, T.152 N., R.30 and 31 W., at State Highway 72, ¼ mile below an unnamed tributary entering from the south, and 5½ miles northwest of Shooks, Minn.	-	1964-65	8- 2-66 8- 4-66 9-21-66	*.21 a*.3 0
Blackduck River	Lower Red Lake	On line between secs.22 and 23, T.151 N., R.32 W., at County Highway 101, ¼ mile below South Cormorant River and ½ mile southwest of Quiring, Minn.	-	1964-65	8- 3-66 8- 4-66 9-21-66 9-23-66	*13.2 *7.96 0 4.41
Hay Creek	Lower Red Lake	SW¼SE¼ sec.30, T.151 N., R.32 W., at bridge on State Highway 1, 5¾ miles east of Redby, Minn.	-	-	9-22-66	*2.49
Pike Creek	Lower Red Lake	NW¼NW¼ sec.28, T.151 N., R.34 W., at culverts on State Highway 1 at Red Lake, Minn.	-	-	9-22-66	*4.82
Sandy River	Lower Red Lake	N½ sec.2, T.150 N., R.36 W., at U.S. Indian Service Highway, 2½ miles above mouth, and 9½ miles west of Red Lake, Minn.	-	1964-65	8- 3-66 8- 4-66 9-19-66 9-22-66	*12.4 13.0 *9.38 *10.2
Moose River	Thief River	NE¼SE¼ sec.36, T.158 N., R.40 W., at bridge on State Highway 89, about 3½ miles northeast of Gatzke, Minn.	-	1964-65	4- 6-66 4-14-66	1,080 588
Mud River	Thief River	At intersection of secs. 13, 14, 23, and 24, T.156 N., R.40 W., at bridge on State Highway 89, 6 miles west of Grygla, Minn.	-	-	4- 6-66 4-14-66	962 770
Red Lake River	Red River of the North	NW¼ sec.34, T.154 N., R.43 W., at bridge on U.S. Highway 59, 0.4 mile downstream from Thief River at Thief River Falls, Minn.	-	-	9-19-66	1,220
Clearwater River	Red Lake River	On line between sec.31 and 32, T.147 N., R.37 W., at bridge on County Highway 28, ½ mile south of Bagley, Minn.	-	-	9-20-66	*9.82
Clearwater River	Red Lake River	On line between secs.33 and 34, T.148 N., R.36 W., at bridge on county road, 8¾ miles northeast of Bagley, Minn.	-	-	9-20-66	*26.7
Clearwater River Tributary	Clearwater River	SW¼ sec.22, T.148 N., R.35 W., at culvert on County Highway 5, 1½ miles north of Pinewood, Minn.	-	-	9-20-66	*3.85
Clearwater River	Red Lake River	On line between sec.6, T.148 N. and secs. 31 and 32, T.149 N., R.35 W., at bridge on County Highway 24, 5½ miles northwest of Pinewood, Minn.	-	-	9-20-66	*39.7
Clearwater River	Red Lake River	On line between secs.9 and 10, T.149 N., R.36 W., at bridge on County Highway 14, 6 miles north of Leonard, Minn.	-	-	9-20-66	*49.2
Anderson Lake Outlet	Clearwater River	NW¼NW¼ sec.16, T.149 N., R.36 W., at bridge on County Highway 13, 5½ miles north of Leonard, Minn.	-	-	9-20-66	*.40
Clearwater River	Red Lake River	S½ sec.26, T.150 N., R.37 W., downstream from bridge on County Highway 11, 6½ miles northeast of Clearbrook, Minn.	-	-	9-20-66	*50.8
Clearwater River	Red Lake River	At intersection of secs.1 and 2, T.151 N., and secs.35 and 36, T.152 N., R.41 W., at bridge on County Highway 5, 6½ miles north of Oklee, Minn.	-	-	9-20-66	*55.4

* Base flow.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Red River of the North basin--continued				
Lost River	Clearwater River	On line between secs.17 and 20, T.148 N., R.38 W., at bridge on County Highway 81, 1 mile south of Weme, Minn.	-	-	9-21-66	*1.20
Lost River	Clearwater River	In N½ sec.32, T.149 N., R.38 W., at bridge on County Highway 45, ¼ mile upstream from Pine Lake and 3 miles southwest of Gonvick, Minn.	-	-	9-21-66	*1.78
Lost River	Clearwater River	Near center of sec.21, T.149 N., R.38 W., at bridge on county road, ½ mile downstream from Pine Lake and 2 miles south of Gonvick, Minn.	-	-	9-21-66	*4.93
Lost River	Clearwater River	On line between secs.34 and 35, T.150 N., R.38 W., at bridge on county road, 2 miles northeast of Gonvick, Minn.	-	-	9-21-66	*4.49
Lost River Tributary	Lost River	On line between secs.30 and 31, T.149 N., R.37 W., at bridge on County Highway 74, 1 mile west of Clearbrook, Minn.	-	-	9-21-66	*.14
Talge Lake Outlet	Lost River	On line between secs.34 and 35, T.150 N., R.38 W., at bridge on county road, 2½ miles northeast of Gonvick, Minn.	-	-	9-21-66	*.68
Lost River	Clearwater River	On line between secs.18 and 19, T.150 N., R.38 W., at bridge on county road, 3 miles northeast of Gully, Minn.	-	-	9-21-66	*5.07
Lost River	Clearwater River	In NW¼ sec.2, T.150 N., R.42 W., at bridge on U.S. Highway 59, 2 miles north of Brooks, Minn.	-	-	9-22-66	*6.76
Hill River	Lost River	On line between secs.35 and 36, T.150 N., R.41 W., at bridge on County Highway 8, 4½ miles south of Oklee, Minn.	-	-	9-21-66	*7.13
Hill River	Lost River	In S½ sec.11, T.150 N., R.42 W., at bridge on U.S. Highway 59 at Brooks, Minn.	-	-	9-21-66	*6.51
Poplar River	Lost River	Near center of sec.36, T.148 N., R.40 W., at bridge on County Highway 27, 3 miles northeast of Fosston, Minn.	-	-	9-21-66	*4.31
Poplar River	Lost River	On line between secs.14 and 23, T.148 N., R.41 W., at bridge on County Highway 41, 1½ miles east of McIntosh, Minn.	-	-	9-21-66	*3.76
Poplar River	Lost River	On line between secs.28 and 33, T.149 N., R.41 W., at bridge on County Highway 35, 4½ miles northeast of Erskine, Minn.	-	-	9-21-66	*3.93
Poplar River	Lost River	SE¼NW¼ sec.14, T.149 N., R.42 W., at bridge on U.S. Highway 59, 3¾ miles north of Erskine, Minn.	-	-	9-21-66	*3.99
Poplar River	Lost River	On line between secs.17 and 20, T.150 N., R.42 W., at County Road B3, 2½ miles above mouth, and 2¼ miles west of Brooks, Minn.	-	1950, 1964-65	8- 3-66 9-20-66 9-22-66	*3.54 *3.45 *3.72
Barnums Creek	Red Lake River	On line between secs.10 and 15, T.149 N., R.47 W., at town road about ¼ mile above U.S. Highway 75, and ¾ mile northeast of Girard, Minn.	-	1964-65	8- 3-66 9-20-66 9-22-66	*<.05 *.08 a*.04

* Base flow.
a Estimated.
< Less than.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Lake of the Woods basin						
Little Fork River	Rainy River	SE¼NE¼ sec.13, T.62 N., R.19 W., at bridge on U.S. Highway 53, 0.6 mile west of Cook, Minn.	-	1950, 1958-65	10-22-65	206
					11-17-65	37.7
					2- 7-66	4.65
					2-25-66	2.81
					4-16-66	691
					6- 1-66	31.2
					6-28-66	9.4
					7-21-66	4.80
					8-18-66	9.25
Big Fork River	Rainy River	In sec.12, T.149 N., R.47 W., at bridge on County Highway 29 at Dora Lake, Minn.	-	1965	11- 4-65	326
					5-26-66	1,130
					6-23-66	429
					7-29-66	142
					8- 2-66	80.3
					8-25-66	117
					9-14-66	146
Mississippi River main stem						
Mississippi River	Gulf of Mexico	In N½ sec.13, T.155 N., R.26 W., at dam at outlet of Pokegama Lake, 3½ miles northwest of Grand Rapids, Minn.	3,265	1929-30, 1944-45, 1948-55, 1957-65	2- 9-66	1,850
					3-30-66	2,140
					7-12-66	1,700
					9-15-66	1,860
Swan River basin						
Hay Creek	Swan River	SW¼NE¼ sec.26, T.56 N., R.22 W., at culvert on Duluth, Missabe and Iron Range railroad, 1.9 miles above Hay Lake, and 5.0 miles southeast of Pengilly, Minn.	-	1964-65≠	7-27-66	.46
Crow Wing River basin						
Crow Wing River	Mississippi River	NE¼NE¼ sec.20, T.139 N., R.33 W., at State Highway 87, at outlet of Third Crow Wing Lake and about 6½ miles east of Hubbard, Minn.	-	1964-65	8- 2-66	150
					9-15-66	*114
Straight River	Shell River	NW¼NE¼ sec.18, T.139 N., R.34 W., at State Highway 87, about ½ mile below Fish Hook River, about 2 miles above mouth and 2 miles northwest of Hubbard, Minn.	-	1964-65	8- 2-66	215
					9-15-66	*182
Long Lake Outlet	Straight River	SE¼NW¼ sec.20, T.139 N., R.34 W., at outlet of Long Lake at Hubbard, Minn.	-	1964-65	8- 2-66	48.1
					9-15-66	*22.7
Shell River	Crow Wing River	NW¼ sec.30, T.139 N., R.34 W., at town road about 0.2 mile below Straight River and 1 mile west of Hubbard, Minn.	-	1964-65	8- 2-66	376
					9-15-66	*314
Leaf River	Crow Wing River	E½ sec.20, T.135 N., R.34 W., at County Highway 22, 5½ miles north of Verndale, Minn.	-	1964-65	8- 3-66	172
					9-16-66	*93.7
Wing River	Leaf River	On line between secs.16 and 21, T.133 N., R.35 W., at bridge on U.S. Highway 210 in Hewitt, Minn.	-	-	9-16-66	*19.1
Wing River	Leaf River	N½ sec.8, T.134 N., R.34 W., at County Highway 4, 2 miles north of Verndale, Minn.	-	1964-65	8- 3-66	81.3
					9-16-66	*32.6
Redeye River	Leaf River	On line between secs.13 and 24, T.135 N., R.34 W., at County Highway 7, 1½ miles above mouth and 8½ miles north of Aldrich, Minn.	-	1964-65	8- 2-66	132
					9-15-66	*45.3
Partridge River	Crow Wing River	NW¼SW¼ sec.15, T.134 N., R.33 W., on County Highway 29, about ¾ mile above mouth, and 5½ miles northeast of Aldrich, Minn.	-	1964-65	8- 3-66	30.3
					9-16-66	*10.4

* Base flow.
≠ Operated as a crest-stage partial-record station.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Crow Wing River basin--continued						
Mosquito Creek	Crow Wing River	E½SW¼ sec.7, T.133 N., R.31 W., at U.S. Highway 210 at Motley, Minn. and about 0.2 mile above mouth.	-	1964-65	8- 3-66	10.9
Elk River basin						
Battle Brook	St. Francis River	In NW¼SW¼ sec.31, T.35 N., R.26 W., at dam at outlet of Elk Lake, 2.7 miles northwest of Zimmerman, Minn.	-	-	11-24-64	*6.57
					2-24-65	*6.92
					3-29-65	7.74
					4-12-65	28.3
					4-14-65	b95.1
					4-16-65	b27.6
					4-22-65	83.6
					6- 3-65	25.1
					7- 9-65	14.3
					8- 3-65	12.0
					8-31-65	12.9
					10-15-65	6.13
					11-16-65	17.7
					12-15-65	28.5
					1-18-66	*11.2
					2-24-66	*12.3
					4-20-66	39.0
					5-18-66	26.6
					6-17-66	*14.0
					7-14-66	31.8
					8-22-66	19.0
					9-19-66	*8.38
Mississippi River main stem						
Mississippi River	Gulf of Mexico	SE¼ sec.34, T.33 N., R.26 W., on left bank in town of Elk River, and at mile 884.6 above Ohio River.	14,500	1915-56≠	3-25-66	28,500
Crow River basin						
South Fork Crow River	Crow River	In SE¼ sec.11, T.118 N., R.25 W., at bridge in Delano, Minn.	-	1962-63	3-31-66	1,020
Bassett Creek basin						
Bassett Creek	Mississippi River	W½ sec.28, T.118 N., R.21 W., at bridge on County Highway 66 in Golden Valley, Minn. and ¼ mile west of underpass on State Highway 100.	-	1964-65	10-22-65	*20.6
					11-12-65	22.1
					2- 9-66	66.7
					4-22-66	15.2
					5-31-66	*5.33
					6-25-66	13.7
					8- 2-66	6.05
					8-20-66	4.38
					9-12-66	*4.75
North Fork Bassett Creek	Bassett Creek	NW¼ sec.21, T.118 N., R.21 W., at culvert on 34th Ave. North at Crystal, Minn., and ¾ mile above mouth.	-	1964-65	10-22-65	*1.12
					11-12-65	2.36
					4-22-66	.85
					5-31-66	a.002
					8- 2-66	0
					8-20-66	.38
					9-12-66	a*.01
South Fork Bassett Creek	Bassett Creek	Near center of W½ sec.19, T.29 N., R.24 W., at culvert on Olsen Highway, Golden Valley, Minn., and ¼ mile east of State Highway 100.	-	1964-65	10-22-65	*2.31
					11-12-65	8.49
					4-22-66	1.76
					5-31-66	*1.25
					6-29-66	1.58
					8- 1-66	4.16
					8-20-66	2.41
					9-12-66	*1.97

* Base flow.
≠ Operated as a continuous-record gaging station.
a Estimated
b Water flow into lake from St. Francis River upstream via Battle Brook.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Bassett Creek basin--continued				
Bassett Creek	Mississippi River	SE¼ sec.20, T.29 N., R.24 W., at Fruen Mill, Minneapolis, Minn., and 700 feet downstream from Glenwood Ave.	-	1952, 1954-55 1963-65	10-22-65 11-12-65 2-10-66 4-22-66 5-31-66 6-29-66 8- 2-66 8-20-66 9-12-66	*25.1 21.7 274 21.2 *8.22 18.7 8.33 10.3 *9.06
		Minnehaha Creek basin				
Minnehaha Creek	Mississippi River	E½ sec.15, T.117 N., R.22 W., at bridge on County Highway 16 at Minnetonka Mills, Minn., 2.2 miles below outlet of Minnetonka Lake.	130	1953-64≠ 1965	2-24-66	112
		Mississippi River main stem				
Mississippi River	Gulf of Mexico	At Washington Ave. and Dartmouth Ave. bridges in Minneapolis, Minn., and 9 miles above Minnesota River.	-	1912 1953-54 1957 1963-65	3-22-66 7-21-66 8-25-66	41,900 6,500 12,300
Mississippi River	Gulf of Mexico	Below lock and dam No. 1, between Minneapolis and St. Paul, Minn., 4 miles upstream from Minnesota River.	19,700	1935 1938-39 1941 1945-50 1954 1959 1961-65	9-23-66	5,040
		Minnesota River basin				
Lac qui Parle River	Minnesota River	SW¼NE¼ sec.14, T.114 N., R.45 W., at bridge on State Highway 68, 2.4 miles southeast of Canby, Minn.	-	1965	3-21-66	110
Lac qui Parle River	Minnesota River	On line between secs.21 and 22, T.115 N., R.44 W., at bridge on county highway, 6 miles northeast of Canby, Minn.	-	-	3-20-66	143
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, ½ mile above Canby Creek, and 8 miles northeast of Canby, Minn.	-	1963-65	10- 7-65 11- 6-65 3-20-66	*2.35 a*.43 132
Canby Creek	Lac qui Parle River	SE¼SE¼ sec.30, T.116 N., R.44 W., at U.S. Highway 75, 8½ miles northeast of Canby, Minn.	-	1965	10- 7-65 11- 6-65	*22.3 *6.7
Florida Creek	W. Br. Lac qui Parle River	On line between secs.8 and 17, T.116 N., R.45 W., at bridge on county highway, 12 miles southwest of Dawson, Minn.	-	-	3-20-66	.27
W. Br. Lac qui Parle River	Lac qui Parle River	Near center of sec.17, T.117 N., R.44 W., at bridge on U.S. Highway 75, 7 miles west of Dawson, Minn.	-	-	3-19-66	870
W. Br. Lac qui Parle River	Lac qui Parle River	S½NE¼ sec.21, T.117 N., R.43 W., at dam in Dawson, Minn.	-	1963-65	10- 6-65 11- 6-65 3-19-66	*55.7 *15.3 960
Chippewa River	Minnesota River	On line between secs.17 and 18, T.125 N., R.40 W., at highway bridge, 1¼ miles north of Cyrus, Minn.	-	1963-65	10- 4-65 11- 1-65	*82.7 *87.4
East Branch Chippewa River	Chippewa River	SE¼NW¼ sec.29, T.122 N., R.39 W., at county highway, 1½ miles north of Benson, Minn.	-	1964-65	10- 4-65 11- 1-65	*169 *168

* Base flow.
≠ Operated as a continuous-record gaging station.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Minnesota River basin--continued				
Chippewa River Diversion	Minnesota River	In SE¼ sec.16, T.118 N., R.14 W., at weir at bridge on county highway, 1 mile north of Watson, Minn.	-	1943-58 1960-65	3-29-66 4-19-66 5-19-66 6-18-66 9- 1-66 9-22-66	1,240 204 124 0 0 0
Chippewa River	Minnesota River	In NW¼ sec.22, T.118 N., R.41 W., below diversion channel, at culvert and spillway, at bridge on county highway, 1 mile northeast of Watson, Minn.	-	1943-58 1960-61	3-29-66 4-19-66 5-19-66	231 791 730
Yellow Medicine River	Minnesota River	On line between secs.13 and 14, T.113 N., R.44 W., at bridge on county highway, 3½ miles southeast of Porter, Minn.	-	-	3-21-66	47.9
Yellow Medicine River	Minnesota River	Near center of line between secs.1 and 2, T.113 N., R.43 W., 3 miles above So. Br. Yellow Medicine River, and 4½ miles north of Minneota, Minn.	-	1963-65	10- 7-65 11- 6-65 3-21-66 8-26-66 9-21-66	*5.13 *1.80 84.9 *1.15 *.53
Mud Creek	Yellow Medicine River	On line between secs.21 and 22, T.114 N., R.44 W., at bridge on county highway, 2 miles north of Porter, Minn.	-	-	3-21-66	3.70
Mud Creek	Yellow Medicine River	On line between secs.28 and 29, T.114 N., R.43 W., at bridge on county highway, 3½ miles north of Taunton, Minn.	-	-	3-21-66	5.32
Yellow Medicine River	Minnesota River	On line between secs.7 and 18, T.114 N., R.41 W., at bridge on County Highway 18, 4.3 miles west of Hanley Falls, Minn.	-	1965	3-22-66	185
Spring Creek	Yellow Medicine River	On line between secs.35 and 36, T.115 N., R.43 W., at bridge on county highway, 3 miles east of St. Leo, Minn.	-	-	3-22-66	66.4
Spring Creek	Yellow Medicine River	On line between secs.6 and 1, T.114 N., R.41 W. and R.42 W., at bridge on county highway at Spring Creek, Minn.	-	-	3-22-66	79.6
Chetomba Creek	Hawk Creek	In NW¼NW¼ sec.9, T.116 N., R.33 W., at bridge on county highway, 1 mile east and 2 miles south of Maynard, Minn.	200	1949-51≠	11- 4-65 9-14-66	a*.01 0
Redwood River	Minnesota River	On line between secs.25 and 36, T.110 N., R.43 W., at bridge on county highway, 1¼ miles southwest of Russell, Minn.	-	-	11- 3-65 6-21-66 7-13-66 9-14-66	*1.22 *.29 14.8 1.88
Coon Creek	Redwood River	On line between secs.23 and 24, T.110 N., R.43 W., at bridge on county highway, 1 mile west of Russell, Minn.	-	-	11- 3-65 9-14-66	a*.08 0
Beaver Creek	Minnesota River	In NE¼NW¼ sec.22, T.113 N., R.35 W., at bridge on county highway in Beaver Falls, Minn.	-	-	11- 2-65 6-20-66 7-12-66 9-14-66	*24.2 16.2 13.2 *5.96
Little Rock Creek	Minnesota River	In NW¼NW¼ sec.30, T.111 N., R.31 W., at bridge on County Highway 21, 10 miles southeast of Fairfax, Minn.	-	-	11- 2-65 6-20-66 7-12-66 9-13-66	*2.35 2.98 .74 *.07
Cottonwood River	Minnesota River	In SE¼SE¼ sec.8, T.109 N., R.37 W., 2½ miles northwest of Lamberton, Minn.	-	-	11- 3-65 6-23-66 7-21-66 9-16-66	*7.67 a.20 0 .72
Cottonwood River	Minnesota River	On line between secs.21 and 22, T.109 N., R.33 W., at bridge on county highway, ¼ mile north of Leavenworth, Minn.	-	-	11- 3-65 6-23-66 7-21-66 9-16-66	*64.4 39.6 *11.4 13.2

* Base flow.
≠ Operated as a continuous-record station.
a Estimated.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Minnesota River basin--continued				
Sleepy Eye Creek	Cottonwood River	On line between secs.8 and 9, T.109 N., R.33 W., at bridge on county highway, 1¾ miles southeast of Cobden, Minn.	-	-	11- 3-65 6-22-66 7-21-66 9-16-66	*13.4 13.1 *5.40 7.31
Little Cottonwood River	Minnesota River	Near center of sec.17, T.109 N., R.29 W., at bridge on State Highway 68, ½ mile south of Courtland, Minn.	-	-	11- 2-65 6-24-66 7-22-66 9-13-66	*50.5 20.7 *14.2 6.53
Swan Lake Outlet	Minnesota River	In NW¼SW¼ sec.5, T.109 N., R.28 W., at bridge on U.S. Highway 14, 2 miles west of Nicollet, Minn.	-	-	4-22-66	22.5
Swan Lake Outlet	Minnesota River	On line between secs.27 and 28, T.109 N., R.28 W., at culvert on county highway, 4½ miles south of Nicollet, Minn.	-	-	11- 2-65 6-24-66 7-27-66 9-13-66	*14.6 17.4 *3.47 .76
Sand Creek	Minnesota River	In NE¼NW¼ sec.19, T.114 N., R.23 W., at bridge on U.S. Highway 169 at Jordan, Minn.	-	1936 1960	3-11-66	532
		Mississippi River main stem				
Mississippi River	Gulf of Mexico	At Hastings, Minn.	37,100	1929 1931-39 1945-48 1950 1953-57 1959-65	10- 8-65 3-29-66 4-26-66 5-25-66	35,300 42,200 38,000 28,700
		St. Croix River basin				
Crooked Creek	St. Croix River	NE¼NE¼ sec.30, T.41 N., R.17 W., at bridge on State Highway 48, 2¾ miles above mouth, and 19 miles east of Hinckley, Minn.	-	-	7-19-66 8-16-66 9-13-66	12.8 23.1 12.7
Sand Creek	St. Croix River	NW¼SW¼ sec.13, T.40 N., R.18 W., at bridge on St. Croix State Park road, 2½ miles above mouth, and 13 miles southeast of Hinckley, Minn.	-	-	7-19-66 8-16-66 9-13-66	17.0 45.9 15.5
Kettle River	St. Croix River	NW¼NW¼ sec.5, T.46 N., R.20 W., at bridge on State Highway 73, 1¼ miles northwest of Kettle River, Minn.	-	-	9-30-65	249
Kettle River	St. Croix River	NW¼SE¼ sec.21, T.46 N., R.20 W., at bridge on State Highway 27, 2 miles south of Kettle River, Minn.	-	-	9-30-65	649
Kettle River	St. Croix River	NW¼NW¼ sec.16, T.45 N., R.20 W., at bridge on County Highway 46, 2½ miles west of Sturgeon Lake, Minn.	-	-	9-30-65 7-20-66 8-17-66 9-14-66	1,800 59.1 424 42.4
Moose River	Kettle River	NW¼SW¼ sec.14, T.45 N., R.20 W., at bridge on County Highway 46, in Sturgeon Lake, Minn., and 1½ miles above mouth.	-	-	9-30-65 7-20-66 8-18-66 9-14-66	237 99.7 332 50.0
Kettle River	St. Croix River	SW¼NE¼ sec.26, T.43 N., R.20 W., at bridge on State Highway 23, about 1¾ miles northeast of Sandstone, Minn.	-	-	10- 1-65 8-17-66 9-14-66	3,360 1,100 235
Kettle River	St. Croix River	NE¼NW¼ sec.26, T.41 N., R.20 W., at bridge on State Highway 48, 4½ miles east of Hinckley, Minn.	-	-	10- 1-65	3,370
Knife River	Snake River	SE¼SE¼ sec.27, T.40 N., R.24 W., at bridge on County Highway 77, 2½ miles north of Mora, Minn.	-	-	7-18-66 8-18-66 9-15-66	14.0 14.0 6.82

* Base flow.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		St. Croix River basin--continued				
Snake River	St. Croix River	SE¼SW¼ sec.14, T.39 N., R.24 W., at bridge on State Highways 23 and 65, in Mora, Minn.	-	-	7-18-66 8-18-66 9-15-66	67.5 125 76.3
Groundhouse River	Snake River	SW¼SE¼ sec.12, T.38 N., R.24 W., at bridge on county highway in Brunswick, Minn., and 2 miles above mouth.	-	-	7-18-66 8-18-66 9-15-66	10.1 10.2 6.25
St. Croix River	Mississippi River	At Prescott, Wis.	7,650	1939 1946-48 1950 1953-57 1959-65	10- 8-65 3-29-66 4-26-66 5-25-66	9,800 15,600 12,300 7,600
		Vermillion River basin				
Vermillion River	Mississippi River	SE¼SW¼ sec.33, T.115 N., R.17 W., at highway bridge in Hastings, 0.7 mile upstream from mill dam, and 3 miles upstream from Vermillion Slough.	195	1942-47≠	3-31-66	180
		Cannon River basin				
Straight River	Cannon River	In SE¼ sec.9, T.107 N., R.20 W., at bridge on West Bridge Street in Owatonna, Minn.	-	-	4-27-66 5-24-66 6-21-66 7-20-66 8-30-66 9-19-66	112 70.2 27.0 *22.0 *9.32 *8.79
Crane Creek	Straight River	In SE¼NW¼ sec.20, T.108 N., R.20 W., at culvert on service road, 1 mile northwest of Clinton Falls, Minn.	-	-	8-31-65 9-27-65 10-22-65 11-18-65 12-16-65 1-21-66 2-16-66 3- 8-66 4- 2-66 4-27-66 5-24-66 6-21-66 7-20-66 8-30-66 9-19-66	43.3 65.3 30.7 *17.1 50.0 *8.10 67.4 106 254 52.3 26.8 10.5 *2.09 *.60 *.62
Cannon River	Mississippi River	In SW¼NE¼ sec.30, T.110 N., R.20 W., at mill dam above bridge on State Highway 3, in Faribault, Minn.	-	-	8-31-65 9-27-65 10-22-65 11-18-65 12-16-65 1-21-66 2-16-66 3- 7-66 4-26-66 5-23-66 6-20-66 7-19-66 8-15-66 9-19-66	111 59.5 72.2 *29.3 153 *57.9 315 362 158 97.2 84.8 *15.9 22.0 *16.8
Prairie Creek	Cannon River	On line between secs.21 and 28, T.112 N., R.18 W., at bridge on State Highway 19, 4½ miles southwest of Cannon Falls, Minn.	-	-	5- 2-66 6- 7-66 6-29-66 8- 8-66 8-30-66 9-26-66	29.9 24.8 10.4 8.14 *7.45 *6.82
Little Cannon River	Cannon River	In SW¼ sec.25, T.112 N., R.18 W., at bridge on county highway, 2½ miles south of Cannon Falls, Minn.	-	-	5- 2-66 6- 7-66 6-29-66 8- 8-66 8-29-66 9-26-66	46.5 41.8 20.1 13.4 *11.2 11.3

* Base flow.
≠ Operated as a continuous-record gaging station.

Discharge measurements made at miscellaneous sites during water year 1966

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
		Cannon River basin--continued				
Belle Creek	Cannon River	In SE¼ sec.4, T.112 N., R.16 W., at bridge on county highway, 2 miles north of Vasa, Minn.	-	-	5- 5-66	15.6
					6- 7-66	30.8
					6-29-66	11.4
					8-29-66	*5.25
					9-29-66	6.44
		Mississippi River main stem				
Mississippi River	Gulf of Mexico	At lock and dam No. 7 near Dreshbach, Minn.	-	-	7-27-66	16,200
Mississippi River	Gulf of Mexico	At lock and dam No. 8 near Genoa, Wis.	-	-	7-28-66	17,500
		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, 3¼ miles northeast of Dundee, Minn.	-	1963-65	10-20-65	31.0
					11-10-65	*5.20
					12-14-65	27.5
					1-11-66	*7.17
					3-17-66	310
					4-20-66	88.0
					5-24-66	53.9
					6-22-66	*2.95
					8-17-66	.38
					9-16-66	*.19

* Base flow.

GPO 803-695-12

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

WATER RESOURCES DATA FOR MINNESOTA

1966

Part 2. Water-Quality Records

Prepared in cooperation with

Minnesota Department of Conservation, Division of Waters

Copies of this report may be obtained from
District Chief, Water Resources Division
U.S. Geological Survey
1002 Post Office Building
St. Paul, Minnesota 55101

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Part 2. Water-Quality Records

[Symbols after station name designate type of data: c, chemical; t, water temperature; s, sediment]

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ILLUSTRATION

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Figure 1. Map showing locations of water-quality stations in Minnesota, 1966 water year. 180

WATER RESOURCES DATA FOR MINNESOTA, 1966

Part 2. Water-Quality Records

INTRODUCTION

The quality-of-water investigations of the U.S. Geological Survey are concerned with the chemical and physical characteristics of surface and ground water supplies of the Nation. The basic records for the 1966 water year for quality of surface waters in Minnesota are given in this report. For convenience and interest, records for a few water-quality stations in bordering States are also given.

The Geological Survey began publishing annual basic records of chemical quality, water temperatures, and suspended sediment in 1941 in the water-supply paper series, "Quality of Surface Waters of the United States." The records prior to 1948 were published each year in a single volume for the entire country and in two volumes in 1948 and 1949. Beginning in 1950 the records were published in four volumes and beginning in 1959 in five volumes; each volume covered an area where boundaries coincided with those of certain natural drainage areas. The records for Minnesota are contained in Parts 4, 5, and 6. These publications, listed on page 179, are available in most major public libraries.

Beginning with the 1964 water year, water quality records will be released by the Geological Survey in annual reports on a State-boundary basis. Distribution of this report is limited, and it is primarily for local and immediate use. The records will be published in the Geological Survey water-supply papers at 5-year intervals. The first compilation will cover only the years 1964 and 1965.

COOPERATION

The records of water quality in this report were obtained under the supervision of David B. Anderson, district engineer, Surface Water Branch, U.S. Geological Survey, St. Paul, Minnesota. Most of the records for Minnesota were

obtained as a part of a cooperative program with the Minnesota Department of Conservation, Division of Waters, Sidney A. Frellsen, director. Some records for the Red River of the North, which borders the State on the west, were obtained at the request of other Federal agencies as a part of the program of the United States Department of the Interior for development of the Missouri River basin.

DEFINITION OF TERMS AND ABBREVIATIONS

Terms and abbreviations that are used in water-quality work and that are not defined in Part 1 of this report, are as follows:

Discharge, in its simplest concept, means outflow; therefore, the use of this term is not restricted as to course or location, and can be applied to describe the flow of water from a pipe or from a drainage basin. It is also correct to speak of the discharge of a canal or stream into a lake, a stream, or an ocean.

Daily mean discharge is the mean discharge for one day.

Instantaneous discharge (at time of sampling). If the discharge value at the time of sampling is reported instead of daily mean value, the heading of the discharge column will be "Discharge (cfs)."

Equivalents per million (epm) is a unit for expressing the concentration of chemical constituents in terms of the interreacting values of the electrically charged particles, or ions, in solution. One equivalent per million of a positively charged ion will react with one equivalent per million of a negatively charged ion. Parts per million is converted to equivalents per million by multiplying by the reciprocal of the combining weight of the ion. (See table, p. 175.)

Hardness of water is the property of water attributable to the presence of alkaline earths and is expressed as equivalent calcium carbonate ($CaCO_3$). Hardness is a physical-chemical characteristic, not a substance.

Conversion factors: Parts per million to equivalents per million

Ion	Multiply by	Ion	Multiply by
Aluminum (Al^{+3}).....	0.11119	Hydroxide (OH^{-1})....	0.05880
Arsenic (As^{+3}).....	.04004	Iodide (I^{-1}).....	.00788
Barium (Ba^{+2}).....	.01456	Iron (Fe^{+3}).....	.05372
Beryllium (Be^{+2})....	.22192	Lead (Pb^{+2}).....	.00965
Bicarbonate ($HCO3^{-1}$)	.01639	Lithium (Li^{-1}).....	.14411
Bromide (Br^{-1}).....	.01251	Magnesium (Mg^{+2})....	.08226
Cadmium (Cd^{+2}).....	.01779	Manganese (Mn^{+2})....	.03640
Calcium (Ca^{+2}).....	.04990	Nickel (Ni^{+2}).....	.03406
Carbonate ($CO3^{-2}$)...	.03333	Nitrate ($NO3^{-1}$).....	.01613
Chloride (Cl^{-1}).....	.02821	Phosphate ($PO4^{-3}$)...	.03159
Chromium (Cr^{+6}).....	.11539	Potassium (K^{+1}).....	.02557
Cobalt (Co^{+2}).....	.03394	Sodium (Na^{+1}).....	.04350
Copper (Cu^{+2}).....	.03148	Strontium (Sr^{+2})....	.02282
Fluoride (F^{-1}).....	.05264	Sulfate ($SO4^{-2}$).....	.02082
Hydrogen (H^{+1}).....	.99209	Zinc (Zn^{+2}).....	.03060

Parts per million (ppm) is a unit for expressing the concentration of chemical constituents by weight, usually as grams of constituents per million grams of a solution. In the laboratory the results are expressed in weights of solutes in a given volume of water. To express the results in parts per million, the data must be converted. For most waters this conversion is made by assuming that a liter of water weighs 1 kilogram; and thus milligrams per liter is equivalent to parts per million. Parts per million, for suspended sediment, is computed as 1 million times the ratio of the weight of sediment to the weight of the mixture of water and sediment.

Solute is any substance derived from the atmosphere, vegetation, soil, or rocks and dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current and is expressed in micromhos per centimeter at 25°C. Because the specific conductance is related to the number and specific chemical types of ions in solution, it can be used for approximating the concentration of dissolved solids in the water. The following

general relations are applicable:

Specific conductance x (0.65 ± 0.05)=ppm dissolved solids;

$$\frac{\text{Specific conductance}}{100} = \frac{\text{total epm}}{2}$$

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reaction with soil and is an index of sodium or alkali hazard to the soil. This ratio should be known especially for water used for irrigating farmland.

Thermograph is a thermometer for continuously recording variations of temperature automatically on a chart. The term "temperature recorder" is used to indicate the location of the thermograph in station descriptions in the table headings.

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the year after thorough mixing in the reservoir.

STATION NUMBERS

A station number has been assigned as an added means of identification for each stream location where regular measurements of streamflow and determinations of water quality have been made. The numbers have been assigned to conform with the standard downstream order of listing gaging stations. The numbering system consists of two digits followed by a hyphen and a six-digit number. The notation to the left of the hyphen identifies the Part or hydrologic region used by the Geological Survey for reporting hydrologic data. The number to the right of the hyphen represents the position of the location in the standard downstream order listing the stations within each of the parts. The assigned numbers are in numerical order but are not consecutive. They are so selected from the complete six-digit-number scale that intervening numbers

will be available for future assignments to new locations. The identification number for each station in this report is printed to the left of the station name and contains only the essential digits. For example, the number is printed as 5-3165 for a station whose complete identification number is 5-3165.00.

COLLECTION AND EXAMINATION OF SAMPLES

Water samples ordinarily were obtained at or near gaging stations because water-discharge data are essential for computation and interpretation of water-quality records. Samples generally were taken by Geological Survey personnel or by personnel of cooperating agencies. The map on page 180 shows the locations of the water-quality sampling stations.

Solutes

The methods of collecting water samples and of compositing daily samples prior to laboratory analysis are described in a manual by Rainwater and Thatcher (1960). No single method of compositing of daily samples is applicable for all water-quality stations; the method used depends on the type of water problem being studied at the station. Generally, only samples having similar dissolved-solids content, indicated by measurements of conductivity, are included in any given composite. Samples collected monthly or less frequently are analyzed individually. The laboratory results in this report are supplemented by other information in the files such as river stage, weather conditions, and, for some stations, continuous records of conductivity or frequent measurements of chloride.

Temperature

Water temperatures were measured at most of the water-quality stations. For daily stations, the water temperatures were taken at about the same time each day in order that the data would be relatively unaffected by diurnal variations in temperature. Most large swiftly flowing streams probably have a small diurnal variation in water temperature, whereas sluggish or shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. The thermometers used for determining the water temperature were accurate to plus or minus 0.5°F.

At stations where thermographs are located, the records consist of maximum and minimum temperatures for each day and the monthly averages of maximum daily and minimum daily temperatures.

REFERENCES

The following publications are available for background information on the methods for collecting, analyzing, and evaluating the chemical and physical properties of surface waters:

Hem, J. D., 1959, Study and interpretation of the chemical characteristics of natural water: U.S. Geol. Survey Water-Supply Paper 1473, 269 p.

Langbein, W. B., and Iseri, K. T., 1960, General introduction and hydrologic definitions: U.S. Geol. Survey Water-Supply Paper 1541-A, 29 p.

Rainwater, F. H., and Thatcher, L. L., 1960, Methods for collection and analysis of water samples: U.S. Geol. Survey Water-Supply Paper 1454, 301 p.

ANNUAL SERIES OF WATER-SUPPLY PAPERS FOR QUALITY OF SURFACE WATERS

The table below lists the annual Water-Supply Papers in which records on the quality of surface waters in Minnesota are given. Records for streams in the St. Lawrence River basin (northeastern Minnesota) are given in Part 4. Those for streams in the Hudson Bay, Upper Mississippi River, and Missouri River basins are given in Parts 5 and 6.

Water-supply paper numbers and parts, water years 1941-63

Water year	Parts 1-14	Parts 1-4	Parts 3-4	Parts 5-6
1941	942	--	--	--
1942	950	--	--	--
1943	970	--	--	--
1944	1022	--	--	--
1945	1030	--	--	--
1946	1050	--	--	--
1947	1102	--	--	--
1948	--	1132	--	1132
1949	--	1162	--	1162
1950	--	1186	--	1187
1951	--	1197	--	1198
1952	--	1250	--	1251
1953	--	1290	--	1291
1954	--	1350	--	1351
1955	--	1400	--	1401
1956	--	1450	--	1451
1957	--	1520	--	1521
1958	--	1571	--	1572
1959	--	--	1642	1643
1960	--	--	1742	1743
1961	--	--	1882	1883
1962	--	--	1942	1943
1963	--	--	1948	1949

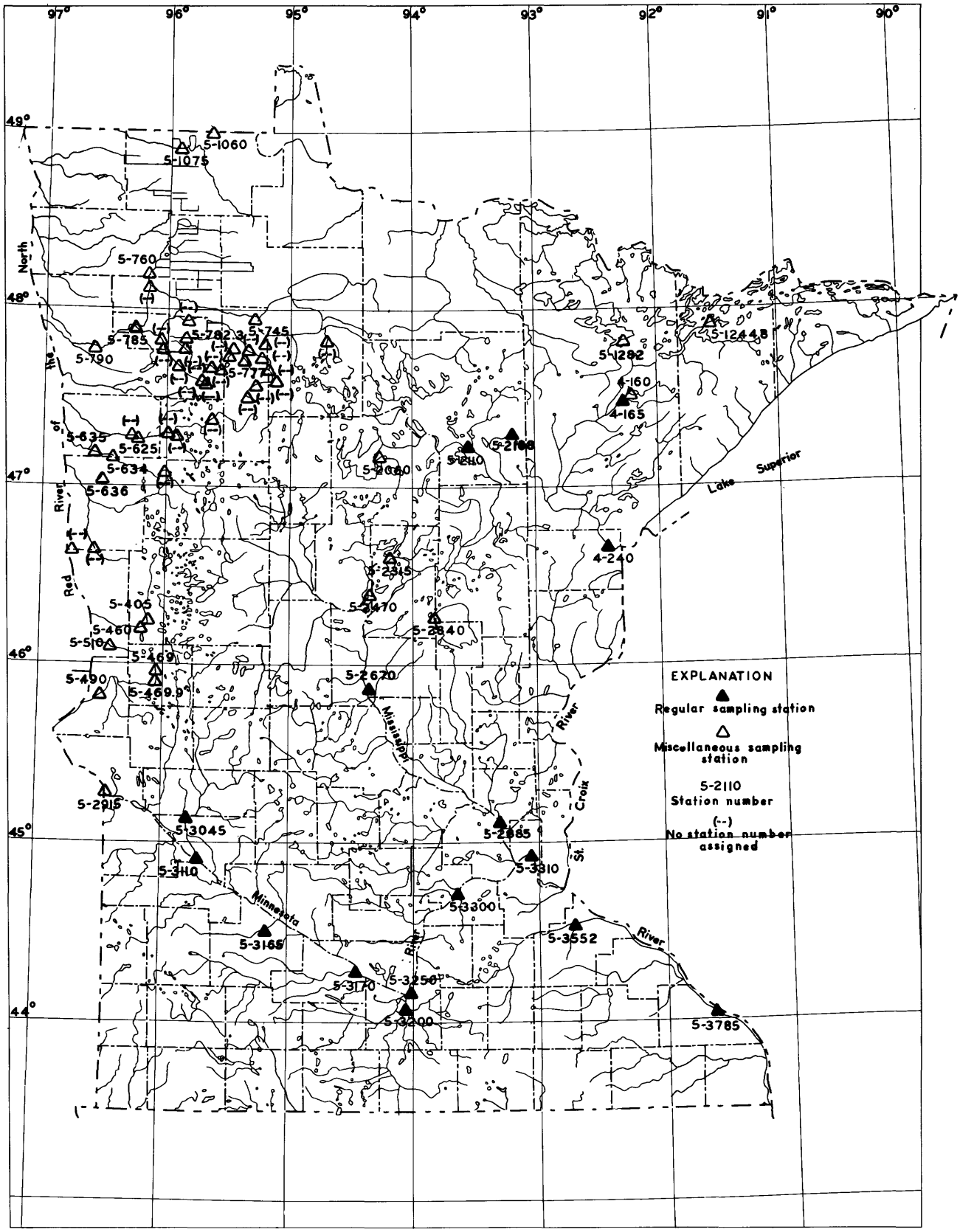

Figure 1.-- Map showing location of water-quality stations in Minnesota, 1966 water year.

WATER QUALITY RECORDS

PART 4. ST. LAWRENCE RIVER BASIN

STREAMS TRIBUTARY TO LAKE SUPERIOR

4-0160. PARTRIDGE RIVER NEAR AURORA, MINN.

LOCATION.--Lat 47°31'02", long 92°11'24", at gaging station at highway bridge, 1,000 feet downstream from Second Creek, 2.5 miles east of Aurora, St. Louis County, and 2.8 miles upstream from mouth.
DRAINAGE AREA.--156 square miles.
RECORDS AVAILABLE.--Chemical analyses: April 1956 to September 1959, July 1960 to July 1966 (discontinued).
Water temperatures: April 1956 to September 1959, July 1960 to September 1963.

Chemical analyses, in parts per million, October 1965 to July 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Nov. 23, 1965	70	12	1.0	0.52	0.15	19	16	8.6	2.5	66	0	67	6.8	0.3	2.9	0.02	203	115	61	0.4	267	7.7	100
Jan. 18, 1966	A49	14	.7	.62	.10	19	14	11	2.8	76	0	56	6.0	.3	4.6	.06	199	107	45	.5	266	7.8	70
Feb. 24.....	33	16	.1	.48	.35	24	17	12	2.8	88	0	64	11	.2	6.0	.09	221	130	58	.5	315	7.3	50
Apr. 5.....	120	11	.1	.39	.22	22	20	15	5.1	80	0	76	16	.3	8.4	.06	230	136	70	.6	356	8.0	20
May 26.....	385	14	.0	.17	.05	12	5.4	5.2	2.6	54	0	14	7.1	.1	.4	.02	115	52	7	.3	135	7.6	24
June 28.....	133	7.4	.7	.53	.21	17	11	8.7	2.8	68	0	35	6.3	.3	2.6	.08	162	88	32	.4	215	7.1	100
July 20.....	54	11	.7	.81	.25	22	16	11	3.8	102	0	50	6.9	.3	3.0	.09	207	122	38	.4	288	7.8	108

A Daily mean discharge.

STREAMS TRIBUTARY TO LAKE SUPERIOR--Continued

4-0165. ST. LOUIS RIVER NEAR AURORA, MINN.

LOCATION.--Lat 47°29'30", long 92°14'20", at gaging station at highway bridge, 0.8 mile downstream from Partridge River, and 1.5 miles south of Aurora, St. Louis County.
DRAINAGE AREA.--312 square miles.
RECORDS AVAILABLE.--Chemical analyses: April 1956 to September 1959, July 1960 to July 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to July 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
Nov. 24, 1965	132	9.9	1.2	0.54	0.08	11	7.4	4.0	1.0	42	0	28	3.3	0.2	1.7	0.03	144	58	24	0.2	132	7.6	120
Jan. 18, 1966	A89	13	.9	.70	.03	11	7.2	4.7	1.3	49	0	22	3.0	.2	2.1	.04	130	57	17	.3	134	7.1	110
Feb. 24.....	44	3.6	.0	.04	.06	7.0	1.8	1.4	.7	23	0	8.0	1.4	.1	.1	.02	52	25	6	.1	60	7.0	10
Apr. 5.....	314	11	.2	.54	.06	8.9	7.0	4.5	1.4	36	0	23	4.6	.2	2.0	.11	109	51	21	.3	126	7.4	60
May 27.....	851	3.6	.4	.47	.05	4.5	2.9	1.4	.6	18	0	8.8	1.5	.2	1.3	.07	83	23	8	.1	48	7.1	110
June 28.....	222	5.2	.8	.61	.08	6.8	3.4	1.4	.6	30	0	7.2	1.0	.2	1.2	.07	75	31	6	.1	60	6.7	104
July 21.....	93	9.3	.8	.94	.09	15	10	5.8	2.1	70	0	23	5.5	.3	1.3	.09	146	80	23	.3	175	7.6	112

A Daily mean discharge.

STREAMS TRIBUTARY TO LAKE SUPERIOR--Continued

4-0240. ST. LOUIS RIVER AT SCANLON, MINN.

LOCATION.--Lat 46°42'12", long 92°25'07", at gaging station at bridge on U.S. Highway 61 at Scanlon, Carlton County, 0.6 mile downstream from Minnesota Power and Light Co. powerplant, 3 miles upstream from Thomson Reservoir, and 3.2 miles upstream from Midway River.
DRAINAGE AREA.--3,430 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: July 1958 to September 1959, July 1960 to July 1966 (discontinued).
REMARKS.--Some spectrographic data available in district office at St. Paul, Minn.

Chemical analyses, in parts per million, October 1965 to July 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 27, 1965	A4340	8.8	1.3	0.58	0.14	18	5.4	4.2	1.6	56	0	19	7.3	0.3	1.9	0.03	139	67	21	0.2	141	7.7	150
Dec. 2.....	A2370	9.1	1.2	.58	.06	20	5.9	5.5	1.0	68	0	18	8.1	.3	1.4	.03	141	74	18	.3	163	7.8	110
Jan. 21, 1966	2290	10	1.1	.59	.11	18	5.9	5.0	.8	61	0	16	8.1	.0	1.3	.02	136	69	19	.3	152	7.3	95
Feb. 17.....	2480	10	.3	.63	.08	19	6.5	5.5	.9	65	0	20	9.3	.2	.9	.17	141	74	21	.3	165	7.1	45
Mar. 21.....	A6540	7.7	1.1	.34	.09	12	4.9	4.9	1.2	44	0	12	6.8	.2	.5	.16	103	50	14	.3	132	7.7	50
May 24.....	7270	5.9	.3	.44	.10	13	3.5	2.7	.7	42	0	14	4.3	.2	1.2	.06	113	47	13	.2	102	6.9	95
June 21.....	2260	6.9	.4	.62	.14	16	5.4	4.4	.9	49	0	16	8.3	.2	1.6	.11	130	62	22	.2	137	7.5	105
July 18.....	2850	8.2	.8	.88	.13	18	5.6	5.1	1.2	65	0	14	7.3	.2	1.3	.10	134	68	15	.3	151	7.0	112

A Daily mean discharge.

PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS

RED RIVER OF THE NORTH BASIN

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.

LOCATION.--Lat 46°51'40", long 96°47'00", at gaging station at city waterplant on 4th St. S. in Fargo, Cass County, 25 miles upstream from mouth of Sheyenne River, and at mile 453.
DRAINAGE AREA.--6,800 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1955 to September 1966.
Water temperatures: October 1955 to September 1966.
EXTREMES, 1965-66.--Dissolved solids: Maximum, 442 ppm Feb. 21 to Mar. 13; minimum, 180 ppm Mar. 20.
Hardness: Maximum, 339 ppm Feb. 21 to Mar. 13; minimum, 120 ppm Mar. 20.
Specific conductance: Maximum daily, 795 micromhos Feb. 17; minimum daily, 267 micromhos Mar. 19.
Water temperatures: Maximum, 81°F July 12, 13; minimum, 34°F on many days during January and February.
EXTREMES, 1955-66.--Dissolved solids (1955-58, 1959-66): Maximum, 650 ppm May 6-9, 1958; minimum, 174 ppm Dec. 1-2, 1955.
Hardness: Maximum, 420 ppm May 6-9, 1958; minimum, 118 ppm Apr. 6-17, 1962.
Specific conductance: Maximum daily, 960 micromhos May 6, 1958; minimum daily, 223 micromhos Apr. 11, 1962.
Water temperatures: Maximum, 82°F on several days in 1957, 1960, and 1964; minimum, 33°F on many days in 1956 and 1959.
REMARKS.--Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Daily samples for chemical analysis composited by discharge.

Chemical analyses, in parts per million, water year October 1965 to September 1966

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)			Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH
															Parts per million	Tons per acre-foot	Tons per day	Calcium, Magnesium	Noncarbonate			
Oct. 1-3, 5-31, 1965	808	--	--	--	--	20	--	244	0	132	--	--	--	--	423	0.58	923	302	102	0.5	627	7.8
Oct. 4	1340	17	0.04	56	39	19	7.1	242	0	131	5.8	0.2	0.4	0.08	414	.56	1500	299	101	.5	627	7.6
Nov. 1-29	577	--	--	--	--	17	--	258	0	100	--	--	--	--	374	.51	583	284	72	.4	588	8.0
Nov. 30	275	12	.05	53	38	18	5.7	268	0	101	3.5	.2	.1	.03	376	.51	279	289	69	.5	603	7.9
Dec. 1-31	512	--	--	--	--	18	--	272	0	92	--	--	--	--	374	.51	517	287	64	.5	596	7.8
Jan. 1-31, 1966	491	--	--	--	--	14	--	281	7	56	--	--	--	--	339	.46	449	270	28	.4	544	8.3
Feb. 1-20	514	--	--	--	--	15	--	318	0	60	--	--	--	--	357	.49	495	292	31	.4	582	8.2
Feb. 21-Mar. 13	436	--	--	--	--	20	--	316	0	112	--	--	--	--	442	.60	520	339	80	.5	688	7.8
Mar. 14-17	2575	--	--	--	--	13	--	182	0	63	--	--	--	--	260	.35	1810	184	35	.4	423	7.6
Mar. 18	6500	9.0	--	30	12	6.4	5.3	116	0	36	3.4	.1	8.0	.03	187	.25	3280	123	28	.2	282	7.3
Mar. 19, 21-23	9225	--	--	--	--	6.8	--	108	0	56	--	--	--	--	194	.26	4830	132	43	.3	307	7.3
Mar. 20	9000	8.5	.06	27	13	5.8	5.7	97	0	48	3.0	.1	5.9	.04	180	.24	4370	120	40	.2	277	7.4
Mar. 24	8700	11	--	36	16	8.3	7.0	107	0	82	3.6	.2	8.8	.04	245	.33	5760	156	68	.3	362	7.5
Mar. 25-31	5614	--	--	--	--	11	--	146	0	78	--	--	--	--	260	.35	3940	177	57	.4	406	7.3
Apr. 1-2	4625	--	--	--	--	17	--	172	0	84	--	--	--	--	293	.40	3660	199	58	.5	463	7.8

RED RIVER OF THE NORTH BASIN--Continued

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C) Parts per million	Tons per acre-foot	Tons per day	Hardness as $CaCO_3$ Calcium, Magnesium	Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH
Apr. 3-4, 1966....	3550	--	--	--	--	18	--	188	0	91	--	--	--	--	317	0.43	3040	217	63	0.5	504	8.1
Apr. 5.....	3000	14	--	47	26	19	7.6	196	0	94	10	0.3	2.8	0.08	331	.45	2680	224	63	.6	516	7.6
Apr. 6-11.....	2068	--	--	--	--	18	--	212	0	88	--	--	--	--	344	.47	1920	232	58	.5	522	7.6
Apr. 12-21.....	1498	--	--	--	--	16	--	233	0	81	--	--	--	--	340	.46	1380	245	54	.4	526	7.7
Apr. 22-25.....	2038	--	--	--	--	17	--	224	0	109	--	--	--	--	376	.51	2070	267	83	.5	569	7.7
Apr. 26-May 8.....	2657	--	--	--	--	19	--	213	0	142	--	--	--	--	414	.56	2970	287	112	.5	615	8.0
May 9-19.....	2122	--	--	--	--	19	--	224	0	124	--	--	--	--	389	.53	2230	282	98	.5	600	8.0
May 20-25.....	2270	--	--	--	--	20	--	226	4	150	--	--	--	--	422	.57	2590	301	109	.5	636	8.3
May 26.....	2230	7.1	0.04	63	31	19	6.1	228	0	130	7.0	.2	.1	.09	398	.54	2400	286	99	.5	608	8.0
May 27-June 8.....	2165	--	--	--	--	19	--	237	0	122	--	--	--	--	400	.54	2340	290	96	.5	616	7.9
June 9-15.....	1944	--	--	--	--	19	--	244	0	130	--	--	--	--	422	.57	2210	303	103	.5	636	7.8
June 16-20.....	1610	--	--	--	--	18	--	250	0	119	--	--	--	--	392	.53	1700	293	88	.5	610	7.7
June 21.....	1350	9.5	.03	54	38	19	6.7	260	0	111	6.2	.2	.1	.09	379	.52	1380	289	76	.5	596	7.8
June 22-July 7....	1488	--	--	--	--	16	--	236	0	90	--	--	--	--	350	.48	1410	258	64	.4	547	7.6
July 8-20.....	709	--	--	--	--	14	--	248	0	55	--	--	--	--	294	.40	563	236	33	.4	490	8.1
July 21-31.....	531	--	--	--	--	13	--	243	0	40	--	--	--	--	272	.37	390	220	21	.4	453	8.2
Aug. 1-9.....	1015	--	--	--	--	14	--	199	0	58	--	--	--	--	271	.37	743	194	31	.4	430	7.6
Aug. 10.....	883	18	.02	41	24	12	5.1	205	0	58	5.2	.2	.2	.07	285	.39	679	203	35	.4	433	7.9
Aug. 11-22.....	752	--	--	--	--	18	--	210	0	90	--	--	--	--	335	.46	680	230	58	.5	510	7.7
Aug. 23-28.....	1113	--	--	--	--	24	--	218	0	114	--	--	--	--	386	.52	1160	257	78	.7	578	7.8
Aug. 29-Sept. 30..	438	--	--	--	--	19	--	248	0	86	--	--	--	--	348	.47	412	257	54	.5	551	7.7
Weighted average	--	--	--	--	--	16	--	211	--	95	--	--	--	--	337	0.45	1150	243	69	0.4	522	7.7
Time-weighted average.....	1268	--	--	--	--	17	--	247	--	93	--	--	--	--	361	--	--	268	65	0.5	563	7.8
Tons per day....	--	--	--	--	--	54	--	723	--	324	--	--	--	--	--	--	--	--	--	--	--	--

RED RIVER OF THE NORTH BASIN--Continued

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

Specific conductance (micromhos at 25°C), water year October 1965 to September 1966

Day	October	November	December	January	February	March	April	May	June	July	August	September
1.....	689	583	596	598	476	732	438	549	609	569	428	638
2.....	655	577	575	541	476	706	474	618	609	526	455	641
3.....	619	578	588	637	527	672	480	656	613	533	462	629
4.....	627	575	632	637	507	--	499	660	613	533	512	629
5.....	696	580	588	510	526	687	516	655	599	512	364	610
6.....	744	582	620	539	503	693	517	640	613	505	373	589
7.....	667	585	562	525	504	676	516	636	617	508	405	555
8.....	646	587	551	562	523	677	513	618	617	502	397	553
9.....	638	589	553	675	513	675	512	595	629	495	400	556
10.....	636	585	560	527	517	664	510	595	627	494	433	542
11.....	638	584	575	630	525	669	516	587	623	484	462	534
12.....	637	582	576	506	519	675	517	582	623	477	473	524
13.....	630	580	565	527	535	632	512	585	625	507	441	521
14.....	640	570	566	568	599	628	521	600	625	479	470	511
15.....	642	573	563	540	657	506	524	564	628	465	479	508
16.....	638	639	545	531	793	357	516	572	630	464	485	502
17.....	632	505	550	516	795	411	519	602	592	451	495	490
18.....	616	600	537	564	727	282	524	612	589	452	514	485
19.....	612	585	568	494	712	267	528	593	599	454	503	482
20.....	604	595	590	536	686	277	529	614	594	445	563	478
21.....	601	584	596	527	709	301	527	632	596	451	582	472
22.....	590	584	621	547	665	302	524	644	515	446	584	465
23.....	597	570	600	537	702	315	650	640	499	445	572	461
24.....	597	534	670	548	699	362	530	635	538	440	546	460
25.....	580	601	615	564	703	389	540	617	518	441	520	462
26.....	571	601	618	524	697	403	566	608	516	468	584	452
27.....	581	601	584	533	693	404	618	583	521	450	591	447
28.....	571	586	588	528	677	413	568	614	575	447	626	447
29.....	570	591	582	503	--	410	549	606	581	431	661	444
30.....	575	603	574	489	--	397	550	603	620	434	657	442
31.....	569	--	575	494	--	406	--	611	--	446	640	--
Average	622	582	583	547	613	499	526	610	591	475	505	517

RED RIVER OF THE NORTH BASIN--Continued

5-0540. RED RIVER OF THE NORTH AT FARGO, N. DAK.--Continued

Temperature (°F) of water, water year October 1965 to September 1966

Month	Day																															Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
October	49	50	49	50	53	53	53	53	53	54	53	53	51	51	51	51	52	54	54	55	55	55	54	51	50	50	49	48	47	46	48	51
November	48	47	47	46	46	47	46	44	41	41	41	41	41	39	36	36	37	36	36	37	37	35	36	35	36	36	35	35	35	35	--	40
December	35	35	35	35	35	35	35	35	35	36	37	36	35	35	35	35	35	35	35	35	35	35	35	36	35	35	35	35	36	36	35	35
January	34	34	35	35	35	35	35	35	35	35	35	35	35	35	35	35	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
February	34	34	35	35	35	35	35	35	35	35	35	35	34	35	35	35	35	34	35	35	34	34	34	34	34	35	35	35	--	--	--	35
March	35	35	35	--	36	36	35	35	35	36	35	36	36	36	36	37	36	36	36	36	36	36	35	35	36	38	38	35	36	36	36	36
April	42	44	45	44	44	42	41	41	38	38	41	41	43	44	45	46	45	48	47	45	46	44	46	47	50	50	49	47	46	45	--	44
May	48	45	45	47	51	52	53	54	56	57	55	55	53	54	55	52	54	55	57	58	58	58	62	62	63	64	64	64	64	65	66	56
June	66	66	66	67	67	66	66	66	66	66	66	66	66	67	68	68	69	70	72	73	73	74	74	75	75	75	74	74	75	76	--	70
July	77	79	79	79	79	79	79	79	78	80	79	81	81	80	80	79	80	80	79	79	77	77	78	77	79	78	79	77	78	77	78	79
August	78	78	78	77	77	77	77	75	73	73	71	71	70	70	69	70	72	71	71	70	70	67	65	64	64	65	68	68	71	72	74	71
September	74	75	74	73	70	69	68	68	69	68	68	70	70	67	66	66	65	65	64	64	64	64	64	64	63	61	60	60	59	58	--	66

RED RIVER OF THE NORTH BASIN--Continued

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.

LOCATION.--Lat 47°56'28", long 97°02'40", at dam at Riverside Park in Grand Forks, Grand Forks County, 1,500 feet upstream from gaging station, 2 miles downstream from Red Lake River, and at mile 296.0.
DRAINAGE AREA.--30,100 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: September 1956 to September 1966.
Water temperatures: October 1956 to September 1966.
EXTREMES, 1965-66.--Dissolved solids: Maximum, 416 ppm June 19; minimum, 191 ppm Mar. 24.
Hardness: Maximum, 293 ppm June 19; minimum, 133 ppm Mar. 24.
Specific conductance: Maximum daily, 639 micromhos Nov. 25; minimum daily, 278 micromhos Mar. 26.
Water temperatures: Maximum, 80°F July 12, 13; minimum, 33°F on many days during December to March.
EXTREMES, 1956-66.--Dissolved solids (1956-58, 1959-66): Maximum, 540 ppm Jan. 21, 1962; minimum, 191 ppm Mar. 24, 1966.
Hardness: Maximum, 468 ppm Dec. 29-31, 1958; minimum, 126 ppm Apr. 12, 1965.
Specific conductance: Maximum daily, 976 micromhos Dec. 29-31, 1958; minimum daily, 278 micromhos Mar. 26, 1966.
Water temperatures: Maximum, 82°F July 19, 1964; minimum, 33°F on many days in 1958-59, 1964-66.
REMARKS.--Values reported for sodium (Na) are determined by analysis and do not include potassium (K). Daily samples for chemical analysis composited by discharge. Additional samples were collected for more comprehensive definition of water quality at this station.

Chemical analyses, in parts per million, water year October 1965 to September 1966

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C): Parts per million	Dissolved solids: Tons per acre-foot	Dissolved solids: Tons per day	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH
Oct. 1-3, 5-28, 1965	3918	--	--	--	--	16	--	233	0	104	--	--	--	--	371	0.50	3920	275	84	0.4	578	7.5
Oct. 4	3770	11	0.05	59	28	14	4.5	236	0	92	7.2	0.3	0.2	0.07	342	.47	3480	263	69	.4	541	7.5
Oct. 29	3590	13	--	66	29	16	5.9	247	0	99	9.0	.3	1.6	.07	380	.52	3680	282	79	.4	587	7.8
Oct. 30-Nov. 29	2430	--	--	--	--	17	--	262	0	95	--	--	--	--	383	.52	2510	292	77	.4	594	7.8
Nov. 30	1600	11	.13	65	31	19	5.1	277	0	87	9.6	.2	.7	.08	389	.53	1680	291	64	.5	611	7.7
Dec. 1-31	2153	--	--	--	--	15	--	216	0	62	--	--	--	--	300	.41	1740	223	46	.4	468	7.8
Jan. 1-31, 1966	1892	--	--	--	--	16	--	279	0	61	--	--	--	--	351	.48	1790	265	36	.4	553	8.1
Feb. 1-28	1812	--	--	--	--	15	--	280	0	44	--	--	--	--	317	.43	1550	255	25	.4	520	8.2
Mar. 1-15	1732	--	--	--	--	17	--	278	0	59	--	--	--	--	361	.49	1690	264	36	.5	549	7.7
Mar. 16-17	2080	--	--	--	--	16	--	268	0	66	--	--	--	--	354	.48	1990	264	44	.4	542	7.9
Mar. 18-19	5375	--	--	--	--	15	--	226	0	60	--	--	--	--	317	.43	4600	226	41	.4	491	7.8
Mar. 20	10300	10	.30	42	15	9.3	5.7	170	0	38	5.8	.0	4.8	.18	237	.32	6590	167	28	.3	368	7.2
Mar. 21-23	16400	--	--	--	--	8.6	--	129	0	44	--	--	--	--	224	.30	9920	139	33	.3	323	7.6
Mar. 24	21700	10	--	33	12	7.3	5.3	130	0	36	3.6	.2	5.7	.05	191	.26	11190	133	26	.3	306	7.2
Mar. 25-Apr. 10	37940	--	--	--	--	10	--	142	0	55	--	--	--	--	234	.32	23970	157	40	.3	365	7.4
Apr. 11-17, 19-28	15750	--	--	--	--	12	--	192	0	75	--	--	--	--	303	.41	12890	215	58	.4	465	7.4
Apr. 18	14400	6.2	--	51	22	9.5	4.8	196	0	72	7.0	.2	.3	.05	308	.42	11980	216	55	.3	451	7.7
Apr. 29-May 12	14960	--	--	--	--	14	--	215	0	100	--	--	--	--	369	.50	14900	259	83	.4	538	7.8
May 13-31	8274	--	--	--	--	15	--	235	0	104	--	--	--	--	380	.52	8490	274	81	.4	566	7.8
June 1-18	5772	--	--	--	--	16	--	247	0	100	--	--	--	--	362	.49	5640	279	76	.4	576	8.2

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C): Parts per million	Dissolved solids: Tons per acre-foot	Dissolved solids: Tons per day	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH
June 19, 1966.....	4950	10	0.09	63	33	17	4.7	253	0	110	9.0	0.3	0.2	0.07	416	0.57	5560	293	85	0.4	604	7.7
June 20-July 13...	3954	--	--	--	--	17	--	240	0	90	--	--	--	--	345	.47	3680	261	64	.5	552	8.1
July 14-31.....	2486	--	--	--	--	17	--	236	0	74	--	--	--	--	320	.44	2150	243	49	.5	514	8.1
Aug. 1-9.....	2866	--	--	--	--	18	--	224	0	78	--	--	--	--	332	.45	2570	239	55	.5	512	7.5
Aug. 10.....	3450	14	.03	50	25	17	4.5	229	0	67	7.6	.2	.2	.09	312	.42	2910	228	40	.5	502	7.9
Aug. 11-31.....	3767	--	--	--	--	15	--	212	0	78	--	--	--	--	322	.44	3280	232	58	.4	494	7.6
Sept. 1-30.....	2308	--	--	--	--	14	--	228	0	67	--	--	--	--	310	.42	1930	230	43	.4	488	7.5
Weighted average	--	--	--	--	--	13	--	199	--	74	--	--	--	--	306	0.41	5010	220	56	0.4	472	7.6
Time-weighted average.....	6050	--	--	--	--	15	--	235	--	76	--	--	--	--	334	--	--	249	56	0.4	522	7.7
Tons per day....	--	--	--	--	--	215	--	3260	--	1220	--	--	--	--	--	--	--	--	--	--	--	--

Analyses of additional samples

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Apr. 5, 1966.	54000	14	0.2	0.06	0.00	38	13	22	5.6	142	0	47	22	0.2	1.0	0.08	243	148	32	0.8	337	8.1	--
May 25.....	8130	6.5	.2	.02	.03	58	33	16	4.7	243	0	108	7.8	.2	.3	.07	375	280	81	.4	576	7.9	17
June 21.....	4530	9.1	.2	.07	.01	60	34	18	4.9	255	0	109	7.7	.2	.8	.09	390	289	80	.5	598	8.0	18
Aug. 29.....	4270	14	.2	.04	.09	57	27	19	4.4	237	0	86	8.6	.1	.3	.05	366	253	59	.5	547	7.4	22
Sept. 27.....	1780	4.3	.1	.01	.02	50	21	14	3.8	229	0	48	8.2	.1	.2	.02	281	212	24	.4	450	7.5	16

RED RIVER OF THE NORTH BASIN--Continued

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

Additional determinations, in parts per million

Date of collection	Lithium (Li)	Total chromium (Cr)	Nickel (Ni)	Copper (Cu)	Lead (Pb)	Zinc (Zn)	Cobalt (Co)	Cadmium (Cd)
Apr. 5, 1966.	0.02	0.00	0.01	0.00	0.00	0.00	0.00	--
May 25.....	.02	.00	.00	.00	.00	.00	.00	--
June 21.....	.03	.00	.01	.00	.00	.00	.00	--
Aug. 29.....	.03	.00	.01	.00	.00	.00	.00	0.00
Sept. 27.....	.03	.00	.01	.00	.00	.00	.00	.00

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

Specific conductance (micromhos at 25°C), water year October 1965 to September 1966

Day	October	November	December	January	February	March	April	May	June	July	August	September
1.....	535	581	513	559	516	554	352	509	557	537	514	522
2.....	511	575	513	570	519	552	354	513	564	528	555	527
3.....	511	565	441	585	524	--	353	514	564	522	549	524
4.....	541	569	510	563	514	--	351	520	558	539	480	524
5.....	567	569	433	573	512	--	365	526	548	553	498	510
6.....	591	567	471	569	509	544	387	541	556	553	501	515
7.....	623	564	471	563	515	556	384	564	556	553	489	508
8.....	619	549	519	566	501	561	407	562	557	525	507	510
9.....	590	557	520	561	499	549	423	572	558	539	484	496
10.....	565	556	468	556	493	535	436	568	558	548	502	496
11.....	587	560	408	554	487	528	458	562	580	533	459	494
12.....	623	551	344	542	487	536	472	562	581	535	442	490
13.....	600	543	315	550	496	535	468	567	578	496	438	478
14.....	593	555	--	544	494	513	459	557	563	502	451	476
15.....	590	581	537	537	497	516	424	556	580	511	451	472
16.....	582	595	543	534	491	530	442	557	589	511	442	468
17.....	567	602	449	545	497	548	445	551	600	515	449	462
18.....	573	579	371	563	501	557	451	549	596	519	496	456
19.....	548	588	494	542	504	457	449	558	604	520	496	457
20.....	514	580	416	556	500	368	460	568	593	545	498	460
21.....	501	611	534	538	504	337	460	571	593	530	500	457
22.....	512	615	515	534	506	312	463	571	590	496	488	446
23.....	528	597	427	538	512	309	470	573	578	517	485	448
24.....	542	597	507	527	528	306	470	569	563	519	477	440
25.....	546	639	386	524	551	301	478	578	548	519	484	438
26.....	549	615	389	527	589	278	486	579	548	509	489	443
27.....	558	633	431	520	585	300	492	582	524	497	516	438
28.....	559	629	319	534	568	307	499	594	512	483	535	440
29.....	587	605	418	514	--	323	506	591	532	476	537	425
30.....	564	611	492	520	--	338	515	586	532	480	525	426
31.....	565	--	445	526	--	337	--	580	--	492	518	--
Average	562	584	453	546	514	442	439	559	565	519	492	474

RED RIVER OF THE NORTH BASIN--Continued

5-0825. RED RIVER OF THE NORTH AT GRAND FORKS, N. DAK.--Continued

Temperature (°F) of water, water year October 1965 to September 1966

Month	Day																															Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
October	43	47	47	48	48	49	48	48	48	49	49	49	49	48	48	48	49	49	49	50	49	50	50	48	48	48	46	45	45	45	45	48
November	45	45	45	44	44	44	42	42	40	40	38	37	36	36	36	36	35	35	35	35	35	35	35	35	35	35	35	35	35	35	--	38
December	35	35	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	33	33	33	33	33	33	33	34
January	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
February	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	--	--	--	33
March	34	33	--	--	--	33	33	34	34	34	34	34	34	34	34	34	34	34	34	35	34	34	34	34	34	35	35	35	34	34	34	34
April	34	34	35	35	35	35	35	36	36	36	36	36	36	36	40	43	44	43	44	41	42	43	43	45	46	45	45	43	42	40	--	39
May	39	39	41	42	45	46	53	52	52	52	51	50	50	51	50	50	51	53	54	54	55	58	60	60	61	62	62	61	63	63	63	53
June	64	65	65	64	65	64	64	64	65	65	64	64	64	64	64	64	64	66	69	71	72	73	74	74	74	74	73	74	75	77	--	68
July	78	79	77	77	76	76	76	76	76	78	78	80	80	79	79	78	79	78	78	77	76	75	76	74	74	74	73	75	78	75	76	77
August	76	76	76	76	76	76	75	74	73	71	70	70	69	69	69	70	70	70	70	69	67	64	63	62	64	65	66	69	69	70	72	70
September	72	72	71	70	69	67	66	66	66	67	67	68	67	66	65	65	65	63	62	62	63	63	62	62	60	59	59	58	57	56	--	64

LAKE OF THE WOODS BASIN

5-1244.8. KAWISHIWI RIVER NEAR ELY, MINN.

LOCATION.--Lat 47°55'22", long 91°32'06", temperature recorder at gaging station on left bank, 2 miles upstream from South Kawishiwi River, 2.2 miles southwest of Fernberg lookout tower, and 14 miles east of Ely, Lake County.
RECORDS AVAILABLE.--Water temperatures: July to September 1966.
EXTREMES, July to September 1966.--Water temperatures: Maximum, 76°F July 24, 25.

Chemical analyses, in parts per million, July to September 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
July 21, 1966	131	4.7	0.4	0.17	0.05	2.4	1.7	1.0	0.4	13	0	4.5	0.5	0.1	0.4	0.03	40	13	2	0.1	31	6.9	36

Temperature (°F) of water, July to September 1966
(Recorder with temperature attachment, continuous ethyl alcohol-actuated thermograph)

Month	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average
July																																
Maximum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75	75	74	74	74	75	74	74	74	76	76	75	75	74	74	73	73	--
Minimum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75	74	74	74	73	73	74	73	73	73	75	74	74	74	73	73	73	--
August																																
Maximum	75	75	74	75	75	75	74	72	70	69	69	69	69	68	70	69	68	68	67	65	65	65	64	64	66	66	67	68	68	69	69	69
Minimum	73	73	73	73	73	74	72	70	69	69	68	69	68	67	68	68	68	67	65	65	65	64	64	64	64	65	66	67	68	68	68	68
September																																
Maximum	69	71	71	69	66	64	64	64	65	65	64	65	65	64	63	63	63	64	66	66	65	63	63	62	60	59	59	58	58	56	--	64
Minimum	69	68	69	66	64	64	63	63	64	64	64	64	64	63	63	63	63	63	64	64	63	62	62	60	59	58	58	58	56	55	--	63

MISSISSIPPI RIVER MAIN STEM

5-2110. MISSISSIPPI RIVER AT GRAND RAPIDS, MINN.

LOCATION.--Lat 47°13'56", long 93°31'48", at gaging station at bridge on State Highway 169 at Grand Rapids, Itasca County, 2.5 miles upstream from Prairie River, and at mile 1,182 above Ohio River.
DRAINAGE AREA.--3,370 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: April 1964 to July 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to July 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 21, 1965	2530	7.5	0.5	0.08	0.06	31	13	4.7	2.3	166	0	6.8	1.7	0.1	0.6	0.03	162	133	0	0.2	265	8.0	27
Dec. 1.....	1870	8.2	.5	.08	.09	34	16	5.4	1.9	184	0	8.8	1.4	.1	.0	.02	177	149	0	.2	292	8.1	8
Jan. 17, 1966	1850	9.6	.4	.11	.02	36	16	5.2	2.0	196	0	7.0	2.2	.1	.3	.02	190	156	0	.2	299	8.2	5
Feb. 10.....	2130	9.2	.0	.07	.09	37	16	6.5	1.9	199	0	8.0	1.9	.1	.0	.03	188	158	0	.2	316	7.8	8
Mar. 11.....	1970	8.8	.1	.12	.04	37	16	6.2	2.1	199	0	8.2	3.4	.3	.2	.06	195	160	0	.2	322	7.8	10
Apr. 1.....	2620	7.6	.1	.26	.07	34	13	4.5	2.3	172	0	6.5	2.8	.1	.0	.07	175	140	0	.2	278	8.1	20
Apr. 6.....	3250	7.2	.0	.18	.05	28	11	3.5	1.6	139	0	7.8	2.2	.1	.2	.09	144	115	1	.1	228	7.5	25
Apr. 9.....	3440	7.3	.2	.16	.02	27	11	3.0	1.4	135	0	6.0	2.0	.1	.2	.08	144	111	0	.1	219	8.0	25
Apr. 16.....	3510	6.5	.2	.16	.01	27	9.9	3.0	1.2	130	0	6.8	1.6	.1	.2	.06	140	108	1	.1	215	7.6	35
May 31.....	2730	4.9	.0	.08	.02	33	11	4.5	1.5	157	0	9.0	2.1	.2	.4	.05	177	129	0	.2	255	7.4	33
June 20.....	2390	6.1	.0	.06	.08	36	13	6.0	1.9	178	0	8.5	2.3	.1	.0	.04	182	144	0	.2	291	7.4	7
July 21.....	1800	8.2	.3	.06	.02	31	14	3.9	1.5	170	0	5.0	1.2	.1	.1	.03	161	137	0	.1	264	8.1	6

SWAN RIVER BASIN

5-2168. O'BRIEN CREEK NEAR PENGILLY, MINN.

LOCATION.--Lat 47°18'56", long 93°09'26", at gaging station, 200 feet upstream from Duluth, Missabe and Iron Range Railroad bridge, 1.0 mile upstream from mouth, and 2 miles southeast of Pengilly, Itasca County.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to June 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to June 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
Nov. 19, 1965	21.2	15	0.6	0.29	0.24	31	13	6.0	1.9	116	0	38	3.9	0.1	6.4	0.04	190	131	36	0.2	279	8.1	8
Mar. 9, 1966.	9.6	21	.0	.16	1.3	45	18	9.5	2.1	171	0	50	9.6	.1	4.4	.10	258	185	45	.3	389	7.5	5
June 22.....	13.2	8.1	.0	.10	.12	35	14	5.9	1.5	140	0	36	3.3	.2	.2	.08	199	144	29	.2	294	7.9	35

MISSISSIPPI RIVER MAIN STEM

5-2670. MISSISSIPPI RIVER NEAR ROYALTON, MINN.

LOCATION.--Lat 45°51'40", long 94°21'30", at gaging station at plant of Minnesota Power and Light Co., 4 miles northwest of Royalton, Morrison County, 4.5 miles downstream from Swan River, and at mile 956 upstream from Ohio River.
DRAINAGE AREA.--11,600 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to July 1966 (discontinued).
REMARKS.--Some spectrographic data available in district office at St. Paul, Minn.

Chemical analyses, in parts per million, October 1965 to July 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 18, 1965	10400	9.3	0.6	0.17	0.01	35	8.9	3.7	2.1	146	0	8.5	2.2	0.2	0.6	0.03	157	124	4	0.1	248	7.3	50
Nov. 24.....	5680	8.6	.4	.14	.07	38	12	4.3	1.5	174	0	9.2	2.2	.2	.3	.03	182	145	2	.2	285	7.6	25
Dec. 20.....	6680	10	.3	.10	.11	45	12	4.5	1.4	195	0	9.0	2.1	.2	.3	.03	188	163	3	.2	312	7.8	22
Jan. 17, 1966	5210	11	.4	.21	.12	29	13	4.5	1.4	150	3	9.0	2.2	.1	.4	.02	156	128	0	.2	252	8.3	30
Feb. 17.....	6110	11	.4	.14	.00	40	14	4.8	2.0	189	0	8.0	2.2	.2	1.1	.03	193	156	1	.2	308	7.7	17
Mar. 21.....	22600	6.3	.7	.30	.16	20	8.3	2.4	2.3	101	0	5.2	1.8	.1	1.6	.02	113	84	1	.1	178	7.4	17
Apr. 19.....	20200	8.0	1.4	.23	.07	28	7.6	2.6	1.0	121	0	6.8	1.2	.1	.4	.03	143	101	1	.1	207	7.7	35
May 17.....	16800	5.8	.8	.21	.09	31	7.7	2.9	1.7	130	0	8.5	3.0	.1	.4	.04	146	109	2	.1	215	7.9	45
June 15.....	5190	6.4	.2	.15	.00	36	11	3.7	1.2	162	0	6.8	2.4	.1	.2	.12	174	136	3	.1	266	7.5	25
July 13.....	6950	6.1	1.4	.11	.12	35	12	3.8	1.6	164	0	9.8	2.1	.4	.4	.04	168	136	1	.1	264	8.2	23

MISSISSIPPI RIVER MAIN STEM--Continued

5-2885. MISSISSIPPI RIVER NEAR ANOKA, MINN.

LOCATION.--Lat 45°07'36", long 93°17'48", at gaging station, 0.5 mile downstream from Coon Creek, 1.5 miles downstream from hydroelectric plant at Northern States Power Co. at Coon Rapids, 6.5 miles downstream from Anoka, Hennepin County, and at mile 864.8 upstream from Ohio River.
DRAINAGE AREA.--19,100 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: August 1960 to August 1966 (discontinued).
Water temperatures: August 1960 to September 1963.

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 6, 1965.	22000	11	0.5	0.10	0.00	39	12	4.4	2.7	156	0	19	3.8	0.3	1.6	0.04	182	145	17	0.2	295	7.3	35
Nov. 24.....	10300	8.3	.4	.13	.05	44	16	5.6	2.5	199	0	19	4.0	.2	.7	.09	207	174	11	.2	341	7.8	25
Dec. 10.....	8480	9.0	.3	.15	.06	48	18	6.0	2.3	214	0	20	4.5	.3	1.0	.04	224	194	18	.2	367	7.5	22
Jan. 12, 1966	21600	11	.4	.14	.11	37	17	5.8	2.1	186	0	21	3.4	.2	.7	.04	197	163	10	.2	328	8.0	30
Feb. 16.....	25900	8.4	.4	.13	.05	31	9.8	4.1	5.2	127	0	16	4.6	.2	8.1	.03	169	118	14	.2	260	7.4	27
Mar. 25.....	35900	8.3	.8	.27	.08	27	9.4	3.0	3.1	119	0	14	3.4	.1	2.2	.01	148	106	8	.1	228	8.0	22
Apr. 22.....	27900	7.5	.6	.21	.05	36	11	3.6	2.0	152	0	17	3.0	.1	.8	.03	184	136	11	.1	270	7.8	35
May 20.....	21700	5.5	1.2	.16	.05	41	13	4.3	2.1	165	0	23	4.0	.2	.6	.05	199	154	19	.1	306	7.4	40
June 21.....	8120	7.2	.2	.05	.00	42	15	4.6	1.5	192	0	14	3.8	.1	.1	.01	204	165	7	.2	330	7.4	20
July 18.....	8670	12	.0	.03	.04	39	14	4.6	1.5	179	0	14	3.2	.2	1.1	.06	197	156	9	.2	306	8.1	25
Aug. 9.....	7010	8.5	.1	.01	.13	35	16	5.0	1.6	181	0	13	3.5	.2	.2	.04	184	152	3	.2	300	8.2	9

MINNESOTA RIVER BASIN

5-3045. CHIPPEWA RIVER NEAR MILAN, MINN.

LOCATION.--Lat 45°06'39", long 95°47'57", at gaging station, 800 feet upstream from bridge on State Highway 40, 2.0 miles upstream from small tributary, and 5.5 miles east of Milan, Chippewa County.
DRAINAGE AREA.--1,870 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1961 to September 1966 (discontinued).

Chemical analyses, in parts per million, water year October 1965 to September 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
Oct. 6, 1965.	439	19	0.7	0.04	0.01	82	36	12	7.6	304	0	118	6.0	0.3	0.6	0.07	443	354	105	0.3	675	7.2	15
Nov. 4.....	359	16	.5	.04	.04	78	41	11	6.4	334	0	107	5.6	.3	.2	.07	460	365	91	.3	691	7.6	15
Dec. 1.....	193	20	.3	.03	.09	86	52	16	8.0	390	0	128	6.9	.3	.2	.09	534	428	108	.3	806	7.6	10
Jan. 9, 1966.	115	24	.2	.07	.27	109	59	19	8.8	463	0	161	8.9	.4	4.1	.10	651	516	136	.4	958	7.6	17
Feb. 10.....	203	14	.5	.08	.26	54	27	11	8.0	221	0	76	13	.2	2.9	.08	329	244	63	.3	514	7.5	27
Mar. 29.....	1540	14	.9	.06	.10	48	25	5.4	6.3	191	8	62	4.2	.2	3.2	.06	289	223	53	.2	444	8.5	25
Apr. 19.....	1090	5.4	.9	.07	.06	60	33	8.6	5.7	249	5	86	5.0	.2	1.1	.05	366	286	73	.2	557	8.4	25
May 19.....	929	6.6	.8	.06	.08	75	42	12	5.9	321	0	110	6.4	.3	1.1	.08	444	361	98	.3	682	8.1	20
June 18.....	303	14	.3	.04	.00	79	39	13	5.9	318	4	105	6.6	.3	1.7	.07	453	356	88	.3	682	8.3	25
July 22.....	109	22	.1	.02	.20	72	50	16	6.7	332	0	141	8.1	.4	.4	.13	503	385	113	.4	749	8.1	12
Sept. 1.....	143	21	.1	.04	.07	72	46	14	5.3	314	0	124	5.9	.3	.4	.11	468	368	110	.3	690	8.1	15

MINNESOTA RIVER BASIN--Continued

5-3110. MINNESOTA RIVER AT MONTEVIDEO, MINN.

LOCATION.--Lat 44°56'00", long 95°44'00", at gaging station at bridge on U.S. Highway 212 at Montevideo, Chippewa County, and 500 feet downstream from Chippewa River.
DRAINAGE AREA.--6,180 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: November 1961 to September 1966 (discontinued).
Water temperatures: November 1961 to September 1963.
REMARKS.--Some spectrographic data available in district office at St. Paul, Minn.

Chemical analyses, in parts per million, water year October 1965 to September 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
Oct. 7, 1965.	1770	18	0.6	0.02	0.00	89	47	26	8.4	282	0	223	7.6	0.3	3.1	0.17	579	417	186	0.6	849	7.3	10
Nov. 5.....	801	13	.4	.02	.03	94	52	26	8.0	306	0	232	8.8	.3	2.6	.16	637	448	197	.5	892	7.6	10
Dec. 7.....	435	16	.2	.03	.09	96	55	23	7.8	333	13	204	8.6	.3	1.9	.13	623	465	170	.5	896	8.4	10
Jan. 8, 1966.	387	16	.2	.04	.13	118	66	32	8.8	392	0	290	9.6	.3	2.2	.19	784	566	244	.6	1090	7.6	11
Feb. 10.....	480	9.6	.6	.09	.03	33	16	7.8	10	118	0	60	8.6	.2	10	.07	227	148	51	.3	350	7.3	50
Mar. 24.....	7660	11	.7	.08	.09	45	24	8.9	6.7	168	0	86	6.6	.4	5.6	.06	295	211	73	.3	448	7.8	22
Apr. 20.....	2730	9.6	.6	.07	.07	76	31	17	7.1	221	0	159	5.8	.2	1.0	.09	454	315	134	.4	655	7.8	12
May 20.....	2080	7.1	.6	.06	.06	98	51	25	7.4	285	0	255	9.4	.3	.7	.13	636	455	221	.5	893	7.9	20
June 18.....	720	10	.2	.02	.00	101	50	26	9.6	300	0	245	7.8	.3	.8	.08	622	457	211	.5	910	7.9	10
July 22.....	266	21	.1	.03	.05	84	59	26	8.3	298	0	247	8.8	.4	.2	.17	644	452	208	.5	904	8.0	4
Sept. 22.....	124	22	.1	.04	.17	77	49	22	6.5	276	14	174	9.8	.4	5.3	.18	545	392	142	.5	783	8.4	14

MINNESOTA RIVER BASIN--Continued

5-3165. REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

LOCATION.--Lat 44°31'25", long 95°10'20", at gaging station at highway bridge, 3 miles west of town of Redwood Falls, Redwood County, and 8.5 miles upstream from mouth.
DRAINAGE AREA.--697 square miles.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 18, 1965	202	15	0.5	0.03	0.36	149	75	122	10	294	0	585	63	0.3	1.3	0.35	A1170	682	441	2.0	1620	7.4	10
Nov. 8.....	19	8.6	.3	.03	.17	131	75	52	7.2	253	0	480	22	.3	.3	.19	974	636	428	.9	1280	7.3	5
Dec. 13.....	27	10	.2	.05	.19	157	78	49	7.2	272	0	536	15	.3	2.0	.18	A989	712	489	.8	1360	7.4	6
Jan. 10, 1966	7.4	13	.3	.05	.22	234	98	74	8.4	484	0	652	30	.4	3.5	.27	A1350	985	588	1.0	1800	7.3	6
Feb. 17.....	91	10	1.0	.16	.13	49	14	6.3	11	114	0	93	5.4	.3	11	.07	279	180	86	.2	410	7.6	50
Mar. 15.....	1350	13	.4	.09	.42	61	14	6.0	6.6	154	0	88	4.8	.3	7.6	.04	297	208	82	.2	437	7.4	27
Apr. 18.....	66	13	.5	.09	.06	155	54	36	6.9	276	0	415	15	.3	.7	.15	901	607	381	.6	1180	7.8	12
May 23.....	76	8.3	.6	.01	.10	139	76	48	7.0	232	0	538	4.8	.3	.1	.17	A936	660	470	.8	1280	7.4	7
June 20.....	13	14	.2	.02	.00	140	73	59	7.1	250	9	487	26	.4	.6	.18	A940	651	431	1.0	1310	8.5	5
July 12.....	2.3	20	.1	.04	.27	104	66	42	7.5	251	0	390	17	.4	.2	.24	833	529	323	.8	1090	7.8	5
Aug. 16.....	26	20	.0	.04	.18	68	42	22	6.3	216	0	195	9.4	.3	4.6	.18	503	344	167	.5	725	8.0	4

A Calculated from determined constituents.

GPO 803-895-14

MINNESOTA RIVER BASIN--Continued

5-3170. COTTONWOOD RIVER NEAR NEW ULM, MINN.

LOCATION.--Lat 44°17'40", long 94°26'40", at gaging station, 600 feet upstream from highway bridge, 1.8 miles south of New Ulm, Brown County, and 2 miles upstream from mouth.
DRAINAGE AREA.--1,280 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 15, 1965	138	19	0.5	0.01	0.04	133	46	25	5.4	356	0	240	14	0.4	6.7	0.11	700	522	230	0.5	1000	7.5	10
Nov. 30.....	114	14	.3	.02	.15	151	60	29	5.8	412	0	303	12	.4	11	.13	820	622	284	.5	1140	8.0	7
Dec. 14.....	219	15	.3	.05	.11	96	47	21	5.0	257	0	232	9.8	.3	9.9	.11	593	433	222	.4	855	7.6	5
Jan. 11, 1966	54	18	.3	.03	.23	116	60	28	4.6	319	0	307	12	.2	9.4	.10	745	543	281	.5	1040	8.2	5
Feb. 16.....	A680	12	.4	.26	.07	49	15	5.9	8.8	126	0	84	5.6	.3	13	.06	270	184	81	.2	407	7.3	45
Mar. 28.....	342	18	.3	.04	.17	112	45	20	4.9	294	0	230	10	.3	8.1	.10	657	464	223	.4	897	7.9	12
Apr. 20.....	486	11	.4	.03	.11	118	46	19	4.3	304	0	242	11	.4	9.4	.11	669	484	235	.4	922	7.7	10
May 24.....	221	7.6	1.0	.04	.19	119	61	24	4.7	240	0	360	10	.4	4.6	.12	774	547	350	.4	1030	7.5	3
June 23.....	78	16	.2	.03	.00	88	47	26	5.1	236	0	249	12	.3	4.1	.13	599	412	218	.6	854	7.7	10
July 22.....	38	22	.0	.03	.17	70	45	36	5.9	250	0	177	36	.5	1.5	.15	554	358	153	.8	819	7.7	3
Aug. 15.....	42	17	.0	.06	.13	64	37	25	4.9	255	0	133	16	.3	3.9	.14	441	312	103	.6	683	8.1	4

A Daily mean discharge.

MINNESOTA RIVER BASIN--Continued

5-3200. BLUE EARTH RIVER NEAR RAPIDAN, MINN.

LOCATION.--Lat 44°05'44", long 94°06'33", at gaging station, 0.2 mile downstream from powerplant of Northern States Power Co., 2 miles west of Rapidan, Blue Earth County, 3.5 miles downstream from Watonwan River, and 7.8 miles upstream from Le Sueur River.
DRAINAGE AREA.--2,430 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 15, 1965	1010	26	0.4	0.01	0.01	120	34	14	3.3	361	0	131	12	0.5	18	0.06	553	438	142	3.0	828	7.3	10
Nov. 30.....	443	18	.3	.03	.14	124	45	21	3.5	416	0	159	16	.5	14	.08	619	493	152	.4	933	7.8	5
Dec. 15.....	515	19	.3	.02	.15	74	37	18	3.0	277	0	112	13	.4	13	.05	436	337	110	.4	675	8.0	2
Jan. 12, 1966	287	25	.2	.04	.31	134	48	25	3.7	476	0	147	17	.5	16	.11	665	532	142	.5	1010	7.4	6
Feb. 15.....	979	15	.6	.09	.04	51	15	6.4	5.7	154	0	54	8.2	.4	16	.03	265	188	62	.2	402	7.6	27
Apr. 21.....	1660	19	.6	.04	.07	105	33	13	2.3	333	0	118	11	.4	20	.05	523	399	126	.3	765	7.8	12
May 25.....	793	12	.6	.01	.08	79	38	16	2.3	271	0	124	15	.5	16	.07	460	355	133	.4	703	7.6	5
June 24.....	3720	23	.0	.04	.05	63	18	6.0	2.4	193	0	53	8.0	.4	30	.05	318	230	72	.2	469	7.5	12
July 27.....	424	24	.1	.04	.19	62	31	18	3.4	241	0	100	15	.4	3.5	.09	393	281	83	.5	599	8.0	7
Aug. 18.....	409	18	.1	.02	.14	75	34	26	4.3	284	0	124	17	.4	1.4	.12	452	328	95	.6	701	8.1	3

5-3250. MINNESOTA RIVER AT MANKATO, MINN.

LOCATION.--Lat 44°10'10", long 94°00'15", at gaging station at Main Street Bridge in Mankato, Nicollet County, 1.8 miles downstream from Blue Earth River, and at mile 106.4 upstream from Mississippi River.
DRAINAGE AREA.--14,900 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966 (discontinued).
REMARKS.--Some spectrographic data available in district office at St. Paul, Minn.

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 14, 1965	3470	22	0.6	0.03	0.03	108	43	19	6.2	332	0	185	9.6	0.4	10	0.11	584	448	176	0.4	863	--	10
Nov. 29.....	1080	16	.3	.04	.19	108	49	26	6.2	359	0	192	17	.3	12	.09	624	471	176	.5	920	7.8	5
Dec. 15.....	2300	18	.3	.04	.09	84	44	19	5.5	287	0	160	12	.3	15	.08	519	389	154	.4	774	7.6	6
Jan. 12, 1966	922	20	.4	.03	.18	138	59	28	6.0	462	0	226	14	.4	9.1	.13	768	587	208	.5	1100	7.5	10
Feb. 23.....	2480	15	.7	.11	.08	74	26	13	9.0	230	0	113	9.4	.3	7.0	.08	400	291	102	.3	602	7.3	30
Mar. 28.....	8830	13	.3	.05	.08	50	29	9.2	6.3	180	0	103	4.8	.2	5.8	.06	342	243	95	.3	508	7.8	17
Apr. 21.....	7400	14	.4	.04	.06	63	46	14	5.1	273	0	133	7.2	.3	10	.06	466	348	124	.3	690	7.9	7
May 25.....	4300	8.8	.5	.02	.07	102	54	22	6.4	300	0	254	9.4	.3	2.9	.11	646	476	230	.4	910	7.7	15
June 27.....	4260	23	.0	.01	.07	58	44	12	4.0	256	0	114	9.1	.4	19	.07	445	327	117	.3	647	7.6	20
July 28.....	683	20	.0	.03	.16	84	41	24	5.7	302	0	161	15	.4	.3	.18	544	380	132	.5	785	7.7	18
Aug. 19.....	705	18	.0	.01	.23	82	44	25	5.9	282	7	165	14	.4	2.7	.14	523	387	144	.6	774	8.4	5

MINNESOTA RIVER BASIN--Continued

5-3300. MINNESOTA RIVER NEAR CARVER, MINN.

LOCATION.--Lat 44°43'28", long 93°37'58", at gaging station, 2.5 miles south of Carver, Carver County, and at mile 36 upstream from Mississippi River.
DRAINAGE AREA.--16,200 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: December 1962 to August 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 21, 1965	3350	22	0.5	0.03	0.02	108	40	18	5.2	345	3	157	13	0.4	10	0.08	562	436	148	0.4	828	8.3	10
Dec. 1.....	A2080	16	.3	.02	.25	115	48	25	5.6	407	0	171	21	.4	2.5	.09	634	484	150	.5	948	7.2	8
Dec. 16.....	3170	20	.3	.17	.07	83	38	17	5.8	284	0	128	14	.3	20	.07	478	365	132	.4	728	7.5	7
Jan. 13, 1966	1000	17	.4	.02	.25	86	54	27	5.4	305	6	198	17	.3	9.3	.10	592	438	178	.6	883	8.0	5
Mar. 22.....	10300	15	.7	.57	.05	58	23	8.0	6.3	186	0	92	6.6	.2	10	.06	354	241	88	.2	504	8.0	25
May 26.....	4960	9.8	.6	.03	.05	102	47	21	5.3	306	0	208	12	.4	6.5	.10	601	447	196	.4	862	7.8	5
June 29.....	5720	24	.1	.00	.06	52	44	11	3.6	245	0	100	9.7	.4	21	.08	430	311	110	.3	621	7.6	18
Aug. 19.....	1040	18	.1	.03	.12	68	37	26	5.5	254	7	128	21	.3	2.6	.13	458	323	103	.6	696	8.4	6

A Daily mean discharge.

5-3310. MISSISSIPPI RIVER AT ST. PAUL, MINN.

LOCATION.--Lat 44°56'40", long 93°05'20", temperature recorder at gaging station, on left bank in St. Paul, Ramsey County, 300 feet upstream from Robert Street Bridge, 6 miles downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.
DRAINAGE AREA.--36,800 square miles, approximately.
RECORDS AVAILABLE.--Water temperatures: October 1956 to September 1966.
EXTREMES, 1965-66.--Water temperatures: Maximum, 86°F July 13; minimum, freezing point on many days during December to February.
EXTREMES, 1956-66.--Water temperatures: Maximum, 87°F July 24-28, 1964; minimum, freezing point on many days during winter months.

Temperature (°F) of water, water year October 1965 to September 1966
(Recorder with temperature attachment, continuous ethyl alcohol-actuated thermograph)

Month	Day																															Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
October																																
Maximum	56	55	55	55	55	55	55	55	55	55	55	55	54	54	54	54	55	57	58	58	58	57	56	54	54	53	53	52	52	52	52	55
Minimum	55	55	54	54	55	55	55	55	55	55	55	54	53	53	54	54	54	55	57	58	57	56	54	53	52	52	52	51	50	50	49	54
November																																
Maximum	51	51	50	51	51	50	51	50	49	48	48	48	47	46	47	46	45	44	43	43	43	43	43	42	42	43	42	43	43	40	--	46
Minimum	49	49	49	49	49	48	49	48	46	46	45	45	44	40	40	39	39	36	35	36	36	35	37	35	36	35	34	33	33	33	--	41
December																																
Maximum	40	39	38	39	38	38	38	37	38	39	37	36	34	35	37	36	35	36	38	36	33	34	34	33	36	38	36	37	36	36	36	37
Minimum	32	32	32	32	34	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
January																																
Maximum	38	37	37	37	38	40	39	39	38	36	36	37	36	35	35	35	37	37	36	37	37	37	36	39	39	39	37	38	38	38	40	37
Minimum	34	32	32	32	32	33	32	33	32	32	32	32	32	32	32	32	32	32	32	32	32	33	32	33	35	35	32	33	36	36	37	33
February																																
Maximum	40	39	39	40	39	40	41	38	36	34	32	32	35	33	32	32	32	32	34	35	35	36	37	38	39	40	39	38	--	--	--	36
Minimum	34	34	34	36	34	37	36	34	33	32	32	32	32	32	32	32	32	32	32	33	33	35	36	34	38	38	37	37	--	--	--	34
March																																
Maximum	38	39	39	37	38	38	36	37	37	37	36	39	38	38	38	37	37	36	36	36	36	36	36	36	35	35	35	36	37	38	39	37
Minimum	36	37	37	36	36	35	35	35	36	36	35	36	36	35	35	37	36	36	36	36	36	36	36	35	35	35	35	35	36	37	38	36
April																																
Maximum	40	41	41	41	41	41	41	42	41	41	41	42	42	43	44	45	46	46	47	48	48	48	48	49	50	52	52	52	52	51	--	45
Minimum	39	40	41	41	41	41	41	41	41	41	41	41	42	42	43	44	45	46	46	47	48	48	48	48	49	50	52	52	51	51	--	45
May																																
Maximum	51	50	51	51	51	53	54	54	54	53	54	54	53	53	53	54	56	57	56	57	59	61	61	63	64	66	67	67	67	67	67	57
Minimum	50	50	50	50	50	51	52	53	53	53	53	53	53	52	52	52	54	55	54	54	55	57	58	59	59	60	63	64	64	64	64	55
June																																
Maximum	69	69	69	70	69	69	69	69	68	68	70	69	70	70	70	71	71	73	73	73	75	77	77	78	79	78	78	77	79	81	--	73
Minimum	64	65	64	66	64	65	65	66	66	65	66	66	67	67	67	67	67	69	69	69	70	72	71	73	75	74	74	76	76	79	--	69
July																																
Maximum	82	83	83	84	84	83	82	83	83	84	84	85	86	83	81	80	81	83	83	82	81	81	81	81	83	85	85	85	83	82	82	83
Minimum	79	80	81	80	79	80	80	80	80	79	81	81	81	80	79	79	79	79	79	78	78	77	77	76	77	78	79	79	79	79	79	79

MISSISSIPPI RIVER MAIN STEM--Continued

5-3310. MISSISSIPPI RIVER AT ST. PAUL, MINN.--Continued

Temperature (°F) of water, water year October 1965 to September 1966--Continued
(Recorder with temperature attachment, continuous ethyl alcohol-actuated thermograph)

Month	Day																															Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
August																																
Maximum	81	80	80	80	80	80	80	78	78	75	74	74	73	72	71	70	79	73	72	72	69	68	65	65	65	66	68	69	71	72	73	73
Minimum	78	76	76	76	77	77	77	76	75	74	72	72	72	71	70	70	70	72	72	69	67	65	64	65	65	65	66	67	69	70	70	71
September																																
Maximum	73	73	73	72	71	69	68	69	69	69	70	71	71	71	70	69	68	68	67	67	67	67	67	67	66	64	63	63	63	63	--	68
Minimum	72	72	72	71	69	68	67	68	68	68	69	69	70	69	69	68	67	67	67	67	67	64	66	66	64	63	63	62	62	62	--	67

CANNON RIVER BASIN

5-3552. CANNON RIVER AT WELCH, MINN.

LOCATION.--Lat 44°33'50", long 92°43'55", at gaging station, 0.3 mile downstream from highway bridge at Welch, Goodhue County, and 1.8 miles upstream from Belle Creek.
DRAINAGE AREA.--1,320 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966 (discontinued).

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
Oct. 29, 1965	171	17	0.4	0.02	0.01	80	25	6.9	3.7	304	0	44	11	0.3	9.0	0.03	366	301	52	0.2	569	7.4	10
Nov. 29.....	177	13	.9	.02	.01	84	28	9.5	3.5	325	0	51	14	.2	7.2	.03	389	323	56	.2	623	7.4	5
Dec. 20.....	164	12	.3	.01	.08	80	28	8.6	3.3	316	0	46	12	.3	8.7	.03	364	314	53	.2	599	8.1	18
Jan. 24, 1966	82	14	.2	.02	.18	48	30	8.2	3.0	229	2	44	10	.2	8.0	.01	286	242	51	.2	480	8.3	8
Mar. 4.....	8470	10	.7	.14	.09	51	14	6.0	6.4	186	0	27	9.8	.2	13	.03	253	186	33	.2	397	7.6	33
May 5.....	746	3.7	.6	.06	.07	56	24	6.6	3.5	228	0	46	11	.2	5.2	.05	292	237	50	.2	465	7.6	15
June 7.....	324	3.4	.6	.02	.06	61	26	7.7	3.7	253	0	46	11	.2	3.7	.03	302	257	49	.2	504	8.1	10
Aug. 1.....	81	11	.1	.01	.14	53	28	5.7	2.6	254	0	34	8.2	.2	.6	.05	275	246	38	.2	477	8.1	3

MISSISSIPPI RIVER MAIN STEM

5-3785. MISSISSIPPI RIVER AT WINONA, MINN.

LOCATION.--Lat 44°03'20", long 91°38'15", at gaging station at Winona pumping station in Winona, Winona County, 9.5 miles upstream from Trempealeau River, and at mile 725.7 upstream from Ohio River.
DRAINAGE AREA.--59,200 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: October 1963 to August 1966 (discontinued).
REMARKS.--Some spectrographic data available in district office at St. Paul, Minn.

Chemical analyses, in parts per million, October 1965 to August 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
Oct. 1, 1965.	35400	3.2	0.2	0.05	0.05	39	14	8.2	2.3	168	0	23	7.9	0.2	1.2	0.11	187	155	17	0.3	330	7.4	20
Nov. 4.....	25100	11	.6	.15	.04	42	14	6.6	2.3	166	0	31	6.2	.2	2.0	.04	222	163	27	.2	334	7.4	35
Nov. 24.....	25900	10	.7	.16	.07	40	14	6.9	2.1	162	0	30	6.2	.3	2.2	.04	218	158	25	.2	330	7.4	35
Dec. 13.....	33400	9.8	.3	.18	.14	41	14	7.1	2.1	166	0	27	6.2	.3	1.7	.04	210	160	24	.2	334	7.6	30
Jan. 18, 1966	23600	13	.4	.21	.27	39	16	7.7	2.3	173	0	31	3.8	.3	1.7	.04	212	164	22	.3	344	8.1	32
Feb. 19.....	11800	12	.5	.17	.13	39	14	9.9	3.2	164	0	24	9.4	.2	4.8	.04	215	155	21	.3	328	8.2	25
Mar. 26.....	96500	11	1.1	.18	.13	31	10	4.6	3.5	127	0	21	4.8	.2	3.4	.02	175	120	16	.2	268	7.4	27
May 4.....	63800	6.3	.9	.15	.08	38	12	5.3	2.0	143	0	31	4.0	.1	2.1	.02	201	143	26	.2	298	7.6	27
May 26.....	45300	4.1	.7	.07	.06	38	15	6.4	2.1	155	0	37	5.8	.2	1.1	.04	204	156	29	.2	325	7.6	30
June 24.....	19200	5.6	.0	.06	.07	35	14	6.8	2.0	148	0	29	6.8	.2	2.0	.04	191	145	24	.2	305	7.4	29
Aug. 10.....	13600	6.6	.1	.03	.09	38	16	12	2.4	177	0	29	11	.3	1.1	.07	215	161	16	.4	363	7.8	7

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA

Chemical analyses, in parts per million, water year October 1965 to September 1966

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS																							
RED RIVER OF THE NORTH BASIN																							
5-0405. PELICAN RIVER NEAR FERGUS FALLS, MINN. (462010N 0960700)																							
Sept. 19, 1966.....	A86	20	0.1	0.03	0.04	35	32	9.5	5.5	262	0	22	7.2	0.2	0.2	0.02	264	221	6	0.3	447	7.7	12
5-0460. OTTER TAIL RIVER BELOW ORWELL DAM, NEAR FERGUS FALLS, MINN. (461235N 0961105)																							
Oct. 29, 1965	527	13	0.5	0.05	0.00	34	28	7.1	4.1	239	0	21	4.2	0.2	0.1	0.05	239	202	5	0.2	398	8.2	8
June 21, 1966	1040	9.5	.0	.01	.05	35	27	6.5	3.4	234	0	14	3.4	.2	3.5	.05	250	198	6	.2	389	7.6	5
5-0469. MUSTINKA RIVER NEAR ELBOW LAKE, MINN. (455410N 0960225)																							
Nov. 2, 1965.	35	11	0.4	0.03	0.12	100	76	24	11	307	0	336	10	0.2	0.8	0.11	793	564	312	0.4	1070	7.8	20
5-0469.9. MUSTINKA RIVER NORTHEAST OF HERMAN, MINN. (455205N 0960525)																							
Nov. 2, 1965.	36	11	0.3	0.06	0.13	114	76	26	12	329	0	358	10	0.3	0.3	0.14	831	599	329	0.5	1120	7.2	20
5-0490. MUSTINKA RIVER ABOVE WHEATON, MINN. (454915N 0962925)																							
Nov. 2, 1965.	48	11	0.6	0.03	0.07	119	79	29	12	325	0	383	11	0.3	0.2	0.12	880	622	355	0.5	1170	7.8	20
5-0500. BOIS DE SIOUX RIVER NEAR WHITE ROCK, S. DAK. (455145N 0963425)																							
Oct. 5, 1965.	24.5	21	0.4	0.03	0.04	82	52	43	13	224	0	314	13	0.4	2.1	0.20	672	420	236	0.9	941	7.4	25
Jan. 5, 1966.	19.5	6.8	.3	.03	.12	117	98	72	18	278	12	568	21	.3	1.0	.29	B1050	695	447	1.2	1440	8.4	30
Apr. 25.....	872	7.7	--	.07	.09	78	47	26	7.9	254	0	216	6.8	.3	1.4	.10	563	387	179	.6	803	8.0	35
June 16.....	467	10	.4	.06	.01	103	62	46	8.4	314	0	323	11	.3	1.1	.21	790	514	256	.9	1090	7.8	30

A Daily mean discharge.
B Calculated from determined constituents.

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
5-0510. RABBIT RIVER AT CAMPBELL, MINN. (460540N 0962440)																							
Nov. 2, 1965.	13	8.6	0.5	0.03	0.09	134	96	52	13	334	0	535	8.8	0.3	0.4	0.12	B1010	728	454	0.8	1400	7.7	25
WOLVERTON CREEK NEAR COMSTOCK, MINN. (463955N 0964420)																							
Sept. 20, 1966.....	0.6	25	0.4	0.08	0.22	82	40	35	9.8	330	6	152	9.2	0.2	0.9	0.04	542	369	88	0.8	802	8.3	31
SOUTH BRANCH BUFFALO RIVER NEAR BARNESVILLE, MINN. (463929N 0963457)																							
Sept. 20, 1966.....	0.4	19	0.2	0.02	0.06	104	64	22	6.2	356	13	239	3.2	0.2	0.2	0.10	683	525	211	0.4	974	8.3	6
WILD RICE RIVER NEAR ROY LAKE, MINN. (472320N 0953815)																							
Sept. 21, 1966.....	11	16	0.1	0.08	0.08	55	22	5.6	2.0	280	0	8.2	1.6	0.2	0.8	0.00	259	228	0	0.2	427	7.8	18
WHITE EARTH RIVER AT MAHNOMEN, MINN. (471855N 0955600)																							
Sept. 21, 1966.....	3.5	14	0.2	0.04	0.05	45	25	6.8	3.1	266	0	14	2.0	0.2	0.2	0.01	243	216	0	0.2	423	8.1	8
WILD RICE RIVER AT MAHNOMEN, MINN. (471840N 0955715)																							
Sept. 21, 1966.....	37	12	0.2	0.04	0.04	48	24	7.3	2.0	255	6	15	1.9	0.2	0.3	0.03	249	220	0	0.2	426	8.4	17

B Calculated from determined constituents.

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
5-0625. WILD RICE RIVER AT TWIN VALLEY, MINN. (471600N 0961440)																							
Sept. 21, 1966.....	48.5	12	0.2	0.03	0.10	50	25	8.5	2.2	274	0	18	2.4	0.2	0.3	0.03	265	227	2	0.2	437	8.0	12
WILD RICE TRIBUTARY NEAR TWIN VALLEY, MINN. (471655N 0961630)																							
Sept. 21, 1966.....	0.1	22	0.2	0.04	0.06	89	36	40	6.5	368	0	144	8.1	0.3	0.2	0.11	534	368	66	0.9	812	8.0	15
SOUTH BRANCH WILD RICE RIVER NEAR OGEMA, MINN. (470437N 0960027)																							
Sept. 20, 1966.....	0.1	23	0.2	0.04	0.00	57	37	15	3.9	360	0	32	2.4	0.2	0.9	0.05	347	296	0	0.4	579	8.0	12
5-0634. SOUTH BRANCH WILD RICE RIVER NEAR FELTON, MINN. (4707 N 09625)																							
Sept. 20, 1966.....	2.8	17	0.2	0.05	0.11	78	39	17	4.6	349	11	75	5.7	0.2	0.3	0.05	424	356	51	0.4	686	8.3	13
5-0635. SOUTH BRANCH WILD RICE RIVER NEAR BORUP, MINN. (471140N 0963440)																							
Sept. 20, 1966.....	2.6	14	0.2	0.02	0.02	79	39	17	5.4	367	0	84	6.9	0.2	0.3	0.06	430	356	55	0.4	693	8.0	14
5-0638. STATE DITCH NO. 45 NEAR FELTON, MINN. (4702. N 09630)																							
Sept. 20, 1966.....	2.3	23	0.1	0.04	0.07	69	27	5.8	3.3	342	0	19	1.9	0.2	3.4	0.00	318	282	1	0.1	539	8.2	4

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
BLACKDUCK RIVER NEAR QUIRING, MINN. (475230N 0944315)																							
Aug. 4, 1966.	8.0	18	0.2	0.04	0.04	64	24	7.2	2.4	317	0	10	2.5	0.2	0.2	0.06	289	258	0	0.2	479	8.0	25
SANDY RIVER NEAR RED LAKE, MINN. (475040N 0951340)																							
Aug. 4, 1966.	13.0	19	0.2	0.04	0.00	67	24	4.8	2.0	328	0	8.2	1.1	0.3	0.2	0.06	293	268	0	0.1	482	7.9	25
5-0745. RED LAKE RIVER NEAR RED LAKE, MINN. (4757 N 09517)																							
Apr. 29, 1966	592	9.0	0.1	0.04	0.01	38	14	3.0	2.1	175	0	13	2.0	0.2	0.2	0.07	195	153	9	0.1	295	8.0	20
Sept. 18.....	1100	1.0	.1	.02	.06	37	15	3.3	2.7	182	0	8.2	2.4	.1	1.6	.01	181	156	6	.1	296	8.0	7
5-0760. THIEF RIVER NEAR THIEF RIVER FALLS, MINN. (4811 N 09610)																							
June 7, 1966.	808	3.4	0.0	0.05	0.06	72	24	3.1	2.6	210	0	109	1.6	0.2	0.3	0.05	355	277	105	0.8	515	7.5	43
RED LAKE RIVER BELOW THIEF RIVER, AT THIEF RIVER FALLS, MINN. (480709N 961023)																							
Sept. 19, 1966.....	1220	3.1	0.2	0.03	0.03	42	16	3.2	2.3	184	0	26	1.6	0.2	0.3	0.01	206	172	21	0.1	324	7.9	12
CLEARWATER RIVER AT SOUTH EDGE OF BAGLEY, MINN. (473040N 0952410)																							
Sept. 20, 1966.....	9.8	19	0.2	0.05	0.19	61	24	4.5	2.6	314	0	6.8	2.0	0.2	2.0	0.04	280	251	0	0.1	464	8.1	15

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
CLEARWATER RIVER NEAR BAGLEY, MINN. (473510N 0951600)																							
Sept. 20, 1966.....	27	18				72	23	6.9	3.0	335	0	6.5	4.8	0.2	0.2	0.02	306	274	0	0.2	513	7.7	25
CLEARWATER RIVER TRIBUTARY NEAR PINEWOOD, MINN. (473710N 0950700)																							
Sept. 20, 1966.....	3.8	21	0.2	0.05	0.05	45	18	2.6	2.0	227	0	6.5	1.0	0.1	0.8	0.04	223	186	0	0.1	349	7.7	20
CLEARWATER RIVER NEAR PINEWOOD, MINN. (474020N 0951030)																							
Sept. 20, 1966.....	40	19	0.2	0.04	0.00	26	24	5.1	2.2	204	0	6.5	4.0	0.1	0.1	0.03	202	165	0	0.2	322	8.1	
CLEARWATER RIVER NEAR LEONARD, MINN. (474410N 0951530)																							
Sept. 21, 1966.....	49	17	0.2	0.04	0.02	52	21	4.5	2.2	248	6	8.2	2.5	0.1	0.1	0.04	240	215	1	0.1	399	8.3	15
CLEARWATER RIVER NEAR CLEARBROOK, MINN. (474630N 0952120)																							
Sept. 20, 1966.....	51	17	0.2	0.03	0.00	50	22	4.6	2.2	263	0	8.8	2.3	0.1	0.1	0.04	240	217	1	0.1	406	7.9	20
5-0777. RUFFY BROOK NEAR GONVICK, MINN. (474450N 0952445)																							
Aug. 5, 1966.	2.1	23	0.2	0.02	0.09	48	46	9.0	3.4	380	0	15	2.4	0.3	0.1	0.09	340	308	0	0.2	559	8.1	10

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
CLEARWATER RIVER NEAR OKLEE, MINN. (475600N 0955140)																							
Sept. 20, 1966.....	55	14				61	20	5.4	3.2	262	6	18	2.5	0.2	1.1	0.03	270	234	9	0.2	439	8.3	15
LOST RIVER AT INLET OF PINE LAKE, NEAR GONVICK, MINN. (474110N 0953300)																							
Sept. 21, 1966.....	1.8	25	0.3	0.03	0.10	73	37	12	4.2	408	0	25	1.8	0.2	0.2	0.08	385	334	0	0.3	623	7.9	25
LOST RIVER NEAR GONVICK, MINN. (474600N 0952940)																							
Sept. 21, 1966.....	4.5	22	0.3	0.06	0.03	34	24	7.4	4.9	201	0	32	2.5	0.2	1.8	0.07	242	185	20	0.2	376	7.8	25
TALGE LAKE OUTLET NEAR GONVICK, MINN. (474620N 0952940)																							
Sept. 21, 1966.....	0.7	21	0.3	0.05	0.08	80	30	11	4.7	363	8	29	7.8	0.3	0.7	0.07	388	324	13	0.3	599	8.3	42
5-0782.3. LOST RIVER AT OKLEE, MINN. (475035N 0955130)																							
Sept. 20, 1966.....	A10	22	0.2	0.02	0.01	63	28	9.2	3.8	286	0	56	3.0	0.2	0.2	0.07	339	272	37	0.2	529	7.9	20
HILL RIVER NEAR FOSSTON, MINN. (473840N 0953820)																							
Sept. 21, 1966.....	C0.05	30	0.4	0.06	0.04	42	29	2.8	5.3	254	0	16	2.9	0.2	4.1	0.08	291	226	18	0.1	419	7.6	35

A Daily mean discharge.
C Estimated.

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
HILL RIVER NEAR OKLEE, MINN. (474630N 0955150)																							
Sept. 21, 1966.....	7.1	24	0.2	0.01	0.02	77	27	7.1	3.0	330	0	42	1.7	0.2	2.0	0.06	345	302	31	0.2	559	8.0	15
POPLAR RIVER NEAR FOSSTON, MINN. (473530N 0954130)																							
Sept. 21, 1966.....	4.3	25				49	24	4.1	5.1	248	0	23	2.8	0.2	3.4	0.07	286	223	20	0.1	419	8.0	35
POPLAR RIVER NEAR MC INTOSH, MINN. (473540N 0954130)																							
Sept. 21, 1966.....	3.8	24				71	37	9.1	3.6	398	0	17	2.2	0.2	0.2	0.06	373	328	1	0.2	606	7.9	20
POPLAR RIVER NEAR ERSKINE, MINN. (474120N 0955520)																							
Sept. 21, 1966.....	3.9	14	0.3	0.04	0.00	66	28	13	3.8	320	0	34	9.4	0.3	0.2	0.08	343	282	20	0.3	553	7.9	25
POPLAR RIVER NEAR BROOKS, MINN. (474820N 0960330)																							
Sept. 22, 1966.....	3.7	14	0.4	0.10	0.02	68	32	14	4.0	338	0	33	14	0.3	0.3	0.08	370	300	23	0.4	588	7.7	35
5-0785. CLEARWATER RIVER AT RED LAKE FALLS, MINN. (475315N 0961625)																							
June 7, 1966.	382	12	0.0	0.03	0.05	69	29	7.3	3.4	301	0	52	3.4	0.2	0.2	0.06	353	290	43	0.2	539	7.8	26

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
																		Calcium, magnesium	Noncarbonate				
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
RED RIVER OF THE NORTH BASIN--Continued																							
5-0790. RED LAKE RIVER AT CROOKSTON, MINN. (474632N 0963633)																							
June 30, 1966	A1590	8.5	0.5	0.05	0.05	52	22	5.0	3.1	210	0	45	2.7	0.3	1.5	0.05	276	218	46	0.1	416	7.8	12
5-1060. SPRAGUE CREEK NEAR SPRAGUE, MANITOBA (485933N 0953943)																							
Sept. 20, 1966.....	5.2	19	0.4	0.08	0.10	53	18	4.1	1.2	248	0	9.2	1.8	0.3	0.8	0.01	251	208	4	0.1	375	8.1	55
5-1075. ROSEAU RIVER AT ROSS, MINN. (485437N 0955518)																							
Sept. 20, 1966.....	39.6	15	0.3	0.03	0.07	53	20	7.7	1.2	256	0	13	5.7	0.3	0.6	0.01	266	216	6	0.2	414	7.9	37
LAKE OF THE WOODS BASIN																							
5-1282. VERMILION LAKE NEAR SOUDAN, MINN. (474952N 0921620)																							
May 26, 1966.	(D)	7.1	0.2	0.23	0.06	7.9	2.0	1.7	0.7	25	0	9.2	1.9	0.1	0.6	0.04	79	28	7	0.1	62	7.1	50
LEECH LAKE RIVER BASIN																							
5-2065. LEECH LAKE RIVER AT FEDERAL DAM, MINN. (471445N 0941312)																							
May 25, 1966.	A832	8.0	0.0	0.04	0.00	31	12	5.0	1.5	161	0	3.5	1.4	0.1	0.5	0.07	155	128	0	0.2	257	7.6	10

A Daily mean discharge.
D Lake station, contents not available.

MISCELLANEOUS ANALYSES OF LAKES AND STREAMS IN MINNESOTA--Continued

Chemical analyses, in parts per million, water year October 1965 to September 1966--Continued

Date of collection	Discharge (cfs)	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Sodium adsorption ratio	Specific conductance (micromhos at 25°C)	pH	Color
PART 5. HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS--Continued																							
PINE RIVER BASIN																							
5-2315. PELICAN LAKE NEAR PEQUOT LAKES, MINN. (4637 N 09411)																							
Nov. 1, 1965.	(D)	1.5	0.4	0.02	0.00	26	11	4.8	2.0	145	0	3.0	1.5	0.1	0.0	0.01	130	109	0	0.2	226	8.2	3
May 25, 1966.	(D)	1.0	.0	.04	.00	29	9.6	4.3	1.5	145	0	2.5	1.8	.1	.0	.08	127	112	0	.2	229	7.8	5
CROW WING RIVER BASIN																							
5-2470. GULL RIVER AT GULL LAKE DAM, NEAR BRAINERD, MINN. (462440N 0942112)																							
Nov. 1, 1965.	A182	7.0	0.4	0.01	0.00	30	8.8	3.5	1.4	136	0	4.8	1.2	0.1	0.2	0.02	136	111	0	0.1	220	8.0	7
RUM RIVER BASIN																							
5-2840. MILLE LACS LAKE AT GARRISON, MINN. (461805N 0934905)																							
Oct. 19, 1965	(D)	7.7	0.4	0.06	0.02	26	8.5	3.7	2.6	121	0	8.5	2.0	0.1	0.4	0.03	132	100	0	0.2	207	7.9	9
Nov. 1.....	(D)	11	.4	.04	.05	26	9.5	5.0	2.3	124	0	8.8	2.5	.1	.1	.03	141	104	2	.2	213	7.9	4
Jan. 10, 1966	(D)	12	.4	.01	.00	30	9.0	4.2	2.6	138	0	8.8	2.0	.2	.3	.03	152	112	0	.2	232	7.7	2
May 24.....	(D)	9.5	.0	.03	.00	26	8.1	3.5	1.7	117	0	7.0	2.2	.1	.0	.09	131	98	2	.2	204	7.7	5
MINNESOTA RIVER BASIN																							
5-2915. BIG STONE LAKE AT ORTONVILLE, MINN. (451818N 0962657)																							
Mar. 22, 1966	(D)	11	0.5	0.06	0.23	45	28	20	8.3	134	0	149	6.6	0.2	4.6	0.16	360	228	118	0.6	530	7.6	15
June 17.....	(D)	1.3	.2	.04	.00	72	37	29	9.2	189	0	222	10	.2	2.0	.21	510	330	175	.7	746	7.6	5

A Daily mean discharge.
D Lake station, contents not available.

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