



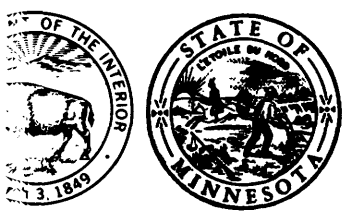
Water Resources Data Minnesota Water Year 1986

Volume 1. Great Lakes and Souris-Red-Rainy River Basins



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN-86-1
Prepared in cooperation with the Minnesota Department of
Natural Resources, Division of Waters; the Minnesota
Department of Transportation; and with other State,
municipal and Federal agencies

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Volume 1. Great Lakes and Souris-Red-Rainy River Basins

by Kurt T. Gunard, Joseph H. Hess, James L. Zirbel, and Charles E. Cornelius



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Prepared in cooperation with the Minnesota Department of Natural Resources, Division of Waters; the Minnesota Department of Transportation; and with other State, municipal, and Federal agencies

DEPARTMENT OF THE INTERIOR

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PREFACE

This volume of the annual hydrologic data report of Minnesota is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each State, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and water quality provide the hydrologic information needed by State, local, and Federal agencies, and the private sector for developing and managing our Nation's land and water resources. Hydrologic data for Minnesota are contained in two volumes:

- Volume 1. Great Lakes and Souris-Red-Rainy River Basins
- Volume 2. Upper Mississippi and Missouri River Basins

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following individuals contributed significantly to the preparation of this report:

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SURFACE-WATER STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED

Note.--Data for partial-record stations and miscellaneous sites for both surface-water quantity and quality are published in separate sections of the data report. See references at the end of this list for page numbers for these sections.

[Letters after station name designates type of data: (d) discharge; (e) gage height, elevation, or contents: (c) chemical, radio-chemical, or pesticides: (b) biological or micro-biological; (p) physical (water temperature, sediment, or specific conductance)]

ST. LAWRENCE RIVER BASIN

STREAMS TRIBUTARY TO LAKE SUPERIOR

Pigeon River at Middle Falls, near Grand Portage.....	(d - - - p)...	36,160
Baptism River near Beaver Bay.....	(d - c b p)...	37,160
Knife River near Two Harbors.....	(d - - - p)...	40,160
St. Louis River:		
Partridge River above Colby Lake at Hoyt Lakes.....	(d - - - p)...	41,160
St. Louis River near Aurora.....	(d - - - p)...	42,160
St. Louis River at Forbes.....	(d - - - p)...	43,161
St. Louis River at Scanlon.....	(d - c b p)...	44,161
Nemadji River:		
Deer Creek near Holyoke.....	(d - - - p)...	47,161
* * * * *		

HUDSON BAY BASIN

Lake Winnipeg (head of Nelson River):

RED RIVER OF THE NORTH BASIN

Otter Tail River (head of Red River of the North):

Otter Tail River near Fergus Falls.....	(- - c b p)...	48
Orwell Lake (Reservoir) near Fergus Falls.....	(- e - - -)...	49
Otter Tail River below Orwell Dam, near Fergus Falls.....	(d - c b p)...	50,161
Bois de Sioux River near White Rock, SD.....	(d - - - p)...	52,161
Red River of the North at Wahpeton, ND.....	(d - c - p)...	53
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Red River of the North at Fargo, ND.....	(d - c - p)...	57
Buffalo River near Hawley.....	(d - - - p)...	59,161
South Branch Buffalo River at Sabin.....	(d - - - p)...	60,162
Buffalo River near Dilworth.....	(d - - - p)...	61,162
Wild Rice River at Hendrum.....	(d - - - p)...	62,162
Red River of the North at Halstad.....	(d - c b p)...	63
Marsh River near Shelly.....	(d - - - p)...	66,162
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Red Lake River:		
Mud River at Redby.....	(d - - - -)...	68
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Sandy River near Red Lake.....	(d - - - -)...	74
Lower Red Lake near Red Lake.....	(- e - - -)...	77
Red Lake River near Red Lake.....	(d - - - p)...	78,163
Red Lake River at Highland, near Goodridge.....	(d - - - p)...	79,163
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Red River of the North at Grand Forks, ND.....	(d - c - p)	93
Snake River:		
Middle River at Argyle.....	(d - - - p)	95,164
Red River of the North at Drayton, ND.....	(d - c - p)	96
Two Rivers:		
South Branch Two Rivers at Lake Bronson.....	(d - - - p)	98,164
Red River of the North at Emerson, Manitoba.....	(d - c b p)	99
Roseau River below South Fork near Malung.....	(d - - - p)	103,164
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Roseau River at Ross.....	(d - - - p)	105,164
Roseau River below State ditch 51, near Caribou.....	(d - c b p)	106,165

* * * * *

LAKE OF THE WOODS BASIN (head of Winnipeg River)

Namakan River (head of Rainy River):

Basswood River:

Kawishiwi River near Ely.....	(d - c b p)	109,165
Kawishiwi River near Winton.....	(d - - - p)	112,165
Basswood River near Winton.....	(d - - - p)	113,165
Namakan River at outlet of Lac la Croix, Ontario.....	(d - - - p)	114,165

Vermilion River:

Vermilion Lake near Soudan.....	(- e - -)	115
Vermilion River near Crane Lake.....	(d - - - p)	116,165
Gold Portage Outlet from Kabetogama Lake near Ray.....	(d - - - p)	117,165
Rainy Lake near Fort Frances, Ontario.....	(- e - -)	118

Rainy River:

Little Fork River:

Sturgeon River near Chisholm.....	(d - - - p)	119,165
Little Fork River at Littlefork.....	(d - c b p)	120,166
Big Fork River at Big Falls.....	(d - - - p)	123,166
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GROUND-WATER WELLS, BY COUNTY, FOR WHICH
RECORDS ARE PUBLISHED

GROUND-WATER LEVELS

BECKER

Well 464613095524801 Local number 138N41W17ADA01.....	170
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CLAY

Well 463854096250701 Local number 137N45W30CDB01.....	170
Well 465237096383901 Local number 139N47W05CDC01.....	171
Well 465328096391001 Local number 139N47W06AAA01.....	172
Well 465231096415801 Local number 139N48W11ABA01.....	172

GRANT

Well 455932095582601 Local number 129N42W09CCC01.....	173
---	-----

ITASCA

Well 473840093515101 Local number 148N25W08DDD01.....	173
---	-----

MAHNOMEN

Well 471653096020301 Local number 144N42W20BBA01.....	174
---	-----

OTTER TAIL

Well 463956095352601 Local number 137N39W22ACD01.....	175
---	-----

GROUND-WATER WELLS, BY COUNTY, FOR WHICH
RECORDS ARE PUBLISHED--Continued

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GROUND-WATER LEVELS

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ST. LOUIS

Well 472638092533601	Local number 057N20W05DAD01.....	175
Well 472230092561001	Local number 057N20W31DBC01.....	176
Well 473102092345001	Local number 058N18W12CCC01.....	177
Well 473011092524301	Local number 058N20W16DBC01.....	177
Well 474253091574101	Local number 060N13W01BBA01.....	178
Well 475502091494601	Local number 063N12W26ABB01.....	179

TRAVERSE

Well 455700096314001	Local number 129N47W25CDC01.....	179
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WATER RESOURCES DATA FOR MINNESOTA, 1986

INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Minnesota each water year. These data, accumulated during many years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Minnesota."

Water resources data for the 1986 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume contains discharge records for 52 gaging stations; stage only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 10 stream stations and 15 partial-record lake stations; and water levels for 16 observation wells. Also included are 35 high-flow partial-record stations and 23 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. These data, together with the data in Volume 2, represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota.

This series of annual reports for Minnesota began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Minnesota were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Parts 4, 5 and 6A." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply papers can be consulted in the libraries of the principal cities of the United States and may be purchased from Distribution Branch, Text Products Section, U.S. Geological Survey, 604 Pickett Street, Alexandria, VA 22304.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and volume number. For example, this volume is identified as the "U.S. Geological Survey Water-Data Report MN-86-1. For archiving and general distribution, the reports for 1971-1974 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the district chief at the address given on the back of the title page or by telephone (612) 229-2600.

COOPERATION

The U.S. Geological Survey and organizations of the State of Minnesota have had cooperative agreements for the systematic collection of streamflow records since 1909, for ground-water levels since 1948, and for water-quality records since 1952. Organizations that assisted in collecting data through cooperative agreement with the Survey are:

Minnesota Department of Natural Resources, Division of Waters, Lawrence D. Seymour, director.

Minnesota Department of Transportation, Richard P. Braun, commissioner.

Minnesota Pollution Control Agency, Thomas J. Kalitowski, executive director.

Metropolitan Waste Control Commission of the Twin Cities Area, Peter E. Meintsman, chairperson.

Metropolitan Council of the Twin Cities Area, Sandra Gardebring, chairperson.

Elm Creek Conservation Commission, Gerald E. Butcher, chairperson.

Red Lake Watershed District, Truman Sandland, president.

Red Lake Reservation Business Committee, Roger Jourdain, chairperson.

Middle River-Snake River Watershed District, Donald Rivard, chairperson.

White Earth Reservation Business Committee, Darrell Wadena, chairperson.

Assistance in the form of funds or services was given by the Corps of Engineers, U.S. Army, in collecting records for 48 gaging stations and 12 water-quality stations published in this report. Thirteen gaging stations in the Hudson Bay and St. Lawrence River basins were maintained by funds appropriated to the United States Department of State. Eight of these, on water adjacent to the international boundary, 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."

SUMMARY OF HYDROLOGIC CONDITIONS

PRECIPITATION

Precipitation during the 1986 water year varied from slightly below normal in a small area in extreme northwestern and north-central Minnesota, bordering Canada, to 22 in. (inches) above normal in small parts of central and east-central Minnesota (fig.1). Normal annual precipitation in Minnesota ranges from 19 in. in the northwest to 32 in. in the southeast. Precipitation during water year 1986 ranged from 18 in. in parts of the northwest to greater than 48 in. in small parts of central and east-central Minnesota.

Precipitation was normal at the beginning of the 1st quarter, above normal in midquarter and below normal toward the end of the 1st quarter. Precipitation during the 2nd quarter continued in the below-normal range, except during February, when it was normal to slightly above in the northern two thirds of the State. In the 3rd quarter, precipitation was above normal except during May when it was below normal statewide. Precipitation during the final quarter was considerably above normal over the entire State, except during August when it was below normal in the north and in parts of south and central Minnesota.

Annual precipitation was considerably above normal for most of the State; new 12-month precipitation records were set at several places in central and south-central Minnesota. The most noteworthy new record was 49.39 in. at New London, in central Minnesota; annual precipitation of this magnitude is extremely rare in this part of the State, usually occurring only in the southeasternmost part. The 30-year (1951-80) annual normal precipitation for New London is slightly greater than 27 in.

Water year 1986 was a continuation of a long-term, extremely wet period as indicated by a new 10-year precipitation record set at Caledonia in extreme southeastern Minnesota--383.31 in.; this is the greatest 10-year precipitation total ever observed in Minnesota.

STREAMFLOW

Average annual runoff in Minnesota ranges from 1 in. in the west to 14 in. in the northeast. Annual runoff in 1986 ranged from 2.5 in. along the northwestern border to 21 in. in east-central Minnesota [33.7 in. of runoff were recorded on an extremely small area of 7.77 square miles in east-central Minnesota (table 1)]. Runoff varied from 95 percent of average in parts of the north to more than 400 percent of average in parts of the south. West-central and part of central Minnesota had the greatest area of much-above-average runoff, ranging from 300 to 415 percent of the long-term average. The lowest average runoff, ranging from 95 to 150 percent of the long-term average, occurred in the northeast "arrow-head" region and parts of the northwest, north-central, and southeast regions. Runoff in the remaining area of the State ranged from 150 to 280 percent of the long-term average....a most unusual year, with above-average runoff recorded over almost the entire State. Runoff to the Mississippi River at St. Paul reflects this situation. At St. Paul, the Mississippi River drains 40 percent of the State and, in 1986, broke an 88-year period of record with a mean annual flow of 29,580 cubic feet per second--a rate 1.4 times greater than the previous maximum set in 1983.

In 1986, records for stations in northern Minnesota indicate variations in annual runoff from 1.2 to 1.8 times the average annual runoff. Runoff in the Roseau River at Ross, in northwestern Minnesota, was 5.22 in.--an amount 1.8 times the 58-year average annual runoff of 2.98 in. and the 8th highest for period of record. Farther east in northern Minnesota, runoff in the Little Fork River at Littlefork was 9.89 in.--an amount 1.2 times the average annual runoff of 8.38 in., but considerably less than the 12.95 in. recorded in the 1985 water year. In northeastern Minnesota, runoff in the Baptism River near Beaver Bay was 19.50 in.--also an amount 1.2 times the average annual runoff of 16.49 in. but 2.19 in. greater than runoff of 17.31 in. during the previous water year. A comparison of annual and monthly mean discharges for these stations to median discharges for a 30-year base period is shown in figure 2.

Despite record, or near record, monthly flow volumes in some areas during water year 1986, no peaks of record were exceeded at any station on streams for which records are published in this volume.

WATER QUALITY

Four U.S. Geological Survey National Stream-Quality Accounting Network (NASQAN) stations are used to monitor variability in concentrations of dissolved solids and in nitrate (as nitrogen) in, and between, the three major basins covered in this volume (figs. 3 and 4): the Lake Superior, Rainy River, and Red River of the North basins.

Dissolved-solids concentrations generally were lower than the monthly medians at the Baptism and St. Louis River stations, and were near the monthly medians at the Rainy and Red Lake River stations.

Nitrate concentrations reported as nitrogen (analysis for nitrate plus nitrite as nitrogen, but nitrite concentration assumed to be negligible) were lower than the monthly medians at the Baptism and St. Louis River stations and were near the monthly medians at the Rainy and Red Lake River stations.

No ground-water samples were collected this water year in the drainage areas included in this volume.

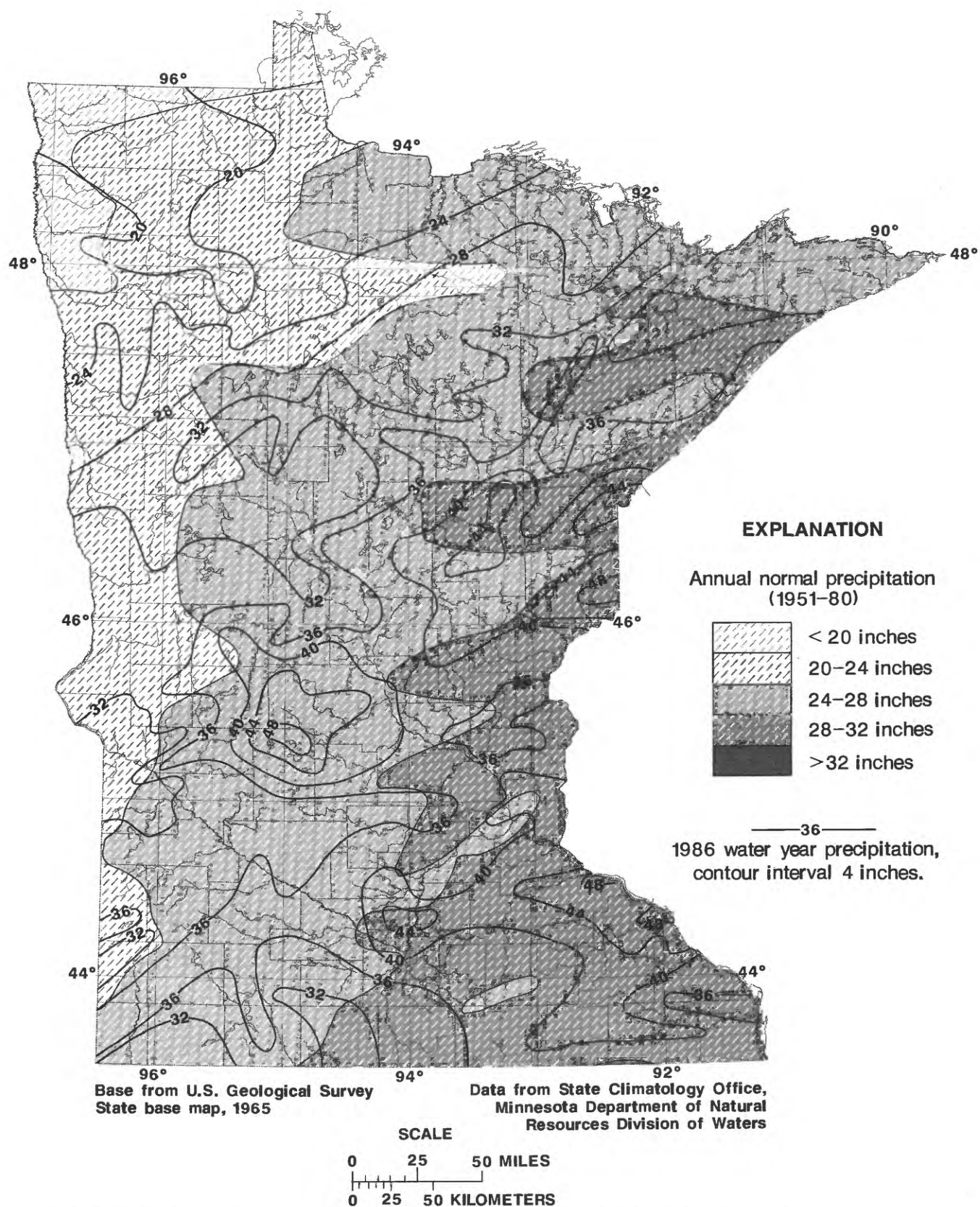


Figure 1.--Precipitation, in inches, during 1986 water year compared to normal annual precipitation for Minnesota

Table 1.--Runoff at streamflow stations in 1986 compared with long-term average for river basins in Minnesota

[Average runoff for station is based on period of record. Previous or present maximum runoff and year of occurrence are shown. mi², square miles.]

Station No.	Station name	Drainage Area (mi ²)	Runoff (inches)			
			1986 Water year	Average	Maximum Inches	Maximum Water year
04010500	Pigeon River at Middle Falls near Grand Portage	600	13.96	11.50	19.01	1971
04014500	Baptism River near Beaver Bay	140	19.50	16.49	32.50	1972
04015330	Knife River near Two Harbors	85.6	23.32	15.48	21.42	1978
04015475	Partridge River above Colby Lake at Hoyt Lake	106	12.98	11.86	14.22	1983
04016500	St. Louis River near Aurora	290	15.17	11.80	20.74	1950
04024000	St. Louis River at Scanlon	3,430	15.47	9.30	16.93	1972
04024098	Dear Creek near Holyoke	7.77	33.70	14.66	17.65	1985
05046000	Otter Tail River below Orwell Dam near Fergus Falls	1,830	6.25	2.37	4.96	1966
05050000	Bois de Sioux River near White Rock	1,160	3.85	0.98	3.70	1962
05051500	Red River of the North at Wahpeton	4,010	5.00	1.88	3.36	1962
05061500	South Branch Buffalo River at Sabin	522	4.18	1.53	5.15	1962
05062000	Buffalo River near Dilworth	1,040	4.41	1.76	5.76	1975
05064000	Wild Rice River at Hendrum	1,600	4.45	2.27	5.79	1975
05069000	Sand Hill River at Climax	426	3.97	2.33	6.50	1950
05074500	Red Lake River near Red Lake	1,950	6.30	3.52	9.00	1951
05076000	Thief River near Thief River Falls	959	5.04	2.38	8.60	1966
05078500	Clearwater River at Red Lake Falls	1,370	4.48	3.19	8.48	1950
05079000	Red Lake River at Crookston	5,280	5.25	2.97	8.05	1950
05082500	Red River of the North at Grand Forks	30,100	2.60	1.18	3.42	1950
05087500	Middle River at Argyle	265	3.15	2.15	5.74	1966
05102500	Red River of the North at Emerson	40,200	2.44	1.15	4.09	1950
05104500	Roseau River below South Fork near Malung	573	4.55	3.48	8.18	1950
05107500	Roseau River at Ross	1,220	5.22	2.98	8.07	1950
05112000	Roseau River below State No. 51 near Caribou	1,570	4.66	2.57	5.91	1927
05124480	Kawishiwi River near Ely	253	11.05	11.59	16.80	1971
05127000	Kawishiwi River near Winton	1,229	13.03	11.46	21.73	1950
05127500	Basswood River near Winton	1,740	12.48	10.95	20.63	1950
05128000	Namakan River at Outlet of Lac la Croix	5,170	12.62	10.10	19.10	1950
05130500	Sturgeon River near Chisholm	187	10.36	9.08	15.11	1950
05131500	Little Fork River at Littlefork	1,730	9.89	8.38	15.01	1966
05132000	Big Fork River at Big Falls	1,460	10.39	6.85	12.67	1950
05133500	Rainy River at Manitou Rapids	19,400	12.16	9.10	16.28	1950

GROUND-WATER LEVELS

Water levels in unconfined (water-table) aquifers generally were above normal in more than half the observation wells throughout the 1986 water year. Figure 5 shows how water levels relate seasonally to normal levels, based on water-level fluctuations in 25 wells in unconfined aquifers. Levels for the 1986 water year are compared to the long-term normal for each month and grouped by seasons. Water levels generally declined seasonally from November through March, rose in spring, and declined during summer. Water levels rose again in late summer in 11 of the 25 observation wells. During fall 1985 (October through December), water levels were above normal in 72 percent of the 25 observation wells, and new record-high monthly levels were recorded in 36 percent of the wells. During winter 1986 (January through March), water levels were above normal in 56 percent of the 25 observation wells, and new record-high monthly levels were recorded in 20 percent of the wells. During spring and summer 1986 (April through September), water levels were above normal in 80 percent of the 25 observation wells. In spring new record-high monthly levels were recorded in 44 percent of the wells and during summer new record high monthly levels were recorded in 64 percent of the wells. One observation well in south-central Minnesota had below-normal levels from fall 1985 through spring 1986. Water levels in the well returned to normal in summer 1986. Water levels in central and much of eastern Minnesota were consistently above normal throughout the 1986 water year, similar to water levels in the adjacent area of Wisconsin. Water levels in northwestern and southwestern Minnesota generally were in the normal range during the 1986 water year.

In much of Minnesota, water levels in confined drift and bedrock aquifers generally were above normal throughout the 1986 water year (fig. 6). Water levels in many wells were steady or declined slightly during fall and winter and rose to the high level for the year in spring or summer 1986. Water levels in 58 observation wells producing from confined drift or the first bedrock aquifer were compared seasonally to long-term normal levels. In fall 1985 (October through December), at the beginning of the 1986 water year, water levels in 72 percent of the 58 wells were above normal (fig. 6), 16 percent were in the normal range, and 12 percent were below normal. New monthly record-high water levels were recorded in 48 percent of the wells during fall. During summer 1986 (July through September), at the end of the 1986 water year, water levels in 76 percent of the 58 wells were above normal, 15 percent were in the normal range, and 9 percent were below normal. New monthly record-high water levels were recorded in 53 percent of the wells during summer. The cones of depression that develop in the St. Paul and Minneapolis areas continued below-normal levels throughout the 1986 water year as indicated in figure 6. Two or three other areas of below-normal levels were observed in southern and western Minnesota. Levels in the Mount Simon-Hinckley aquifer in the Twin Cities basin were consistently below normal, and new seasonal record-low-water levels were recorded.

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 57 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

National Stream Quality Accounting Network (NASQAN) is a national data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of the hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water quality assessment and hydrologic research.

The National Trends Network (NTN) is a 150-station network for sampling atmospheric deposition in the United States. The purpose of the network is to determine the variability, both in location and in time, of the composition of atmospheric deposition, which includes snow, rain, dust particles, and aerosols, and gases. The core from which the NTN was built was the already-existing deposition-monitoring network of the National Atmospheric Deposition Program (NADP).

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Tritium network is a network of stations which has been established to provide baseline information on the occurrence of tritium in the Nation's surface waters. In addition to the surface-water stations in the network, tritium data are also obtained at a number of precipitation stations. The purpose of the precipitation stations is to provide an estimate sufficient for hydrologic studies of the tritium input to the United States.

EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1985 water year that began October 1, 1984, and ended September 30, 1985. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for the surface and ground water, and ground-water-level data. The locations of the stations and wells where the data were collected are shown in figures 8, 9, 10, and 11. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

STATION IDENTIFICATION NUMBERS

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The system used by the U.S. Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for regular surface-water stations and the "latitude-longitude" system is used for wells and, in Minnesota, for surface-water stations where only miscellaneous measurements are made.

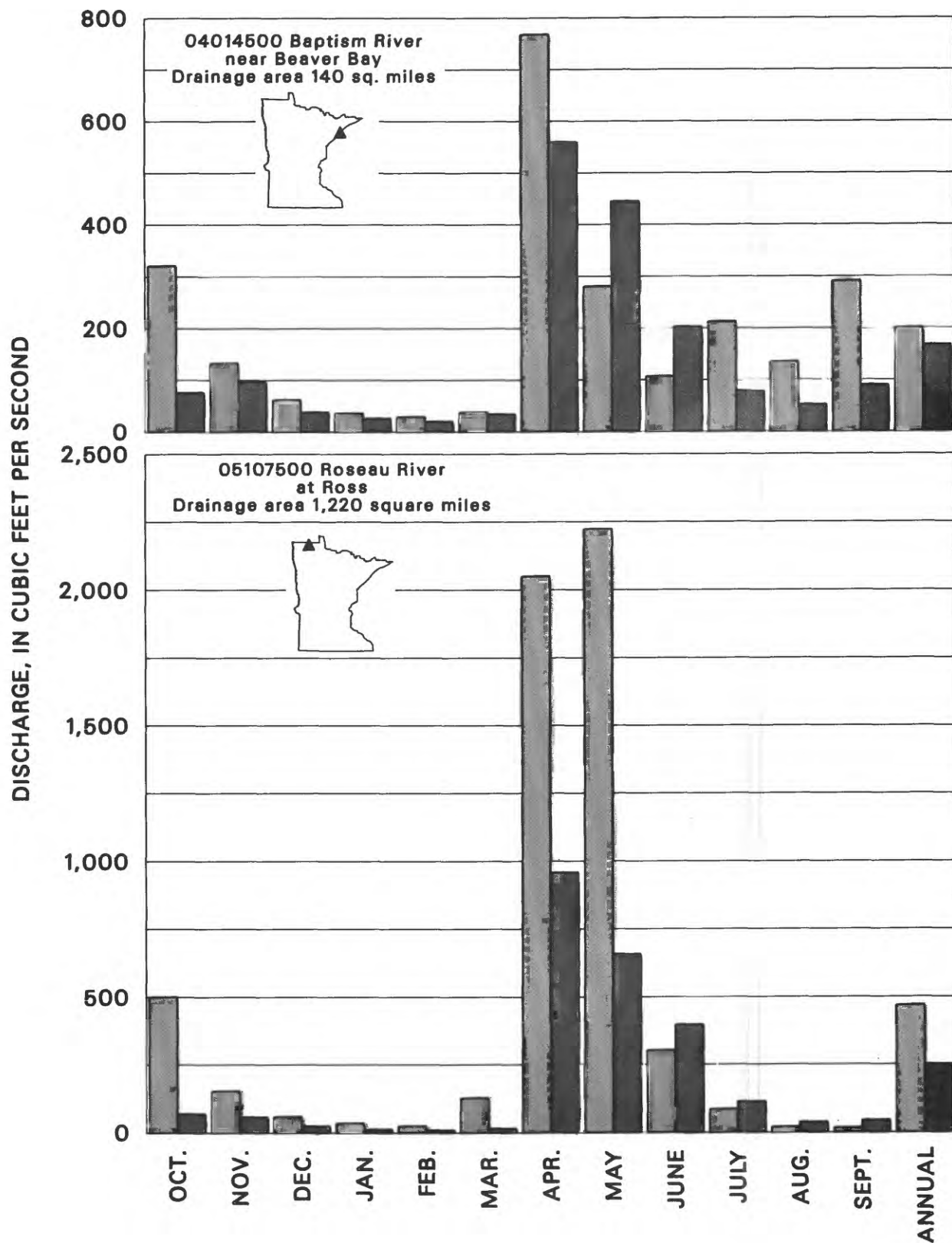
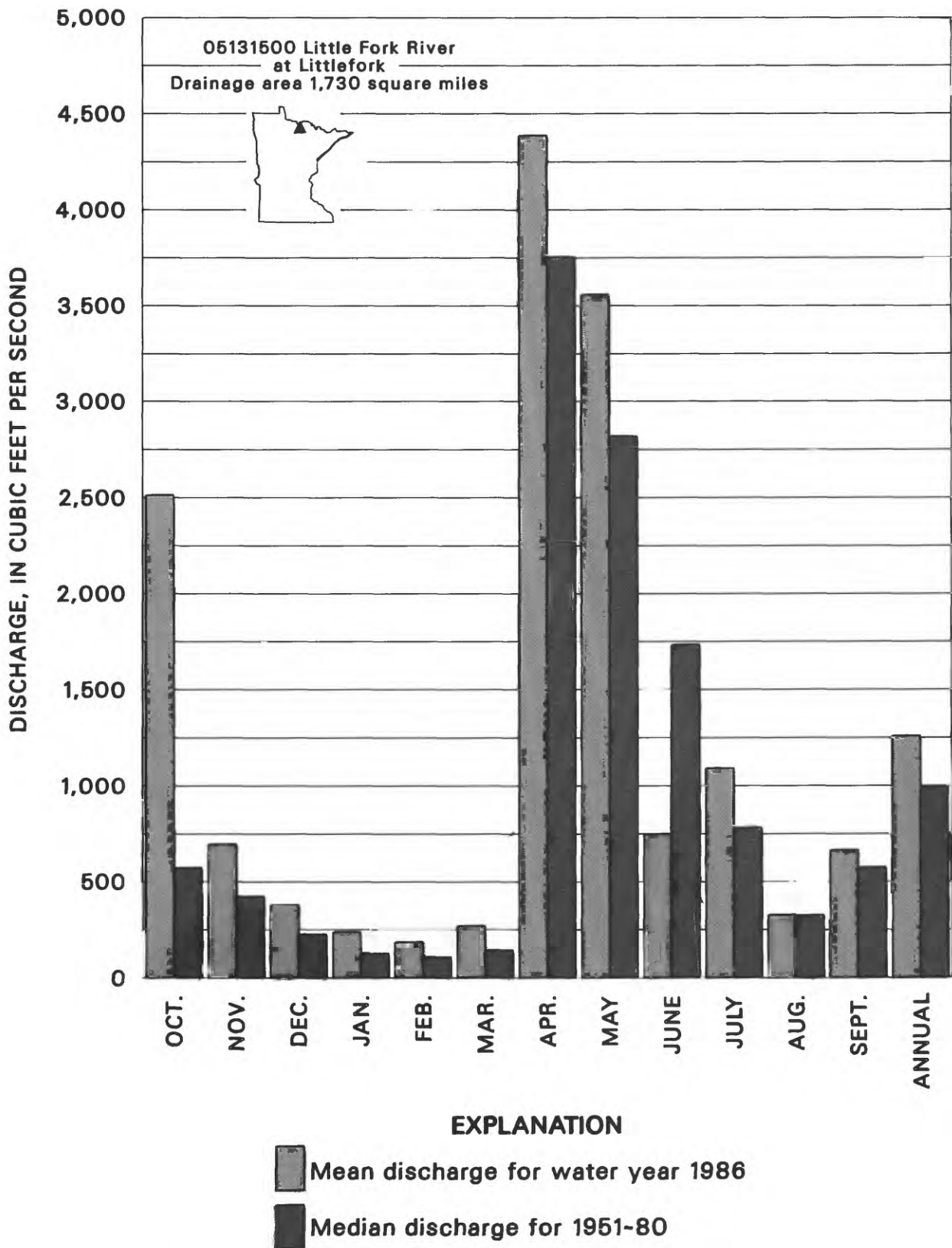


Figure 2.--Comparison of mean discharge for the 1986 water year with median



discharge for 1951-80 at three long-term representative gaging stations

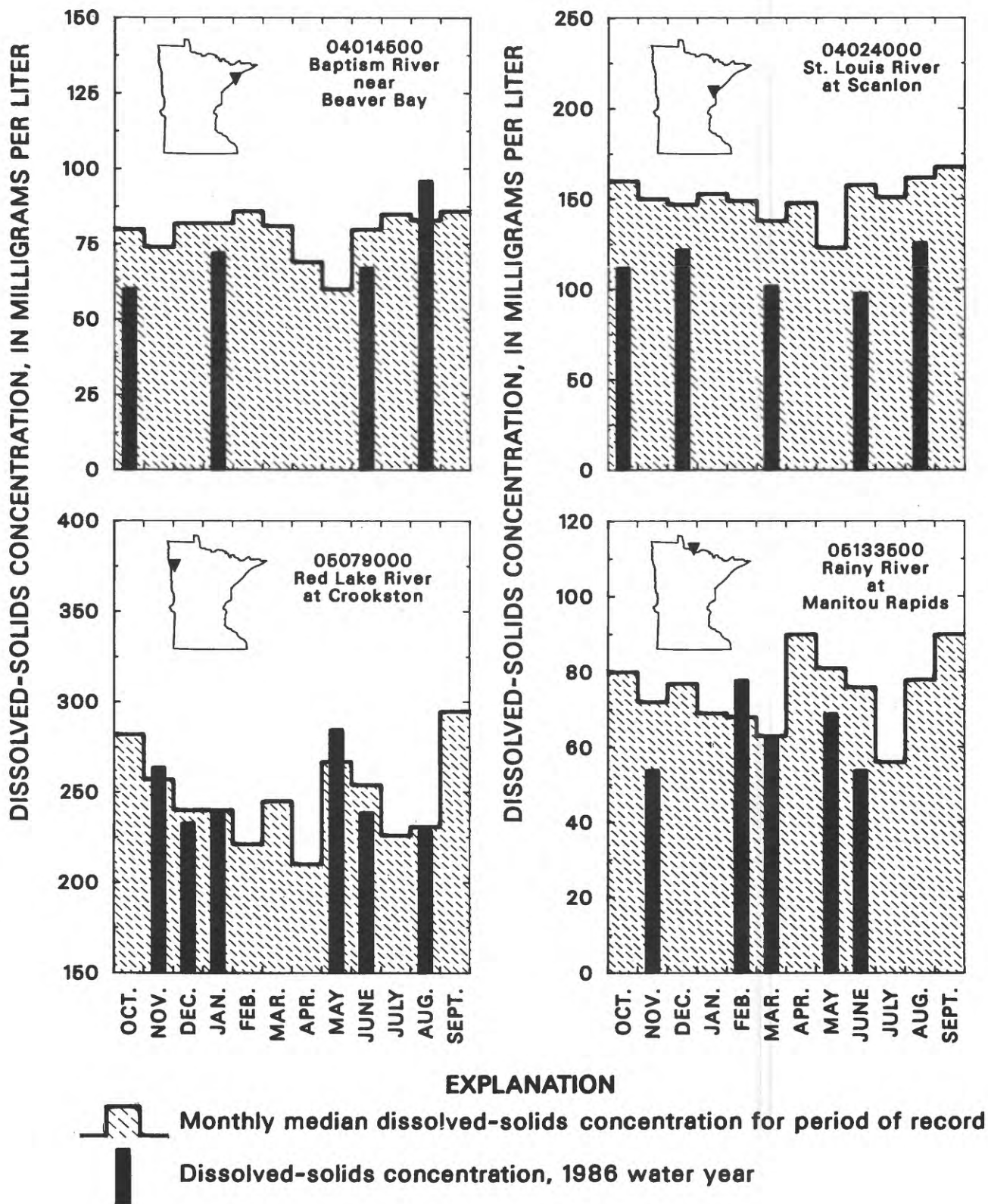


Figure 3.--Comparisons between the monthly median for the period of record and the single samples of dissolved-solids concentrations collected during the 1986 water year

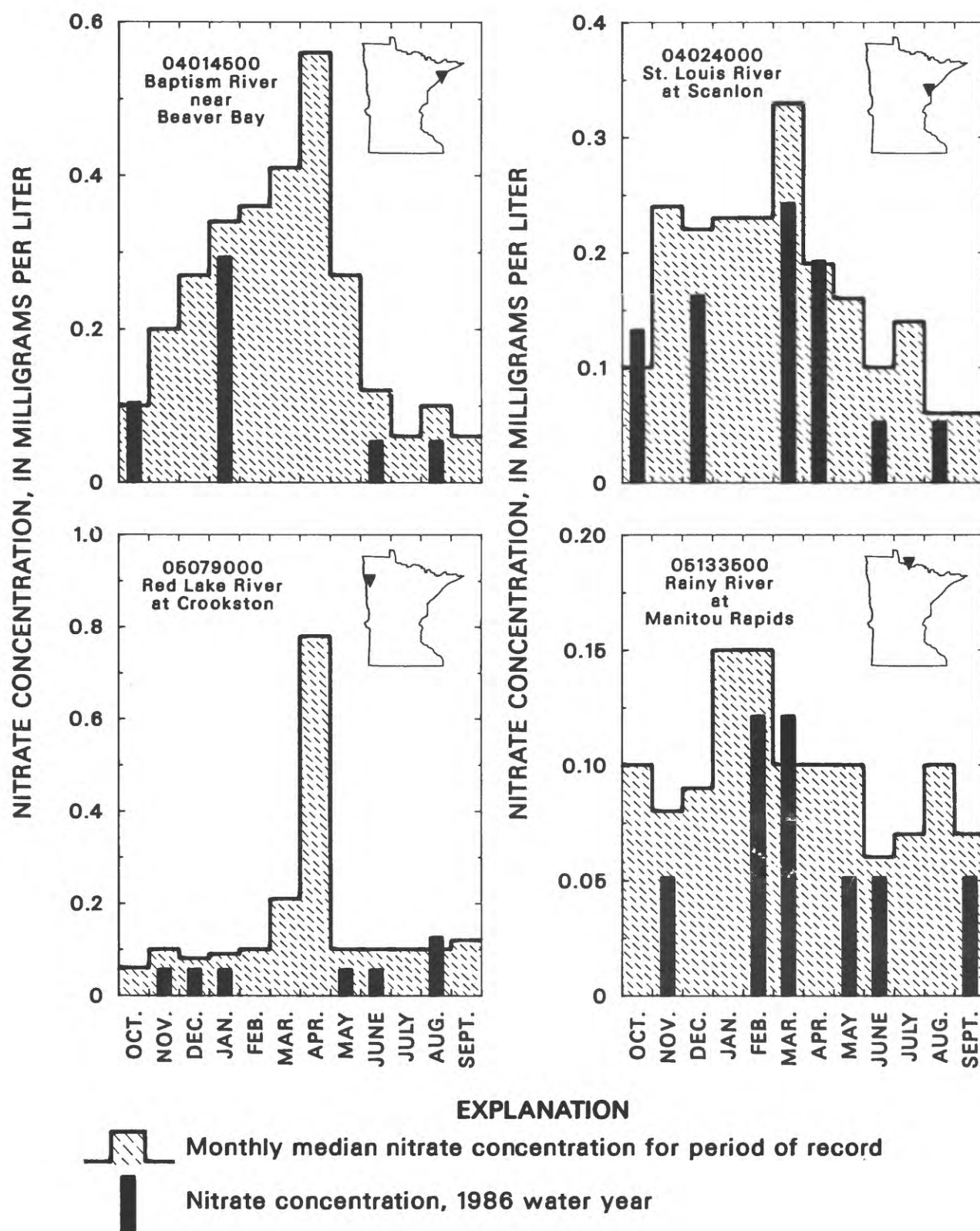


Figure 4.--Comparisons between the monthly median for the period of record and the single samples of nitrate concentrations collected during the 1986 water year

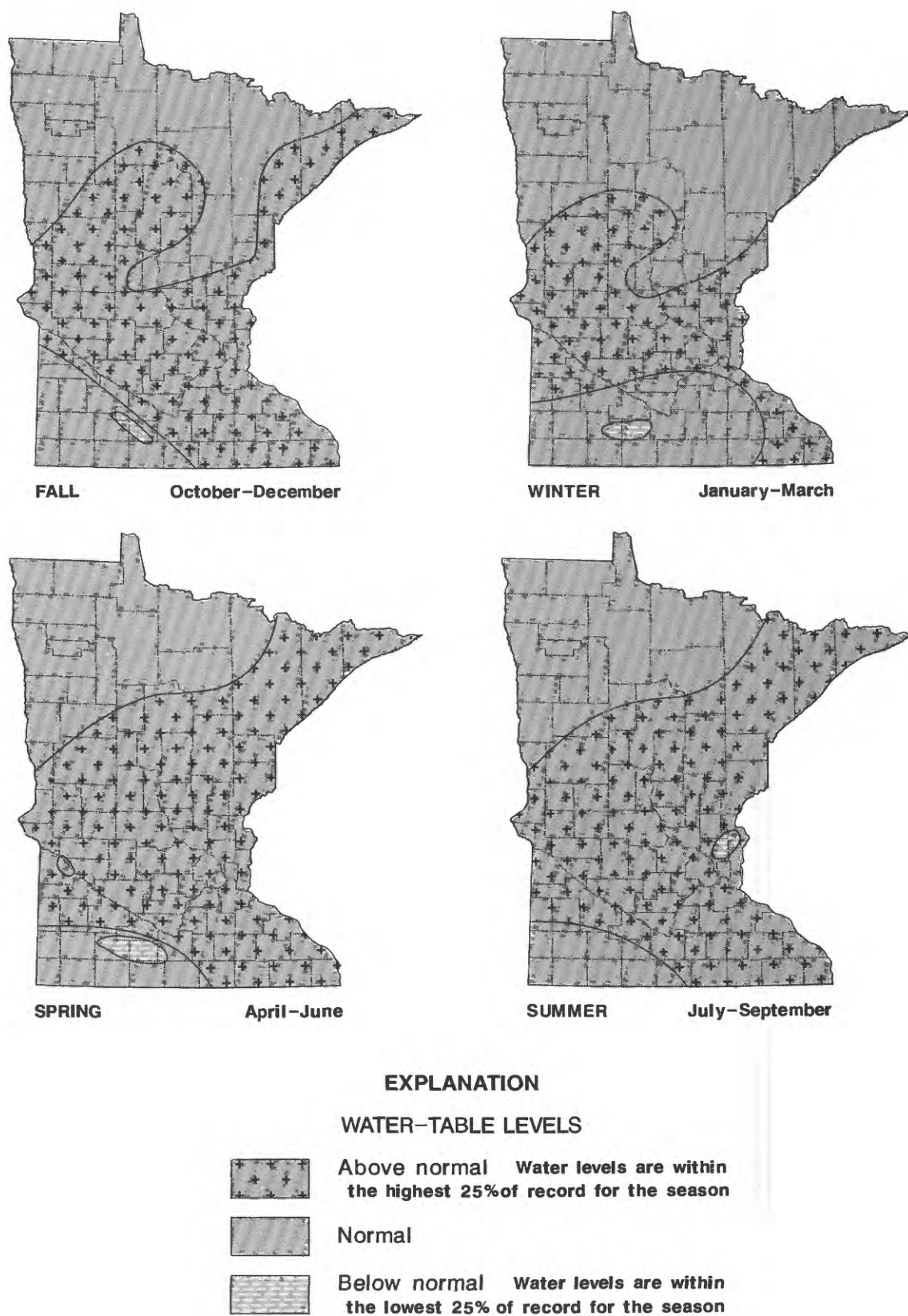
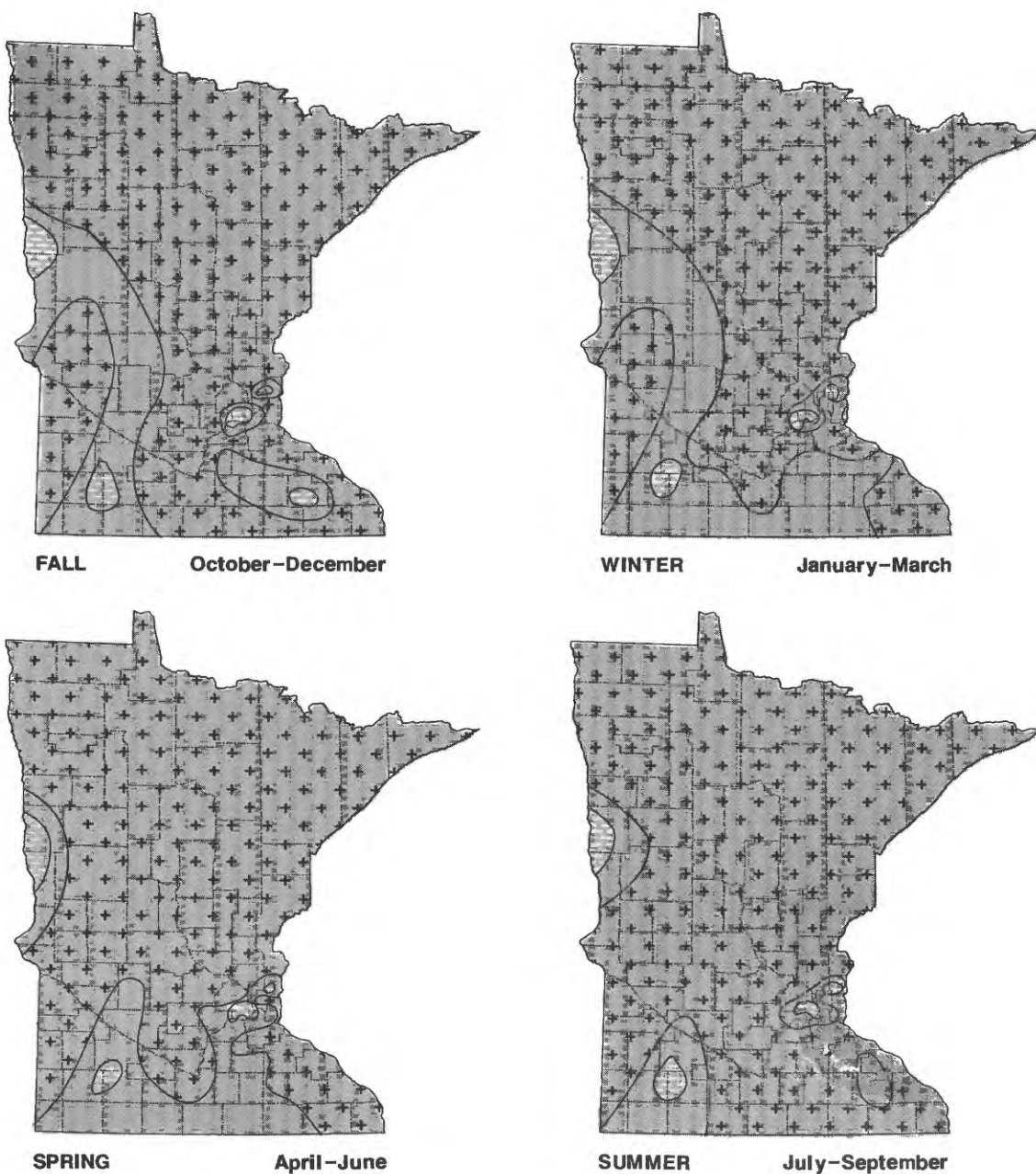


Figure 5.--Relation of seasonal water-table levels to long-term mean levels



EXPLANATION

CONFINED-AQUIFER WATER LEVELS

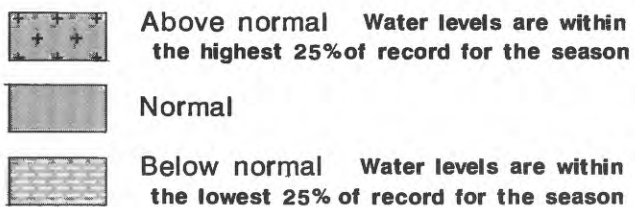


Figure 6.--Relation of seasonal water levels in confined aquifers to long-term mean levels

Downstream Order System and Station Number

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary that enters between two main-stream sections is listed between them. A similar order is followed by listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary on which a station is situated with respect to the stream to which it is immediately tributary is indicated by an indentation in a list of stations in front of the report. Each indentation represents one rank. This downstream order and system of indentation show which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

As an added means of identification, each hydrologic station and partial-record station has been assigned a station number. These are in the same downstream order in this report. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, 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 series of 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 05041000, which appears just to the left of the station name, includes the 2-digit part number "05" plus the 6-digit downstream order number "041000."

Latitude-Longitude System for Wells and Miscellaneous Sites

The 8-digit downstream order station numbers are not assigned to wells and miscellaneous sites where only random water-quality samples or discharge measurements are taken.

The well and miscellaneous site numbering system of the U.S. Geological Survey is based on the grid system of latitude and longitude. The system provides the geographic location of the well or miscellaneous site and a unique number for each site. The number consists of 15 digits. The first 6 digits denote the degrees, minutes, and seconds of latitude, the next 7 digits denote degrees, minutes, and seconds of longitude, and the last 2 digits (assigned sequentially) identify the wells or other sites within a 1-second grid. See figure 7. Each well site is also identified by a local well number which consists of township, range, and section numbers, three letters designating 1/4, 1/4, 1/4 section location, and a two-digit sequential number.

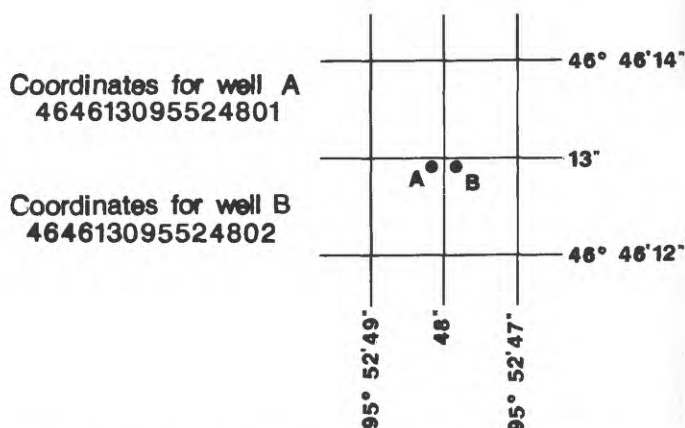


Figure 7.--Example of system for numbering wells and miscellaneous sites

RECORDS OF STAGE AND WATER DISCHARGE

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharge may be computed for any time, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-day contents commonly are published for such stations, they are referred to as "daily stations".

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "High-flow partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record and high-flow partial-record stations for which data are given in this report are shown in figures 8 and 10.

Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with analog recorders that trace continuous graphs of stage or with digital recorders that punch stage values on paper tapes at selected time intervals. Measurements of discharge are made with current meters using methods adapted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, in Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6.

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of current-meter measurements, the curves are extended using: (1) logarithmic-plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow-over-dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the daily mean stages (gage heights) to the stage-discharge curves or tables. 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 the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations the stage-discharge relation is affected by the 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 computing discharge. 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; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves, or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as time since the last survey increases. Discharge over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

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 daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

Data Presentation

The records published for each gaging station consist of two parts, the manuscript or station description and the data table for the current water year. The manuscript provides, under various headings, descriptive information, such as station location; period of record; average discharge; historical extremes; record accuracy; and other remarks pertinent to station operation and regulation. The following information as appropriate is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement," Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA.--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time when the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS.--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all reports in which revisions have been published for the station and water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE.--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS.--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. If a remarks statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

AVERAGE DISCHARGE.--The discharge value given is the arithmetic mean of the water-year mean discharges. It is computed only for stations having at least 5 water years of complete record, and only water years of complete record are included in the computation. It is not computed for stations where diversions, storage, or other water-use practices cause the value to be meaningless. If water developments significantly altering flow at a station are put into use after the station has been in operation for a period of years, a new average is computed as soon as 5 water years of record have accumulated following the development. The median of yearly mean discharges also is given under this heading for stations having 10 or more water years of record, if the median differs from the average given by more than 10 percent.

EXTREMES FOR PERIOD OF RECORD.--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the manner as the maximum.

EXTREMES OUTSIDE PERIOD OF RECORD.--Included here is the information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

EXTREMES FOR THE CURRENT YEAR.--Extremes given here are similar to those for the period of record, except the peak discharge listing which may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

REVISIONS.--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the District office to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

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.

The daily table for stream-gaging stations gives mean discharge for each day and is followed by monthly and yearly summaries. In the monthly summary below the daily table, the line headed "TOTAL" gives the sum of the daily figures. The line headed "MEAN" gives the average flow in cubic feet per second during the month. The lines headed "MAX" and "MIN" give the maximum and minimum daily discharges, respectively, for the month. Discharge for the month also is usually 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 there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. In the yearly summary below the monthly summary, the figures shown are the appropriate discharges for the calendar and water years. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversions or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge 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. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. 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.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated", or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

Accuracy of the Records

The accuracy of streamflow records 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 measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of the true; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned, are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft³/s; to the nearest tenth between 1.0 and 10 ft³/s; to whole numbers between 10 and 1000 ft³/s; and to 3 significant figures for more than 1000 ft³/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharges listed for partial-record stations and miscellaneous sites.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of 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 if adjustments or losses are large in comparison with the observed discharge.

Other Records Available

Information of a more detailed nature than that published for most of the gaging stations such as observations of water temperatures, discharge measurements, gage-height records, and rating tables is on file in the district office. Also most gaging-station records are available in computer-usable form and many statistical analyses have been made.

Information on the availability of unpublished data or statistical analyses may be obtained from the district office.

The National Water Data Exchange, Water Resources Division, U.S. Geological Survey, National Center, Reston, VA 22092, maintains an index of all discharge measurement sites in the State as well as an index of records of discharge collected by other agencies but not published by the Geological Survey. Information on records available at specific sites can be obtained upon request.

RECORDS OF SURFACE-WATER QUALITY

Records of surface water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station, where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records" as used in this report and "continuous recordings," which refers to a continuous graph or a series of discrete values punched at short intervals on a paper tape. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figure 10.

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for partial-record stations and for miscellaneous sampling sites appear in separate tables following the table of discharge measurements at miscellaneous sites.

On-Site Measurement and Collection

In obtaining water quality data, a major concern needs to be assuring that the data obtained represents the in situ quality of water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen need to be made onsite when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for onsite measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. C2; Book 5 Chap. A1, A3, and A4. All of these references are listed on p. 17 of this report. Also, detailed information on collecting, treating, and shipping samples may be obtained from the Geological Survey District office.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. All samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals, depends on flow conditions and other factors which must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. In the rare case where an apparent inconsistency exists between a reported pH value and the relative abundance of carbon dioxide species (carbonate and bicarbonate), the inconsistency is the result of a slight uptake of carbon dioxide from the air by the sample between measurement of pH in the field and determination of carbonate and bicarbonate in the laboratory.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record. More detailed records (hourly values) may be obtained from the U.S.G.S. district office whose address is given on the back of the title page of this report.

Water Temperature

Water temperatures are measured at most of the water-quality stations. In addition, water temperatures are taken at time of discharge measurements for water-discharge stations. For stations where water temperatures are taken manually once or twice daily, the water temperatures are taken at about the same time each day. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the District office.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section, or a single sample may be obtained at a fixed point and a coefficient applied to determine the mean concentration in the cross sections.

During periods of rapidly changing flow or rapidly changing concentration, samples may have been collected more frequently (twice daily or, in some instances, hourly). The published sediment discharges for days of rapidly changing flow or concentration were computed by the subdivided-day method (time-discharge weighted average). Therefore, for those days when the published sediment discharge value differs from the value computed as the product of discharge times mean concentration times 0.0027, the reader can assume that the sediment discharge for that day was computed by the subdivided-day method. For periods when no samples were collected, daily loads of suspended sediment were estimated on the basis of water discharge, sediment concentrations observed immediately before and after the periods, and suspended-sediment loads for other periods of similar discharge.

At other stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

In addition to the records of suspended sediment discharge, records of the periodic measurements of the particle-size distribution of the suspended sediment and bed material are included for some stations.

Laboratory Measurements

Samples for indicator bacteria and specific conductance are analyzed locally. All other samples are analyzed in the Geological Survey laboratories in Arvada, Colo., Doraville, Ga., or Iowa City, Ia. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1. Methods used by the Geological Survey laboratories are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4.

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance, pH, water temperature, dissolved, and suspended sediment then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, when appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of stage and Water Discharge"; same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of stage and Water Discharge"; same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION.--Information on instrumentation is given only if a water-quality monitor, temperature recorder, sediment pumping sampler, or other sampling device is in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently, because the true maximums or minimums may not have been sampled. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS.--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water-quality records for partial-record stations and miscellaneous sampling sites are published in separate tables following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this report:

<u>PRINTED OUTPUT</u>	<u>REMARK</u>
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organisms count less than 0.5 percent (organisms may be observed rather than counted)
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant

RECORDS OF GROUND-WATER LEVELS

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Minnesota are shown in figure 11.

Although, in this report, records of water levels are presented for fewer than 200 wells, records are obtained through cooperative efforts of many Federal, State, and local agencies for several hundred observation wells throughout Minnesota and are placed in computer storage. Each spring, the Minnesota Department of Natural Resources, Division of Waters publishes a report for the previous water year entitled "Observation Well Data Summary, Water Year 19__." This report contains hydrographs of recorder wells, detailed maps showing the location of active observation wells, and other useful items. Information about the availability of the data in the water-level file may be obtained from the District Chief, Minnesota District. (See address on back of front page).

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well assure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level records are obtained from direct measurements with a steel tape or from the graph or punched tape of a water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (eom).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error in determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given only to a tenth of a foot or a larger unit.

Hydrographs showing water-level fluctuations are included for 14 representative wells; 1 bedrock, 6 surficial-sand, and 7 buried-sand wells.

Data Presentation

Each well consists of two parts, the station description and the data table of water levels observed during the water year. The description of the well is presented first through use of descriptive headings preceeding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes and seconds); a landline location designation; the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.-- This entry designates by name(if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and includes additional information such as casing breaks, collapsed screen, and other changes since construction.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in the top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that are also water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of the publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR THE PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (eom). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level.

RECORDS OF GROUND-WATER QUALITY

Records of ground-water quality in this report differ from other types of records in that for most sampling sites they consist of only one set of measurements for the water year. The quality of ground water ordinarily changes only slowly; therefore, for most general purposes one annual sampling, or only a few samples taken at infrequent intervals during the year, is sufficient. Frequent measurement of the same constituents is not necessary unless one is concerned with a particular problem, such as monitoring for trends in nitrate concentration. In the special cases where the quality of ground water may change more rapidly, more frequent measurements are made to identify the nature of the changes.

Data Collection and Computation

The records of ground-water quality in this report were obtained mostly as a part of special studies in specific areas. Consequently, a number of chemical analyses are presented for some counties but none are presented for others. As a result, the records for this year, by themselves, do not provide a balanced view of ground-water quality statewide. Such a view can be attained only by considering records for this year in context with similar records obtained for these and other counties in earlier years.

Most methods for collecting and analyzing water samples are described in the "U.S. Geological Survey Techniques of Water-Resources Investigation" manuals listed on a following page. The values reported in this report represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. All samples were obtained by trained personnel. The wells sampled were pumped long enough to assure that the water collected came directly from the aquifer and had not stood for a long time in the well casing where it would have been exposed to the atmosphere and to the material, possibly metal, comprising the casings.

Data Presentation

The records of ground-water quality are published in a section titled QUALITY OF GROUND WATER immediately following the ground-water-level records. Data for quality of ground water are listed alphabetically by County, and are identified by well number. The prime identification number for wells sampled is the 15-digit number derived from the latitude-longitude locations. No descriptive statements are given for ground-water-quality records; however, the well number, depth of well, date of sampling, and other pertinent data are given in the table containing the chemical analyses of the ground water. The REMARK codes listed for surface-water-quality records are also applicable to ground-water-quality records.

ACCESS TO WATSTORE DATA

The National WATER Data STORage and RETrieval System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from each of the Water Resources Division's district offices (see address given on back of the title page).

General inquiries about WATSTORE may be directed to:

Chief Hydrologist
U.S. Geological Survey
437 National Center
Reston, Virginia 22092

DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting inch-pound units to International System of units (SI) on the inside of back cover.

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Adenosine triphosphate (ATP) is the primary energy donor in cellular life process. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP, therefore, provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

Algae are mostly aquatic single-celled, colonial, or multi-celled plants, containing chlorophyll and lacking roots, stems, and leaves.

Algal growth potential (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

Aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

Bacteria are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as the organisms which produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35°C \pm 1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal coliform bacteria are bacteria that are present in the intestine or feces of warmblooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all organisms which produce blue colonies within 24 hours when incubated at 44.5°C \pm 0.2°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria also found in the intestine of warmblooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C \pm 1.0°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Bed material is the unconsolidated material of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by microorganisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter (g/m^3), and periphyton and benthic organisms in grams per square meter (g/m^2).

Dry mass refers to the weight of residue present after drying in an oven at 60°C for zooplankton and 105°C for periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and the ash mass, and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Bottom material: See Bed Material.

Cells/volume refers to the number of cells or any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters (mL) or liters (L).

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, approximately 1.9835 acre-feet, or about 646,000 gallons or 2,447 cubic meters.

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water, and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common pigments in plants.

Color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

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.

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, an artificial structure, or a uniform cross section over a long reach of the channel.

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.

Cubic foot per second (ft^3/s , ft^3/s) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment), that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Dissolved refers to the amount of substance present in true chemical solution. In practice, however, the term includes all forms of substance that will pass through a 0.45-micrometer membrane filter, and thus may include some very small (colloidal) suspended particles. Analyses are performed on filtered samples.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Diversity index is a numerical expression of evenness of distribution of aquatic organisms. The formula for diversity index is:

$$\bar{d} = - \sum_{i=1}^s \frac{n_i}{n} \log_2 \frac{n_i}{n}$$

Where 'n_i' is the number of individuals per taxon, 'n' is the total number of individuals, and 's' is the total number of taxa in the sample of the community. Diversity index values range from zero, when all the organisms in the sample are the same, to some positive number, when some or all of the organisms in the sample are different.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains 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.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (G.H.) 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.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is attributable to the presence of alkaline earths (principally calcium and magnesium) and is expressed as equivalent calcium carbonate (CaCO₃).

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an 8-digit number.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

Methylene blue active substance (MBAS) is a measure of apparent detergents. This determination depends on the formation of a blue color when methylene blue dye reacts with synthetic detergent compounds.

Micrograms per gram (UG/G, ug/g) is a unit expressing the concentration of a chemical element as the mass (micrograms) of the element sorbed per unit mass (gram) of sediment.

Micrograms per kilogram (MG/KG, mg/kg) is a unit expressing the concentration of a chemical element as the mass (micrograms) of the element sorbed per unit mass (kilogram) of sediment.

Micrograms per liter (UG/L, ug/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (MG/L, mg/L) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represent the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in mg/L, and is based on the mass of sediment per liter of water-sediment mixture.

National Geodetic Vertical Datum of 1929 (NGVD) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Stream Quality Accounting Network (NASQAN) is a nationwide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water-quality assessment and hydrologic research.

The National Trends Network (NTN) is a 150-station network for sampling atmospheric deposition in the United States. The purpose of the network is to determine the variability, both in location and in time, of the composition of atmospheric deposition, which includes snow, rain, dust particles, aerosols, and gases. The core from which the NTN was built was the already-existing deposition-monitoring network of the National Atmospheric Deposition Program (NADP).

Organism is any living entity, such as an insect, phytoplankter, or zooplankter.

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meters (m^2), acres, or hectares. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliters (mL) or liters (L). Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Parameter code numbers are unique five-digit code numbers assigned to each parameter placed into storage. These codes are assigned by the Environmental Protection Agency and are also used to identify data exchanged among agencies.

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

Particle size is the diameter, in millimeters (mm), of suspended sediment or bed material determined by either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in distilled water (chemically dispersed).

Particle-size classification used in this report agrees with recommendations made by the American Geophysical Union Subcommittee on Sediment Terminology.

The classification is as follows:

Classification	Size (mm)	Method of analysis
Clay	0.00024 - 0.004	Sedimentation.
Silt	.004 - .062	Sedimentation.
Sand	.062 - 2.0	Sedimentation or sieve.
Gravel	2.0 - 64.0	Sieve.

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic material is removed and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass or volume.

Periphyton is the assemblage of microorganisms attached to and growing upon solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms. Periphyton is a useful indicator of water quality.

Pesticides are chemical compounds used to control undesirable plants and animals. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides. Insecticides and herbicides, which control insects and plants respectively, are the two categories reported.

Picocurie (PC, pCi) is one trillionth (1×10^{-12}) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields 3.7×10^{10} radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment, and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells/mL of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algal mats or floating "moss" in lakes. Their concentrations are expressed as number of cells/mL of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column, and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated by the plants (carbon method).

Milligrams of carbon per area or volume per unit time [$\text{mg C}/(\text{m}^2 \cdot \text{time})$ for periphyton and macrophytes and $\text{mg C}/(\text{m}^3 \cdot \text{time})$ for phytoplankton] are units for expressing primary productivity. They define the amount of carbon dioxide consumed as measured by radioactive carbon (carbon 14). The carbon 14 method is of greater sensitivity than the oxygen light and dark bottle method, and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Milligrams of oxygen per area or volume per unit time [$\text{mg O}_2/(\text{m}^2 \cdot \text{time})$ for periphyton and macrophytes and $\text{mg O}_2/(\text{m}^3 \cdot \text{time})$ for phytoplankton] are the units for expressing primary productivity. They define production and respiration rates as estimated from changes in the measured dissolved oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of only readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Runoff in inches (IN, 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.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L).

Mean concentration is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment discharge (tons/day) is the rate at which dry weight of sediment passes a section of a stream or is the quantity of sediment, as measured by dry weight or volume, that passes a section in a given time. It is computed by multiplying discharge times mg/L times 0.0027.

Suspended-sediment load is quantity of suspended sediment passing a section in a specified period.

Total sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry weight or volume, that passes a section during a given time.

Total-sediment load or total load is a term which refers to the total sediment (bed load plus suspended-sediment load) that is in transport. It is not synonymous with total-sediment discharge.

7-day 10 year low flow (7 Q₁₀) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance derived from the atmosphere, vegetation, soil, or rocks that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in micromhos per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in micromhos). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Stage-discharge relation is the relation between gage height (stage) and volume of water per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as a streamflow may be applied to discharge whether or not it is affected by diversion of regulation.

Substrate is the physical surface upon which an organism lived.

Natural substrates refers to any naturally occurring emersed or submersed solid surface, such as a rock or tree, upon which an organism lived.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest USGS topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimetered. All areas shown are those for the stage when the planimetered map was made. All areas shown are those for the stage when the planimetered map was made.

Surficial bed material is that part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of the total concentration in a water-sediment mixture. The water-sediment mixture is associated with (or sorbed on) that material retained on a 0.45 micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."

Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchical scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, Hexagenia limbata is the following:

Kingdom.....Animal
Phylum.....Arthropoda
Class.....Insects
Order.....Ephemeroptera
Family.....Ephemeridae
Genus.....Hexagenia
Species.....Hexagenia limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the year.

Tons per acre-foot indicates the dry mass of dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration in milligrams per liter by 0.00136.

Tons per day is the quantity of substance in solution or suspension that passes a stream section during a 24-hour day.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determines all of the constituent in the sample.)

Total in bottom material is the total amount of a given constituent in a representative sample of bottom material. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total in bottom material."

Total load (tons) is the total quantity of any individual constituent, as measured by dry mass or volume, that is dissolved in a specific amount of water (discharge) during a given time. It is computed by multiplying the total discharge, times the mg/L of the constituent, times the factor 0.0027, times the number of days.

Total recoverable refers to the amount of a given constituent that is in solution after a representative water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent percent in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Tritium Network is a network of stations which has been established to provide baseline information on the occurrence of tritium in the Nation's surface waters. In addition to the surface-water stations in the network, tritium data are also obtained at a number of precipitation stations. The purpose of the precipitation stations is to provide an estimate sufficient for hydrologic studies of the tritium input to the United States.

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, 1980, is called the "1980 water year."

WDR is used as an abbreviation for "Water-Data Report" in reference to published reports beginning in 1975.

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a 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 water year after thorough mixing in the reservoir.

WRD is used as an abbreviation for "Water-Resources Data" in the REVISED RECORDS paragraph to refer to State annual basic-data reports published before 1975.

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

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

- 1-D1. *Water temperature--influential factors, field measurement, and data presentation*, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.
- 1-D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents*, by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.
- 2-D1. *Application of surface geophysics to ground-water investigations*, by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages.
- 2-E1. *Application of borehole geophysics to water-resources investigations*, by W. S. Keys and L. M. MacCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages.
- 3-A1. *General field and office procedures for indirect discharge measurements*, by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.
- 3-A2. *Measurement of peak discharge by the slope-area method*, by Tate Dalrymple and M. A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages.
- 3-A3. *Measurement of peak discharge at culverts by indirect methods*, by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.
- 3-A4. *Measurement of peak discharge at width contractions by indirect methods*, by H. F. Matthai: USGS--TWRI Book 3, Chapter A4. 1967. 44 Pages.
- 3-A5. *Measurement of peak discharge at dams by indirect methods*, by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.
- 3-A6. *General procedure for gaging streams*, by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.
- 3-A7. *Stage measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A7. 1968. 28 pages.
- 3-A8. *Discharge measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.
- 3-A9. *Measurement of time of travel and dispersion in streams by dye tracing*, by E. F. Hubbard, F. A. Kilpatrick, L. A. Martens, and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1982. 44 pages.
- 3-A10. *Discharge ratings at gaging stations*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.
- 3-A11. *Measurement of discharge by moving-boat method*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.
- 3-A13. *Computation of continuous records of streamflow*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.
- 3-A14. *Use of flumes in measuring discharge*, by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.
- 3-A15. *Computation of water-surface profiles in open channels*, by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages.
- 3-B1. *Aquifer-test design, observation, and data analysis*, by R. W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages.
- 3-B2. *Introduction to ground-water hydraulics, a programed text for self-instruction*, by G. D. Bennett: USGS--TWRI Book 3, Chapter B2. 1976. 172 pages.
- 3-B3. *Type curves for selected problems of flow to wells in confined aquifers*, by J. E. Reed: USGS--TWRI Book 3, Chapter B3. 1980. 106 pages.

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS--Continued

- 3-C1. *Fluvial sediment concepts* by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.
- 3-C2. *Field methods for measurement of fluvial sediment*. by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.
- 3-C3. *Computation of fluvial-sediment discharge*, by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.
- 4-A1. *Some statistical tools in hydrology*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.
- 4-A2. *Frequency curves*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.
- 4-B1. *Low-flow investigations*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.
- 4-B2. *Storage analyses for water supply*, by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.
- 4-B3. *Regional analyses of streamflow characteristics*. by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.
- 4-D1. *Computation of rate and volume of stream depletion by wells* by C. T. Jenkins: USGS--TWRI Book 4, Chapter D1. 1970. 17 pages.
- 5-A1. *Methods for determination of inorganic substances in water and fluvial sediments* by M. W. Skougstad and others, editors: USGS--TWRI Book 5, Chapter A1. 1979. 626 pages.
- 5-A2. *Determination of minor elements in water by emission spectroscopy*. by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.
- 5-A3. *Methods for analysis of organic substances in water*. by D. F. Goerlitz and Eugene Brown: USGS--TWRI Book 5, Chapter A3. 1972. 40 pages.
- 5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*. edited by P. E. Greeson, T. A. Ehlke, G. A. Irwin, B. W. Lium, and K. V. Slack: USGS--TWRI Book 5, Chapter A4. 1977. 332 pages.
- 5-A5. *Methods for determination of radioactive substances in water and fluvial sediments*. by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.
- 5-A6. *Quality assurance practices for the chemical and biological analyses of water and fluvial sediments*, by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.
- 5-C1. *Laboratory theory and methods for sediment analysis*. by H. P. Guy: USGS--TWRI Book 5, Chapter C1. 1969. 58 pages.
- 7-C1. *Finite difference model for aquifer simulation in two dimensions with results of numerical experiments*, by P. C. Trescott, G. F. Pinder, and S. P. Larson: USGS--TWRI Book 7, Chapter C1. 1976. 116 pages.
- 7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water*, by L. F. Konikow and J. D. Bredehoeft: USGS--TWRI Book 7, Chapter C2. 1978. 90 pages.
- 7-C3. *A model for simulation of flow in singular and interconnected channels* by R. W. Schaffranek, R. A. Baltzer, and D. E. Goldberg: USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.
- 8-A1. *Methods of measuring water levels in deep wells* by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.
- 8-A2. *Installation and service manual for U.S. Geological Survey manometers* by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.
- 8-B2. *Calibration and maintenance of vertical-axis type current meters*. by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 15 pages.

DISCONTINUED GAGING STATIONS

The following continuous-record streamflow or stage stations in Minnesota have been discontinued or converted to partial-record stations. Daily streamflow or stage records were collected and published for the period of record shown for each station.

Station number	Station name	Drainage area (mi ²)	Period of record
Streams tributary to Lake Superior			
04010000	Pigeon River above mouth of Arrow River, MN	256	1924-27
04011000	Brule River at mouth near Hoveland, MN	248	1911 ¥
04011500	Devil Track River at mouth near Grand Marais, MN	a77	1911 ¥
04012000	Cascade River at mouth near Grand Marais, MN	111	1911 ¥
*04012500	Poplar River at Lutsen, MN	114	1911 ¥ , 1912-17, 1928-47, 1952-61
04013000	Cross River at Schroeder, MN	a91	1931-32
04015000	Beaver Creek (Beaver Bay Run) at Beaver Bay, MN	126	1911-14, 1928-31
04015455	South Branch Partridge River near Babbitt, MN	18.5	1977-80
04015500	Second Creek near Aurora, MN	29	1955-80
04016000	Partridge River near Aurora, MN	161	1942-82
04017000	Embarrass River at Embarrass, MN	93.8	1942-64
04018000	Embarrass River near McKinley, MN	171	1953-62
04018900	East Two Rivers near Iron Junction, MN	40.0	1966-79
04019000	West Two Rivers near Iron Junction, MN	65.3	1953-62, 1965-79
04019300	West Swan River near Silica, MN	16.3	1963-79
04019500	East Swan River near Toivola, MN	112	1953-62, 1964-71
04020000	Swan River near Toivola, MN	254	1952-61
04021000	Whiteface River below (at) Meadowlands, MN	453	1909-17
04021530	Stoney Brook at Brookston, MN	97.3	1983-84
04023000	Cloquet River at Independence, MN	a750	1909-17
04023150	Simian Creek near Brookston, MN	-	1983-84
04023500	St. Louis River near Cloquet, MN	a3,400	1903 ¥
04023600	Squaw Creek near Cloquet, MN	-	1983-84
04024015	Otter Creek near Cloquet, MN	-	1983-84
04024090	Elim Creek near Holyoke, MN	1.06	1976-78
04024093	Skunk Creek below Elim Creek near Holyoke, MN	8.83	1976-78
Red River of the North basin			
05030000	Otter Tail River near Detroit Lakes, MN	270	1937-71
05030500	Otter Tail River at German Church, near Fergus Falls, MN	a1,230	1904-17
05033900	Pelican River at Detroit Lakes, MN	-	1968-71, 1974-75
05034100	Pelican River at Detroit Lake outlet near Detroit Lakes, MN	-	1968-71, 1972-75
05035100	Long Lake outlet near Detroit Lakes, MN	-	1968-71
05035200	West Branch County Ditch No. 14 near Detroit Lakes, MN	-	1968-71
05035300	East Branch County Ditch No. 14 near Detroit Lakes, MN	-	1968-71
05035500	St. Clair Lake outlet near Detroit Lakes, MN	-	1968-75

"See footnotes at end of table."

DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi ²)	Period of record
Red River of the North basin--Continued			
05035600	Pelican River at Muskrat Lake outlet near Detroit Lakes, MN	-	1968-75
05037100	Pelican River at Sallie Lake outlet near Detroit Lakes, MN	-	1968-75
05039100	Pelican River at Lake Melissa outlet near Detroit Lakes, MN	-	1968-75
05040000	Pelican River near Detroit Lakes, MN	123	1942-53
05040500	Pelican River near Fergus Falls, MN	482	1909-12, 1942-80
05045500	Otter Tail River (Red River) near Fergus Falls, MN	a1,690	1909-10 4
05046500	Otter Tail River near Breckenridge, MN	a2,040	1931-32, 1939-46 4
05047000	Mustinka River (head of Bois de Sioux River) near Norcross, MN	-	1940-47
05047500	Mustinka ditch above West Branch Mustinka River (Twelve Mile Creek) near Charlesville, MN	-	1943-55
05048000	Mustinka ditch below West Branch Mustinka River (Twelve Mile Creek) near Charlesville, MN	-	1943-55
05048500	West Branch Mustinka River (Twelve Mile Creek) below Mustinka ditch near Charlesville, MN	-	1943-55
05049000	Mustinka River above (near) Wheaton, MN	834	1915-24, 1930-58
05050500	Bois de Sioux River below Fairmont, ND	a1,540	1919-44
05051000	Rabbit River at Cambell, MN	266	1942-52
05054020	Red River of the North below Fargo, ND	-	1969-78
*05061200	Whiskey Creek at Barnesville, MN	25.3	1964-66
05062500	Wild Rice River at Twin Valley, MN	888	1909-17 1930-83
05063000	Wild Rice River near Ada, MN	a1,100	1948-54
*05063500	South Branch Wild Rice River near Borup, MN	254	1944-49
05067000	Marsh River below Ada, MN	-	1948-52
05068000	Sand Hill River at Beltrami, MN	a324	1943-58
05068500	Sand Hill ditch at Beltrami, MN	-	1943-58
05075500	Thief River near Gatske, MN	-	1953-56
05076500	Red Lake River at Thief River Falls, MN	a3,450	1909-18, 1920-30
05077000	Clearwater River near Pinewood, MN	132	1940-45
05077500	Clearwater River near Leonard, MN	153	1934-47
*05077700	Ruffy Brook near Gonvick, MN	45.2	1960-78
05083500	Red River of the North at Oslo, MN	331,200	1936-37, 1941-43, 1945-60, 1973-78
05085500	Snake River at Warren, MN	a175	1945, 1953-56
05086000	Snake River at Alvarado, MN	309	1945, 1953-56
05086500	Snake River near Argyle, MN	481	1945
05087000	Middle River near Strandquist, MN	-	1953-56
05090500	Tamarac River near Strandquist, MN	-	1953-56
05091000	Tamarac River at Stephen, MN	-	1945
05091500	Tamarac River near Stephen, MN	a320	1945, 1953-55

"See footnotes at end of table."

DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi ²)	Period of record
Red River of the North basin--Continued			
05092500	Two Rivers (Middle Fork Two Rivers) near Hallock, MN	131	1931-38
05093000	South Branch (South Fork) Two Rivers near Pelan, MN	281	1928-38, 1953-56
05094500	South Branch Two Rivers (Two Rivers) at Hallock, MN	-	1940-47
05095000	Two Rivers (South Branch Two Rivers) at Hallock, MN		1911-14 1929-30 1938-39 1941-43
05095500	Two Rivers below Hallock, MN	644	1945-55
05096000	North Branch (North Fork) Two Rivers near Lancaster, MN	a32	1929-38, 1941-55
05096500	State Ditch 85 near Lancaster, MN	a95	1929-38, 1942-55
05097000	North Branch Two Rivers at Lancaster, MN	209	1941-42, 1953-56
05097500	North Branch Two Rivers near Northcote, MN	386	1941-42, 1945-51
05098000	Two Rivers below North Branch near Hallock, MN	a1,060	1941-43
05103000	Roseau River (at) near Malung, MN	252	1928-46
05104000	South Fork (West Branch) Roseau River near Malung, MN	312	1911-14, 1928-46
05105000	Roseau River at Roseau, MN	-	1940-47
05105500	Roseau River near Roseau, MN	-	1930-60
05106000	Sprague Creek near Sprague, Manitoba	176	1928-81
05107000	Pine Creek near Pine Creek, MN	74.6	1928-53
05108000	Roseau River near Badger, MN	-	1928-69
05108500	Roseau River near Duxby, MN	-	1929-51, 1952-56
05109000	Badger Creek near Badger, MN	a2.2	1929-30, 1931-38
05109500	Roseau River near Haug, MN	-	1932-66
05110000	Roseau River at outlet of State Ditch 69 near Oak Point, MN	-	1939-42
05110500	Roseau River at head of State Ditch 51 near Oak Point, MN	-	1933-42
05111000	Roseau River at Oak Point, MN	-	1933-39, 1941-60
05112500	Roseau River at International boundary, near Caribou, MN	a1,590	1933-69
Lake of the Woods basin			
05124500	Isabella River near Isabella, MN	341	1953-61, 1976-77
05124990	Filson Creek near Ely, MN	9.66	1974-85
05125000	South Kawishiwi River near Ely, MN	-	1953-61, 1976-78
05125500	Stony River near Isabella, MN	180	1953-64
05125550	Stony River near Babbitt, MN	219	1975-80
05126000	Dunka River near Babbitt, MN	53.4	1951-62, 1975-80
05126210	South Kawishiwi River above White Iron Lake near Ely, MN		1975-78

*See footnotes at end of table."

DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi ²)	Period of record
Lake of the Woods basin--Continued			
05126500	Bear Island River near Ely, MN	68.5	1953-62, 1975-77
05127205	Burntside River near Ely, MN	-	1967-78
05127207	Bjorkman's Creek near Ely, MN	1.36	1972-78
05127210	Armstrong Creek near Ely, MN	5.29	1967-78
05127215	Longstorff Creek near Ely, MN	8.84	1967-78
05127219	Shagawa Lake tributary at Ely, MN	1.84	1971-78
05127220	Burgo Creek near Ely, MN	3.04	1967-78
05127230	Shagawa River near Ely, MN	99	1967-78
05128340	Pike River near Biwabik, MN	-	1977-79
05128500	Pike River near Embarrass, MN	115	1953-64, 1976-79
05129000	Vermilion River below Vermilion Lake near Tower, MN	483	1911-17, 1928-81
05129500	Rainy River at International Falls, MN	14,900	1905-60
05130000	Sturgeon River (Lake) at Side Lake, MN	-	1938-47
05131000	Dark River near Chisholm, MN	50.6	1942-61, 1965-79
05131800	Deer Lake outlet (Deer Lake) near Effie, MN	-	1937-39, 1940-46
05132500	Big Fork River at Laurel, MN	-	1909
05133000	Black River near Loman, MN	-	1909
05139500	Warroad River near Warroad, MN	162	1946-80
*05140000	Bulldog Run near Warroad, MN	14.2	1946-51, 1966-77
*05140500	East Branch Warroad River near Warroad, MN	102	1946-54, 1966-77

* Presently operated as high-flow partial-record station.

‡ Stage records only.

a Approximately.

EXPLANATION

- ▲ Stream gage
- ▴ Lake gage

Volume I

Hudson Bay basin

Great Lakes basin

Volume II

Upper Mississippi River basin

Missouri River basin

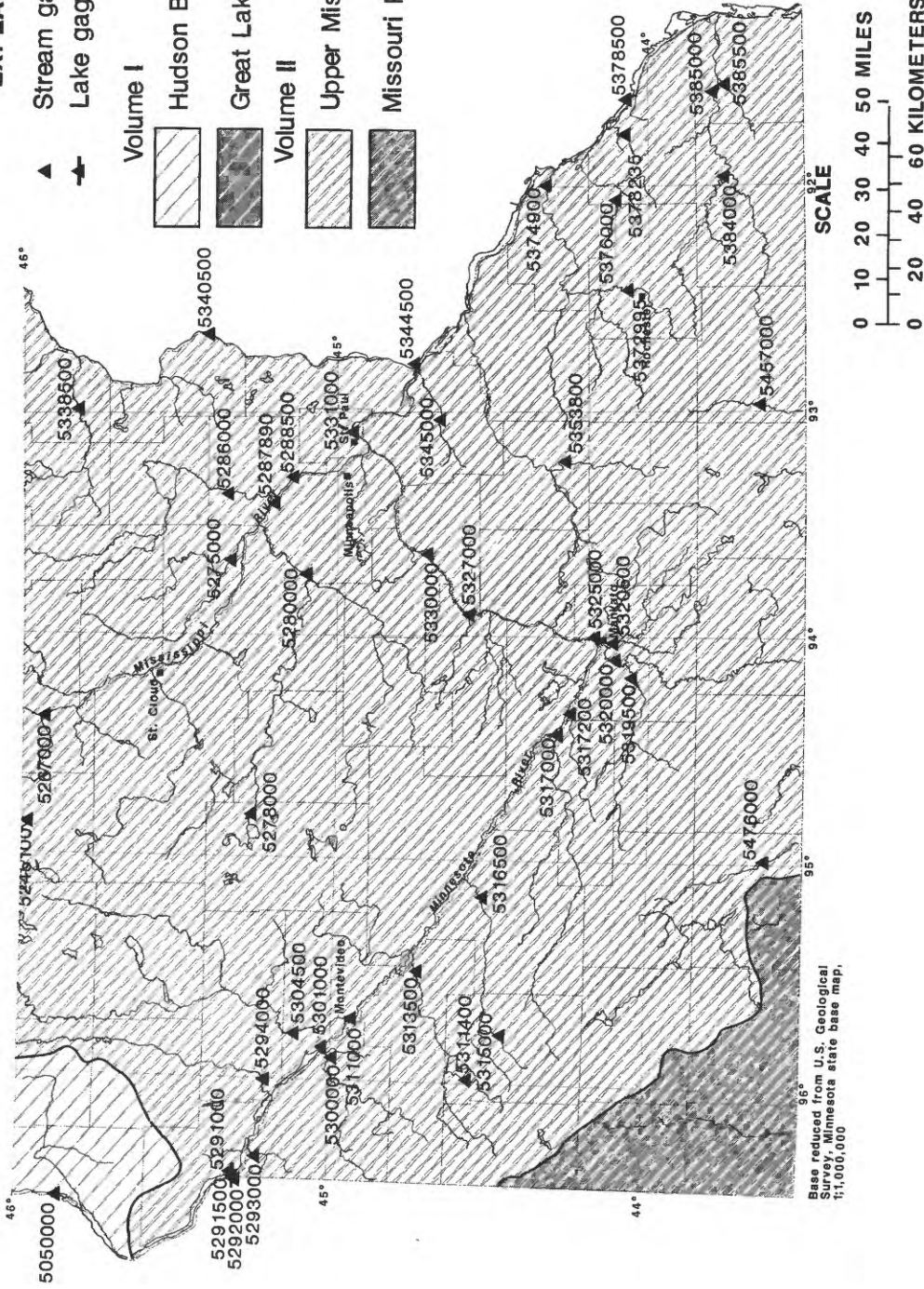
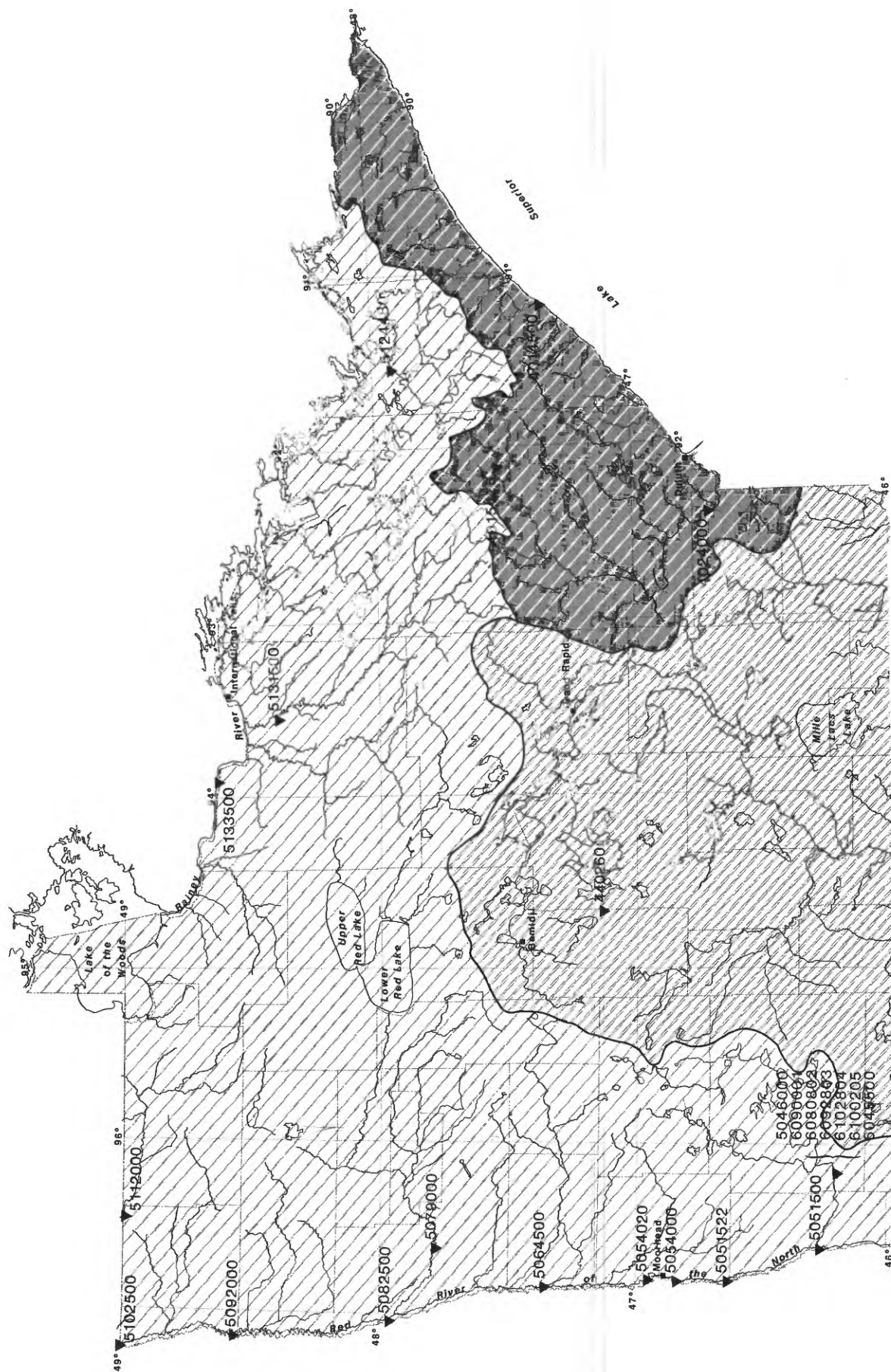


Figure 8.--Location of lake and stream-gaging stations



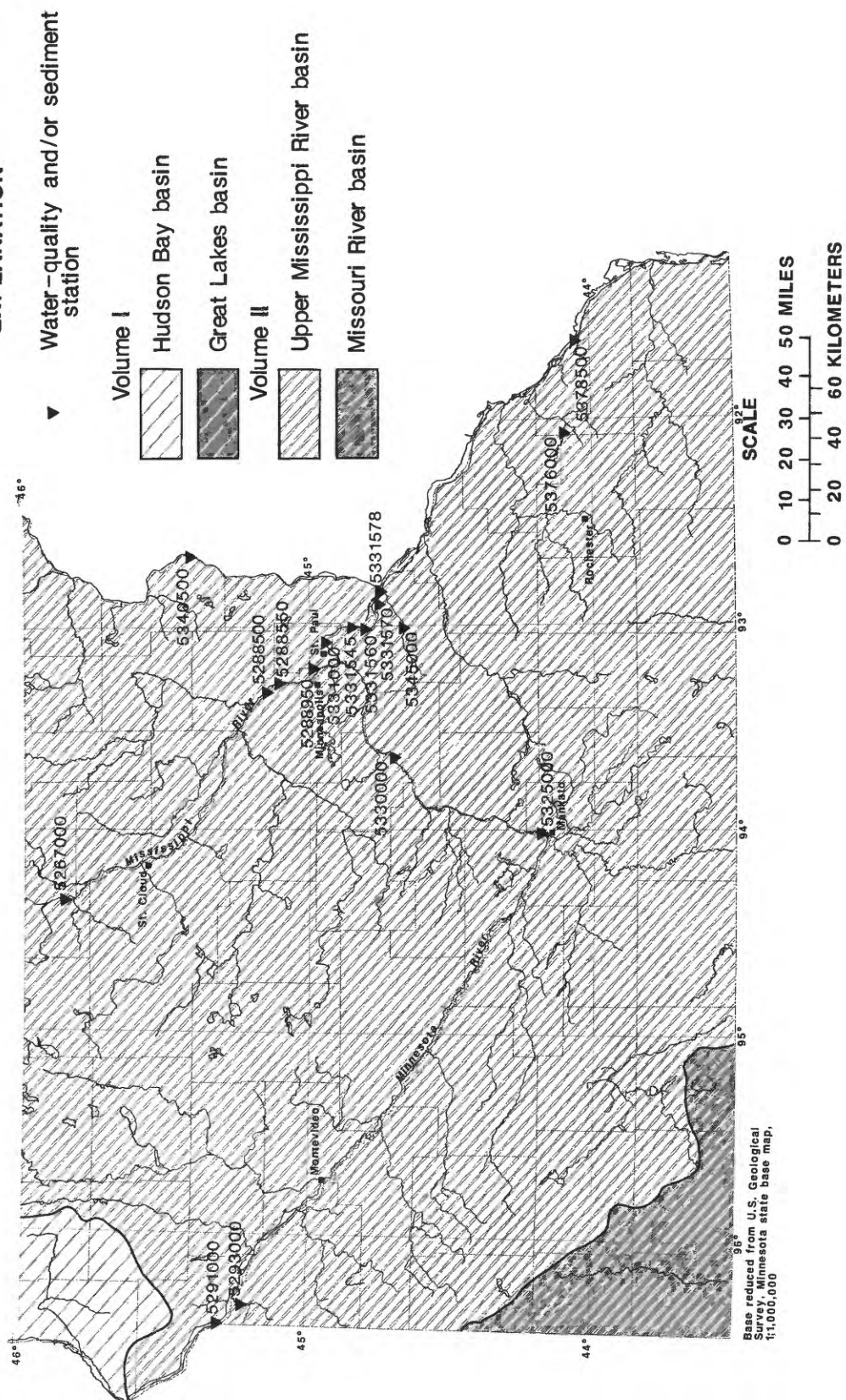


Figure 9.--Location of surface-water-quality stations

STREAMS TRIBUTARY TO LAKE SUPERIOR

04010500 PIGEON RIVER AT MIDDLE FALLS, NEAR GRAND PORTAGE, MN
(International gaging station)

LOCATION.--Lat 48°00'44", long 89°36'58", in SW¼NE¼ sec.24, T.64 N., R.6 E., Cook County, Hydrologic Unit 04010101, on the Grand Portage Indian Reservation, on right bank 400 ft upstream from Middle Falls, 2.5 mi upstream from Grand Portage Port of Entry, 3.5 mi upstream from mouth, and 4.7 mi northeast of village of Grand Portage.

DRAINAGE AREA.--600 mi².

PERIOD OF RECORD.--June to October 1921, April to November 1922, March 1923 to current year. Published as "at International Bridge" April 1924 to September 1940; as "below International Bridge" October 1940 to September 1965. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 744: 1927-28. WSP 804: 1934(M). WSP 974: Drainage area. WSP 1337: 1924(M), 1925, 1926-28(M), 1931(M), 1938(M), 1941(M), 1945-46(M), 1947, 1948(M), 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 787.58 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1940, nonrecording gage at International Bridge, 5.8 mi upstream at datum 102.24 ft higher. Oct. 1, 1940, to Dec. 31, 1975, at present site at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 12-15 and Nov. 22 to Apr. 8. Records good except those for periods with ice effect, Nov. 12-15 and Nov. 22 to Apr. 8, which are fair. Satellite telemeter at station.

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

AVERAGE DISCHARGE.--63 years (water years 1924-86), 508 ft³/s, 11.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,000 ft³/s, May 5, 1934, gage height, 7.6 ft, site and datum then in use, from rating curve extended above 7,000 ft³/s; minimum daily, 1.0 ft³/s, Jan. 15-21, 1977; minimum recorded gage height, 1.24 ft, Jan. 7, 8, 15, 1977, but may have been less during period of no gage-height record, Jan. 16 to Apr. 17, 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft³/s and maximum (*):

Date	Time	Discharge (ft ³ /s)	Gage height (ft)	Date	Time	Discharge (ft ³ /s)	Gage height (ft)
Oct. 8	0730	3,290	8.42	Apr. 30	0030	*5,340	*10.07
Minimum discharge, 122 ft ³ /s, Sept. 1, gage height, 2.78 ft.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1180	686	390	255	200	190	460	4020	650	350	317	146
2	1370	950	385	252	200	190	560	3170	614	332	320	248
3	1310	922	380	250	200	190	720	2650	586	320	302	305
4	1330	838	375	248	200	189	860	2300	563	311	317	374
5	1500	766	370	245	200	188	960	2070	535	305	377	314
6	1260	730	365	242	200	187	1050	1940	493	302	341	275
7	1070	738	360	240	200	186	1200	1810	482	290	311	242
8	2510	714	355	238	200	184	1800	1700	482	287	299	216
9	2350	674	350	235	200	182	2100	1590	476	272	299	191
10	1840	528	345	232	199	180	2190	1510	437	250	314	184
11	1470	490	340	230	199	179	2300	1420	434	238	308	178
12	1330	495	335	228	198	178	2390	1370	430	252	281	167
13	1330	500	330	225	198	177	2040	1410	412	338	258	157
14	1220	485	325	220	197	176	1930	1790	406	383	248	148
15	1110	465	320	218	197	175	1960	1860	383	371	238	144
16	1020	462	315	216	196	174	1940	1700	486	335	225	136
17	950	490	310	215	196	173	1840	1520	602	504	214	140
18	892	486	305	214	195	172	1780	1380	549	514	202	157
19	842	468	300	213	195	171	1900	1270	479	486	191	157
20	790	454	295	212	194	170	2050	1180	426	430	191	161
21	743	430	290	211	194	170	1950	1100	416	380	189	161
22	704	425	290	210	193	171	1700	1040	430	347	184	165
23	714	420	285	210	193	172	1480	990	434	323	191	157
24	758	415	285	209	192	174	1580	946	412	332	184	146
25	738	410	280	209	192	178	2590	910	380	341	178	142
26	714	405	280	208	191	180	2800	874	380	323	170	142
27	662	400	275	208	190	185	3040	834	423	362	161	245
28	630	395	270	207	190	200	3270	802	448	514	157	347
29	594	395	265	205	---	225	4900	766	420	493	148	341
30	574	390	260	203	---	280	5120	730	380	398	138	323
31	552	---	260	200	---	350	---	690	---	350	128	---
TOTAL	34057	16426	9890	6908	5499	5896	60460	47342	14048	11033	7381	6209
MEAN	1099	548	319	223	196	190	2015	1527	468	356	238	207
MAX	2510	950	390	255	200	350	5120	4020	650	514	377	374
MIN	552	390	260	200	190	170	460	690	380	238	128	136
CFSM	1.83	.91	.53	.37	.33	.32	3.36	2.55	.78	.59	.40	.35
IN	2.11	1.02	.61	.43	.34	.37	3.75	2.94	.87	.68	.46	.38
AC-FT	67550	32580	19620	13700	10910	11690	119900	93900	27860	21880	14640	12320

CAL YR 1985 TOTAL 218135 MEAN 598 MAX 3800 MIN 84 CFSM 1.00 IN 13.52 AC-FT 432700

STREAMS TRIBUTARY TO LAKE SUPERIOR

04014500 BAPTISM RIVER NEAR BEAVER BAY, MN

LOCATION.--Lat 47°20'07", long 91°12'06", in SE¼NE¼ sec.15, T.56 N., R.7 W., Lake County, Hydrologic Unit 04010101, on right bank 400 ft upstream from bridge on U.S. Highway 61, 0.3 mi upstream from mouth, 4 mi northeast of Silver Bay, and 7 mi northeast of village of Beaver Bay.

DRAINAGE AREA.--140 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1927 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 894: 1939. WSP 1337: 1933-34(M), 1935.

GAGE.--Water-stage recorder. Datum of gage is 613.65 ft above National Geodetic Vertical Datum of 1929 (U.S. Army Corps of Engineers bench mark). Prior to Oct. 5, 1934, nonrecording gage, and Oct. 5, 1934 to Nov. 22, 1978, water-stage recorder at site 370 ft downstream and at datum 3.68 ft lower.

REMARKS.--Estimated daily discharges: Nov. 6 to Apr. 2, 11-17. Records good except those for period with ice effect, Nov. 6 to Apr. 2, and those for period of no gage-height record, Apr. 11-17, which are fair.

AVERAGE DISCHARGE.--59 years, 170 ft³/s, 16.49 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,000 ft³/s, Sept. 24, 1977, gage height, 8.33 ft site and datum then in use, from highwater mark in well, from rating curve extended above 4,200 ft³/s on basis of slope-area measurement of peak flow; maximum gage height, 11.06 ft, Apr. 12, 1965, site and datum then in use, from floodmark (backwater from ice); no flow Jan. 14 to Mar. 2, 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,300 ft³/s and maximum (*):

Date	Time	Discharge (ft ³ /s)	Gage height (ft)	Date	Time	Discharge (ft ³ /s)	Gage height (ft)
Apr. 1	1300	Ice jam	*10.23	Apr. 27	2200	*1,990	9.84
Apr. 7	2200	1,330	9.84				

Minimum daily discharge, 25 ft³/s, Mar. 2-11; minimum gage height, 5.92 ft, Mar. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	440	182	105	41	32	26	400	704	50	49	68	216
2	426	233	102	40	32	25	500	544	48	43	62	320
3	398	209	98	40	31	25	640	424	45	39	54	314
4	360	184	95	39	31	25	667	352	47	176	49	439
5	306	163	87	39	31	25	724	305	43	191	57	359
6	258	174	84	38	31	25	702	272	40	157	54	212
7	233	183	80	38	30	25	985	248	75	106	83	157
8	945	159	77	38	30	25	1240	238	84	89	155	121
9	788	125	74	37	30	25	1150	262	67	96	145	101
10	577	102	70	37	30	25	883	241	115	84	220	128
11	428	93	68	37	29	25	750	287	307	95	168	181
12	494	93	65	36	29	26	700	344	232	452	109	240
13	509	93	63	36	29	26	650	541	161	809	84	196
14	404	93	61	35	29	27	600	709	124	650	161	152
15	328	93	58	35	29	27	570	594	106	515	302	128
16	273	95	56	34	28	27	540	458	232	348	221	106
17	242	100	54	34	28	28	520	348	176	260	152	359
18	224	110	52	34	28	29	509	274	113	244	115	459
19	200	130	50	34	28	30	617	229	91	258	78	376
20	180	135	48	34	28	31	635	191	81	249	204	375
21	166	133	47	34	27	32	539	165	120	206	260	331
22	158	131	46	34	27	34	417	144	130	155	203	360
23	209	130	45	33	27	35	350	131	101	120	317	305
24	243	128	44	33	27	37	481	118	77	101	214	235
25	209	126	43	33	27	39	682	115	74	240	160	537
26	186	123	43	33	26	40	736	108	87	241	122	597
27	170	119	43	33	26	43	1670	95	125	178	98	430
28	154	116	42	33	26	48	1860	85	111	150	80	359
29	146	113	42	33	---	58	1380	73	77	117	66	331
30	156	109	42	32	---	80	948	64	61	90	58	292
31	147	---	41	32	---	200	---	54	---	80	74	---
TOTAL	9957	3977	1925	1099	806	1173	23045	8717	3200	6588	4193	8716
MEAN	321	133	62.1	35.5	28.8	37.8	768	281	107	213	135	291
MAX	945	233	105	41	32	200	1860	709	307	809	317	597
MIN	146	93	41	32	26	25	350	54	40	39	49	101
CFSM	2.29	.95	.44	.25	.21	.27	5.49	2.01	.76	1.52	.96	2.08
IN.	2.65	1.06	.51	.29	.21	.31	6.12	2.32	.85	1.75	1.11	2.32
AC-FT	19750	7890	3820	2180	1600	2330	45710	17290	6350	13070	8320	17290
CAL YR 1985	TOTAL	69540.8	MEAN 191	MAX 1200	MIN 9.7	CFSM 1.36	IN 18.48	AC-FT 137900				
WTR YR 1986	TOTAL	73396.0	MEAN 201	MAX 1860	MIN 25	CFSM 1.44	IN 19.50	AC-FT 145600				

STREAMS TRIBUTARY TO LAKE SUPERIOR

04014500 BAPTISM RIVER NEAR BEAVER BAY, MN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT 22...	1430	153	78	62	7.5	7.2	10.0	6.0	1.0	743
JAN 15...	1300	36	103	104	7.6	8.1	-3.0	0.0	1.5	742
JUN 03...	1030	45	72	84	7.8	7.8	12.0	13.5	1.0	748
AUG 19...	1030	76	68	76	7.6	7.5	17.0	16.0	0.7	757

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCHI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
OCT 22...	11.8	K4	20	7.6	2.0	2.2	0.4	27	0
JAN 15...	14.1	K3	20	12	3.7	3.4	0.6	47	0
JUN 03...	10.2	K4	K370	9.4	3.1	2.8	0.5	39	0
AUG 19...	9.3	K12	150	10	3.2	2.5	0.4	39	0

DATE	ALKA- LINITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA- LINITY, FIXED ENDPT, FIELD (MG/L AS CAC03) (00410)	ALKA- LINITY LAB (MG/L AS CAC03) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
OCT 22...	22	24	22	4.0	2.3	0.1	9.0	59	0.05
JAN 15...	39	39	38	11	2.5	0.2	15	71	<0.01
JUN 03...	32	34	34	8.5	1.9	0.2	7.6	66	<0.01
AUG 19...	32	31	32	12	2.0	0.2	10	95	<0.01

STREAMS TRIBUTARY TO LAKE SUPERIOR

04014500 BAPTISM RIVER NEAR BEAVER BAY, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

		NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDEDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)		
	DATE											
	OCT											
	22...	0.10	0.21	0.14	0.3	0.03	0.01	0.01	3	59		
	JAN											
	15...	0.29	0.04	0.04	0.5	<0.01	<0.01	0.01	3	66		
	JUN											
	03...	<0.10	0.01	0.01	0.4	0.01	0.01	<0.01	2	65		
	AUG											
	19...	<0.10	0.02	0.02	0.9	0.02	0.02	<0.01	5	85		
	DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
	OCT											
	22...	1430	80	<1	12	<0.1	<1	<1	<3	3	230	<1
	JAN											
	15...	1300	40	<1	6	<0.5	<1	<1	<3	1	270	<1
	AUG											
	19...	1030	90	<1	10	0.7	1	<1	<3	3	460	<5
	DATE		LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
	OCT											
	22...		<4	3	<0.1	<10	6	<1	<1	22	<6	<3
	JAN											
	15...		<4	3	<0.1	<10	<1	<1	<1	34	<6	18
	AUG											
	19...		<4	6	0.1	<10	2	<1	<1	32	<6	21

STREAMS TRIBUTARY TO LAKE SUPERIOR

04015330 KNIFE RIVER NEAR TWO HARBORS, MN

LOCATION.--Lat 46°56'49", long 91°47'32", in SW¼NW¼ sec.31, T.52 N., R.11 W., Lake County, Hydrologic Unit 04010102, on right bank 600 ft downstream from bridge on U.S. Highway 61, 0.5 mi upstream from bridge on County Highway 102, in town of Knife River, 0.8 mi upstream from Lake Superior, and 7.8 mi southwest of Two Harbors.

DRAINAGE AREA.--85.6 mi².

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1970-71, July 1974 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 640 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 8 to Apr. 1. Records fair except those for period with ice effect, Nov. 8 to Apr. 1, which are poor.

AVERAGE DISCHARGE.--12 years, 97.6 ft³/s, 15.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,440 ft³/s, May 10, 1979, gage height, 11.16 ft; minimum, no flow Dec. 2, 1976 to Mar. 4, 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 800 ft³/s and maximum (*):

Date	Time	Discharge (ft ³ /s)	Gage height (ft)	Date	Time	Discharge (ft ³ /s)	Gage height (ft)
Apr. 1	--	1,500	Ice jam	June 10	1900	*3,380	*8.04
Apr. 15	0145	826	5.09	July 13	0330	1,700	6.29
Apr. 24	2100	949	5.27	July 19	0500	2,970	7.69
Apr. 27	0800	1,860	6.47	Sept. 17	1200	1,220	5.71
May 13	1230	1,920	6.53	Sept. 25	1200	2,090	6.77

Minimum discharge, 10 ft³/s, Aug. 7; minimum gage height, 2.78 ft, July. 8, 9, Aug. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	535	83	33	16	13	12	1100	338	22	31	18	62
2	325	105	32	16	13	12	1030	252	22	26	17	295
3	219	86	31	16	13	12	782	189	22	22	14	305
4	158	71	30	15	13	12	581	154	29	20	13	357
5	123	61	29	15	13	12	636	132	29	20	11	184
6	112	61	28	15	13	12	533	115	25	19	11	104
7	94	65	27	15	13	12	500	103	35	17	22	66
8	402	60	26	15	13	12	549	134	57	14	84	50
9	295	55	25	15	12	12	383	271	34	15	58	40
10	178	50	24	14	12	12	314	224	912	17	58	155
11	127	45	23	14	12	12	266	472	1390	92	37	192
12	434	40	23	14	12	12	231	460	548	1140	24	200
13	362	40	22	14	12	12	188	1340	240	1160	19	157
14	206	39	22	14	12	12	231	719	134	456	106	103
15	147	38	21	14	12	12	703	384	88	216	201	75
16	108	38	21	14	12	12	455	260	89	131	104	54
17	88	39	20	14	12	13	290	188	73	90	58	696
18	78	45	20	14	12	13	216	136	51	63	34	489
19	68	100	19	14	12	14	319	105	40	1230	23	303
20	59	80	19	13	12	15	289	87	33	298	215	610
21	55	65	19	13	12	20	213	73	87	144	266	344
22	52	55	18	13	12	30	153	65	207	85	281	435
23	116	50	18	13	12	40	130	55	106	55	487	241
24	152	45	18	13	12	40	369	52	61	44	183	149
25	105	43	18	13	12	40	596	48	55	39	107	1080
26	83	41	17	13	12	40	415	47	98	28	63	717
27	71	39	17	13	12	40	1310	43	250	28	42	375
28	61	38	17	13	12	50	1420	37	118	32	31	233
29	55	36	17	13	---	100	853	32	64	25	25	186
30	86	34	16	13	---	300	484	28	42	21	20	162
31	79	---	16	13	---	700	---	24	---	19	19	---
TOTAL	5033	1647	686	434	344	1647	15539	6567	4961	5597	2651	8419
MEAN	162	54.9	22.1	14.0	12.3	53.1	518	212	165	181	85.5	281
MAX	535	105	33	16	13	700	1420	1340	1390	1230	487	1080
MIN	52	34	16	13	12	12	130	24	22	14	11	40
CFSM	1.89	.64	.26	.16	.14	.62	6.05	2.48	1.93	2.11	1.00	3.28
IN.	2.19	.72	.30	.19	.15	.72	6.75	2.85	2.16	2.43	1.15	3.66
AC-FT	9980	3270	1360	861	682	3270	30820	13030	9840	11100	5260	16700
CAL YR 1985	TOTAL	41727.3	MEAN 114	MAX 1140	MIN 4.0	CFSM 1.33	IN 18.13	AC-FT 82770				
WTR YR 1986	TOTAL	53525.0	MEAN 147	MAX 1420	MIN 11	CFSM 1.72	IN 23.26	AC-FT 106200				

STREAMS TRIBUTARY TO LAKE SUPERIOR

04015475 PARTRIDGE RIVER ABOVE COLBY LAKE, AT HOYT LAKES, MN

LOCATION.--Lat 47°31'38", long 92°7'21", in SW¼ sec.9, T.58 N., R.14 W., St. Louis County, Hydrologic Unit 04010201, in Superior National Forest, 10 ft upstream from bridge on County Highway 110, 1 mi east of Hoyt Lakes.

DRAINAGE AREA.--106 mi² of which 6.0 mi² is noncontributing.

PERIOD OF RECORD.--October 1978 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,455 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 19 to Mar. 30. Records good except those for period with ice effect, Nov. 19 to Mar. 30, which are fair.

AVERAGE DISCHARGE.--8 years, 92.6 ft³/s, 11.86 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,020 ft³/s, Apr. 22, 1979, gage height, 10.89 ft; minimum, 0.88 ft³/s, Feb. 15, 1981, gage height, 4.81 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--A discharge of 0.50 ft³/s was measured Aug. 23, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 639 ft³/s, Apr. 30, gage height, 8.62 ft; minimum daily, 6.5 ft³/s, Feb. 11 to Mar. 17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	219	62	35	12	7.0	6.5	140	628	40	48	54	32
2	271	61	33	12	7.0	6.5	270	572	35	39	48	43
3	334	64	32	11	7.0	6.5	356	481	33	32	45	70
4	387	62	31	11	7.0	6.5	404	395	33	43	40	112
5	422	56	30	11	7.0	6.5	468	325	31	66	37	137
6	423	55	29	11	7.0	6.5	501	265	29	77	33	135
7	390	62	28	11	7.0	6.5	498	231	40	68	35	107
8	364	63	27	11	7.0	6.5	468	209	74	57	56	88
9	351	57	26	11	7.0	6.5	454	202	92	56	72	69
10	345	51	25	10	7.0	6.5	431	202	85	54	62	57
11	323	46	25	10	6.5	6.5	401	218	106	51	49	59
12	297	41	24	10	6.5	6.5	368	248	128	54	42	96
13	276	38	23	10	6.5	6.5	339	299	124	68	37	119
14	256	38	22	9.5	6.5	6.5	317	342	103	77	46	110
15	230	35	21	9.5	6.5	6.5	288	359	85	77	72	89
16	198	33	20	9.5	6.5	6.5	260	371	111	71	82	72
17	165	32	19	9.0	6.5	6.5	238	356	133	87	72	89
18	145	32	18	9.0	6.5	7.0	222	325	128	108	58	167
19	132	34	18	9.0	6.5	7.0	220	280	105	113	48	210
20	116	38	18	8.5	6.5	7.0	231	229	80	101	45	228
21	106	43	17	8.5	6.5	7.0	238	191	66	86	49	228
22	95	44	17	8.5	6.5	7.5	220	161	61	70	52	210
23	92	44	16	8.0	6.5	7.5	200	140	62	57	61	183
24	94	43	16	8.0	6.5	7.5	185	119	58	74	66	151
25	92	42	15	8.0	6.5	8.0	181	108	54	151	66	146
26	82	41	15	8.0	6.5	8.5	177	97	59	197	60	169
27	77	39	14	7.5	6.5	9.5	248	87	81	177	52	168
28	76	38	14	7.5	6.5	11	374	73	94	129	45	148
29	69	37	13	7.5	---	13	494	63	83	100	38	138
30	64	36	13	7.5	---	18	609	55	62	78	34	129
31	63	---	12	7.5	---	54	---	47	---	63	31	---
TOTAL	6554	1367	666	291.5	187.0	283.0	9800	7678	2275	2529	1587	3759
MEAN	211	45.6	21.5	9.40	6.68	9.13	327	248	75.8	81.6	51.2	125
MAX	423	64	35	12	7.0	54	609	628	133	197	82	228
MIN	63	32	12	7.5	6.5	6.5	140	47	29	32	31	32
CFSM	1.99	.43	.20	.09	.06	.09	3.09	2.34	.72	.77	.48	1.18
IN.	2.30	.48	.23	.10	.07	.10	3.44	2.69	.80	.89	.56	1.32
AC-FT	13000	2710	1320	578	371	561	19440	15230	4510	5020	3150	7460

CAL YR 1985	TOTAL	39534.2	MEAN	108	MAX	635	MIN	1.5	CFSM	1.02	IN	13.87	AC-FT	78420
WTR YR 1986	TOTAL	36976.5	MEAN	101	MAX	628	MIN	6.5	CFSM	.95	IN	12.98	AC-FT	73340

STREAMS TRIBUTARY TO LAKE SUPERIOR

04016500 ST. LOUIS RIVER NEAR AURORA, MN

LOCATION.--Lat 47°29'30", long 92°14'20", in NW¼ sec.22, T.58 N., R.15 W., St. Louis County, Hydrologic Unit 04010201, on left bank at upstream side of highway bridge, 0.8 mi downstream from Partridge River and 1.5 mi south of Aurora.

DRAINAGE AREA.--290 mi² of which 13.3 mi² is noncontributing.

PERIOD OF RECORD.--August 1942 to current year.

REVISED RECORDS.--WSP 1337: 1950. WDR MN-77-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,371.24 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 26, 1944, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 19 to Apr. 4. Records good except those for period with ice effect, Nov. 19 to Apr. 4, which are fair. Flow regulated at times by storage in off-channel Partridge Reservoir, formerly known as Whitewater Lake. Reservoir formed from lake by levees around marsh areas and natural outlet. Available capacity 20,000 acre-ft between elevations 1,410 ft, natural lake level, and 1,440 ft. Storage 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. Flow also affected by mining activities in Second Creek basin.

AVERAGE DISCHARGE (adjusted for storage and diversion).--44 years, 252 ft³/s, 11.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,380 ft³/s, May 14, 1950, gage height, 8.37 ft; minimum daily, 4.0 ft³/s, Jan. 29 to Feb. 10, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,500 ft³/s, May 1, gage height, 4.30 ft; minimum daily, 51 ft³/s, Feb. 20 to Mar. 8; minimum gage height, 1.21 ft, Mar. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	675	252	140	60	52	45	200	1490	210	203	219	159
2	737	244	135	60	55	45	350	1450	190	182	202	191
3	825	236	130	60	60	45	600	1330	175	162	187	239
4	873	231	125	60	60	45	750	1200	174	233	171	296
5	903	226	120	58	60	45	888	1060	160	243	154	323
6	915	228	120	58	57	45	951	923	146	244	137	334
7	903	226	115	58	54	45	928	814	195	226	157	315
8	939	220	115	58	52	45	928	752	192	223	184	288
9	967	209	110	58	50	47	907	725	203	214	192	262
10	906	209	105	60	50	50	954	709	227	204	194	257
11	828	211	105	64	50	52	969	767	275	202	171	312
12	808	174	100	67	51	54	935	817	288	225	151	328
13	787	166	95	68	52	56	890	913	296	254	149	336
14	741	173	95	70	53	58	844	1000	279	257	172	323
15	681	159	90	70	54	60	796	1030	265	250	189	297
16	623	149	90	68	55	62	750	1040	293	240	210	270
17	570	148	85	66	56	64	700	1010	293	256	218	356
18	516	147	85	64	57	66	663	947	285	251	197	440
19	474	160	80	60	58	66	664	870	270	277	172	503
20	439	170	80	58	54	65	664	822	250	280	175	555
21	411	180	80	56	51	65	663	761	236	268	179	558
22	386	185	75	54	50	62	650	666	226	244	187	534
23	373	190	75	53	48	60	621	577	215	221	204	489
24	355	190	70	52	47	60	583	497	201	275	202	444
25	343	180	70	51	46	60	568	446	205	320	199	462
26	324	175	70	50	45	60	553	399	223	362	188	494
27	306	168	70	50	45	60	817	362	242	378	178	489
28	290	160	65	50	45	65	1120	329	250	355	165	458
29	277	150	65	50	---	70	1350	295	246	315	155	435
30	270	145	65	50	---	80	1450	268	228	277	145	417
31	263	---	65	50	---	100	---	239	---	243	144	---
TOTAL	18708	5661	2890	1811	1467	1802	23706	24508	6938	7884	5547	11164
MEAN	603	189	93.2	58.4	52.4	58.1	790	791	231	254	179	372
MAX	967	252	140	70	60	100	1450	1490	296	378	219	558
MIN	263	145	65	50	45	45	200	239	146	162	137	159
±	+21.8	+20.5	+12.4	+5.75	+2.80	+2.48	+64.8	+13.4	+9.93	+16.5	+14.3	+18.8
MEAN \$	625	210	106	64.2	55.2	60.6	855	804	241	270	193	391
CFSM \$	2.16	.72	.37	.22	.19	.21	2.95	2.77	.83	.93	.67	1.35
IN. \$	2.49	.80	.42	.26	.20	.24	3.29	3.20	.93	1.08	.77	1.50

CAL YR 1985 TOTAL 111644 MEAN 306 MAX 1380 MIN 22 MEAN \$ 328 CFSM \$ 1.13 IN \$ 15.37
WTR YR 1986 TOTAL 112086 MEAN 307 MAX 1490 MIN 45 MEAN \$ 324 CFSM \$ 1.11 IN \$ 15.17

± 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.

STREAMS TRIBUTARY TO LAKE SUPERIOR

04018750 ST. LOUIS RIVER AT FORBES, MN

LOCATION.--Lat 47°21'48", long 92°35'56", in NE¼SE¼ sec.3, T.56 N., R.18 W., St. Louis County, Hydrologic Unit 04010201, on right bank at downstream side of highway bridge, 1.8 mi downstream from Eveleth Taconite Company dam, 0.6 mi south of Forbes, 1.8 mi upstream from Elbow Creek.

DRAINAGE AREA.--713 mi².

PERIOD OF RECORD.--August 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,293.11 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 28, 1964, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 12 to Apr. 6, 20. Records good except those for period with ice effect, Nov. 12 to Apr. 6, and day of no gage-height record, Apr. 20, which are poor. Natural flow of stream affected by continually changing iron-mining activities that include diversions for iron-ore processing, regulation of storage reservoirs and tailing ponds, and mine pit dewatering. There is some regulation at medium and low flows by Eveleth Taconite Company dam 1.8 mi upstream.

AVERAGE DISCHARGE.--22 years, 569 ft³/s, 10.84 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,200 ft³/s, Apr. 25, 1979, gage height, 17.71 ft; minimum daily, 8.0 ft³/s, Sept. 11, 1984, gage height 5.05 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,450 ft³/s, Apr. 29, gage height, 13.36 ft; maximum gage height, 15.23 ft, Apr. 5 (backwater from ice); minimum daily discharge, 5.0 ft³/s, Feb. 20 and Mar. 4; minimum gage height 5.00 ft, Feb. 10, 11 and 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1370	586	350	180	170	120	400	3330	554	467	516	405		
2	1510	581	340	180	210	140	600	3240	477	447	473	454		
3	1590	559	330	180	80	170	1000	3080	351	415	439	574		
4	1640	530	320	140	130	5.0	1500	2880	446	468	407	684		
5	1660	519	310	180	160	200	2000	2650	440	569	385	726		
6	1680	527	305	210	120	120	2400	2390	402	565	380	773		
7	1680	531	300	160	140	140	2430	2130	436	522	367	814		
8	1780	513	290	150	150	170	2440	1950	494	498	435	832		
9	1810	467	280	140	180	200	2410	1880	456	513	459	842		
10	1790	437	270	160	20	40	2340	1840	473	512	464	871		
11	1720	541	265	210	180	150	2320	2020	655	509	456	1010		
12	1680	450	260	170	170	180	2270	2110	671	695	428	1150		
13	1690	420	250	130	160	20	2170	2160	640	730	422	1150		
14	1660	400	245	130	180	170	2060	2220	629	749	492	1110		
15	1580	380	240	220	110	180	1990	2240	612	729	572	1040		
16	1470	360	230	230	110	20	1890	2380	663	684	542	939		
17	1370	350	225	80	170	260	1780	2360	666	656	514	1170		
18	1280	350	220	240	20	20	1680	2240	631	648	496	1450		
19	1190	380	210	180	200	210	1640	2090	595	760	456	1470		
20	1100	400	205	120	5.0	180	1600	1920	560	843	447	1590		
21	1020	420	200	280	230	20	1580	1800	546	751	511	1620		
22	953	440	195	20	70	80	1480	1680	542	700	529	1590		
23	992	440	190	140	180	40	1300	1530	526	654	630	1520		
24	868	435	190	190	130	230	1410	1390	487	690	644	1410		
25	809	430	185	90	130	50	1300	1260	457	830	589	1390		
26	765	415	185	100	200	180	1260	1150	489	786	543	1480		
27	728	405	185	180	40	160	1670	1030	547	775	497	1460		
28	682	390	180	170	190	120	2810	925	540	760	459	1400		
29	657	370	180	180	---	180	3400	771	517	701	426	1350		
30	627	360	180	130	---	200	3330	726	495	636	398	1290		
31	603	---	180	50	---	250	---	660	---	580	374	---		
TOTAL	39954	13386	7495	4920	3835.0	4205.0	56460	60032	15997	19842	14750	33564		
MEAN	1289	446	242	159	137	136	1882	1937	533	640	476	1119		
MAX	1810	586	350	280	230	260	3400	3330	671	843	644	1620		
MIN	603	350	180	20	5.0	5.0	400	660	351	415	367	405		
CFSM	1.81	.63	.34	.22	.19	.19	2.64	2.72	.75	.90	.67	1.57		
IN.	2.08	.70	.39	.26	.20	.22	2.95	3.13	.83	1.04	.77	1.75		
AC-FT	79250	26550	14870	9760	7610	8340	112000	119100	31730	39360	29260	66570		
CAL YR 1985	TOTAL	252295.0	MEAN	691	MAX	2850	MIN	20	CFSM	.97	IN	13.16	AC-FT	500400
WTR YR 1986	TOTAL	274440.0	MEAN	752	MAX	3400	MIN	5.0	CFSM	1.06	IN	14.32	AC-FT	544400

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024000 ST. LOUIS RIVER AT SCANLON, MN

LOCATION.--Lat 46°42'12", long 92°25'07", in NW¼ sec.30, T.49 N., R.16 W., Carlton County, Hydrologic Unit 04010201, on right bank 25 ft downstream from lower bridge on U.S. Highway 61 at Scanlon, 0.6 mi downstream from Minnesota Power Co. powerplant, 3 mi upstream from Thomson Reservoir, and 3.2 mi upstream from Midway River.

DRAINAGE AREA.--3,430 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1908 to current year. Monthly discharge only for some periods published in WSP 1307. Published as "near Thomson" 1908-50.

REVISED RECORDS.--WSP 1337: 1911-12.

GAGE.--Water-stage recorder. Datum of gage is 1,101.23 ft above National Geodetic Vertical Datum of 1929. Oct. 5, 1909, to Sept. 5, 1914, nonrecording gage 3 mi 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.

REMARKS.--Estimated daily discharges: Nov. 27 to Mar. 3, and Apr. 2-6. Records good except those for period with ice effect, Nov. 27 to Mar. 3, and those for period of no gage-height record, Apr. 2-6, which are fair. Diurnal fluctuation caused by powerplant upstream. Flow regulated by Whiteface Reservoir and Boulder, Island, Rice and Fish Lakes, combined capacity, 332,160 acre-ft; the water discharge table shows the monthly change in contents (§).

AVERAGE DISCHARGE (UNADJUSTED).--78 years, 2,349 ft³/s, 9.30 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 37,900 ft³/s, May 9, 1950; maximum gage height, 15.8 ft, May 9, 1950, from Minnesota Department of Transportation (discharge uncertain); minimum discharge, 54 ft³/s, July 30, 1980; minimum daily, 88 ft³/s, Aug. 24, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 22,200 ft³/s, Apr. 30, gage height, 10.99 ft; minimum daily, 1,120 ft³/s, Aug. 5; minimum gage height, 2.49 ft, Jan. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5360	2290	2000	1800	1600	1550	11200	18900	1840	2040	1610	2330
2	6520	2320	2000	1800	1600	1550	18000	16500	1690	1900	1430	2540
3	6630	2230	2000	1700	1600	1550	19000	14000	1550	1800	1310	3030
4	6340	2180	2100	1700	1600	1510	18000	11700	1500	1710	1180	3940
5	5910	2070	2200	1700	1600	1510	16000	9820	1270	1710	1120	4660
6	5630	2140	2200	1700	1600	1510	14000	8400	1340	2050	1310	4330
7	5260	2110	2200	1600	1600	1430	12400	7090	1510	2130	1610	3950
8	5400	2210	2100	1600	1600	1430	11800	6520	1360	2000	1690	3600
9	6070	2110	2100	1600	1600	1450	10500	7870	1360	1700	1730	3300
10	6290	1920	2100	1600	1550	1430	9340	8300	1870	1600	1790	3410
11	5780	1800	2000	1600	1550	1420	8470	11800	4310	1720	1930	4080
12	5580	2230	2000	1300	1550	1450	7760	15400	5090	2200	1910	5210
13	6250	2200	1900	2200	1550	1480	7160	14400	4930	2860	1960	5570
14	6520	2290	1900	1600	1550	1640	6660	13100	4180	3410	2140	5120
15	6100	2310	1800	1600	1550	1700	6900	11900	3630	3160	2500	4600
16	5570	2330	1800	1600	1550	1760	7290	10900	3340	2900	2760	4150
17	4920	2170	1800	1600	1550	1920	6860	10400	3260	3000	2730	5310
18	4520	2220	1800	1600	1550	1870	6320	9480	3060	3010	2480	7910
19	4070	2650	1800	1600	1550	1760	6170	8350	2880	3380	2090	8550
20	3780	2610	1800	1600	1550	1800	6280	7610	2810	4300	2360	10100
21	3400	2380	1800	1600	1550	1740	6060	6660	2900	4560	2060	10700
22	3200	2500	1800	1600	1550	1780	5590	5920	3810	4060	2340	10400
23	3150	2190	1800	1600	1550	1770	5080	5240	3570	3390	2530	9800
24	3060	2150	1800	1600	1550	1760	4720	4410	3380	2840	2690	8940
25	2840	1580	1800	1600	1550	1800	4490	3810	3040	2670	2660	8420
26	2630	2020	1800	1600	1550	1830	4550	3560	2800	2670	2470	8470
27	2400	1800	1800	1600	1550	1960	6750	3360	2550	2540	2360	8410
28	2240	1800	1800	1600	1550	2000	15300	2980	2530	2280	2110	7820
29	2260	1900	1800	1600	---	2180	21100	2650	2480	2170	1900	7180
30	2280	1900	1800	1600	---	3290	21100	2300	2080	1950	1950	6830
31	2280	---	1800	1600	---	6640	---	2020	---	1520	2150	---
TOTAL	142240	64610	59400	50700	43850	58470	304850	265350	81920	79230	62860	182660
MEAN	4588	2154	1916	1635	1566	1886	10160	8560	2731	2556	2028	6089
MAX	6630	2650	2200	2200	1600	6640	21100	18900	5090	4560	2760	10700
MIN	2240	1580	1800	1300	1550	1420	4490	2020	1270	1520	1120	2330
§	-80	614	-1009	-956	-818	-814	2629	1469	154	-26	-163	19
MEAN§	4508	2768	907	679	748	1072	12,789	10,029	2885	2530	1865	6108
CFSM§	1.31	.81	.26	.20	.22	.31	3.73	2.92	.84	.74	.54	1.78
IN§	1.52	.90	.30	.23	.23	.36	4.16	3.37	.94	.85	.63	1.99

CAL YR 1985 TOTAL 1,138,029 MEAN 3118 MAX 15,800 MIN 900 MEAN§ 3253 CFSM§ .95 IN§ 12.88
WTR YR 1986 TOTAL 1,396,140 MEAN 3825 MAX 21,100 MIN 1120 MEAN§ 3909 CFSM§ 1.14 IN§ 15.47

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

§ Adjusted for change in contents.

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024000 ST. LOUIS RIVER AT SCANLON, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1958-66, 1968 to current year.

REMARKS.--Letter K indicates non-ideal colony count. Samples collected at cableway 0.75 mi downstream from gage.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT 21...	1400	3520	150	124	7.5	7.2	16.0	6.0	3.0	735
DEC 03...	1630	2040	190	158	7.4	7.6	-18.0	0.0	4.0	736
MAR 03...	1330	990	153	146	7.4	7.8	5.0	0.0	2.7	733
APR 07...	1330	13200	82	--	7.3	--	13.0	3.0	--	728
JUN 02...	1400	1300	100	128	7.5	7.6	18.5	20.5	3.0	741
AUG 18...	1200	1470	160	162	7.9	7.8	20.0	22.5	3.2	744

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD AS HCO3) (99440)	CAR- BONATE IT-FLD AS CO3) (99445)
OCT 21...	11.9	68	20	12	6.8	3.7	1.1	54	0
DEC 03...	14.2	45	30	16	8.0	4.0	1.0	68	0
MAR 03...	10.9	110	35	15	7.0	4.0	1.0	72	0
APR 07...	13.4	49	39	--	--	--	--	41	0
JUN 02...	8.3	K2	130	13	6.3	3.5	1.0	61	0
AUG 18...	8.0	K27	32	15	8.9	4.6	1.2	66	0

DATE	ALKA- LINITY, IT-FLD (MG/L AS CACO3) (99430)	ALKA- LINITY, FIXED ENDPT, FIELD (MG/L AS CACO3) (00410)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
OCT 21...	44	44	43	12	<0.2	0.1	6.8	110	0.06
DEC 03...	56	57	56	18	4.2	0.1	9.4	120	<0.01
MAR 03...	59	60	56	10	3.4	0.1	11	100	<0.01
APR 07...	33	33	--	--	--	--	--	--	<0.01
JUN 02...	50	51	48	15	2.8	0.1	4.9	96	<0.01
AUG 18...	54	55	58	24	3.7	0.1	7.4	124	0.01

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024000 ST. LOUIS RIVER AT SCANLON, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 21...	0.13	0.23	0.16	0.6	0.02	0.01	0.01	8	87
DEC 03...	0.16	0.06	0.06	0.8	<0.01	<0.01	<0.01	7	87
MAR 03...	0.24	0.05	0.05	0.7	0.03	0.03	0.01	2	100
APR 07...	0.19	0.09	0.06	0.8	0.07	0.02	<0.01	58	94
JUN 02...	<0.10	0.01	0.01	0.8	0.03	0.02	<0.01	9	85
AUG 18...	<0.10	0.02	0.01	0.7	0.04	0.02	<0.01	7	78

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
OCT 21...	1400	60	2	18	<0.5	<1	<1	<3	3	510	<1
MAR 03...	1330	50	<1	18	<0.5	<1	<1	<3	<1	690	<1
AUG 18...	1200	20	<1	16	<0.5	<1	<1	<3	5	530	<5

DATE	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
OCT 21...	<4	24	<0.1	<10	<1	<1	<1	39	<6	13
MAR 03...	<4	24	<0.1	<10	1	<1	<1	47	<6	9
AUG 18...	5	21	0.1	<10	1	<1	<1	51	<6	17

STREAMS TRIBUTARY TO LAKE SUPERIOR

04024098 DEER CREEK NEAR HOLYOKE, MN

LOCATION.--Lat 46°31'30", long 92°23'20", in NE¼SE¼ sec.29, T.47 N., R.16 W., Carlton County, Hydrologic Unit 04010301, on left bank 179 ft west of State Highway No. 23, 0.9 mi upstream from mouth and 4.0 mi north of Holyoke.

DRAINAGE AREA.--7.77 mi².

PERIOD OF RECORD.--October 1976 to current year.

GAGE.--Water-stage recorder. Datum of gage is 786.14 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 18-21, Nov. 25 to Apr. 2, 16-19, 21-23, and June 21-24. Records good except those for periods with ice effect, Nov. 18-21, Nov. 25 to Dec 21, and periods of no gage-height record, Dec. 22 to Apr. 2, 16-19, 21-23, and June 21-24, which are fair.

AVERAGE DISCHARGE.--10 years, 8.39 ft³/s, 14.66 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,000 ft³/s, Sept. 3, 1985, gage height, 32.76 ft, from floodmarks, from rating curve extended above 1,000 ft³/s, on basis of flow through culvert computations; minimum discharge, 0.20 ft³/s, Aug. 13, 16, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,440 ft³/s, Apr. 28, gage height, 25.75 ft, from rating curve extended above 1,000 ft³/s, on basis of flow through culvert computations; minimum daily discharge, 1.7 ft³/s, Jan. 28 to Mar. 24; minimum gage height, 11.26 ft, Nov. 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	36	3.4	3.7	2.0	1.7	1.7	35	21	2.7	5.1	3.7	201
2	17	3.4	3.6	2.0	1.7	1.7	35	15	2.5	5.8	3.8	25
3	11	3.4	3.5	2.0	1.7	1.7	35	11	3.3	5.0	3.5	40
4	7.7	3.0	3.4	2.0	1.7	1.7	31	9.1	12	6.4	3.3	27
5	6.4	3.1	3.3	2.0	1.7	1.7	34	7.8	5.0	6.1	3.6	11
6	5.6	3.6	3.2	1.9	1.7	1.7	34	6.7	3.7	5.9	43	7.1
7	5.3	3.6	3.2	1.9	1.7	1.7	37	5.6	26	5.1	166	5.5
8	33	3.0	3.1	1.9	1.7	1.7	24	43	10	4.4	62	4.0
9	14	2.7	3.0	1.9	1.7	1.7	16	38	5.4	5.1	66	3.7
10	9.3	2.6	3.0	1.9	1.7	1.7	13	49	83	4.6	97	12
11	7.6	2.7	2.9	1.9	1.7	1.7	11	99	63	27	53	11
12	33	2.8	2.8	1.9	1.7	1.7	9.0	35	26	41	46	8.1
13	20	2.9	2.8	1.9	1.7	1.7	8.6	52	13	37	41	7.5
14	11	3.0	2.7	1.8	1.7	1.7	148	26	8.9	15	57	4.3
15	9.0	2.8	2.7	1.8	1.7	1.7	247	16	7.3	37	52	4.4
16	8.6	3.0	2.6	1.8	1.7	1.7	140	11	7.5	26	42	3.7
17	6.9	3.0	2.6	1.8	1.7	1.7	35	8.5	6.0	15	38	135
18	5.8	3.5	2.5	1.8	1.7	1.7	90	7.1	5.7	9.9	36	33
19	5.5	5.0	2.5	1.8	1.7	1.7	190	6.2	6.0	106	35	30
20	5.1	4.7	2.4	1.8	1.7	1.7	372	4.5	5.7	26	71	40
21	4.9	4.2	2.4	1.8	1.7	1.7	200	4.4	164	15	38	52
22	4.8	3.8	2.4	1.8	1.7	1.7	108	4.6	38	12	61	81
23	5.2	3.5	2.3	1.8	1.7	1.7	65	4.3	13	7.4	40	20
24	5.1	4.0	2.3	1.8	1.7	1.7	137	4.0	7.3	5.7	14	9.9
25	4.3	4.2	2.2	1.8	1.7	1.8	23	4.2	6.5	5.5	9.1	47
26	4.2	4.2	2.2	1.8	1.7	1.8	15	3.9	7.1	4.2	7.2	30
27	3.6	4.1	2.2	1.8	1.7	1.8	135	3.6	12	32	6.1	32
28	3.6	4.0	2.2	1.7	1.7	1.9	416	3.4	7.0	17	5.4	12
29	3.4	4.0	2.1	1.7	---	3.0	52	3.1	5.6	6.7	5.1	8.6
30	3.8	3.8	2.1	1.7	---	6.5	27	3.0	5.1	4.7	4.7	7.2
31	3.4	---	2.1	1.7	---	15	---	2.8	---	4.4	31	---
TOTAL	304.1	105.0	84.0	57.2	47.6	72.6	2722.6	512.8	568.3	508.0	1144.5	913.0
MEAN	9.81	3.50	2.71	1.85	1.70	2.34	90.8	16.5	18.9	16.4	36.9	30.4
MAX	36	5.0	3.7	2.0	1.7	15	416	99	164	106	166	201
MIN	3.4	2.6	2.1	1.7	1.7	1.7	8.6	2.8	2.5	4.2	3.3	3.7
CFSM	1.26	.45	.35	.24	.22	.30	11.7	2.12	2.43	2.11	4.75	3.91
IN.	1.46	.50	.40	.27	.23	.35	13.03	2.45	2.72	2.43	5.48	4.37
AC-FT	603	208	167	113	94	144	5400	1020	1130	1010	2270	1810

CAL YR 1985 TOTAL 3546.8 MEAN 9.72 MAX 541 MIN 1.4 CFSM 1.25 IN 16.98 AC-FT 7040
WTR YR 1986 TOTAL 7039.7 MEAN 19.3 MAX 416 MIN 1.7 CFSM 2.48 IN 33.70 AC-FT 13960

RED RIVER OF THE NORTH BASIN

05045500 OTTER TAIL RIVER NEAR FERGUS FALLS, MN--Continued

WATER-QUALITY RECORDS

LOCATION.--Lat 46°13'45", long 96°07'00", in SW¼ sec.20, T.132 N., R.43 W., Otter Tail County, Hydrologic Unit 09020103, on left bank 500 ft downstream from Dayton Hollow Dam, 5 miles downstream from Pelican River, and 5 miles southwest of city of Fergus Falls.

DRAINAGE AREA.--1,810 mi², approximately.

PERIOD OF RECORD.--April 1985 to May 1986.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)
FEB 26...	1700	496	411	8.0	0.0	10.3
APR 02...	1315	959	414	7.9	4.5	11.8
MAY 02...	0830	1280	382	8.2	9.5	10.5

DATE	BARO- METRIC PRES- SURE (MM HG) (00025)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)
FEB 26...	750	0.13	0.12	0.6	0.02	<0.01
APR 02...	757	0.41	0.12	0.8	0.05	0.01
MAY 02...	767	<0.10	0.06	0.5	0.03	<0.01

RED RIVER OF THE NORTH BASIN

05045950 ORWELL LAKE NEAR FERGUS FALLS, MN

LOCATION.--Lat 46°12'55", long 96°10'40", in SW¼ sec.26, T.132 N., R.44 W., Otter Tail County, Hydrologic Unit 09020103, at dam on Otter Tail River at outlet of Orwell Lake, 7 mi southwest of Fergus Falls.

DRAINAGE AREA.--1,830 mi², approximately.

PERIOD OF RECORD.--March 1953 to current year. Prior to October 1971, published as Orwell Reservoir.

GAGE.--Water-stage recorder. Datum of gage is adjustment of 1912.

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 is 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 were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--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.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 16,680 acre-ft, May 19, elevation, 1,072.14 ft; minimum, 3,180 acre-ft, Feb. 21, elevation, 1,055.59 ft.

MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30.....	1,065.79	9,820	
Oct. 31.....	1,067.15	11,150	+1,330
Nov. 30.....	1,063.92	8,240	-2,910
Dec. 31.....	1,060.58	5,880	-2,360
CAL YR 1985.....			* -306
Jan. 31.....	1,057.37	4,040	-1,840
Feb. 28.....	1,056.68	3,690	-350
Mar. 31.....	1,069.53	13,530	+9,840
Apr. 30.....	1,069.82	13,820	+290
May 31.....	1,071.67	16,090	+2,270
June 30.....	1,067.58	11,580	-4,510
July 31.....	1,067.78	11,780	+200
Aug. 31.....	1,067.73	11,730	-50
Sept. 30.....	1,069.13	13,130	+1,400
WTR YR 1986.....			+3,310

* Due to revision of elevation-contents table, this value is not compatible with previous year-end value.

RED RIVER OF THE NORTH BASIN

05046000 OTTER TAIL RIVER BELOW ORWELL DAM, NEAR FERGUS FALLS, MN

LOCATION.--Lat 46°12'35", long 96°11'05", in NE¼ sec.34, T.132 N., R.44 W., Otter Tail County, Hydrologic Unit 09020103, on left bank 0.7 mi downstream from Orwell Dam, 6.1 mi downstream from Dayton Hollow Dam, 8 mi southwest of Fergus Falls, and 11.1 mi downstream from Pelican River.

DRAINAGE AREA.--1,830 mi², approximately.

PERIOD OF RECORD.--October 1930 to current year. 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.

REVISED RECORDS.--WSP 785: 1934(M). WSP 1208: 1947(M). WSP 1308: 1931(M).

GAGE.--Water-stage recorder. Datum of gage is 1,029.65 ft, adjustment of 1912 (levels by U.S. Army 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 mi upstream at datum 40.30 ft higher.

REMARKS.--Estimated daily discharges: Nov. 25 to Mar. 2, 6, 7. Records good except those for period with ice effect, Nov. 25 to Mar 2, 6, 7, which are fair. Flow regulated by Orwell Lake (station 05045950) beginning Mar. 21, 1953 and power-plants upstream.

AVERAGE DISCHARGE.--56 years, 320 ft³/s, 231,800 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,710 ft³/s, June 17, 1953, gage height, 5.60 ft, backwater from aquatic vegetation; minimum, 0.70 ft³/s, Aug. 5, 1970, gage height, 1.28 ft, result of regulation.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,600 ft³/s, May 27, gage height, 4.75 ft, result of regulation; minimum, 63 ft³/s, Mar. 27, 28, gage height, 2.25 ft, result of regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	831	905	605	650	590	510	1030	1220	1590	1080	651	560
2	819	905	645	645	575	510	1070	1230	1590	969	631	563
3	811	904	655	640	565	546	1060	1230	1580	919	627	619
4	811	904	655	640	560	567	1050	1240	1580	928	627	650
5	813	902	655	635	555	574	1050	1240	1580	931	623	650
6	812	905	670	625	545	576	1040	1250	1570	938	621	650
7	798	905	710	620	540	578	1030	1240	1570	954	582	650
8	784	931	710	612	540	585	1030	1250	1560	990	554	650
9	746	945	710	602	540	586	968	1260	1550	1000	557	650
10	720	936	710	600	540	590	930	1430	1550	1000	560	650
11	725	929	705	600	540	586	897	1540	1550	999	578	650
12	737	922	705	600	540	585	890	1530	1540	997	593	650
13	745	916	700	595	540	587	885	1470	1520	997	657	647
14	751	909	700	595	540	599	890	1440	1520	975	698	645
15	761	898	700	595	540	621	923	1440	1510	954	676	625
16	770	887	700	590	540	621	748	1450	1500	941	641	610
17	776	876	695	590	540	653	509	1450	1390	928	639	614
18	793	871	695	590	535	680	893	1450	1240	908	617	616
19	823	871	695	590	535	645	1220	1470	1190	898	573	644
20	830	869	690	590	530	619	1220	1490	1230	898	561	662
21	836	859	690	590	530	620	1220	1490	1270	879	562	669
22	841	822	685	590	525	623	1220	1490	1280	830	589	611
23	857	778	685	590	525	633	1220	1490	1320	767	641	570
24	877	734	685	590	520	682	1220	1500	1360	745	656	577
25	882	627	680	590	515	727	1210	1500	1350	725	653	809
26	889	610	675	590	515	593	1220	1500	1340	710	650	933
27	893	599	675	590	510	247	1220	1560	1280	714	623	933
28	892	600	670	590	510	63	1220	1600	1240	718	604	927
29	898	600	665	590	---	66	1220	1600	1240	717	578	924
30	903	600	660	590	---	207	1220	1600	1170	700	560	917
31	903	---	655	590	---	627	---	1600	---	678	560	---
TOTAL	25327	24919	21135	18694	15080	16906	31523	44250	42760	27387	18942	20525
MEAN	817	831	682	603	539	545	1051	1427	1425	883	611	684
MAX	903	945	710	650	590	727	1220	1600	1590	1080	698	933
MIN	720	599	605	590	510	63	509	1220	1170	678	554	560
CFSM	.45	.45	.37	.33	.30	.30	.57	.78	.78	.48	.33	.37
IN.	.51	.51	.43	.38	.31	.34	.64	.90	.87	.56	.39	.42
AC-FT	50240	49430	41920	37080	29910	33530	62530	87770	84810	54320	37570	40710
CAL YR 1985	TOTAL	276137	MEAN 757	MAX 1260	MIN 249	CFSM .41	IN 5.61	AC-FT 547700				
WTR YR 1986	TOTAL	307448	MEAN 842	MAX 1600	MIN 63	CFSM .46	IN 6.25	AC-FT 609800				

RED RIVER OF THE NORTH BASIN

05046000 OTTER TAIL RIVER BELOW ORWELL DAM, NEAR FERGUS FALLS, MN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1961-63, 1965-66, 1985-86.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
FEB										
26...	1635	424	476	7.9	8.2	0.0	12.2	750	45	31
APR										
02...	1415	418	442	7.9	7.9	4.0	13.8	757	42	27
MAY										
01...	1600	399	417	8.3	8.4	9.5	11.5	761	39	26

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	ALKA- LINITY, IT-FLD (MG/L AS CACO3) (99430)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)
FEB										
26...	9.2	3.4	--	--	--	--	15	8.8	0.1	19
APR										
02...	7.9	4.6	201	200	246	0	26	8.0	0.1	15
MAY										
01...	7.4	4.1	--	--	--	--	17	7.2	0.1	10

DATE	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	CARBON, ORGANIC DIS- SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS- PENDED TOTAL (MG/L AS C) (00689)
FEB									
26...	266	0.13	0.14	0.8	0.8	0.03	0.02	6.7	0.3
APR									
02...	265	0.58	0.15	0.8	0.7	0.05	0.03	7.9	0.5
MAY									
01...	246	<0.10	0.03	0.8	0.5	0.05	0.01	8.5	0.7

RED RIVER OF THE NORTH BASIN

05050000 BOIS DE SIOUX RIVER NEAR WHITE ROCK, SD

LOCATION.--Lat 45°51'45", long 96°34'25", in SW¼SW¼ sec.27, T.128 N., R.47 W., Roberts County, Hydrologic Unit 09020101, on Sisseton Indian Reservation, on left bank just downstream from Big Slough Outlet, 300 ft downstream from White Rock Dam, 4 mi south of White Rock, and 5 mi northwest of Wheaton, MN.

DRAINAGE AREA.--1,160 mi², approximately.

PERIOD OF RECORD.--October 1941 to current year.

GAGE.--Water-stage recorder. Datum of gage is 960.00 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Jan. 14, 1943, nonrecording 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.

REMARKS.--Estimated daily discharges: Nov. 9 to Apr. 8. Records fair. Flow regulated by Lake Traverse-Bois de Sioux Flood Control and Water Conservation project (available capacity for flood control, 137,000 acre-ft).

AVERAGE DISCHARGE.--45 years, 83.9 ft³/s, 60,790 acre-ft/yr; median of yearly mean discharges, 53 ft³/s, 38,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,770 ft³/s, occurred during period Apr. 19-21, 1969, gage height, 15.07 ft, from floodmark; no flow at times in most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,820 ft³/s, May 7, gage height, 12.12 ft, due to regulation; minimum daily discharge, 3.3 ft³/s, Dec. 26 to Jan. 1; minimum gage height, 3.46 ft, Oct. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.4	5.4	4.1	3.3	6.0	8.2	196	946	1120	1020	337	81
2	7.2	5.4	4.0	3.4	6.0	8.7	86	501	1130	1000	281	42
3	7.5	5.4	4.0	3.4	6.1	9.3	25	479	1130	992	275	10
4	4.5	5.9	3.9	3.4	6.2	9.7	102	973	1120	980	269	8.8
5	5.4	8.1	3.9	3.4	6.2	10	343	1360	1120	969	265	25
6	5.2	6.4	3.9	3.4	6.3	11	371	1390	1120	958	260	28
7	4.5	5.9	3.9	3.4	6.4	11	542	1390	1140	944	258	22
8	5.4	5.8	3.9	3.4	6.6	12	836	1390	1150	935	218	33
9	5.2	5.7	3.9	3.5	6.6	13	1070	1260	1160	924	144	46
10	5.2	5.6	3.9	3.7	6.7	14	1060	786	1120	916	140	45
11	5.2	5.5	3.9	3.9	6.8	14	1070	529	920	910	136	46
12	9.1	5.4	3.8	4.1	6.8	15	1060	459	894	906	132	46
13	13	5.3	3.8	4.2	6.9	16	1040	491	998	896	130	45
14	13	5.2	3.8	4.3	6.9	17	1140	971	1080	840	127	45
15	10	5.2	3.7	4.5	7.0	18	871	1380	1080	730	122	48
16	13	5.1	3.7	4.7	7.0	19	408	1390	1140	719	120	48
17	14	5.0	3.6	4.8	7.0	20	290	1390	1190	709	114	48
18	12	4.9	3.6	4.9	7.0	21	253	1380	1180	702	85	54
19	10	4.8	3.5	4.9	7.1	22	310	1360	1170	694	46	57
20	11	4.8	3.5	5.0	7.1	24	315	1310	1160	685	57	57
21	13	4.7	3.5	5.1	7.2	26	375	1200	1140	677	62	57
22	15	4.7	3.5	5.2	7.2	60	816	1170	1120	669	97	65
23	15	4.6	3.5	5.3	7.2	80	1050	1160	1120	523	135	74
24	9.1	4.5	3.4	5.4	7.2	120	1100	1160	1110	404	126	66
25	8.1	4.4	3.4	5.5	7.3	160	1150	1150	1110	398	121	60
26	5.6	4.4	3.3	5.6	7.4	170	1150	1160	1100	392	119	52
27	5.6	4.4	3.3	5.6	7.6	65	1180	1150	1080	392	110	90
28	5.7	4.3	3.3	5.7	7.8	117	1230	1150	1080	387	107	145
29	5.9	4.2	3.3	5.8	---	162	1160	1140	1050	381	107	179
30	5.8	4.1	3.3	5.9	---	211	1020	1140	1050	381	99	235
31	5.6	---	3.3	5.9	---	249	---	1140	---	374	85	---
TOTAL	261.2	155.1	113.4	140.6	191.6	1712.9	21619	33855	33082	22407	4684	1857.8
MEAN	8.43	5.17	3.66	4.54	6.84	55.3	721	1092	1103	723	151	61.9
MAX	15	8.1	4.1	5.9	7.8	249	1230	1390	1190	1020	337	235
MIN	4.5	4.1	3.3	3.3	6.0	8.2	25	459	894	374	46	8.8
CFSM	.007	.004	.003	.004	.006	.05	.62	.94	.95	.62	.13	.05
IN.	.01	.00	.00	.00	.01	.05	.69	1.09	1.06	.72	.15	.06
AC-FT	518	308	225	279	380	3400	42880	67150	65620	44440	9290	3680

CAL YR 1985 TOTAL 40396.42 MEAN 111 MAX 852 MIN .00 CFSM .10 IN 1.30 AC-FT 80130
WTR YR 1986 TOTAL 120079.60 MEAN 329 MAX 1390 MIN 3.3 CFSM .28 IN 3.85 AC-FT 238200

RED RIVER OF THE NORTH BASIN

05051500 RED RIVER OF THE NORTH AT WAHPETON, ND

LOCATION.--Lat 46°15'55", long 96°35'40", in NE¼ sec.8, T.132 N., R.47 W., Richland County, Hydrologic Unit 09020104, 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 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1942 to current year. 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 942.97 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 6, 1943, U.S. Weather Bureau nonrecording gage 800 ft upstream, converted to present datum. Aug. 6, 1943, to Oct. 27, 1950, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 19 to Apr. 1. Records good except those for period with ice effect, Nov. 19 to Apr. 1, which are fair. Flow regulated by Orwell Reservoir, capacity, 14,100 acre-ft at elevation 1,070 ft above National Geodetic Vertical Datum of 1929, adjustment of 1912; Lake Traverse, capacity, 137,000 acre-ft, available for flood control; numerous other controlled lakes and ponds, and several powerplants.

AVERAGE DISCHARGE.--43 years (1943-86), 554 ft³/s, 401,400 acre-ft/yr; median of yearly mean discharges, 480 ft³/s, 348,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,200 ft³/s, Apr. 10, 1969, gage height, 16.34 ft; minimum daily, 1.7 ft³/s, Aug. 28 to Sept. 5, 9, 10, 1976.

EXTREMES OUTSIDE PERIOD OF RECORD.--A stage of 17.0 ft, discharge, 10,500 ft³/s, occurred in the spring of 1897 and has not been exceeded since.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,140 ft³/s, Mar. 30, gage height, 14.31 ft; minimum daily, 597 ft³/s, Jan. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	854	813	744	721	686	647	4500	3690	2550	2140	1000	757
2	840	813	693	722	686	655	4170	3800	2540	2050	951	739
3	832	810	642	714	687	663	3410	3320	2530	1960	869	761
4	827	809	726	707	683	687	2650	2610	2540	1930	846	856
5	826	808	802	692	682	726	2490	2430	2510	1900	838	1000
6	822	809	821	680	679	743	2720	2540	2490	1890	835	909
7	822	807	814	666	680	740	2510	2590	2500	1870	834	851
8	815	812	827	683	673	730	2240	2730	2500	1870	810	792
9	809	814	828	694	671	756	2180	3410	2500	1880	746	751
10	786	836	821	691	667	784	2220	4580	2530	1920	683	756
11	745	838	808	687	670	804	2170	5640	2770	1970	670	765
12	783	836	779	685	671	828	2100	5520	3160	2140	675	751
13	767	828	761	678	675	866	2070	4390	3140	2150	701	739
14	756	836	749	675	670	904	2480	3100	2920	2040	802	731
15	757	822	740	669	673	949	3640	2780	2760	1930	813	755
16	762	823	760	671	677	1040	4170	2810	2610	1810	787	739
17	764	810	753	673	669	1120	3630	2800	2550	1770	752	730
18	768	803	737	675	663	1160	2610	2780	2510	1740	740	746
19	779	750	732	679	662	1190	2990	2760	2370	1690	716	912
20	801	680	729	678	663	1220	3350	2730	2260	1620	668	1380
21	812	620	739	682	661	1230	3210	2710	2240	1570	639	1680
22	831	611	752	648	651	1330	2580	2650	2250	1540	706	2440
23	809	670	755	650	613	1450	2490	2610	2240	1500	758	3450
24	806	710	725	676	622	1570	2550	2600	2240	1270	851	3690
25	817	758	687	688	628	1740	2610	2590	2260	1070	883	3500
26	818	753	722	666	628	2470	2670	2580	2260	1080	868	3130
27	819	692	748	597	642	3580	2760	2570	2250	1080	830	2680
28	822	668	732	648	638	5060	3200	2560	2210	1060	794	2230
29	810	710	731	669	---	5680	3410	2590	2180	1050	757	1980
30	816	737	717	672	---	5820	3430	2600	2180	1060	738	1820
31	816	---	722	673	---	4910	---	2580	---	1050	706	---
TOTAL	24891	23086	23296	21009	18570	52052	87210	95650	74550	51600	24266	43020
MEAN	803	770	751	678	663	1679	2907	3085	2485	1665	783	1434
MAX	854	838	828	722	687	5820	4500	5640	3160	2150	1000	3690
MIN	745	611	642	597	613	647	2070	2430	2180	1050	639	730
AC-FT	49370	45790	46210	41670	36830	103200	173000	189700	147900	102300	48130	85330
CAL YR 1985	TOTAL 345348			MEAN	946	MAX	3450	MIN	216	AC-FT 685000		
WTR YR 1986	TOTAL 539200			MEAN	1477	MAX	5820	MIN	597	AC-FT 1070000		

RED RIVER OF THE NORTH BASIN

05051500 RED RIVER OF THE NORTH AT WAHPETON, ND--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	HARD- NESS (MG/L AS CACO3) (00900)	HARD- NESS NONCAR- BONATE (MG/L AS CACO3) (95902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)
OCT											
24...	1210	814	435	--	13.5	9.5	--	--	--	--	--
JAN											
30...	1130	674	505	--	-5.0	0.0	--	--	--	--	--
MAR											
29...	1015	5610	480	--	14.5	1.0	--	--	--	--	--
APR											
01...	1630	4520	559	7.8	15.5	8.5	250	130	59	26	14
23...	1120	2530	610	--	19.0	10.0	--	--	--	--	--
JUL											
10...	1345	2000	740	--	21.5	24.0	--	--	--	--	--
31...	1045	1090	658	--	20.5	24.0	--	--	--	--	--
SEP											
04...	1240	876	650	8.1	19.0	19.0	300	110	56	39	21

DATE	PERCENT SODIUM (00932)	SODIUM AD- SORP- TION RATIO (00931)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)
APR											
01...	10	0.4	7.1	130	130	8.0	0.2	18	362	340	0.49
SEP											
04...	13	0.5	6.3	180	130	10	0.1	17	400	390	0.54

DATE	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)
APR										
01...	5	70	30	<1	24	30	0.1	2	<1	280
SEP										
04...	3	80	30	1	34	20	0.3	3	1	290

RED RIVER OF THE NORTH BASIN

05051522 RED RIVER OF THE NORTH AT HICKSON, ND

LOCATION.--Lat 46°39'35", long 96°47'44", in SW¼ sec.19, T.137 N., R.48 W., Clay County, MN, Hydrologic Unit 09020104, on right bank 60 ft downstream from bridge on township road, and 1 mi southeast of Hickson, ND.

DRAINAGE AREA.--4,300 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1975 to current year.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 877.06 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 2 to Mar. 30 and July 27-31. Records good except those for period with ice effect, Nov. 2 to Mar. 30, which are fair. Flow regulated by Orwell Reservoir, capacity, 14,100 acre-ft at elevation, 1,070 ft above National Geodetic Vertical Datum of 1929, adjustment of 1912; Lake Traverse, capacity, 137,000 acre-ft, available for flood control, numerous other controlled lakes and ponds, and several powerplants.

AVERAGE DISCHARGE.--11 years, 644 ft³/s, 466,600 acre-ft/yr; median of yearly mean discharges, 530 ft³/s, 334,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,600 ft³/s, Apr. 18, 1979, gage height, 33.03 ft; no flow Oct. 26, 1976, to Jan. 9, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,720 ft³/s, Apr. 1, gage height, 27.27 ft; minimum daily, 550 ft³/s, Nov. 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	902	853	785	832	694	656	6630	3940	2570	2160	1080	796
2	893	849	807	841	696	661	6430	4000	2550	2130	1050	835
3	884	845	791	843	691	667	6010	4100	2530	2080	1020	866
4	880	845	758	824	691	675	5430	4120	2520	2030	950	892
5	876	849	757	817	690	687	4690	3830	2510	1950	915	1000
6	872	851	787	791	687	699	3950	3320	2510	1890	898	1110
7	870	844	802	786	685	702	3500	2930	2500	1860	891	1080
8	869	838	804	786	664	739	3200	2790	2480	1860	890	1000
9	862	841	808	788	654	780	2820	2870	2480	1850	873	936
10	850	846	818	790	664	799	2500	3290	2490	1870	840	880
11	844	843	825	785	663	806	2350	3870	2490	2000	778	851
12	836	840	824	777	637	825	2290	4660	2550	2190	736	843
13	829	840	826	746	657	834	2230	5200	2730	2310	731	840
14	830	830	828	728	663	852	2430	5330	2900	2300	765	827
15	822	820	826	720	677	877	3140	4990	2940	2220	809	826
16	813	820	829	731	661	898	3810	4270	2870	2120	846	831
17	818	810	821	739	675	951	4220	3580	2740	1990	845	840
18	824	800	837	737	699	1020	4400	3180	2620	1870	817	832
19	821	755	840	733	682	1070	4470	2960	2560	1810	788	859
20	822	680	833	727	696	1090	4350	2860	2490	1790	776	1080
21	834	692	843	730	699	1120	4270	2800	2390	1770	746	1630
22	842	624	866	704	710	1270	4180	2760	2290	1680	729	2000
23	859	550	855	693	713	1520	3810	2720	2260	1600	752	2260
24	862	610	820	709	689	1760	3310	2670	2240	1560	804	2710
25	851	791	819	717	689	2000	2950	2640	2240	1430	875	3110
26	851	840	812	700	696	2270	2830	2620	2240	1220	923	3310
27	855	810	798	692	685	2560	2910	2610	2240	1200	925	3330
28	855	786	819	665	662	3190	3240	2590	2240	1170	880	3190
29	855	760	824	661	---	4000	3570	2570	2210	1150	856	2860
30	850	749	825	680	---	5520	3820	2570	2170	1130	828	2450
31	850	---	827	680	---	6320	---	2580	---	1100	813	---
TOTAL	26381	23711	25314	23152	19069	47818	113740	105220	74550	55290	26429	44874
MEAN	851	790	817	747	681	1543	3791	3394	2485	1784	853	1496
MAX	902	853	866	843	713	6320	6630	5330	2940	2310	1080	3330
MIN	813	550	757	661	637	656	2230	2570	2170	1100	729	796
AC-FT	52330	47030	50210	45920	37820	94850	225600	208700	147900	109700	52420	89010
CAL YR 1985	TOTAL	354393		MEAN	971	MAX	3600	MIN	235	AC-FT	702900	
WTR YR 1986	TOTAL	585548		MEAN	1604	MAX	6630	MIN	550	AC-FT	1161000	

RED RIVER OF THE NORTH BASIN

05051522 RED RIVER OF THE NORTH AT HICKSON, ND--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1976 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)
OCT										
30...	1045	809	428	8.2	4.0	8.0	10	9.0	11.0	--
DEC										
16...	1500	829	500	--	-23.0	0.0	--	--	--	--
FEB										
12...	1630	630	510	8.1	-15.0	0.0	10	4.0	12.9	92
APR										
02...	1020	6450	542	--	9.5	7.5	--	--	--	--
11...	1330	2470	642	7.8	10.0	10.0	30	27	10.0	91
23...	1750	3680	655	--	21.5	10.5	--	--	--	--
AUG										
01...	1035	1140	660	8.0	20.0	24.5	10	88	5.5	69
SEP										
05...	1040	1020	598	8.2	11.5	18.5	--	--	--	--

DATE	HARD- NESS (MG/L AS CACO3) (00900)	HARD- NESS NONCAR- BONATE (MG/L AS CACO3) (00902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	PERCENT SODIUM (00932)	SODIUM AD- SORP- TION RATIO (00931)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2) (00405)
OCT										
30...	210	19	39	28	10	9	0.3	4.2	194	2.4
FEB										
12...	250	11	46	32	12	9	0.3	4.8	236	3.6
APR										
11...	300	120	62	35	17	11	0.4	7.3	178	5.4
AUG										
01...	320	110	59	41	20	12	0.5	7.1	204	3.9

DATE	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, DIS- SOLVED TOTAL (MG/L AS N) (00615)
OCT									
30...	24	8.6	0.2	13	--	240	0.33	532	<0.01
FEB									
12...	21	9.7	0.1	18	298	290	0.41	507	<0.01
APR									
11...	130	10	0.2	16	430	380	0.58	2870	0.06
AUG									
01...	140	9.9	0.2	18	486	420	0.66	1500	<0.01

DATE	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	BORON, DIS- SOLVED (UG/L AS B) (01020)	CARBON, ORGANIC DIS- SOLVED (MG/L AS C) (00681)	PHENOLS TOTAL (UG/L) (32730)
OCT									
30...	<0.10	<0.10	0.04	0.7	0.05	0.02	40	9.3	16
FEB									
12...	0.20	0.20	0.12	0.9	0.05	0.03	80	9.7	3
APR									
11...	1.3	1.3	0.07	1.1	0.21	0.13	60	11	3
AUG									
01...	0.10	0.10	0.06	<0.2	0.88	0.09	90	12	4

RED RIVER OF THE NORTH BASIN

05054000 RED RIVER OF THE NORTH AT FARGO, ND

LOCATION.--Lat 46°51'40", long 96°47'00", in NW 1/4 sec.18, T.139 N., R.48 W., Cass County, Hydrologic Unit 09020104, at city waterplant on 4th St. S. in Fargo, 25 mi upstream from mouth of Sheyenne River, and at mile 453.0.

DRAINAGE AREA.--6,800 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1901 to current year. Published as "at Moorhead, Minn." 1901. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1308: 1902-4, 1906-7, 1910-14, 1916, 1918, 1924. WSP 1388: 1905-6, 1917-20(M), 1935(M), 1938-39(M), 1943.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 861.8 ft above National Geodetic Vertical Datum of 1929. Oct. 1, 1960, to Sept. 30, 1962, water-stage recorder at present site at datum 5.6 ft higher. See WSP 1728 or 1913 for history of changes prior to Oct. 1, 1960.

REMARKS.--Estimated daily discharges: Nov. 12 to Apr. 1. Records good except those for period with ice effect, Nov. 12 to Apr. 1, which are fair. Flow regulated by Orwell Reservoir, capacity, 14,100 acre-ft at elevation 1,070 ft above National Geodetic Vertical Datum of 1929, adjustment of 1912; Lake Traverse, capacity 137,000 acre-ft, available for flood control, other controlled lakes and ponds, and several powerplants. Some small diversions for municipal supply. Figures of daily discharge do not include diversions to cities of Fargo and Moorhead and from Sheyenne River.

AVERAGE DISCHARGE (UNADJUSTED).--85 years, 578 ft³/s, 418,800 acre-ft/yr; median of yearly mean discharges, 450 ft³/s, 326,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 25,300 ft³/s, Apr. 15, 1969, gage height, 37.34 ft; no flow for many days in each year for period 1932-41, Sept. 30, Oct. 1-2, 1970, Oct. 10-19, 1976.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1897, reached a stage of 39.1 ft present datum, discharge, 25,000 ft³/s at site 1.5 mi downstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,640 ft³/s, Apr. 2, gage height, 27.19 ft; minimum daily, 470 ft³/s, Nov. 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	913	808	650	810	670	670	8410	6320	2710	2320	1270	856
2	894	801	670	810	670	680	8600	6430	2680	2320	1240	880
3	885	797	700	800	670	700	8420	6420	2640	2260	1120	938
4	879	799	740	800	670	730	7940	6380	2620	2250	1060	990
5	876	799	680	800	660	760	7330	6230	2590	2130	995	1110
6	865	796	690	800	660	730	6640	5780	2580	2080	975	1220
7	867	794	800	800	650	730	5870	5020	2600	2060	955	1280
8	862	784	800	790	650	740	5060	4260	2560	2030	939	1210
9	853	784	800	780	640	750	4250	3860	2550	2030	935	1150
10	845	791	800	780	640	760	3400	4080	2560	2090	895	1100
11	835	791	800	780	630	786	2780	4780	2550	2310	826	1020
12	852	790	800	770	610	780	2610	5540	2570	2420	747	981
13	814	746	790	760	620	780	2520	6180	2660	2490	728	954
14	805	790	780	740	630	800	2760	6600	2820	2480	806	930
15	804	790	780	730	640	790	3960	6720	2950	2430	832	936
16	785	790	780	730	650	790	5220	6500	2940	2340	887	911
17	783	790	770	720	660	820	6050	5900	2840	2250	908	925
18	783	780	800	720	670	900	6530	5090	3070	2170	885	932
19	783	630	820	720	680	980	6940	4310	2710	2090	847	971
20	787	540	830	720	680	1020	7210	3730	2630	2030	819	1090
21	797	550	840	720	690	1100	7160	3380	2510	2020	787	1700
22	805	560	830	710	700	1190	7000	3170	2400	1980	761	2210
23	817	470	840	700	700	1300	6710	3050	2320	1910	735	2470
24	826	490	840	700	680	1600	6090	2970	2290	1840	809	2760
25	813	570	830	690	680	2720	5240	2890	2290	1760	874	3220
26	807	740	820	690	680	3760	4490	2850	2360	1540	947	3750
27	813	746	820	680	680	4670	4300	2810	2360	1410	980	4000
28	812	710	820	670	670	5590	4890	2780	2360	1350	975	3990
29	804	690	810	670	---	6650	5620	2760	2350	1310	939	3690
30	805	630	810	670	---	7160	6070	2740	2330	1320	902	3040
31	802	---	810	670	---	7840	---	2730	---	1280	875	---
TOTAL	25671	21546	24350	22930	18530	59276	170070	142260	77400	62300	28253	51214
MEAN	828	718	785	740	662	1912	5669	4589	2580	2010	911	1707
MAX	913	808	840	810	700	7840	8600	6720	3070	2490	1270	4000
MIN	783	470	650	670	610	670	2520	2730	2290	1280	728	856
AC-FT	50920	42740	48300	45480	36750	117600	337300	282200	153500	123600	56040	101600
(+)	1245	1137	1150	1197	1088	1199	1151	1370	1541	1416	1382	1225
MEAN*	848	737	804	760	682	1932	5688	4611	2606	2033	934	1728
AC-FT*	52160	43880	49450	46680	37840	118800	338450	283510	155040	125020	57420	102820
CAL YR 1985	TOTAL 382922	MEAN 1049	MAX 4600	MIN 211	AC-FT 759500	MEAN* 1066	AC-FT* 774265					
WTR YR 1986	TOTAL 703800	MEAN 1928	MAX 8600	MIN 470	AC-FT 1396000	MEAN* 1947	AC-FT* 1411131					

+ - Diversions in acre-feet to cities of Fargo and Moorhead.

* - Adjusted for diversions to cities of Fargo and Moorhead.

RED RIVER OF THE NORTH BASIN

05054000 RED RIVER OF THE NORTH AT FARGO, ND--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	HARD- NESS (MG/L AS CACO3) (00900)	HARD- NESS NONCAR- BONATE (MG/L AS CACO3) (95902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
OCT											
29...	1330	804	450	--	10.5	8.5	--	--	--	--	--
DEC											
17...	1150	771	500	--	-23.5	0.0	--	--	--	--	--
FEB											
12...	1125	613	520	8.1	-14.0	0.0	13.3	--	--	--	--
MAR											
27...	1405	4680	362	--	7.0	0.5	--	--	--	--	--
29...	1550	6890	470	--	--	--	--	--	--	--	--
APR											
02...	1410	9020	465	--	12.0	6.5	--	--	--	--	--
10...	1645	3400	755	8.0	16.0	10.0	--	360	190	75	41
MAY											
02...	1115	6560	645	--	11.0	9.0	--	--	--	--	--
JUL											
02...	1820	2370	--	--	25.0	23.0	--	--	--	--	--
AUG											
07...	1625	952	--	--	23.0	24.0	--	--	--	--	--
SEP											
16...	1630	907	580	8.2	12.0	14.0	--	280	75	53	36

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	PERCENT SODIUM (00932)	SODIUM AD- SORP- TION RATIO (00931)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTITUENTS, DIS- SOLVED (MG/L) (70301)
APR											
10...	26	13	0.6	8.8	170	200	14	0.2	7.9	342	500
SEP											
16...	17	11	0.5	6.2	200	93	9.5	0.3	17	385	360

DATE	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)
APR											
10...	0.47	5	50	20	<1	37	10	0.1	2	<1	340
SEP											
16...	0.52	3	50	10	<1	27	<1	0.3	2	<1	270

RED RIVER OF THE NORTH BASIN

05061000 BUFFALO RIVER NEAR HAWLEY, MN

LOCATION.--Lat 46°51'00", long 96°19'45", in NW¼SE¼ sec.14, T.139 N., R.45 W., Clay County, Hydrologic Unit 09020106, near left downstream end of bridge on farm lane, 2 mi southwest of Hawley.

DRAINAGE AREA.--322 mi².

PERIOD OF RECORD.--March 1945 to current year, WY 1981 (annual maximum only), March 1982 to September 1985 (no winter records).

REVISED RECORDS.--WSP 1308: 1945-46(M), 1948(M).

GAGE.--Water-stage recorder. Datum of gage is 1,111.91 ft above National Geodetic Vertical Datum of 1929. Prior to Jan. 29, 1953, nonrecording gage at bridge 1,800 ft upstream at datum 3.17 ft lower.

REMARKS.--Estimated daily discharges: Nov. 8 to Mar. 18, 20-24. Records good except those for periods with ice effect, Nov. 8 to Mar. 18, 20-24, which are fair.

AVERAGE DISCHARGE.--36 years (water years 1946-80, 1986), 74.1 ft³/s, 53,690 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,050 ft³/s, July 1, 1975, gage height, 9.76 ft; minimum, 2.8 ft³/s, Aug. 26, 1977; minimum gage height, 2.55 ft, Sept. 5, 1961.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage known, about 11.3 ft, present datum, spring of 1921, from information by local resident.

EXTREMES FOR CURRENT PERIOD.--Maximum discharge, 866 ft³/s, May 13, gage height, 8.11 ft; minimum, 17 ft³/s, Aug 31, gage height, 3.25 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	47	83	53	42	36	38	729	362	108	50	40	23
2	48	82	52	42	36	38	683	361	97	49	37	35
3	53	79	52	42	36	38	623	337	94	46	33	52
4	62	77	51	42	36	39	554	311	86	62	30	68
5	56	78	50	41	36	39	522	284	81	57	29	76
6	54	78	50	41	36	39	486	255	76	52	36	72
7	52	75	50	41	36	39	462	228	150	49	66	67
8	59	69	49	40	36	39	415	231	117	47	59	62
9	66	51	49	40	36	39	373	257	96	47	46	58
10	71	63	48	40	36	40	339	375	88	50	39	57
11	69	62	48	39	36	41	308	667	86	49	35	60
12	78	57	48	39	36	42	277	837	81	50	30	65
13	86	58	47	39	36	43	249	853	76	51	27	64
14	94	60	47	39	36	43	270	773	72	53	30	64
15	103	55	47	38	36	43	335	625	77	49	43	65
16	108	58	46	38	36	45	384	490	79	52	45	65
17	100	58	46	38	36	40	367	398	75	75	38	64
18	97	56	46	37	36	46	350	344	189	88	32	68
19	112	56	46	37	36	48	360	306	142	78	29	75
20	120	56	45	37	36	57	385	275	112	61	27	112
21	117	56	45	37	36	48	377	250	133	53	26	136
22	116	56	45	36	36	70	352	224	120	47	31	128
23	114	56	45	36	36	216	325	200	98	45	31	124
24	111	56	45	36	36	288	296	193	83	42	33	117
25	107	55	44	36	37	346	279	191	74	38	32	110
26	103	55	44	36	37	509	263	187	67	39	31	113
27	96	54	44	36	38	701	280	181	62	49	28	106
28	91	54	43	36	38	653	313	163	58	56	26	100
29	93	54	43	36	---	626	352	147	55	53	24	108
30	89	54	43	36	---	748	367	133	53	47	22	112
31	84	---	43	36	---	755	---	121	---	42	20	---
TOTAL	2656	1861	1454	1189	1014	5796	11675	10559	2786	1626	1055	2426
MEAN	85.7	62.0	46.9	38.4	36.2	187	389	341	92.9	52.5	34.0	80.9
MAX	120	83	53	42	38	755	729	853	189	88	66	136
MIN	47	51	43	36	36	38	249	121	53	38	20	23
CFSM	.27	.19	.15	.12	.11	.58	1.21	1.06	.29	.16	.11	.25
IN.	.31	.21	.17	.14	.12	.67	1.35	1.22	.32	.19	.12	.28
AC-FT	5270	3690	2880	2360	2010	11500	23160	20940	5530	3230	2090	4810

WTR YR 1986 TOTAL 44097 MEAN 121 MAX 853 MIN 20 CFSM .38 IN 5.09 AC-FT 87470

RED RIVER OF THE NORTH BASIN

05061500 SOUTH BRANCH BUFFALO RIVER AT SABIN, MN

LOCATION.--Lat 46°46'20", long 96°37'40", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.138 N., R.47 W., Clay County, Hydrologic Unit 09020106, near center of span on downstream side of highway bridge, 0.3 mi downstream from Stony Creek and 1 mi east of Sabin.

DRAINAGE AREA.--522 mi².

PERIOD OF RECORD.--March 1945 to current year, WY 1981 (annual maximum only), March 1982 to September 1985 (no winter records).

REVISED RECORDS.--WSP 1308: 1949(M).

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 902.39 ft above National Geodetic Vertical Datum of 1929 (levels by Soil Conservation Service). Prior to Aug. 17, 1948, nonrecording gage at site 1 mi downstream at different datum.

REMARKS.--Estimated daily discharges: Oct. 6, 13, 14, 20, 27, Nov. 3, Nov. 6 to Mar. 25, 30, Apr. 6, 13, 27, May 4, 17, 18, 24-26, June 1, 8, 15, 21, 22, 29, July 4-6, 13, 20, 27, Aug. 2, 3, 10, 17, 24, 30, 31, and Sept. 1, 7, 14, 21, 28. Records fair except those for period of ice effect, Nov. 6 to Mar. 25, which are poor.

AVERAGE DISCHARGE.--36 years (water years 1946-80, 1986), 58.9 ft³/s, 42,670 acre-ft/yr; median of yearly mean discharges, 42 ft³/s, 30,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,500 ft³/s, July 2, 1975, gage height, 19.90 ft; no flow on many days in most years.

EXTREMES FOR CURRENT PERIOD.--Maximum discharge 2,550 ft³/s, Mar. 25, gage height, 14.86 ft, from highwater mark; minimum daily discharge, 2.0 ft³/s, Feb. 20-24; minimum gage height observed, 4.21 ft, Aug. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34	19	12	5.5	4.3	2.4	1000	742	35	70	28	18
2	33	18	12	5.5	4.2	2.4	886	644	30	53	26	18
3	33	17	11	5.5	4.1	2.5	736	512	26	44	24	96
4	32	16	11	5.4	4.0	2.5	618	365	22	48	22	179
5	33	15	11	5.4	4.0	2.5	574	260	24	56	17	210
6	34	15	10	5.4	3.9	2.5	790	212	23	60	13	224
7	35	15	10	5.4	3.8	2.6	849	183	46	61	15	193
8	36	14	10	5.3	3.7	2.8	718	165	40	47	24	139
9	37	14	9.8	5.3	3.5	2.9	547	188	31	32	30	97
10	38	14	9.2	5.3	3.4	2.9	384	339	28	24	22	78
11	42	14	8.8	5.3	3.3	3.4	268	872	23	62	17	70
12	38	14	8.3	5.2	3.2	5.8	226	1240	23	135	12	68
13	44	14	7.9	5.2	3.1	8.0	210	975	24	125	9.3	69
14	50	14	7.6	5.2	2.9	13	220	738	22	118	14	64
15	56	14	7.3	5.2	2.7	16	432	528	21	85	28	62
16	58	14	7.1	5.2	2.6	22	791	364	21	58	30	77
17	54	14	6.8	5.2	2.4	28	823	275	75	105	22	108
18	51	14	6.7	5.2	2.2	30	675	225	351	197	16	130
19	48	14	6.6	5.1	2.1	36	623	186	683	153	12	148
20	46	14	6.5	5.0	2.0	40	781	155	993	120	15	229
21	44	14	6.4	4.9	2.0	56	813	130	985	97	12	370
22	37	14	6.3	4.9	2.0	86	647	110	795	75	9.7	481
23	31	14	6.2	4.8	2.0	200	474	93	666	62	12	507
24	27	14	6.1	4.7	2.0	550	328	90	584	50	17	453
25	26	14	6.0	4.7	2.1	2090	230	86	466	39	22	323
26	24	14	5.9	4.7	2.3	2410	226	82	304	38	23	237
27	23	13	5.8	4.7	2.4	2220	315	78	220	34	23	187
28	22	13	5.7	4.6	2.4	1750	822	75	172	32	23	140
29	22	13	5.6	4.5	---	1490	1080	62	130	32	17	114
30	20	12	5.6	4.4	---	1350	928	51	94	30	17	116
31	20	---	5.5	4.4	---	1180	---	41	---	27	17	---
TOTAL	1128	432	244.7	157.1	82.6	13610.2	18034	10066	6957	2169	589.0	5205
MEAN	36.4	14.4	7.89	5.07	2.95	439	601	325	232	70.0	19.0	174
MAX	58	19	12	5.5	4.3	2410	1080	1240	993	197	30	507
MIN	20	12	5.5	4.4	2.0	2.4	210	41	21	24	9.3	18
CFSM	.07	.03	.02	.01	.006	.84	1.15	.62	.44	.13	.04	.33
IN.	.08	.03	.02	.01	.01	.97	1.29	.72	.50	.15	.04	.37
AC-FT	2240	857	485	312	164	27000	35770	19970	13800	4300	1170	10320

WTR YR 1986 TOTAL 58674.6 MEAN 161 MAX 2410 MIN 2.0 CFSM .31 IN 4.18 AC-FT 116400

RED RIVER OF THE NORTH BASIN

05062000 BUFFALO RIVER NEAR DILWORTH, MN

LOCATION.--Lat 46°57'40", long 96°39'40", in SW¼SE¼ sec.6, T.140 N., R.47 W., Clay County, Hydrologic Unit 09020106, on left bank 4.5 mi southeast of Kragnes, 6.5 mi northeast of Dilworth, and 9 mi downstream from South Branch.

DRAINAGE AREA.--1,040 mi², approximately.

PERIOD OF RECORD.--March 1931 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1308: 1931(M).

GAGE.--Water-stage recorder. Datum of gage is 878.31 ft above National Geodetic Vertical Datum of 1929 (levels by U.S Army Corps of Engineers). Prior to Apr. 5, 1937, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 9 to Mar. 27. Records good except those for periods with ice effect, Nov. 9 to Mar. 27, which are fair.

AVERAGE DISCHARGE.--55 years, 135 ft³/s, 97,810 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,600 ft³/s, July 2, 1975, gage height, 27.10 ft; no flow at times in 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,440 ft³/s, Mar. 28, gage height, 20.50 ft; minimum, 26 ft³/s, Sept. 2, gage height, 3.52 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	75	103	72	50	45	46	2310	1800	192	175	91	29
2	71	98	71	50	45	46	2090	1740	170	145	80	27
3	68	95	70	50	45	47	1890	1570	150	121	75	31
4	65	92	69	49	45	48	1730	1380	137	121	70	62
5	70	88	63	49	45	48	1640	1150	125	132	65	146
6	78	85	62	49	45	48	1610	911	114	129	62	219
7	77	84	62	48	44	48	1540	716	123	123	59	249
8	76	83	61	48	44	48	1530	594	196	117	65	243
9	77	74	60	48	44	48	1540	561	210	111	84	197
10	80	75	60	47	44	49	1440	599	166	104	78	147
11	83	62	59	47	44	49	1240	826	144	139	74	116
12	90	59	59	47	44	50	985	1120	131	163	66	97
13	100	76	58	47	44	52	748	1570	118	182	56	89
14	114	79	58	47	44	54	689	1870	106	238	51	88
15	124	79	57	47	44	57	918	1870	100	219	53	86
16	143	80	56	46	44	59	1030	1700	96	177	53	86
17	161	80	56	46	44	62	1170	1460	98	144	68	85
18	164	79	56	46	44	66	1360	1180	396	165	73	99
19	157	77	56	46	44	72	1470	924	1010	286	64	122
20	155	75	55	46	44	94	1470	733	1150	301	53	161
21	165	73	55	45	44	97	1430	596	1250	239	46	219
22	169	68	55	45	44	98	1480	498	1310	189	43	348
23	162	75	55	45	44	165	1460	426	1280	155	43	441
24	153	78	54	45	44	300	1310	371	1140	133	43	480
25	145	78	54	45	44	565	1080	336	962	116	39	484
26	137	77	54	45	45	1280	913	319	765	99	42	454
27	130	76	53	45	45	2660	879	308	555	96	47	384
28	122	75	52	45	45	3390	1080	294	387	98	45	315
29	113	74	52	45	---	3080	1310	279	285	102	41	272
30	107	73	51	45	---	2760	1590	253	221	105	37	247
31	108	---	50	45	---	2530	---	221	---	100	33	---
TOTAL	3539	2370	1805	1448	1241	18016	40932	28175	13087	4724	1799	6023
MEAN	114	79.0	58.2	46.7	44.3	581	1364	909	436	152	58.0	201
MAX	169	103	72	50	45	3390	2310	1870	1310	301	91	484
MIN	65	59	50	45	44	46	689	221	96	96	33	27
CFSM	.11	.08	.06	.05	.04	.56	1.31	.87	.42	.15	.06	.19
IN.	.13	.08	.06	.05	.04	.64	1.46	1.01	.47	.17	.06	.22
AC-FT	7020	4700	3580	2870	2460	35730	81190	55890	25960	9370	3570	11950
CAL YR 1985	TOTAL	75451	MEAN 207	MAX 1930	MIN 18	CFSM .20	IN 2.70	AC-FT	149700			
WTR YR 1986	TOTAL	123159	MEAN 337	MAX 3390	MIN 27	CFSM .32	IN 4.41	AC-FT	244300			

WTR YR 1986	TOTAL	191372	MEAN	524	MAX	3800	MIN	58	CFSM	.33	IN	4.45	AC-FT	379600
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RED RIVER OF THE NORTH BASIN

05064500 RED RIVER OF THE NORTH AT HALSTAD, MN
(National stream quality accounting network station and radiochemical program station)

LOCATION.--Lat 47°21'10", long 96°50'50", on line between secs.24 and 25, T.14S N., R.49 W., Traill County, Hydrologic Unit 09020107, on left bank on upstream side of highway bridge, 0.5 mi west of Halstad, 2.5 mi downstream from Wild Rice River, and at mile 375.2.

DRAINAGE AREA.--21,800 mi², approximately, including 3,800 mi² in closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1936 to June 1937 (no winter records), April 1942 to September 1960 (spring and summer months only), May 1961 to current year.

REVISED RECORDS.--WSP 1388: 1936, 1950. WSP 1728: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 826.65 ft above National Geodetic Vertical Datum of 1929. Prior to July 17, 1961, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 8 to Mar. 30 and Sept. 25-30. Records good except those for period with ice effect, Nov. 8 to Mar. 30, and period of no gage height record, Sept. 25-30, which are fair.

AVERAGE DISCHARGE.--25 years (1961-86), 1,839 ft³/s, 1,332,000 acre-ft/yr; median of yearly mean discharges, 1,760 ft³/s, 1,275,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 42,000 ft³/s, Apr. 22, 1979, gage height, 39.00 ft; minimum observed, 5.4 ft³/s, Oct. 8, 9, 12-14, 1936.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in 1897 reached a stage of about 38.5 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 17,400 ft³/s, Mar. 31, gage height, 25.89 ft; minimum daily 894 ft³/s, Jan. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1310	1360	1000	980	915	971	17200	12700	4190	3150	1830	1280
2	1300	1360	940	970	931	1030	16800	12700	4060	3040	1760	1290
3	1290	1350	960	957	943	1080	16300	12600	3960	2960	1700	1270
4	1260	1350	980	956	950	1120	15500	12300	3870	2970	1640	1350
5	1230	1340	1100	964	956	1150	14700	12000	3780	3020	1570	1370
6	1210	1330	1040	975	952	1180	14000	11500	3700	2910	1500	1420
7	1220	1320	990	894	954	1220	13300	10800	4040	2760	1450	1570
8	1240	1300	1010	962	955	1270	12400	9840	4030	2660	1460	1740
9	1280	1200	1000	946	952	1310	11200	8740	3840	2600	1440	1790
10	1300	1200	1050	937	954	1360	9800	7750	3810	2570	1370	1740
11	1300	1190	1150	933	955	1420	8550	7260	3800	2600	1310	1670
12	1330	1170	1150	940	952	1480	7420	7970	3760	2820	1270	1580
13	1340	1160	1150	954	950	1540	6490	8990	3730	3210	1180	1470
14	1360	1140	1140	959	952	1600	5920	9830	3770	3790	1140	1400
15	1360	1130	1130	959	945	1660	6520	10600	3890	3930	1120	1350
16	1370	1110	1120	951	938	1730	8050	11100	4040	3790	1160	1330
17	1370	1090	1110	942	936	1810	9090	11200	4050	3590	1180	1310
18	1380	1080	1100	935	944	1930	9710	10800	4780	3390	1230	1300
19	1390	1060	1090	941	947	2070	11100	9960	5770	3190	1250	1310
20	1410	1040	1080	948	951	2220	12600	8840	5490	3030	1250	1320
21	1420	1030	1070	955	937	2380	13500	7710	5250	2980	1210	1410
22	1410	1010	1060	956	923	2660	13600	6850	5330	2900	1160	1680
23	1400	1000	1060	966	915	3460	13300	6200	5410	2780	1130	2390
24	1400	980	1060	977	918	5740	12700	5740	5200	2620	1130	2850
25	1410	960	1080	959	935	9010	12200	5410	4440	2460	1120	3300
26	1400	947	1060	949	928	11900	11800	5190	4210	2320	1150	3700
27	1390	959	1040	946	911	13800	11500	5000	3930	2310	1200	4100
28	1370	1060	1030	954	925	15400	11700	4820	3680	2250	1260	4250
29	1370	1060	1010	956	---	16200	12200	4630	3460	2100	1290	4300
30	1380	1020	992	933	---	16900	12500	4470	3280	1930	1300	4200
31	1370	---	989	914	---	17300	---	4320	---	1870	1290	---
TOTAL	41570	34306	32741	29468	26324	143901	351650	267820	126550	88500	41050	61040
MEAN	1341	1144	1056	951	940	4642	11720	8639	4218	2855	1324	2035
MAX	1420	1360	1150	980	956	17300	17200	12700	5770	3930	1830	4300
MIN	1210	947	940	894	911	971	5920	4320	3280	1870	1120	1270
AC-FT	82450	68050	64940	58450	52210	285400	697500	531200	251000	175500	81420	121100
CAL YR 1985	TOTAL	771772		MEAN	2114	MAX	10100	MIN	440	AC-FT	1531000	
WTR YR 1986	TOTAL	1244920		MEAN	3411	MAX	17300	MIN	894	AC-FT	2469000	

RED RIVER OF THE NORTH BASIN

05064500 RED RIVER OF THE NORTH AT HALSTAD, MN--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1961-67, 1972 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD- NESS AS CACO3) (00900)
NOV												
04...	1430	1310	535	8.4	5.0	5.0	7.0	12.2	98	K20	K20	250
DEC												
19...	1530	1100	578	8.4	-18.0	0.0	4.9	9.8	69	24	32	270
FEB												
14...	1545	956	625	7.9	-16.5	0.0	5.4	13.4	95	36	21	280
MAR												
31...	1225	17300	445	--	13.0	4.0	--	--	--	--	--	--
APR												
09...	1130	11300	650	7.9	13.0	8.5	39	10.2	90	--	--	290
29...	1205	12300	625	--	15.5	8.5	--	--	--	--	--	--
JUL												
02...	1135	3070	748	8.2	25.0	23.0	180	6.5	79	150	85	340
AUG												
04...	1255	1670	738	8.2	22.0	24.0	--	--	--	--	--	--
SEP												
17...	1730	1370	--	--	15.0	14.0	--	--	--	--	--	--

DATE	HARD- NESS NONCAR- BONATE (MG/L AS CACO3) (00902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	PERCENT SODIUM (00932)	SODIUM AD- SORP- TION RATIO (00931)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2) (00405)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)
NOV												
04...	24	49	30	15	11	0.4	4.8	222	1.7	45	11	0.2
DEC												
19...	22	53	33	22	15	0.6	5.5	246	1.9	49	11	0.2
FEB												
14...	12	56	33	25	16	0.7	5.9	264	6.4	58	12	0.2
APR												
09...	0	66	31	18	11	0.5	7.9	179	8.7	130	11	0.2
JUL												
02...	120	69	41	24	13	0.6	7.1	224	2.8	160	12	0.2

DATE	SILICA, DIS- SOLVED (MG/L AS SiO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTITUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS NH4) (71846)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)
NOV												
04...	12	295	300	0.40	1050	<0.01	<0.10	0.06	0.04	0.05	0.9	0.09
DEC												
19...	18	332	340	0.45	986	<0.01	0.20	0.19	0.18	0.23	0.9	0.08
FEB												
14...	19	370	370	0.50	955	<0.01	0.40	0.19	0.19	0.24	1.2	0.10
APR												
09...	18	425	500	0.58	13000	--	--	--	--	--	--	--
JUL												
02...	15	480	460	0.65	3980	--	--	--	--	--	--	--

RED RIVER OF THE NORTH BASIN

05064500 RED RIVER OF THE NORTH AT HALSTAD, MN--Continued

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	PHOS- PHORUS TOTAL (MG/L AS PO4) (71886)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)
NOV 04...	0.28	0.04	0.04	20	2	67	<0.5	<1	<1	<3	3	3
DEC 19...	--	0.05	0.06	--	--	--	--	--	--	--	--	--
FEB 14...	--	0.08	0.07	20	2	83	<0.5	<1	<1	<3	1	14
APR 09...	--	--	--	20	4	96	<0.5	<1	<1	<3	4	24

DATE	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
NOV 04...	1	20	3	<0.1	<10	<1	<1	<1	160	<6	5
FEB 14...	1	26	14	<0.1	<10	5	<1	<1	200	<6	9
APR 09...	3	31	9	--	<10	2	1	<1	240	<6	10

DATE	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)	URANIUM DIS- SOLVED, EXTRAC- TION (UG/L) (80020)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDE (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 04...	--	--	--	--	--	--	--	--	12	44	95
DEC 19...	--	--	--	--	--	--	--	--	12	36	73
FEB 14...	--	--	--	--	--	--	--	--	12	31	73
APR 09...	7.1	6.3	13	5.1	9.7	4.4	0.09	7.2	--	--	--
JUL 02...	--	--	--	--	--	--	--	--	295	2450	100
SEP 17...	--	--	--	--	--	--	--	--	95	351	99

RED RIVER OF THE NORTH BASIN

05067500 MARSH RIVER NEAR SHELLY, MN

LOCATION.--Lat 47°24'45", long 96°45'50", in NE1/4 sec.3, T.14S N., R.48 W., Norman County, Hydrologic Unit 09020107, near center of span on downstream truss of bridge, 3.8 mi southeast of Shelly and 10 mi upstream from mouth.

DRAINAGE AREA.--151 mi².

PERIOD OF RECORD.--March 1944 to September 1983 and April 1985 to current year. Monthly discharge only for March 1944, published in WSP 1308. Operated as a high-flow partial-record station October 1983 to March 1985.

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 841.14 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Oct.1, 1965, nonrecording gage at datum 3.0 ft higher.

REMARKS.--Estimated daily discharges: Oct. 7, 31, Nov. 5, Nov. 7 to Mar. 28, Apr. 4-6, 8, 9, 12, 13, 27, May 1, 21, 23-25, 28, 29, 31, June 17, 18, 20, 21, 24, 28, 29, July 6, 8, 11, 14, 20, 23-27, Aug. 3, 5, 10, 15, 17, 23-25, Sept. 2-7, 25, and 26. Records poor. Large part of high flow of Wild Rice River diverted into Marsh River basin at overflow section 4.6 mi east of Ada. Another diversion from Wild Rice River basin formed in 1947, 1.5 mi southeast of Ada and diverted water at all stages 1947-51, after which it was closed except for a small regulated flow diverted for abatement of pollution from Ada sewage plant effluent.

AVERAGE DISCHARGE.--40 years (water years 1945-83, 1986), 65.3 ft³/s, 47,310 acre-ft/yr; median of yearly mean discharges, 42 ft³/s, 30,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,880 ft³/s, Apr. 19, 1979, gage height, 23.36 ft, from floodmark; no flow for many days most years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,720 ft³/s, Mar. 30, gage height, 14.59; minimum daily, 0.12 ft³/s, Aug. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	2.5	3.6	.85	.45	.40	.40	718	430	17	14	15	.32		
2	2.8	3.1	.80	.45	.40	.40	407	352	14	10	12	.35		
3	2.5	2.8	.75	.45	.40	.40	286	256	9.0	7.7	9.0	.38		
4	2.5	2.4	.75	.45	.40	.40	310	135	7.7	8.4	6.8	.42		
5	2.2	2.4	.70	.45	.40	.40	330	101	7.7	6.2	6.5	.36		
6	2.5	2.5	.70	.45	.40	.40	300	77	7.7	5.0	6.2	.30		
7	3.5	2.5	.65	.45	.40	.40	169	67	6.8	3.6	6.6	.25		
8	4.6	2.4	.65	.45	.40	.40	130	64	6.4	4.8	5.8	.20		
9	4.8	2.3	.60	.45	.40	.40	90	57	6.4	6.4	6.0	.22		
10	4.8	2.2	.56	.45	.40	.40	70	55	6.0	5.0	5.8	.28		
11	3.6	2.1	.55	.45	.40	.40	58	165	5.4	4.0	5.6	.28		
12	3.7	2.0	.55	.45	.40	.40	56	410	4.6	3.1	5.8	.22		
13	4.8	1.9	.55	.45	.40	.40	52	665	3.9	3.2	5.6	.20		
14	5.2	1.8	.55	.45	.40	.40	49	345	3.7	3.4	5.6	.17		
15	5.2	1.7	.55	.45	.40	.40	480	250	4.8	3.6	5.0	.14		
16	4.6	1.7	.55	.45	.40	.42	510	170	5.8	3.6	4.4	.25		
17	6.4	1.6	.50	.45	.40	.43	335	82	7.0	4.4	3.7	.40		
18	9.8	1.6	.50	.45	.40	.44	229	67	15	27	3.0	.56		
19	8.7	1.5	.50	.45	.40	.45	420	61	43	16	1.6	.75		
20	8.0	1.4	.50	.45	.40	.47	716	48	38	20	1.3	1.0		
21	6.8	1.3	.50	.45	.40	.50	502	37	34	23	.82	1.6		
22	6.0	1.3	.50	.45	.40	.65	342	30	30	68	.82	1.4		
23	4.8	1.2	.50	.45	.40	1.5	248	33	50	60	1.0	1.0		
24	4.4	1.2	.50	.45	.40	8.0	207	37	52	50	1.4	1.2		
25	4.1	1.1	.50	.45	.40	40	162	40	55	43	1.1	1.0		
26	4.4	1.1	.50	.45	.40	180	188	38	46	37	.89	.86		
27	4.4	1.0	.50	.45	.40	250	400	33	31	31	.12	.68		
28	4.4	.95	.45	.45	.40	500	724	29	25	27	1.0	.56		
29	3.9	.95	.45	.40	---	1140	688	25	20	28	.68	.50		
30	3.4	.90	.45	.40	---	1680	482	22	16	24	.40	.56		
31	3.6	---	.45	.40	---	1280	---	19	---	20	.32	---		
TOTAL	142.9	54.50	17.61	13.80	11.20	5088.86	9658	4200	578.9	570.4	129.85	16.41		
MEAN	4.61	1.82	.57	.45	.40	164	322	135	19.3	18.4	4.19	.55		
MAX	9.8	3.6	.85	.45	.40	1680	724	665	55	68	15	1.6		
MIN	2.2	.90	.45	.40	.40	.40	49	19	3.7	3.1	.12	.14		
CFSM	.03	.01	.004	.003	.003	1.09	2.13	.89	.13	.12	.03	.004		
IN.	.04	.01	.00	.00	.00	1.25	2.38	1.03	.14	.14	.03	.00		
AC-FT	283	108	35	27	22	10090	19160	8330	1150	1130	258	33		
WTR YR 1986	TOTAL	20482.43	MEAN	56.1	MAX	1680	MIN	.12	CFSM	.37	IN	5.05	AC-FT	40630

RED RIVER OF THE NORTH BASIN

05069000 SAND HILL RIVER AT CLIMAX, MN

LOCATION.--Lat 47°36'43", long 96°48'52", in NE¼ sec.30, T.148 N., R.48 W., Polk County, Hydrologic Unit 09020301, near center of span on downstream side of bridge on U.S. Highway 75 in Climax and 3.7 mi upstream from mouth.

DRAINAGE AREA.--426 mi².

PERIOD OF RECORD.--March 1943 to September 1984, June 1985 to current year (winter records incomplete prior to 1947). Monthly discharge only for some periods, published in WSP 1308 and 1728. October 1984 to May 1985, operated as a high-flow partial-record station.

REVISED RECORDS.--WSP 1388: 1943(M), 1944, 1947(M). WSP 1728: 1951(M), 1960 (Average discharge).

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 820.10 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Oct. 1, 1966, nonrecording gage at site 3.2 mi upstream at datum 12.78 ft higher.

REMARKS.--Estimated daily discharges: Nov. 7 to Apr. 4, May 7, 8, June 24, 26, 27, and July 22. Records fair except those for period with ice effect, Nov. 7 to Mar. 30, and those for period of backwater from Red River of the North, Mar. 31 to Apr. 4, which are poor.

AVERAGE DISCHARGE.--39 years (water years 1947-84, 1986), 73.1 ft³/s, 52,960 acre-ft/yr; median of yearly mean discharges, 53 ft³/s, 38,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,560 ft³/s, Apr. 14, 1965, gage height, 17.81 ft, site and datum then in use; maximum gage height, 32.79 ft, Apr. 23, 1979, from floodmark (backwater from Red River of the North); minimum daily discharge, 1.0 ft³/s, Jan. 17, 18, 1962.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,000 ft³/s, Mar. 29, gage height, 16.21 ft (backwater from ice); minimum daily, 16 ft³/s, Sept. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	74	63	42	34	26	21	1100	702	96	96	46	16		
2	73	56	41	34	25	21	900	627	86	85	40	21		
3	70	52	41	33	25	21	750	542	79	75	36	22		
4	67	53	41	33	25	21	800	433	76	69	34	20		
5	61	50	41	33	25	21	867	411	71	70	32	18		
6	55	52	41	32	24	21	719	352	69	72	28	18		
7	54	50	41	32	24	21	578	320	76	58	29	19		
8	69	50	40	32	24	21	465	300	78	51	26	18		
9	77	50	40	31	24	21	399	285	68	54	24	17		
10	85	49	40	31	24	21	336	269	64	48	25	20		
11	82	47	40	31	24	22	296	266	63	42	25	19		
12	101	47	40	31	23	22	269	258	60	41	24	21		
13	110	46	39	30	23	23	250	259	58	47	21	20		
14	109	45	39	30	23	23	320	262	57	51	24	19		
15	107	45	39	30	23	24	515	253	54	49	34	20		
16	117	45	38	30	22	25	641	251	52	46	36	19		
17	128	45	38	30	22	26	447	239	52	79	34	18		
18	130	45	38	30	22	28	492	228	50	97	30	20		
19	125	45	37	29	22	30	952	218	49	186	28	20		
20	122	45	37	29	22	35	932	206	48	179	26	20		
21	112	45	37	29	21	40	515	195	48	156	24	22		
22	103	44	36	29	21	50	391	185	52	145	23	28		
23	95	44	36	29	21	70	348	171	52	136	21	39		
24	98	43	36	29	21	90	301	167	68	118	24	25		
25	92	43	35	29	21	120	299	160	89	105	22	22		
26	81	43	35	28	21	200	438	156	96	88	20	19		
27	77	43	35	28	21	400	683	145	90	79	20	20		
28	72	42	35	28	21	800	1100	135	84	76	19	23		
29	67	42	34	27	---	1700	683	124	99	64	18	26		
30	60	42	34	27	---	1500	595	116	101	56	19	26		
31	58	---	34	26	---	1300	---	106	---	51	18	---		
TOTAL	2731	1411	1180	934	640	6738	17381	8341	2085	2569	830	635		
MEAN	88.1	47.0	38.1	30.1	22.9	217	579	269	69.5	82.9	26.8	21.2		
MAX	130	63	42	34	26	1700	1100	702	101	186	46	39		
MIN	54	42	34	26	21	21	250	106	48	41	18	16		
CFSM	.21	.11	.09	.07	.05	.51	1.36	.63	.16	.20	.06	.05		
IN.	.24	.12	.10	.08	.06	.59	1.52	.73	.18	.22	.07	.06		
AC-FT	5420	2800	2340	1850	1270	13360	34480	16540	4140	5100	1650	1260		
WTR YR 1986	TOTAL	45475	MEAN	125	MAX	1700	MIN	16	CFSM	.29	IN	3.97	AC-FT	90200

RED RIVER OF THE NORTH BASIN
05073870 MUD RIVER AT REDBY, MN

LOCATION.--Lat 47°52'52", long 94°54'14", in NW¼SE¼ sec.20, T.151 N., R.33 W., Beltrami County, Hydrologic Unit 09020302, on Red Lake Indian Reservation, on right bank at upstream side of bridge on State Highway 1 in Redby, and 0.2 mi upstream from mouth.

PERIOD OF RECORD.--July 1985 to October 1986 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 1,190 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Sept. 11, 1985, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: July 1, 1985, July 3-18, July 20 to Aug. 4, 6, 8, 10, 11, 17-19, 24, 25, Aug. 31 to Sept. 2, 7, 8, Oct. 26, 27, Nov. 2, 3, 4, 9-11, Nov. 16, 1985 to Mar. 31, 1986, Apr. 2, 5, 6, 11-13, and Oct. 30, 31. Records poor.

EXTREMES FOR CURRENT PERIOD.--July to September, 1985: Maximum daily discharge during period, 45 ft³/s, July 27; minimum daily 10 ft³/s, Sept. 13.

Water year 1986: Maximum discharge, 86 ft³/s, Apr. 29, gage height, 7.30 ft; minimum, 5.7 ft³/s, Aug. 26, 28, 31, gage height, 4.30 ft.

October 1986: Maximum discharge during period, 22 ft³/s, Oct. 6, gage height, 5.05 ft; minimum, 9.0 ft³/s, Oct. 21, gage height, 4.49 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1								---		37	32	17
2								---		34	30	16
3								---		30	28	16
4								---		26	27	16
5								---		23	25	16
6								---		21	20	15
7								---		19	16	14
8								---		18	15	12
9								---		17	14	11
10								---		16	13	11
11								---		15	13	11
12								---		14	23	11
13								---		13	41	10
14								78		12	30	11
15								---		11	24	11
16								---		11	21	12
17								---		13	20	14
18								---		14	23	13
19								---		14	28	13
20								---		15	23	22
21								---		15	20	23
22								---		15	18	19
23								---		17	17	19
24								---		20	16	16
25								---		30	21	14
26								---		40	20	13
27								---		45	19	12
28								---		42	18	12
29								---		39	17	12
30								---		36	19	12
31								---		34	18	---
TOTAL								---		706	669	424
MEAN								---		22.8	21.6	14.1
MAX								---		45	41	23
MIN								---		11	13	10
AC-FT								---		1400	1330	841

RED RIVER OF THE NORTH BASIN

05073870 MUD RIVER AT REDBY, MN--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	27	25	23	19	18	73	75	24	14	7.8	6.9
2	15	26	25	23	19	18	67	70	22	14	7.8	9.5
3	14	26	25	23	19	18	62	64	26	13	7.5	19
4	13	25	25	22	19	18	63	60	31	20	7.7	15
5	12	29	25	22	19	18	64	57	23	19	7.9	12
6	12	30	25	22	19	18	64	54	21	19	7.8	16
7	12	29	25	22	19	18	65	54	24	15	8.3	16
8	23	30	25	22	19	18	60	52	24	16	9.2	14
9	30	30	25	22	19	18	57	54	20	22	9.2	13
10	25	30	25	22	19	18	53	53	20	22	8.6	12
11	22	30	24	22	19	18	50	51	21	25	7.8	25
12	25	29	24	22	19	18	49	50	19	26	13	21
13	31	27	24	21	18	18	47	49	17	23	12	12
14	28	27	24	21	18	19	46	47	16	20	9.0	10
15	25	26	24	21	18	19	47	46	16	17	8.6	9.3
16	24	26	24	21	18	19	45	44	17	16	6.9	8.3
17	22	26	24	21	18	20	43	43	15	17	6.7	7.5
18	21	26	24	21	18	20	42	41	16	20	6.7	7.6
19	19	26	24	21	18	21	48	40	19	16	6.4	7.7
20	18	26	24	21	18	22	51	39	19	14	7.9	10
21	17	26	24	20	18	23	47	38	35	13	7.0	12
22	23	26	24	20	18	24	46	37	32	12	7.6	19
23	52	25	24	20	18	25	45	35	29	12	9.6	13
24	48	25	24	20	18	26	44	37	21	12	7.9	10
25	40	25	24	20	18	28	42	36	19	11	7.2	9.9
26	30	25	23	20	18	31	51	34	18	9.9	6.5	11
27	25	25	23	20	18	35	52	33	19	9.8	6.4	11
28	23	25	23	20	18	40	66	33	17	10	6.1	11
29	25	25	23	20	---	50	83	30	15	9.4	6.2	13
30	25	25	23	20	---	70	76	28	15	8.6	6.1	14
31	25	---	23	20	---	75	---	26	---	8.1	6.2	---
TOTAL	737	803	748	655	516	801	1648	1410	630	483.8	243.6	375.7
MEAN	23.8	26.8	24.1	21.1	18.4	25.8	54.9	45.5	21.0	15.6	7.86	12.5
MAX	52	30	25	23	19	75	83	75	35	26	13	25
MIN	12	25	23	20	18	18	42	26	15	8.1	6.1	6.9
AC-FT	1460	1590	1480	1300	1020	1590	3270	2800	1250	960	483	745
WTR YR 1986	TOTAL	9051.1	MEAN 24.8	MAX 83	MIN 6.1	AC-FT	17950					

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

[illegible]

RED RIVER OF THE NORTH BASIN

05073900 PIKE CREEK AT RED LAKE, MN

LOCATION.--Lat 47°52'34", long 95°01'06" in SW¼SW¼ sec.21, T.151 N., R.34 W., Beltrami County, Hydrologic Unit 09020302, on Red Lake Indian Reservation, on right bank 25 ft upstream from culverts on State Highway 1 in village of Red Lake, and 0.4 mi upstream from mouth.

PERIOD OF RECORD.--July 1985 to October 1986 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 1,180 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Sept. 5, 1985, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: July 1, 1985, July 3-18, July 20 to Aug. 4, 6, 8, 10, 11, 17-19, 21, 24-26, Aug. 31 to Sept. 4, Nov. 9-11, Nov. 16, 1985 to Mar. 31, 1986, Apr. 2, 5, 6, 11-13, and Oct. 2-31.

EXTREMES FOR CURRENT PERIOD.--July to September 1985: Maximum daily discharge during period, 30 ft³/s, July 1; minimum daily, 3.8 ft³/s, Sept. 26, 27.

Water year 1986: Maximum discharge, 60 ft³/s, Apr. 30, gage height, 15.58 ft; maximum gage height, 16.16 ft, Apr. 7 (backwater from beaver dams); minimum discharge, 3.2 ft³/s, Aug. 1, 2, 3; minimum gage height, 13.99 ft, Sept. 19.

October 1986: Maximum daily discharge during period, 8.5 ft³/s, Oct. 6; minimum daily, 7.2 ft³/s, Oct. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1										30	14	9.5
2										24	12	9.0
3										21	11	9.0
4										19	10	9.0
5										17	9.5	8.9
6										16	8.0	8.9
7										15	7.2	7.6
8										14	9.0	6.3
9										13	12	7.1
10										12	9.0	9.2
11										11	8.0	9.1
12										10	7.7	8.1
13										9.5	12	6.8
14										9.0	12	5.5
15										8.5	12	4.4
16										8.5	11	5.0
17										9.0	11	4.8
18										10	12	5.1
19										11	13	4.3
20										11	13	4.3
21										11	13	4.7
22										12	14	4.5
23										13	14	4.3
24										16	14	4.0
25										19	13	3.9
26										22	13	3.8
27										23	13	3.8
28										22	9.5	3.9
29										20	12	4.5
30										18	11	4.2
31										16	10	---
TOTAL										470.5	349.9	183.5
MEAN										15.2	11.3	6.12
MAX										30	14	9.5
MIN										8.5	7.2	3.8
AC-FT										933	694	364

RED RIVER OF THE NORTH BASIN

05073900 PIKE CREEK AT RED LAKE, MN--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.2	5.5	7.0	8.0	11	10	42	58	7.7	7.4	3.7	5.5
2	4.4	5.5	7.5	8.5	11	10	45	54	6.8	8.3	3.3	8.8
3	4.7	5.7	7.5	8.5	11	10	50	48	9.1	7.0	3.4	11
4	4.7	6.0	7.5	8.5	12	10	52	42	13	11	5.0	11
5	4.8	6.8	7.5	8.5	12	10	54	36	9.1	12	3.7	8.8
6	5.1	7.9	7.5	8.5	13	10	56	38	7.0	9.3	4.3	7.2
7	5.8	8.3	7.5	8.5	13	10	59	35	7.7	9.5	5.8	6.5
8	9.1	8.1	7.5	8.5	13	10	48	32	7.6	9.7	7.3	5.9
9	8.7	8.0	7.5	8.5	12	10	38	29	6.3	18	19	6.0
10	7.4	8.0	7.5	8.5	12	10	31	26	6.0	19	22	6.6
11	7.0	7.9	7.5	8.5	12	10	25	27	6.3	23	20	9.4
12	7.2	7.9	7.5	9.0	11	10	20	33	8.5	13	17	9.1
13	7.6	7.6	8.0	9.0	11	10	20	26	8.3	12	17	10
14	7.0	7.2	8.0	9.0	11	10	22	25	5.4	12	16	7.6
15	6.7	6.8	8.0	9.0	11	10	17	23	5.2	13	17	6.7
16	7.4	7.0	8.0	9.0	11	11	17	21	6.0	20	14	6.1
17	7.0	7.0	8.0	9.0	11	11	22	19	6.2	24	17	5.8
18	6.5	7.0	8.0	9.0	10	12	24	19	6.5	21	12	5.4
19	6.8	7.0	8.0	9.0	10	12	28	20	6.3	17	12	5.4
20	6.8	7.0	8.0	9.0	10	13	25	19	6.3	12	11	6.2
21	7.6	7.0	8.0	9.5	10	13	23	17	17	7.9	12	8.0
22	6.0	7.0	8.0	9.5	10	14	20	20	23	5.9	11	11
23	6.7	7.0	8.0	9.5	10	15	16	16	18	5.8	10	9.3
24	7.7	7.0	8.0	10	10	16	13	14	11	9.7	11	6.8
25	7.4	7.0	8.0	10	10	18	13	20	7.9	11	8.1	8.9
26	7.7	7.0	8.0	10	10	20	15	17	8.9	5.9	6.5	7.2
27	7.0	7.0	8.0	10	10	22	19	16	10	6.4	6.5	5.4
28	6.0	7.0	8.0	10	10	25	30	16	13	5.5	6.8	5.4
29	4.8	7.0	8.0	11	---	28	39	11	8.7	5.5	5.6	7.2
30	5.2	7.0	8.0	11	---	32	54	13	6.5	4.6	6.0	7.4
31	5.4	---	8.0	11	---	37	---	9.3	---	3.9	5.6	---
TOTAL	200.4	212.2	241.5	285.5	308	449	937	799.3	269.3	350.3	319.6	225.6
MEAN	6.46	7.07	7.79	9.21	11.0	14.5	31.2	25.8	8.98	11.3	10.3	7.52
MAX	9.1	8.3	8.0	11	13	37	59	58	23	24	22	11
MIN	4.2	5.5	7.0	8.0	10	10	13	9.3	5.2	3.9	3.3	5.4
AC-FT	397	421	479	566	611	891	1860	1590	534	695	634	447
WTR YR 1986	TOTAL	4597.7	MEAN	12.6	MAX	59	MIN	3.3	AC-FT	9120		

RED RIVER OF THE NORTH BASIN

05073980 SANDY RIVER NEAR RED LAKE, MN--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	17	18	16	16	18	18	143	121	9.0	12	6.1	8.4		
2	16	17	16	16	18	18	230	104	10	14	6.5	12		
3	20	17	16	16	18	18	227	110	21	13	6.0	16		
4	20	16	16	16	18	18	196	101	18	14	6.1	17		
5	15	16	16	16	18	18	160	87	14	14	5.6	13		
6	14	16	16	17	18	18	135	64	14	13	6.1	11		
7	15	17	16	17	18	18	118	55	15	12	7.9	11		
8	30	18	16	17	18	18	95	42	14	13	8.3	11		
9	34	17	16	17	18	18	80	44	12	14	8.2	10		
10	32	17	16	17	18	18	65	45	11	16	8.1	10		
11	31	17	16	17	18	18	55	45	12	18	7.9	12		
12	34	17	16	17	18	18	48	46	13	20	7.3	16		
13	35	17	16	17	18	18	45	52	11	22	6.8	14		
14	33	17	16	17	18	18	48	45	11	22	7.1	14		
15	30	17	16	17	18	19	58	37	11	25	7.5	12		
16	30	17	16	17	18	19	54	29	13	24	7.0	10		
17	31	17	16	17	18	19	49	27	10	22	8.3	10		
18	27	17	16	17	18	20	46	26	9.8	20	9.8	10		
19	25	17	16	17	18	20	71	24	10	19	8.3	12		
20	22	17	16	17	18	21	89	19	10	15	12	16		
21	20	17	16	17	18	22	76	17	15	13	11	18		
22	20	17	16	17	18	23	66	13	20	11	14	28		
23	20	17	16	17	18	24	61	11	29	13	11	25		
24	23	17	16	17	18	26	59	11	29	12	11	23		
25	28	17	16	17	18	28	57	13	26	9.0	12	22		
26	51	16	16	18	18	30	56	12	21	8.3	16	23		
27	38	16	16	18	18	35	57	12	20	7.1	13	22		
28	30	16	16	18	18	45	73	11	19	6.4	11	20		
29	26	16	16	18	---	55	92	9.4	14	5.9	9.5	19		
30	23	16	16	18	---	70	116	9.4	13	6.0	8.3	18		
31	21	---	16	18	---	100	---	9.0	---	5.6	8.1	---		
TOTAL	811	504	496	528	504	828	2725	1250.8	454.8	439.3	275.8	463.4		
MEAN	26.2	16.8	16.0	17.0	18.0	26.7	90.8	40.3	15.2	14.2	8.90	15.4		
MAX	51	18	16	18	18	100	230	121	29	25	16	28		
MIN	14	16	16	16	18	18	45	9.0	9.0	5.6	5.6	8.4		
CFSM	.39	.25	.24	.25	.27	.39	1.34	.59	.22	.21	.13	.23		
IN.	.44	.28	.27	.29	.28	.45	1.49	.69	.25	.24	.15	.25		
AC-FT	1610	1000	984	1050	1000	1640	5410	2480	902	871	547	919		
WTR YR 1986	TOTAL	9280.1	MEAN	25.4	MAX	230	MIN	5.6	CFSM	.37	IN	5.08	AC-FT	18410

RED RIVER OF THE NORTH BASIN

05073980 SANDY RIVER NEAR RED LAKE, MN--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

[illegible]

RED RIVER OF THE NORTH BASIN
05074000 LOWER RED LAKE NEAR RED LAKE, MN

LOCATION.--Lat 47°57'27", long 95°16'34", in SW¹/₄ NW¹/₄ sec.28, T.152 N., R.36 W., Clearwater County, Hydrologic Unit 09020302, on Red Lake Indian Reservation, on left bank just upstream from dam at outlet, 13 mi northwest of village of Red Lake.

DRAINAGE AREA.--1,950 mi², approximately.

PERIOD OF RECORD.--June 1930 to November 1932 (published as Red Lake at Redby), May 1933 to current year (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, adjustment of 1912 (levels by U.S. Army Corps of Engineers); gage readings have been reduced to elevations based on adjustment of 1912. May 1933 to Sept. 6, 1934, nonrecording gage at same site and datum. Nonrecording gages at Waskish and Redby at datum 69.00 ft lower.

REMARKS.--Satellite telmeter at station. Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 1,178.53 ft, June 25, 1950; minimum recorded, 1,169.80 ft, Nov. 20, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 1,176.00 ft, May 8; maximum daily, 1,175.84 ft, May 8; minimum, 1,173.73 ft, Sept. 12; minimum daily, 1,173.93 ft, Sept. 12, 23.

MONTHEND ELEVATION, IN FEET, OCTOBER 1985 TO SEPTEMBER 1986

Oct. 31	1,174.92	Feb. 28	1,174.76	June 30	1,175.05
Nov. 30	1,174.91	Mar. 31	1,174.79	July 31	1,174.62
Dec. 31	1,174.84	Apr. 30	1,175.34	Aug. 31	1,174.23
Jan. 31	1,174.82	May 31	1,175.42	Sept. 30	1,173.98

NOTE.--Mean daily gage heights are available.

RED RIVER OF THE NORTH BASIN

05074500 RED LAKE RIVER NEAR RED LAKE, MN

LOCATION.--Lat 47°57'27", long 95°16'35", in SW 1/4 sec.28, T.152 N., R.36 W., Clearwater County, Hydrologic Unit 09020302, on Red Lake Indian Reservation, on left bank 50 ft downstream from dam at outlet of Lower Red Lake and 13 mi northwest of village of Red Lake.

DRAINAGE AREA.--1,950 mi², approximately.

PERIOD OF RECORD.--May 1933 to current year. Monthly discharge only for May 1933, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is 1,167.00 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Sept. 7, 1934, nonrecording 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.

REMARKS.--Estimated daily discharges: Nov. 9 to Mar. 23 and June 3, 4. Records poor. Flow completely regulated by outlet dam on Lower Red Lake.

AVERAGE DISCHARGE.--53 years, 506 ft³/s, 366,600 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,600 ft³/s, 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 ft³/s; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,470 ft³/s, May 28, gage height, 5.59 ft; maximum gage height, 7.28 ft, July 11; minimum daily discharge, 153 ft³/s, May 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	997	993	770	780	790	750	668	153	1350	1050	1000	909		
2	997	993	770	780	790	750	662	322	1350	1050	1000	917		
3	997	989	770	780	790	750	670	627	1350	1000	1000	921		
4	1010	989	770	780	790	750	672	646	1350	1000	1000	914		
5	1010	982	770	780	790	750	685	760	1350	1000	1000	914		
6	1000	985	770	780	780	750	694	932	1300	950	1000	913		
7	1010	985	770	780	780	750	853	949	1300	950	1000	905		
8	955	979	770	780	780	750	1050	951	1300	950	1000	904		
9	733	980	770	780	780	750	1050	952	1300	950	1000	917		
10	509	980	770	780	780	750	1040	983	1250	1000	1000	923		
11	340	800	760	790	780	750	1030	991	1250	1000	1000	927		
12	542	800	760	790	780	750	1030	1010	1250	1000	1000	915		
13	573	800	760	790	780	750	1000	1020	1200	1000	1000	917		
14	586	800	760	790	780	750	992	1010	1200	1000	950	921		
15	718	700	760	790	780	750	1010	1020	1150	1000	950	927		
16	943	600	760	790	780	750	998	1070	1150	1000	950	924		
17	989	550	760	790	780	750	993	1150	1150	1000	900	927		
18	1000	550	760	790	780	750	1050	1160	1150	1000	900	927		
19	1020	700	760	790	780	800	1220	1160	1200	1000	900	933		
20	1020	850	760	790	780	900	1230	1170	1200	1000	900	933		
21	1020	850	770	790	760	900	1180	1230	1200	1000	900	936		
22	1010	800	770	790	760	900	966	1350	1200	1000	900	950		
23	1020	780	770	790	760	900	766	1370	1200	1000	900	937		
24	1030	770	770	790	760	890	744	1400	1200	1000	900	931		
25	1020	770	770	790	760	912	816	1430	1200	1000	900	931		
26	1020	770	770	790	760	928	994	1430	1150	1000	900	930		
27	1010	770	770	790	760	914	1020	1440	1150	1000	900	936		
28	1000	770	770	790	760	691	922	1460	1150	1000	890	932		
29	1000	770	770	790	---	169	492	1450	1100	1000	886	933		
30	997	770	770	790	---	162	171	1400	1100	1000	887	930		
31	993	---	770	790	---	329	---	1400	---	1000	892	---		
TOTAL	28069	24825	23770	24390	21730	22895	26668	33396	36750	30900	29305	27734		
MEAN	905	828	767	787	776	739	889	1077	1225	997	945	924		
MAX	1030	993	770	790	790	928	1230	1460	1350	1050	1000	950		
MIN	340	550	760	780	760	162	171	153	1100	950	886	904		
CFSM	.46	.43	.39	.40	.40	.38	.46	.55	.63	.51	.49	.47		
IN.	.54	.47	.45	.47	.41	.44	.51	.64	.70	.59	.56	.53		
AC-FT	55670	49240	47150	48380	43100	45410	52900	66240	72890	61290	58130	55010		
CAL YR 1985	TOTAL	274548	MEAN	752	MAX	1150	MIN	153	CFSM	.39	IN	5.24	AC-FT	544600
WTR YR 1986	TOTAL	330432	MEAN	905	MAX	1460	MIN	153	CFSM	.46	IN	6.30	AC-FT	655400

RED RIVER OF THE NORTH BASIN

05075000 RED LAKE RIVER AT HIGH LANDING, NEAR GOODRIDGE, MN

LOCATION.--Lat 48°02'34", long 95°48'28", in NW 1/4 sec.28, T.153 N., R.40 W., Pennington County, Hydrologic Unit 09020303, on left bank 50 ft upstream from highway bridge at High Landing, 7 mi south of Goodridge and 33 mi upstream from Thief River.

DRAINAGE AREA.--2,300 mi², approximately.

PERIOD OF RECORD.--September 1929 to current year. Prior to October 1930, published as "at Kratka".

GAGE.--Water-stage recorder. Datum of gage is 1,141.57 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). See WSP 1308 or 1738 for history of changes prior to Oct. 1, 1949.

REMARKS.--Estimated daily discharges: Nov. 10 to Mar. 30. Records good except those for periods with ice effect, Nov. 10 to Mar. 30, which are fair. Flow regulated by outlet dam on Lower Red Lake.

AVERAGE DISCHARGE.--57 years, 568 ft³/s, 411,500 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,060 ft³/s, July 7, 1975, gage height, 13.39 ft; maximum gage height, 13.44 ft, July 3, 1975; no flow during infrequent periods in 1931-34, 1936-37.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,470 ft³/s, Apr. 29, gage height, 10.82 ft; maximum gage height, 12.70 ft, Mar. 29 (backwater from ice); minimum daily discharge, 750 ft³/s, Nov. 19; minimum gage height, 5.28 ft, Nov. 19.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1120	1200	800	780	820	830	1690	1520	1410	1110	1030	882		
2	1140	1190	800	790	820	830	1710	1140	1410	1100	1030	928		
3	1150	1190	800	790	820	830	1640	1170	1410	1090	1030	960		
4	1150	1180	790	790	820	840	1590	1260	1420	1100	1040	972		
5	1150	1180	790	790	820	840	1530	1210	1400	1090	1050	949		
6	1150	1170	780	790	820	840	1480	1240	1390	1050	1060	935		
7	1160	1160	780	790	820	840	1420	1340	1390	1010	1090	934		
8	1490	1130	780	790	820	840	1490	1370	1370	998	1100	933		
9	1720	1130	780	800	820	840	1610	1390	1350	999	1110	936		
10	1510	1100	780	800	820	840	1600	1420	1330	1010	1120	953		
11	1160	900	780	800	820	840	1570	1470	1310	1030	1120	971		
12	910	850	780	800	820	840	1510	1490	1300	1060	1110	981		
13	1000	900	780	800	820	844	1450	1500	1270	1080	1100	971		
14	1000	950	780	800	820	850	1460	1450	1250	1070	1080	973		
15	971	950	770	800	820	850	1630	1390	1240	1060	1070	985		
16	996	950	770	810	830	860	1590	1330	1230	1060	1040	1000		
17	1120	950	770	810	830	870	1520	1320	1220	1070	1020	1020		
18	1200	850	770	810	830	880	1470	1360	1220	1050	992	1020		
19	1230	750	770	810	830	890	1790	1380	1250	1040	961	1020		
20	1250	850	770	810	830	900	2000	1370	1290	1030	927	1040		
21	1250	900	770	810	830	950	1890	1340	1300	1020	899	1060		
22	1250	900	770	810	830	1000	1780	1340	1280	1010	890	1080		
23	1270	900	770	820	830	1100	1550	1420	1250	1010	886	1070		
24	1250	850	770	820	830	1200	1250	1480	1240	1020	883	1050		
25	1250	850	770	820	830	1200	1150	1520	1230	1010	872	1070		
26	1240	850	780	820	830	1300	1500	1520	1210	1010	864	1070		
27	1220	800	780	820	830	1400	1780	1510	1190	1010	859	1070		
28	1230	800	780	820	830	1650	2290	1500	1160	1020	861	1060		
29	1220	800	780	820	---	2000	2400	1480	1130	1020	864	1060		
30	1200	800	780	820	---	1900	1900	1450	1120	1030	865	1060		
31	1210	---	780	820	---	1790	---	1430	---	1030	870	---		
TOTAL	37167	28980	24150	24960	23090	32484	49240	43110	38570	32297	30693	30013		
MEAN	1199	966	779	805	825	1048	1641	1391	1286	1042	990	1000		
MAX	1720	1200	800	820	830	2000	2400	1520	1420	1110	1120	1080		
MIN	910	750	770	780	820	830	1150	1140	1120	998	859	882		
CFSM	.52	.42	.34	.35	.36	.46	.71	.61	.56	.45	.43	.44		
IN.	.60	.47	.39	.40	.37	.53	.80	.70	.62	.52	.50	.49		
AC-FT	73720	57480	47900	49510	45800	64430	97670	85510	76500	64060	60880	59530		
CAL YR 1985	TOTAL	353252	MEAN	968	MAX	2460	MIN	383	CFSM	.42	IN	5.71	AC-FT	700700
WTR YR 1986	TOTAL	394754	MEAN	1082	MAX	2400	MIN	750	CFSM	.47	IN	6.38	AC-FT	783000

RED RIVER OF THE NORTH BASIN

05076000 THIEF RIVER NEAR THIEF RIVER FALLS, MN

LOCATION.--Lat 48°11'08", long 96°10'11", in NW¼SW¼ sec.3, T.154 N., R.43 W., Marshall County, Hydrologic Unit 09020304, on right bank, 0.2 mi upstream from highway bridge, 5 mi north of city of Thief River Falls, 7 mi upstream from mouth, and 9 mi downstream from Mud Lake National Wildlife Refuge.

DRAINAGE AREA.--959 mi².

PERIOD OF RECORD.--July 1909 to September 1917, April 1920 to September 1921, October 1922 to September 1924, October 1928 to September 1981, March 1982 to current year. Monthly discharge only for some periods, annual maximums for water years 1919, 1922, 1925, 1926, published in WSP 1308. October 1981 to February 1982, operated as a high-flow partial-record station.

REVISED RECORDS.--WSP 925: Drainage area. WSP 1308: 1917(M), 1924(M), 1929(M), 1931-33(M), 1935(M), 1937(M).

GAGE.--Water-stage recorder and control of grouted boulders. Datum of gage is 1,112.33 ft above National Geodetic Vertical Datum of 1929 (levels by Minnesota Department of Transportation). Prior to May 4, 1939, nonrecording gages at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 9 to Apr. 4. Records good except those for period with ice effect, Nov. 9 to Apr. 4, which are poor. Some regulation by Thief and Mud Lakes.

AVERAGE DISCHARGE.--68 years (water years 1910-17, 1921, 1923-24, 1929-81, 1983-86), 168 ft³/s, 121,700 acre-ft/yr; median of yearly mean discharges, 117 ft³/s, 84,800 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,610 ft³/s, May 13, 1950, gage height, 17.38 ft; no flow at times in some years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,420 ft³/s, May 1, gage height, 11.82 ft; maximum gage height, 14.25 ft, Mar. 29 (backwater from ice); minimum discharge, 0.17 ft³/s, Aug. 28, gage height, 3.91 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	627	345	83	17	3.1	2.8	2400	2410	275	87	5.5	73
2	608	339	80	16	3.1	2.8	2350	2330	252	65	3.9	77
3	571	339	78	15	3.1	2.8	2300	2190	209	46	3.0	114
4	340	343	74	14	3.1	2.8	2200	2000	229	42	2.3	278
5	322	343	70	13	3.1	2.7	2110	1850	230	36	2.0	295
6	318	336	68	12	3.0	2.7	1920	1710	219	30	1.7	275
7	318	326	66	11	3.0	2.7	1790	1650	305	25	7.3	272
8	370	307	63	11	3.0	2.7	1700	1590	291	22	11	270
9	669	290	60	10	3.0	2.7	1660	1570	255	20	7.4	267
10	788	280	58	9.5	3.0	2.7	1580	1540	292	17	5.2	242
11	808	260	55	9.0	3.0	2.7	1480	1570	372	13	4.7	135
12	824	250	53	8.5	3.0	2.7	1330	1600	355	12	3.2	127
13	839	230	51	8.0	3.0	2.6	1260	1620	290	12	2.2	129
14	792	220	48	7.5	3.0	2.6	1180	1560	283	12	1.8	123
15	726	210	46	7.0	2.9	2.7	1000	1490	282	10	1.5	115
16	822	190	44	6.6	2.9	2.8	835	1420	279	21	.84	107
17	782	180	43	6.2	2.9	3.0	583	1370	273	27	1.5	102
18	756	170	42	5.8	2.9	3.5	424	1340	240	28	1.5	97
19	811	160	39	5.4	2.9	30	513	1260	241	43	.76	60
20	791	150	36	5.1	2.9	100	777	1080	249	40	.48	53
21	773	140	34	4.8	2.9	180	715	919	320	30	.35	54
22	759	130	32	4.5	2.9	250	665	869	289	27	.26	54
23	750	125	30	4.3	2.9	300	598	637	262	25	.26	53
24	726	120	28	4.1	2.9	400	563	446	253	25	.25	54
25	641	115	26	4.0	2.9	450	616	439	226	27	.22	93
26	622	110	24	3.8	2.9	550	944	434	184	26	.20	57
27	614	105	23	3.6	2.8	700	1220	427	139	32	.19	29
28	620	97	21	3.4	2.8	1000	1770	424	126	28	17	22
29	510	93	20	3.3	---	1600	2210	397	121	26	69	21
30	432	88	19	3.2	---	2000	2310	282	113	18	73	20
31	405	---	18	3.2	---	2300	---	275	---	9.1	71	---
TOTAL	19734	6391	1432	239.8	82.9	9910.0	41003	38699	7454	881.1	299.51	3668
MEAN	637	213	46.2	7.74	2.96	320	1367	1248	248	28.4	9.66	122
MAX	839	345	83	17	3.1	2300	2400	2410	372	87	73	295
MIN	318	88	18	3.2	2.8	2.6	424	275	113	9.1	.19	20
CFSM	.66	.22	.05	.008	.003	.33	1.43	1.30	.26	.03	.01	.13
IN.	.77	.25	.06	.01	.00	.38	1.59	1.50	.29	.03	.01	.14
AC-FT	39140	12680	2840	476	164	19660	81330	76760	14790	1750	594	7280

CAL YR 1985 TOTAL 202740.11 MEAN 555 MAX 2100 MIN .00 CFSM .58 IN 7.86 AC-FT 402100
WTR YR 1986 TOTAL 129794.31 MEAN 356 MAX 2410 MIN .19 CFSM .37 IN 5.03 AC-FT 257400

RED RIVER OF THE NORTH BASIN

05077600 CLEARWATER RIVER NEAR CLEARBROOK, MN

LOCATION.--Lat 47°46'30", long 96°21'05", in NW¼NE¼ sec.35, T.150 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, on downstream side of bridge on county road, and 6.5 mi northeast of Clearbrook.

PERIOD OF RECORD.--February 1986 to October 1986 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 1,210 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 17, 1986, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Feb. 11 to Mar. 28. Records good except those for period with ice effect, Feb. 11 to Mar. 28, which are fair.

EXTREMES FOR CURRENT PERIOD.--February to September 1986: Maximum discharge during period, 442 ft³/s, Apr. 2, gage height, 5.58 ft; maximum gage height, 5.64 ft, Mar. 28 (backwater from ice); minimum discharge, 29 ft³/s, Aug. 20, gage height, 2.71 ft; minimum gage height, 2.70 ft, Aug. 29, 30.

October 1986: Maximum discharge during period, 85 ft³/s, Oct. 1, gage height, 3.21 ft; minimum daily, 60 ft³/s, Oct. 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1					---	61	434	311	93	66	39	36
2					---	60	440	296	90	65	39	42
3					---	60	439	274	98	64	36	52
4					---	59	423	254	94	71	33	53
5					---	58	405	247	85	72	33	51
6					---	58	387	250	77	70	35	48
7					---	57	366	240	79	65	40	45
8					---	56	339	220	75	70	40	43
9					---	55	308	206	74	75	41	41
10					---	54	280	231	69	74	42	42
11					54	53	254	220	70	78	39	49
12					55	52	234	226	68	82	38	51
13					56	52	212	228	63	82	37	47
14					56	51	204	226	62	78	36	45
15					57	51	198	220	60	74	36	44
16					57	50	182	219	59	70	36	45
17					58	50	181	217	53	68	36	47
18					58	50	179	214	53	70	33	49
19					59	50	191	210	53	79	32	51
20					60	50	193	204	54	63	31	58
21					60	52	185	195	70	57	32	59
22					61	65	182	190	82	57	34	80
23					62	80	179	177	89	51	37	81
24					62	100	171	170	89	49	36	81
25					63	120	161	157	83	46	36	87
26					63	140	171	142	88	44	35	90
27					62	170	185	129	89	43	34	92
28					62	200	224	118	80	43	33	94
29					---	251	278	133	73	42	31	96
30					---	344	302	122	68	41	30	89
31					---	412	---	107	---	38	33	---
TOTAL					---	3021	7887	6353	2240	1947	1103	1788
MEAN					---	97.5	263	205	74.7	62.8	35.6	59.6
MAX					---	412	440	311	98	82	42	96
MIN					---	50	161	107	53	38	30	36
AC-FT					---	5990	15640	12600	4440	3860	2190	3550

RED RIVER OF THE NORTH BASIN

05077600 CLEARWATER RIVER NEAR CLEARBROOK, MN--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

[illegible]

RED RIVER OF THE NORTH BASIN

05077700 RUFFY BROOK NEAR GONVICK, MN

LOCATION.--Lat 47°44'50", long 95°24'45", in SE¼SE¼ sec.5, T.149 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, on left bank, 10 ft downstream from culverts on County Highway 17, 4 mi upstream from mouth, and 4.8 mi east of Gonvick.

DRAINAGE AREA.--45.2 mi².

PERIOD OF RECORD.--April 1960 to September 1978, February 1986 to October 1986 (discontinued as a continuous-record station; converted to a crest-stage partial-record station). Monthly and daily figures for Apr. 1, 1960, to June 30, 1960, published in WSP 1913. October 1978 to January 1986, operated as a high-flow partial-record station.

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 1,227.93 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Sept. 9, 1960, reference point at same site and datum.

REMARKS.--Estimated daily discharges: Feb. 11 to Mar. 29. Records fair.

AVERAGE DISCHARGE.--18 years (water years 1961-78) 13.8 ft³/s, 10,000 acre-ft/yr.

EXTREMES FOR RECORD OF RECORD.--Maximum discharge, 453 ft³/s, Mar. 30, 1967, gage height, 6.35 ft; maximum gage height, 6.62 ft, Apr. 9, 1969 (backwater from ice); no flow Feb. 20 to Mar. 6, 1968.

EXTREMES FOR CURRENT PERIOD.--February to September 1986: Peak discharges during period greater than base discharge of 65 ft³/s and maximum (*):

Date	Time	Discharge	Gage Height	Date	Time	Discharge	Gage Height
Mar. 29	----	a*190	b*4.61	May 10	1600	116	3.00
Apr. 29	0900	68	2.34				

a Also maximum for 1986 water year.

b Ice jam, also maximum for 1986 water year.

Minimum daily discharge, 1.6 ft³/s, Sept. 8, 9, 17.

October 1986: Maximum daily discharge, 4.8 ft³/s, Oct. 1-3; minimum daily, 3.0 ft³/s, Oct. 15, 24-27, 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1					---	4.4	159	49	5.0	8.3	3.7	2.3
2					---	4.4	138	44	4.5	6.6	3.7	2.6
3					---	4.4	119	38	18	5.0	3.7	3.9
4					---	4.4	99	37	9.6	6.6	2.8	2.8
5					---	4.4	89	34	5.0	6.6	2.8	2.4
6					---	4.4	74	29	5.0	5.5	3.2	2.4
7					---	4.3	66	27	7.4	6.6	3.2	1.8
8					---	4.3	53	28	5.3	7.4	3.7	1.6
9					---	4.3	43	28	4.3	6.8	3.9	1.6
10					---	4.3	37	113	4.8	6.3	3.0	1.8
11					4.1	4.3	32	72	4.8	6.8	3.0	2.8
12					4.1	4.3	27	72	4.3	8.0	3.0	2.4
13					4.2	4.3	24	62	3.0	8.0	2.6	2.8
14					4.2	4.3	26	55	3.0	9.9	3.0	2.4
15					4.2	4.3	28	56	4.3	9.3	3.0	2.1
16					4.3	4.4	24	62	2.8	7.4	2.6	1.8
17					4.3	5.0	22	44	2.4	6.8	2.6	1.6
18					4.3	6.0	26	35	2.6	6.6	2.6	2.1
19					4.3	9.0	30	30	3.0	6.6	2.3	2.4
20					4.3	10	28	23	3.0	6.1	2.3	3.7
21					4.4	10	25	20	20	5.5	2.0	3.9
22					4.4	12	24	17	20	4.5	2.3	6.8
23					4.4	15	22	15	16	4.5	2.3	5.3
24					4.4	20	18	18	11	4.1	2.3	2.3
25					4.4	30	18	19	13	4.1	2.3	2.0
26					4.4	40	19	18	13	11	2.3	5.8
27					4.4	60	23	11	13	9.0	2.3	4.3
28					4.4	93	51	9.9	11	9.0	2.0	2.4
29					---	180	65	7.4	10	4.5	2.0	3.9
30					---	171	55	6.6	7.7	4.1	2.0	5.8
31					---	161	---	6.1	---	3.7	2.0	---
TOTAL					---	891.5	1464	1086.0	236.8	205.2	84.5	89.8
MEAN					---	28.8	48.8	35.0	7.89	6.62	2.73	2.99
MAX					---	180	159	113	20	11	3.9	6.8
MIN					---	4.3	18	6.1	2.4	3.7	2.0	1.6
CFSM					---	.64	1.08	.77	.18	.15	.06	.07
IN.					---	.73	1.20	.89	.19	.17	.07	.07
AC-FT					---	1770	2900	2150	470	407	168	178

RED RIVER OF THE NORTH BASIN

05077700 RUFFY BROOK NEAR GONVICK, MN--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

[illegible]

RED RIVER OF THE NORTH BASIN

05077850 CLEARWATER RIVER NEAR TRAIL, MN

LOCATION.--Lat 47°55'35", long 95°37'29", in NW¼SW¼ sec.2, T.151 N., R.39 W., Polk County, Hydrologic Unit 09020305, on right bank 70 ft upstream from bridge on county road, and 10.5 mi northeast of Trail.

PERIOD OF RECORD.--February 1986 to October 1986 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 1,165 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 18, 1986, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Feb 11 to Mar. 30, Aug. 7-12, 14-18, 20-23, 25, 26, Oct. 9, 10, 12, 13, 30. Records good except those for period with ice effect, Feb. 11 to Mar. 30, which are poor. Occasional regulation from Kiwosay Reservoir and diversions for flooding and draining of wild rice paddies.

EXTREMES FOR CURRENT PERIOD.--February to September, 1986: Maximum discharge during period, 874 ft³/s, Mar. 30, gage height, 10.23 ft; maximum gage height, 11.01 ft, Mar. 29 (backwater from ice); minimum discharge, 37 ft³/s, Aug. 31, gage height, 3.80 ft.

October 1986: Maximum discharge during period, 114 ft³/s, Oct. 1, gage height, 4.71 ft; minimum, 58 ft³/s, Oct. 27, 28; minimum gage height, 3.97 ft, Oct. 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1					---	90	701	730	184	109	143	45
2					---	100	648	662	175	109	172	59
3					---	105	585	591	214	110	128	85
4					---	110	544	507	215	129	117	95
5					---	120	526	470	177	131	165	83
6					---	130	509	425	132	127	143	74
7					---	135	484	395	160	126	130	66
8					---	140	431	385	145	182	120	60
9					---	140	383	357	124	192	110	56
10					---	140	344	514	130	178	105	55
11					68	135	309	689	124	181	100	61
12					70	135	292	594	126	214	95	69
13					70	125	259	597	124	209	88	66
14					70	115	252	559	126	209	82	61
15					70	110	223	506	109	222	77	59
16					70	105	202	507	108	209	73	58
17					70	102	196	494	90	222	70	59
18					71	100	225	446	78	217	66	63
19					71	100	353	401	67	221	61	64
20					71	100	322	345	65	211	58	74
21					72	100	305	300	99	177	54	77
22					72	110	284	298	105	170	52	102
23					72	120	283	255	124	167	54	109
24					73	140	233	293	128	169	56	103
25					75	160	253	293	118	171	54	102
26					76	180	321	258	117	181	50	110
27					78	210	356	215	130	159	47	111
28					85	290	623	200	120	152	45	113
29					---	600	796	209	117	159	42	118
30					---	840	754	214	111	150	40	120
31					---	778	---	188	---	136	39	---
TOTAL					---	5865	11996	12897	3842	5299	2636	2377
MEAN					---	189	400	416	128	171	85.0	79.2
MAX					---	840	796	730	215	222	172	120
MIN					---	90	196	188	65	109	39	45
AC-FT					---	11630	23790	25580	7620	10510	5230	4710

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

[illegible]

RED RIVER OF THE NORTH BASIN

05078000 CLEARWATER RIVER AT PLUMMER, MN

LOCATION.--Lat 47°55'24", long 96°02'46", in SE1/4 sec. 4, T.151 N., R.42 W., Red Lake County, Hydrologic Unit 09020305, on right bank 200 ft downstream from Soo Line Railroad bridge, 300 ft downstream from bridge on U.S. Highway 59, 0.9 mi northwest of railroad depot in Plummer, and 8 mi upstream from Hill River.

DRAINAGE AREA.--512 mi².

PERIOD OF RECORD.--April 1939 to September 1979. March 1982 to current year. Annual maximums only, October 1979 to February 1982.

GAGE.--Water-stage recorder. Datum of gage is 1,099.12 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Nov. 10, 1939, nonrecording gage at site 100 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 10-14 and Nov. 17 to Apr. 2. Records good except those for periods with ice effect, Nov. 10-14 and Nov. 17 to Apr. 2, which are fair. Since 1968, undetermined amounts of water diverted for the flooding of wild rice paddies upstream.

AVERAGE DISCHARGE.--44 years (water years 1940-79, 1983-86), 180 ft³/s, 130,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,940 ft³/s, Apr. 25, 1979, gage height, 12.31 ft; maximum gage height, 12.37 ft, Apr. 18, 1979 (backwater from ice); minimum discharge, 2.5 ft³/s, May 16, 17, 1977, gage height, 1.71 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 500 ft³/s and maximum (*):

Date	Time	Discharge (ft ³ /s)	Gage height (ft)	Date	Time	Discharge (ft ³ /s)	Gage height (ft)
Oct. 9	0315	550	5.17	May 1	0415	*1,430	8.03
Mar. 29	1630	1300	*a8.96	May 12	1015	756	5.91
Apr. 20	0330	857	6.26				

(a) Ice Jam.

Minimum discharge, 23 ft³/s, Nov. 9, gage height, 2.38 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	106	133	100	75	66	84	1100	1400	195	110	133	41
2	110	129	100	75	66	94	980	1230	193	110	146	51
3	105	131	100	75	66	100	920	988	201	109	149	68
4	106	131	100	75	66	110	781	767	241	114	118	92
5	107	118	100	70	66	120	677	610	225	129	120	95
6	106	110	100	70	66	130	628	519	181	126	149	82
7	107	95	96	70	66	135	607	472	163	120	154	74
8	341	69	96	70	70	140	537	433	179	134	175	66
9	514	65	96	70	70	140	467	421	158	192	154	60
10	375	80	96	70	70	140	407	455	141	204	144	56
11	290	85	95	70	70	135	361	650	141	199	131	55
12	263	85	95	65	71	125	302	747	134	231	121	61
13	304	85	90	65	71	120	271	724	133	257	107	66
14	290	83	90	65	71	115	275	666	126	233	93	65
15	259	65	90	65	71	115	426	570	118	247	92	60
16	235	66	90	65	71	110	326	534	110	235	95	57
17	214	67	90	62	71	110	261	532	104	267	78	57
18	204	72	85	62	71	110	255	499	85	247	70	61
19	204	82	85	62	71	110	594	462	66	237	64	61
20	192	92	85	62	71	110	799	398	64	235	61	64
21	179	100	85	62	73	110	562	328	68	208	51	74
22	168	100	80	62	73	140	421	284	94	182	50	82
23	166	100	80	62	73	200	352	273	100	190	51	103
24	168	100	80	62	73	250	341	271	98	186	57	106
25	181	100	80	62	73	310	275	309	95	192	55	100
26	172	100	80	62	73	410	509	304	101	186	54	97
27	168	100	80	62	73	490	724	259	114	182	49	104
28	163	100	75	62	78	750	1110	216	126	158	49	104
29	158	100	75	62	---	1000	1340	197	117	149	47	104
30	148	100	75	66	---	1250	1380	216	114	156	44	109
31	139	---	75	66	---	1200	---	218	---	139	42	---
TOTAL	6242	2843	2744	2053	1970	8463	17988	15952	3985	5664	2903	2275
MEAN	201	94.8	88.5	66.2	70.4	273	600	515	133	183	93.6	75.8
MAX	514	133	100	75	78	1250	1380	1400	241	267	175	109
MIN	105	65	75	62	66	84	255	197	64	109	42	41
CFSM	.39	.19	.17	.13	.14	.53	1.17	1.01	.26	.36	.18	.15
IN.	.45	.21	.20	.15	.14	.61	1.31	1.16	.29	.41	.21	.17
AC-FT	12380	5640	5440	4070	3910	16790	35680	31640	7900	11230	5760	4510
CAL YR 1985	TOTAL	82959	MEAN 227	MAX 1590	MIN 15	CFSM .44	IN 6.03	AC-FT 164500				
WTR YR 1986	TOTAL	73082	MEAN 200	MAX 1400	MIN 41	CFSM .39	IN 5.31	AC-FT 145000				

RED RIVER OF THE NORTH BASIN
05078230 LOST RIVER AT OKLEE, MN

LOCATION.--Lat 47°50'35", long 95°51'30", in SE¼ sec.2, T.150 N., R.41 W., Red Lake County, Hydrologic Unit 09020305, on downstream side of bridge on State Highway 222 at northwest edge of Oklee, 12 mi upstream from mouth.

DRAINAGE AREA.--266 mi².

PERIOD OF RECORD.--April 1960 to September 1981, February 1982 to current year. Monthly and daily figures for April 1960, to June 1960, published in WSP 2113.

GAGE.--Nonrecording gage and crest-stage gage. Datum of gage is 1,126.94 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Sept. 9, 1960, reference points at same site at datum 8.00 ft higher. Sept. 9, 1960, to Sept. 30, 1964, nonrecording gage at same site at datum 8.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 10 to Mar. 29. Records poor.

AVERAGE DISCHARGE.--25 years, 76.2 ft³/s, 55,210 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,210 ft³/s, Apr. 11, 1969, gage height, 14.91 ft, from floodmark; maximum gage height, 16.72 ft, present datum, May 24, 1962; no flow Feb. 16 to Mar. 21, 1963, Feb. 15 to Mar. 2, 1964, Jan. 6 to Mar. 11, 1977.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage known since at least 1897, 18.39 ft, present datum, Apr. 21, 1950, from floodmarks, discharge, 2,790 ft³/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,720 ft³/s, Mar. 30, gage height, 13.50 ft; minimum daily, 1.9 ft³/s, Aug. 25; minimum gage height, 2.73 ft, Aug. 21, 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46	47	35	23	17	16	812	578	22	2.6	7.3	5.7
2	46	47	34	23	17	16	548	359	22	3.7	7.8	7.8
3	46	47	34	22	17	16	445	279	55	3.9	6.4	8.6
4	47	46	13	22	17	17	367	211	40	4.5	7.5	7.8
5	45	46	20	22	17	17	322	181	37	4.7	7.5	7.3
6	41	41	25	21	17	17	331	159	32	2.7	13	6.4
7	43	38	26	21	17	17	297	153	50	4.5	8.3	4.5
8	332	36	30	21	16	17	246	141	54	4.9	8.0	3.7
9	293	34	32	21	16	17	208	144	40	9.4	8.0	8.0
10	199	30	32	21	16	17	182	231	28	9.4	9.4	14
11	159	25	32	20	16	17	171	284	23	13	13	10
12	199	22	31	20	16	17	154	405	23	23	11	7.8
13	207	22	31	20	16	18	139	405	17	26	10	7.3
14	169	22	30	20	16	18	202	301	13	23	12	7.5
15	133	22	30	20	16	18	246	283	8.0	50	16	9.1
16	110	22	30	20	16	18	201	246	6.8	44	16	7.1
17	100	25	29	20	16	18	172	194	5.3	38	12	4.5
18	92	30	29	19	16	20	164	177	4.5	34	8.3	16
19	81	32	28	19	16	20	618	153	4.5	26	5.9	22
20	72	34	28	19	16	20	380	139	14	23	4.9	25
21	64	35	27	19	15	20	246	122	16	19	2.0	23
22	62	35	27	19	15	30	199	111	17	20	2.1	28
23	61	35	26	19	15	80	164	106	36	21	2.1	26
24	66	35	26	18	15	200	126	101	34	17	3.2	24
25	68	35	26	18	15	300	319	97	27	22	1.9	25
26	68	35	25	18	15	450	437	96	18	13	2.0	25
27	62	35	25	18	15	730	507	82	13	9.7	2.9	25
28	59	35	24	18	15	1050	968	53	7.8	5.7	3.2	24
29	55	35	24	18	---	1450	1120	39	5.1	5.5	3.1	25
30	52	35	24	18	---	1630	820	35	3.2	6.2	2.6	24
31	49	---	23	18	---	1200	---	24	---	6.8	2.6	---
TOTAL	3126	1018	856	615	447	7491	11111	5889	676.2	496.2	220.0	439.1
MEAN	101	33.9	27.6	19.8	16.0	242	370	190	22.5	16.0	7.10	14.6
MAX	332	47	35	23	17	1630	1120	578	55	50	16	28
MIN	41	22	13	18	15	16	126	24	3.2	2.6	1.9	3.7
CFSM	.38	.13	.10	.07	.06	.91	1.39	.71	.09	.06	.03	.06
IN.	.44	.14	.12	.09	.06	1.05	1.55	.82	.09	.07	.03	.06
AC-FT	6200	2020	1700	1220	887	14860	22040	11680	1340	984	436	871
CAL YR 1985	TOTAL	45272.3	MEAN	124	MAX	2240	MIN	5.4	CFSM	.47	IN	6.33
WTR YR 1986	TOTAL	32384.5	MEAN	88.7	MAX	1630	MIN	1.9	CFSM	.33	IN	4.53
									AC-FT	89800	AC-FT	64230

RED RIVER OF THE NORTH BASIN

05078500 CLEARWATER RIVER AT RED LAKE FALLS, MN

LOCATION.--Lat 47°53'15", long 96°16'25", in NW¼NE¼ sec.22, T.151 N., R.44 W., Red Lake County, Hydrologic Unit 09020305, on left bank 40 ft downstream from Great Northern Railroad bridge in Red Lake Falls, 1.4 mi upstream from mouth, and 3 mi downstream from Badger Creek.

DRAINAGE AREA.--1,370 mi², approximately.

PERIOD OF RECORD.--June 1909 to September 1917, October 1934 to September 1981, March 1982 to current year. Monthly discharge only for October, November, 1934, published in WSP 1308. October 1981 to February 1982, operated as a high-flow partial-record station.

REVISED RECORDS.--WSP 355: 1911-12. WSP 1438: 1910-11, 1917(M). WDR MN-84-1:1983.

GAGE.--Water-stage recorder. Datum of gage is 949.49 ft, adjustment of 1912 (levels by U.S. Army Corps of Engineers). Prior to Sept. 12, 1911, nonrecording gage at site 0.5 mi upstream, and Sept. 12, 1911, to Sept. 30, 1917, nonrecording gage at site 40 ft upstream at different datum.

REMARKS.--Estimated daily discharges: Nov. 11 to Apr. 2. Records good except those for period with ice effect, Nov. 11 to Apr. 2, which are poor.

AVERAGE DISCHARGE.--59 years (1910-17, 1935-81, 1983-86), 322 ft³/s, 233,300 acre-ft/yr; median of yearly mean discharges, 284 ft³/s, 206,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,300 ft³/s, Apr. 25, 1979, gage height, 12.38 ft; maximum gage height, 15.85 ft, Mar. 6, 1983, from high-water mark (backwater from ice); no flow Sept. 15, 1936, Sept. 14, 1939, Aug. 19-22, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,720 ft³/s, Apr. 30, gage height, 7.39 ft; maximum gage height, 9.58 ft, Mar. 28 (backwater from ice); minimum discharge, 64 ft³/s, Aug. 31, Sept. 1, gage height, 1.98 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	222	302	195	135	120	130	3100	3520	423	151	178	68
2	218	289	190	135	120	135	2850	2950	383	146	171	72
3	213	279	190	135	120	140	2610	2310	397	142	193	79
4	211	285	190	135	120	145	2240	1840	402	152	189	94
5	207	278	185	135	120	155	1940	1520	428	161	160	121
6	209	263	185	130	120	170	1780	1330	387	169	167	125
7	212	248	180	130	120	180	1680	1210	463	165	193	110
8	397	227	180	130	120	190	1530	1140	433	166	209	98
9	1120	131	180	130	120	190	1330	1110	374	191	221	88
10	988	178	178	130	120	190	1200	1150	310	245	199	80
11	744	190	175	130	125	185	1090	1350	274	254	187	74
12	646	200	170	125	125	180	980	1680	255	252	171	75
13	734	200	170	125	125	175	879	1720	236	321	166	82
14	781	200	165	125	125	170	876	1550	225	316	159	85
15	682	180	165	125	125	170	1330	1400	206	299	169	82
16	599	155	165	125	125	170	1260	1290	194	340	170	78
17	534	157	160	125	125	170	995	1220	182	361	158	77
18	487	159	160	125	130	170	905	1150	174	368	133	74
19	455	160	155	121	130	170	1680	1060	153	323	120	77
20	440	180	155	121	130	180	2380	971	134	312	105	90
21	441	200	155	121	130	190	1740	867	135	301	96	101
22	415	200	150	121	130	240	1290	779	142	258	86	120
23	393	200	150	121	130	320	1080	745	161	261	83	122
24	374	200	150	121	130	440	956	709	162	258	79	146
25	353	200	145	120	130	580	890	729	171	246	84	147
26	355	205	145	120	130	800	1260	727	168	246	82	136
27	339	205	145	120	130	1200	2030	682	164	252	78	137
28	332	200	140	120	130	1700	3350	599	165	228	72	147
29	344	200	140	120	---	2500	3620	537	170	206	70	149
30	327	195	140	120	---	3500	3570	484	155	194	67	150
31	312	---	140	120	---	3500	---	471	---	195	65	---
TOTAL	14084	6266	5093	3896	3505	18335	52421	38800	7626	7479	4280	3084
MEAN	454	209	164	126	125	591	1747	1252	254	241	138	103
MAX	1120	302	195	135	130	3500	3620	3520	463	368	221	150
MIN	207	131	140	120	120	130	876	471	134	142	65	68
CFSM	.33	.15	.12	.09	.09	.43	1.28	.91	.19	.18	.10	.08
IN.	.38	.17	.14	.11	.10	.50	1.42	1.05	.21	.20	.12	.08
AC-FT	27940	12430	10100	7730	6950	36370	104000	76960	15130	14830	8490	6120

CAL YR 1985	TOTAL	214187	MEAN 587	MAX 6720	MIN 60	CFSM .43	IN 5.82	AC-FT 424800
WTR YR 1986	TOTAL	164869	MEAN 452	MAX 3620	MIN 65	CFSM .33	IN 4.48	AC-FT 327000

RED RIVER OF THE NORTH BASIN

05079000 RED LAKE RIVER AT CROOKSTON, MN

LOCATION.--Lat 47°46'32", long 96°36'33", in SW¼SW¼ sec.30, T.150 N., R.46 W., Polk County, Hydrologic Unit 09020303, on right bank 100 ft upstream from Sargent Street bridge in Crookston, 0.3 mi downstream from Interstate Power Co.'s dam, 0.6 mi downstream from bridge on U.S. Highway 75, and 53 mi upstream from mouth.

DRAINAGE AREA.--5,280 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1901 to current year. 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.

REVISED RECORDS.--WSP 1115: 1906, 1915-16, 1919-20, 1922, 1925, 1927, 1929. WSP 1308: 1916(M), 1919(M), 1928(M), 1930(M). See also PERIOD OF RECORD.

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

REMARKS.--Estimated daily discharges: Nov. 17 to Apr. 1. Records good except those for period with ice effect, Nov. 17 to Apr. 1, which are fair. Diurnal fluctuation prior to 1975 caused by powerplant 1,000 ft upstream. Runoff from 1,950 mi² in the headwaters of Red Lake River is completely controlled by dam at outlet of Lower Red Lake. Flow partially affected by occasional regulation at Thief and Mud Lakes in Thief River basin (see station 05076000).

AVERAGE DISCHARGE.--85 years, 1,155 ft³/s, 836,800 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 28,400 ft³/s, Apr. 12, 1969, gage height, 27.33 ft; no flow for part of July 13, 1960 (caused by regulation of powerplant upstream).

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 11,500 ft³/s, Apr. 1, gage height, 19.47 ft (backwater from ice); maximum gage height, 21.78 ft, Mar. 30, (backwater from ice); minimum discharge, 542 ft³/s, Sept. 5, gage height, 3.83 ft, caused by unusual regulation; minimum daily, 930 ft³/s, Feb. 24 to Mar. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	2070	1940	1100	1000	980	930	11000	10000	2100	1360	1100	1000		
2	1990	1850	1100	1000	980	930	9780	9220	2020	1340	1110	1070		
3	1990	1810	1100	1000	980	930	8220	7350	2010	1300	1090	1200		
4	2010	1820	1100	1000	980	960	7360	6040	2020	1300	1120	1170		
5	1760	1780	1100	1000	980	1000	6690	5390	2000	1280	1140	1130		
6	1730	1810	1050	1000	960	1000	6090	4870	2000	1260	1100	1370		
7	1740	1790	1050	1000	960	1000	5610	4410	2000	1230	1140	1320		
8	1860	1750	1050	1000	960	1000	5160	4330	2130	1240	1170	1290		
9	2830	1580	1050	1000	960	1000	4800	4300	2090	1180	1200	1240		
10	3990	1210	1050	1000	960	1000	4650	4260	1920	1210	1270	1250		
11	3810	1010	1050	1000	960	1000	4480	4380	1880	1270	1220	1280		
12	3300	1330	1050	1000	960	1000	4240	4770	1900	1260	1180	1130		
13	2840	1450	1050	1000	960	1000	3900	5080	1890	1300	1210	1180		
14	2860	1250	1050	1000	960	1000	3760	5030	1770	1460	1180	1100		
15	2760	1210	1050	1000	960	1000	4300	4710	1750	1530	1220	1110		
16	2560	1270	1050	1000	960	1000	4570	4410	1690	1270	1190	1140		
17	2440	1300	1050	1000	960	1000	3970	4150	1650	1420	1120	1110		
18	2380	1300	1050	1000	940	1000	3410	4000	1630	1500	1120	1130		
19	2420	1300	1050	1000	940	1000	3960	3870	1580	1490	1100	1150		
20	2510	1300	1050	1000	940	1050	6130	3810	1570	1430	1030	1110		
21	2470	1300	1050	980	940	1100	6050	3370	1620	1360	1030	1150		
22	2460	1250	1050	980	940	1200	4770	3220	1750	1280	983	1230		
23	2430	1250	1050	980	940	1500	4060	3000	1710	1260	977	1160		
24	2400	1250	1050	980	930	2000	3610	2840	1620	1310	948	1190		
25	2360	1200	1050	980	930	3000	3190	2640	1620	1290	951	1220		
26	2270	1200	1000	980	930	4000	3410	2670	1590	1260	964	1280		
27	2210	1200	1000	980	930	5000	4990	2670	1540	1210	953	1160		
28	2170	1150	1000	980	930	6400	7300	2590	1460	1230	945	1210		
29	2200	1150	1000	980	---	8000	9530	2470	1420	1190	962	1180		
30	2110	1150	1000	980	---	10000	9700	2380	1390	1190	946	1180		
31	1980	---	1000	980	---	10700	---	2190	---	1130	979	---		
TOTAL	74910	42160	32500	30780	26710	72700	168690	134420	53320	40340	33648	35440		
MEAN	2416	1405	1048	993	954	2345	5623	4336	1777	1301	1085	1181		
MAX	3990	1940	1100	1000	980	10700	11000	10000	2130	1530	1270	1370		
MIN	1730	1010	1000	980	930	930	3190	2190	1390	1130	945	1000		
CFSM	.46	.27	.20	.19	.18	.44	1.07	.82	.34	.25	.21	.22		
IN.	.53	.30	.23	.22	.19	.51	1.19	.95	.38	.28	.24	.25		
AC-FT	148600	83620	64460	61050	52980	144200	334600	266600	105800	80010	66740	70300		
CAL YR 1985	TOTAL	796690	MEAN	2183	MAX	9240	MIN	900	CFSM	.41	IN	5.61	AC-FT	1580000
WTR YR 1986	TOTAL	745618	MEAN	2043	MAX	11000	MIN	930	CFSM	.39	IN	5.25	AC-FT	1479000

RED RIVER OF THE NORTH BASIN

05079000 RED LAKE RIVER AT CROOKSTON, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1962, 1974-76, 1979 to current year.

REMARKS.--Letter K indicates non-ideal colony count. Letter E indicates estimated value.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
NOV 05...	1500	1730	395	395	8.3	7.9	2.0	4.5	3.5	718
DEC 10...	1330	1040	350	403	7.8	7.9	-9.0	0.0	2.4	740
JAN 22...	1530	979	392	349	7.8	7.7	-12.0	0.0	2.6	747
MAY 19...	1430	3840	389	443	8.2	8.4	16.5	15.5	17	749
JUN 24...	1430	1640	360	364	8.4	8.4	22.0	21.5	9.0	744
AUG 12...	1500	1190	357	353	8.4	8.3	25.0	21.0	16	742

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
NOV 05...	9.8	K10	54	55	19	5.0	2.2	--	--
DEC 10...	12.5	K17	--	51	17	4.1	2.5	217	0
JAN 22...	13.2	K12	K6	51	18	4.1	2.8	228	0
MAY 19...	9.8	K8	K15	57	20	4.4	3.1	227	0
JUN 24...	7.4	98	83	48	16	3.6	2.1	198	0
AUG 12...	8.4	K21	K44	48	16	3.9	2.9	210	E2.0

DATE	ALKA- LINITY, IT-FLD (MG/L AS CACO3) (99430)	ALKA- LINITY, FIXED ENDPT, FIELD (MG/L AS CACO3) (00410)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SiO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
NOV 05...	--	--	174	36	4.5	0.1	6.8	262	<0.01
DEC 10...	178	176	187	16	2.8	0.1	12	231	<0.01
JAN 22...	187	186	188	14	2.8	0.1	14	237	<0.01
MAY 19...	186	184	180	57	4.5	0.2	5.3	283	<0.01
JUN 24...	162	158	163	32	2.6	0.1	8.8	237	<0.01
AUG 12...	172	168	174	21	3.2	0.1	11	227	<0.01

RED RIVER OF THE NORTH BASIN

05079000 RED LAKE RIVER AT CROOKSTON, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE		NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV										
05...		<0.10	0.03	0.02	1.0	0.06	0.03	0.03	18	94
DEC										
10...		0.10	0.10	0.10	0.9	0.03	0.01	<0.01	11	67
JAN										
22...		<0.10	0.08	0.08	0.5	0.03	0.02	0.02	10	80
MAY										
19...		<0.10	0.03	0.03	1.2	0.06	0.01	<0.01	43	91
JUN										
24...		<0.10	0.03	0.03	0.9	0.04	0.02	0.02	38	96
AUG										
12...		0.12	0.02	0.02	0.9	0.06	0.03	0.02	33	100

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
NOV											
05...	1500	50	2	48	<0.5	<1	10	<3	3	8	4
JAN											
22...	1530	<10	1	38	<0.5	<1	<1	<3	<1	24	2
AUG											
12...	1500	10	2	55	<0.5	<1	<1	<3	2	13	<5

DATE		LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
NOV											
05...		12	14	<0.1	<10	1	<1	<1	110	<6	5
JAN											
22...		9	27	<0.1	<10	<1	<1	<1	110	<6	20
AUG											
12...		11	9	2.0	20	1	<1	<1	100	<6	13

RED RIVER OF THE NORTH BASIN

05082500 RED RIVER OF THE NORTH AT GRAND FORKS, ND

LOCATION.--Lat 47°55'38", long 97°01'34", in sec.2, T.151 N., R.50 W., Grand Forks County, Hydrologic Unit 09020301, on the right bank, 200 ft upstream from the DeMers Avenue bridge, .4 mi downstream from Red Lake River, and at mile 293.8.

DRAINAGE AREA.--30,100 mi², approximately, including 3,800 mi² in closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1882 to current year. Prior to May 1901 monthly discharge only, published in WSP 1308.

REVISED RECORDS.--WSP 855: 1936(M). WSP 1115: 1942. WSP 1175: 1897(M). WSP 1388: 1904, 1914-15, 1917-19, 1921-22, 1927, 1950. WSP 1728: Drainage area. WRD-ND-81-1: 1882, 1897 (M).

GAGE.--Water-stage recorder. Datum of gage is 780.00 ft above National Geodetic Vertical Datum of 1929. Apr. 14, 1965, to Sept. 30, 1983, water-stage recorder 1.9 mi downstream at a datum of 778.35 ft. Nov. 3, 1933, to Apr. 13, 1965, water-stage recorder 0.3 mi upstream at 778.35 ft datum. See WSP 1728 or 1913 for history of changes prior to Nov. 3, 1933.

REMARKS.--Estimated daily discharges: Oct. 23, 24, Mar. 29, Apr. 13, 14, 16, May 11, 12, 22, 23, June 10-16, June 23 to July 9, and Aug. 26-28. Records good.

AVERAGE DISCHARGE.--104 years, 2,623 ft³/s, 1,900,000 acre-ft/yr; median of yearly mean discharge, 2,370 ft³/s, 1,720,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, about 85,000 ft³/s, Apr. 10, 1897, gage height, 50.2 ft, site and datum then in use, from rating curve extended above 54,000 ft³/s; minimum, 1.8 ft³/s, Sept. 2, 1977, caused by unusual regulation during repair of dam at Grand Forks.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 31,900 ft³/s, Apr. 2, gage height, 37.00 ft; minimum daily, 1,630 ft³/s, Nov. 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3560	3540	2230	1880	1850	1790	30500	22800	6980	4760	3080	2260
2	3530	3480	2230	1870	1820	1800	31800	23300	6660	4560	2930	2320
3	3470	3390	2190	1890	1840	1850	31200	23600	6430	4480	2910	2360
4	3410	3310	2150	1870	1860	1850	29600	22800	6270	4460	2830	2440
5	3380	3310	2110	1840	1860	1890	27700	21200	6150	4370	2770	2520
6	3170	3280	2090	1850	1860	1910	25400	19700	6050	4320	2710	2430
7	3070	3240	2080	1840	1850	1940	23500	18400	6010	4220	2620	2710
8	3120	3190	2050	1850	1840	1980	21800	17300	6160	3980	2580	2860
9	3220	3110	2020	1870	1840	2020	20000	16100	6320	3890	2560	3000
10	4050	2490	2030	1880	1850	2060	18400	14900	6140	3750	2580	3070
11	5190	1870	2030	1890	1840	2070	16900	13700	5880	3710	2590	3070
12	5390	1650	2030	1890	1840	2110	15200	12900	5820	3820	2520	2970
13	5010	2110	2030	1900	1830	2140	13400	13000	5790	3950	2440	2780
14	4560	2200	2030	1910	1830	2200	11600	14000	5710	4450	2430	2660
15	4460	2180	2040	1940	1830	2240	10300	15100	5620	5190	2380	2550
16	4420	2190	2020	1950	1830	2300	11200	15700	5570	5570	2270	2480
17	4240	2400	1980	1950	1840	2350	13300	16100	5610	5400	2260	2470
18	4110	2530	1960	1980	1820	2430	14100	16200	5670	5430	2270	2460
19	4050	2270	2000	1980	1800	2530	14900	15800	6280	5280	2290	2440
20	4050	2110	2010	1950	1820	2660	17000	15200	7160	5120	2280	2470
21	4140	1980	2000	1920	1800	2910	19200	14100	7200	4900	2240	2480
22	4170	1760	2030	1900	1800	3580	20200	12700	7000	4680	2220	2580
23	4130	1650	2010	1870	1800	5140	20300	11300	7020	4600	2140	2820
24	4100	1630	1970	1910	1800	6680	19100	10200	7020	4440	2060	3410
25	4060	1820	1950	1910	1800	11100	17900	9380	6780	4220	2000	4160
26	4010	1920	1960	1880	1810	15800	16900	8740	6360	4010	1980	4670
27	3910	1940	1960	1840	1820	18700	16500	8430	6040	3830	2030	5170
28	3830	2010	1940	1830	1800	20800	17700	8190	5710	3780	2090	5580
29	3730	2070	1900	1830	---	22700	20000	7880	5280	3620	2140	5950
30	3750	2170	1900	1850	---	25300	21900	7550	5030	3430	2190	6110
31	3670	---	1900	1850	---	27900	---	7340	---	3210	2230	---
TOTAL	122960	72800	62830	58570	51180	202730	587500	453610	185720	135430	74620	95250
MEAN	3966	2427	2027	1889	1828	6540	19580	14630	6191	4369	2407	3175
MAX	5390	3540	2230	1980	1860	27900	31800	23600	7200	5570	3080	6110
MIN	3070	1630	1900	1830	1800	1790	10300	7340	5030	3210	1980	2260
AC-FT	243900	144400	124600	116200	101500	402100	1165000	899700	368400	268600	148000	188900
CAL YR 1985	TOTAL	1700320		MEAN	4658	MAX	17700	MIN	1230	AC-FT	3373000	
WTR YR 1986	TOTAL	2103200		MEAN	5762	MAX	31800	MIN	1630	AC-FT	4172000	

RED RIVER OF THE NORTH BASIN

05082500 RED RIVER OF THE NORTH AT GRAND FORKS, ND--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1949, 1956 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	HARD- NESS (MG/L AS CACO3) (00900)	HARD- NESS NONCAR- BONATE (MG/L AS CACO3) (95902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)
OCT											
22...	1230	4210	480	--	13.0	9.0	--	--	--	--	--
DEC											
19...	1530	1990	475	--	-16.0	0.0	--	--	--	--	--
JAN											
27...	1615	1850	--	--	-16.0	0.5	--	--	--	--	--
FEB											
26...	1215	1810	525	--	0.0	0.5	--	--	--	--	--
MAR											
29...	1420	22600	--	--	20.0	--	--	--	--	--	--
30...	1525	25700	--	--	10.0	--	--	--	--	--	--
APR											
02...	1110	31800	350	--	0.0	4.5	--	--	--	--	--
05...	1025	27800	425	--	4.0	6.0	--	--	--	--	--
08...	1140	21800	460	7.2	7.0	6.5	220	80	55	21	8.0
11...	1320	16800	500	--	20.0	11.0	--	--	--	--	--
14...	1155	11500	635	--	-3.0	8.0	--	--	--	--	--
21...	1200	19200	--	--	7.0	--	--	--	--	--	--
25...	1035	17900	515	--	5.0	9.0	--	--	--	--	--
30...	1130	21800	545	--	8.0	9.5	--	--	--	--	--
MAY											
07...	1240	18500	--	--	10.0	10.0	--	--	--	--	--
12...	1240	12800	555	--	16.0	15.0	--	--	--	--	--
16...	1245	15700	590	--	8.0	15.0	--	--	--	--	--
21...	1140	14200	658	--	17.0	16.5	--	--	--	--	--
AUG											
25...	1630	1930	--	--	22.0	--	--	--	--	--	--
SEP											
26...	1340	4700	610	7.8	14.0	15.5	--	--	--	--	--

DATE	PERCENT SODIUM RATIO (00932)	SODIUM AD- SORP- TION (00931)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)
APR											
08...	7	0.2	6.0	140	83	7.3	0.1	12	300	280	0.41

DATE	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)
APR										
08...	2	60	40	<1	14	20	0.2	1	<1	220

RED RIVER OF THE NORTH BASIN

05087500 MIDDLE RIVER AT ARGYLE, MN

LOCATION.--Lat 48°20'25", long 96°48'58", in NE1/4 sec.15, T.156 N., R.48 W., Marshall County, Hydrologic Unit 09020309, on left bank 30 ft upstream of bridge on County Highway 4 in Argyle and 14 mi upstream from mouth.

DRAINAGE AREA.--265 mi².

PERIOD OF RECORD.--March to September 1945, October 1950 to September 1981, February 1982 to current year. Monthly discharge only for some periods, published in WSP 1728. October 1981 to January 1982, operated as a high-flow partial-record station.

GAGE.--Water-stage recorder. Datum of gage is 828.53 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 8, 1951, nonrecording gage and Nov. 8, 1951, to Sept. 18, 1952, water-stage recorder at site 800 ft downstream at datum 1.0 ft higher. Sept. 19, 1952, to June 28, 1982, recording gage at site 800 feet downstream at present datum. June 29, 1982, to Sept. 20, 1983, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 6 to Mar 28 and May 13-28. Records fair except those for period with ice effect, Nov. 8 to Mar. 28, which are poor.

AVERAGE DISCHARGE.--35 years (water years 1951-81, 1983-86), 42.0 ft³/s, 30,430 acre-ft/yr; median of yearly mean discharges, 40 ft³/s, 29,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,260 ft³/s, July 3, 1975, gage height, 16.59 ft present datum, site then in use; no flow at times in most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1950 reached a stage of 15.25 ft present datum, site then in use, from floodmarks, discharge, 2,790 ft³/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,040 ft³/s, Mar. 31, gage height, 13.43 ft; minimum, 0.07 ft³/s, Sept. 1, gage height 2.67 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	20	5.2	3.4	3.7	2.9	974	674	20	5.1	.87	.08
2	14	18	5.0	3.4	3.7	2.9	921	617	17	4.3	1.4	.16
3	15	16	4.9	3.5	3.6	2.9	733	572	17	3.8	.52	.22
4	14	14	4.8	3.5	3.6	2.8	559	476	15	3.9	.68	.24
5	12	13	4.7	3.5	3.6	2.8	459	378	15	3.4	.93	.22
6	10	12	4.6	3.5	3.5	2.8	393	301	15	3.1	1.1	.18
7	12	12	4.5	3.5	3.5	2.8	337	247	61	2.6	1.9	.17
8	16	11	4.3	3.5	3.5	2.7	297	217	160	2.5	1.6	.15
9	15	10	4.2	3.5	3.4	2.7	260	185	167	2.7	2.1	.14
10	17	10	4.1	3.6	3.4	2.7	230	173	124	3.8	1.5	.14
11	19	9.8	4.0	3.6	3.4	2.7	199	164	87	3.2	.76	.15
12	36	9.5	3.9	3.6	3.3	2.7	173	187	62	2.4	.32	.14
13	77	9.2	3.7	3.7	3.3	2.7	152	200	46	2.2	.28	.13
14	121	8.8	3.6	3.7	3.3	2.6	136	190	34	3.3	.26	.13
15	148	8.5	3.6	3.8	3.3	2.6	121	165	27	3.4	.27	.13
16	152	8.2	3.5	3.8	3.2	2.6	115	140	22	3.3	.26	.12
17	137	8.0	3.5	3.8	3.2	2.6	111	120	18	3.2	.24	.16
18	115	7.8	3.5	3.8	3.2	2.7	106	105	18	3.0	.20	.17
19	95	7.6	3.4	3.8	3.2	2.8	107	90	17	2.8	.16	.17
20	81	7.3	3.4	3.8	3.1	2.9	130	77	15	2.7	.16	.17
21	71	7.0	3.4	3.8	3.1	3.6	207	65	14	2.6	.13	.19
22	67	6.7	3.4	3.9	3.1	5.0	251	58	11	2.9	.12	.23
23	70	6.5	3.4	3.9	3.1	10	231	51	8.8	3.9	.13	.20
24	58	6.4	3.4	3.9	3.0	20	203	45	8.0	2.8	.15	.21
25	58	6.1	3.4	3.9	3.0	50	173	41	7.0	1.4	.14	.25
26	44	6.0	3.4	3.9	3.0	150	159	39	6.7	1.0	.13	.25
27	35	5.8	3.4	3.9	3.0	350	209	37	5.9	2.0	.13	.26
28	30	5.7	3.4	3.9	3.0	600	343	36	5.2	1.7	.12	.26
29	27	5.5	3.4	3.9	---	741	482	35	4.4	1.1	.10	.28
30	24	5.3	3.4	3.8	---	890	658	30	4.6	1.5	.08	.29
31	23	---	3.4	3.8	---	994	---	25	---	.87	.08	---
TOTAL	1628	281.7	119.8	114.9	92.3	3868.5	9429	5740	1032.6	86.47	16.82	5.59
MEAN	52.5	9.39	3.86	3.71	3.30	125	314	185	34.4	2.79	.54	.19
MAX	152	20	5.2	3.9	3.7	994	974	674	167	5.1	2.1	.29
MIN	10	5.3	3.4	3.4	3.0	2.6	106	25	4.4	.87	.08	.08
CFSM	.20	.04	.02	.01	.01	.47	1.19	.70	.13	.01	.002	.001
IN.	.23	.04	.02	.02	.01	.54	1.32	.81	.14	.01	.00	.00
AC-FT	3230	559	238	228	183	7670	18700	11390	2050	172	33	11
CAL YR 1985 TOTAL	19865.63			MEAN 54.4	MAX 900	MIN .13	CFSM .21	IN 2.79	AC-FT 39400			
WTR YR 1986 TOTAL	22415.68			MEAN 61.4	MAX 994	MIN .08	CFSM .23	IN 3.15	AC-FT 44460			

RED RIVER OF THE NORTH BASIN

05092000 RED RIVER OF THE NORTH AT DRAYTON, ND

LOCATION.--Lat 48°34'20", long 97°08'50", in SE~~1~~SE~~1~~SE~~1~~ sec.24, T.159 N., R.51 W., Pembina County, Hydrologic Unit 09020311, on downstream end of east pier of interstate highway bridge, 1.5 mi northeast of Drayton, and at mile 206.7.

DRAINAGE AREA.--34,800 mi², approximately, includes 3,800 mi² in closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1936 to June 1937, April 1941 to current year (fragmentary prior to April 1949).

REVISED RECORDS.--WSP 1388: 1949-50. WSP 1728: Drainage area.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 755.00 ft above National Geodetic Vertical Datum of 1929 (Minnesota highway benchmark). Prior to Nov. 30, 1954, nonrecording gage at site 1.5 mi upstream at datum 1.59 ft higher.

REMARKS.--Estimated daily discharges: Nov. 7 to Mar. 24. Records good except those for period with ice effect, Nov. 7 to Mar. 24, which are fair. Some regulation by reservoirs on tributaries.

AVERAGE DISCHARGE.--37 years (water years 1950-86), 3,906 ft³/s, 2,830,000 acre-ft/yr; median of yearly mean discharges, 3,800 ft³/s, 2,753,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 92,900 ft³/s, Apr. 28, 1979, gage height, 43.66 ft; minimum observed, 7.7 ft³/s, Oct. 16, 1936, gage height, 1.75 ft, former site and datum.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1897 reached a stage of about 41 ft, at site and datum in use prior to Nov. 30, 1954.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 29,700 ft³/s, Apr. 7, gage height, 36.59 ft; minimum daily, 1,600 ft³/s, Nov. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3110	3420	2500	2180	1730	1640	25200	20300	7660	5430	3900	2200
2	3080	3330	2500	2180	1720	1640	26500	21600	7320	5210	3780	2380
3	3060	3220	2400	2180	1710	1640	27400	22900	7030	5000	3600	2430
4	3030	3110	2400	2180	1720	1650	28500	23900	6770	4870	3460	2430
5	3010	3000	2400	2180	1720	1640	29100	24600	6580	4800	3360	2430
6	2970	2950	2300	2050	1720	1640	29500	25000	6450	4680	3260	2520
7	2910	2900	2300	2020	1720	1650	29100	24500	6330	4600	3120	2510
8	2870	2900	2300	2040	1710	1650	28500	23600	6250	4550	3020	2580
9	2840	2800	2300	2080	1700	1650	27700	22300	6320	4400	2930	2780
10	2820	2700	2320	2040	1690	1660	26600	21100	6460	4340	2890	2970
11	3070	2500	2320	2040	1690	1660	25700	19900	6470	4200	2870	3110
12	4170	2000	2300	2020	1680	1670	24500	18600	6350	4100	2860	3180
13	5210	1600	2340	1940	1680	1680	23400	17500	6190	4110	2840	3190
14	5500	1900	2370	1940	1680	1720	22000	16700	6000	4180	2740	3100
15	5330	2100	2370	1940	1680	1760	20500	16300	5880	4530	2630	2940
16	4990	2400	2390	1950	1680	1810	18800	16200	5770	4940	2560	2800
17	4840	2600	2370	1950	1670	1900	17400	16000	5690	5370	2510	2670
18	4690	2700	2360	1950	1670	2010	16300	15800	5690	5450	2460	2570
19	4500	2500	2370	1950	1660	2200	15500	15600	5730	5460	2410	2520
20	4330	2300	2350	1950	1660	2250	15000	15400	6000	5450	2390	2490
21	4180	2100	2320	2000	1660	2370	14800	15100	6570	5400	2390	2490
22	4150	1900	2330	1980	1650	2900	15500	14600	6900	5280	2390	2500
23	4080	1800	2290	1950	1650	4300	16600	13900	6960	5170	2390	2500
24	4050	1700	2220	1930	1650	6020	17100	13100	6960	5000	2340	2600
25	4030	1800	2200	1910	1640	8630	17700	12100	6960	4960	2240	2990
26	3960	1900	2180	1900	1640	11500	17900	11100	6850	4790	2180	3530
27	3900	2000	2180	1810	1640	13800	17700	10200	6690	4620	2160	4110
28	3800	2100	2180	1800	1640	16100	17700	9400	6420	4400	2130	4630
29	3680	2200	2180	1780	---	18900	18200	8860	6120	4260	2100	5120
30	3560	2400	2180	1750	---	21600	19000	8400	5730	4120	2120	5510
31	3480	---	2180	1730	---	23400	---	8000	---	4000	2150	---
TOTAL	119200	72830	71700	61300	47060	164640	649400	522560	193100	147670	84180	89780
MEAN	3845	2428	2313	1977	1681	5311	21650	16860	6437	4764	2715	2993
MAX	5500	3420	2500	2180	1730	23400	29500	25000	7660	5460	3900	5510
MIN	2820	1600	2180	1730	1640	1640	14800	8000	5690	4000	2100	2200
AC-FT	236400	144500	142200	121600	93340	326600	1288000	1036000	383000	292900	167000	178100
CAL YR 1985	TOTAL	1836090		MEAN	5030	MAX	17400	MIN	1250	AC-FT	3642000	
WTR YR 1986	TOTAL	2223420		MEAN	6092	MAX	29500	MIN	1600	AC-FT	4410000	

RED RIVER OF THE NORTH BASIN

05092000 RED RIVER OF THE NORTH AT DRAYTON, ND--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	HARD- NESS (MG/L AS CACO3) (00900)	HARD- NESS NONCAR- BONATE (MG/L AS CACO3) (95902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)
OCT											
16...	1350	4960	565	--	3.0	5.0	--	--	--	--	--
DEC											
09...	1500	2140	680	--	-7.0	0.5	--	--	--	--	--
10...	1610	2330	648	--	-12.0	0.0	--	--	--	--	--
MAR											
10...	1800	1660	--	--	0.0	--	--	--	--	--	--
31...	1810	23900	380	--	10.0	4.0	--	--	--	--	--
APR											
04...	1105	28300	400	--	6.0	5.5	--	--	--	--	--
07...	1515	29100	470	7.1	--	7.0	210	75	50	21	12
10...	1710	26700	500	--	21.0	11.0	--	--	--	--	--
16...	1430	18600	710	--	10.0	8.0	--	--	--	--	--
MAY											
02...	1600	22000	650	--	12.0	9.0	--	--	--	--	--
13...	1440	17300	760	--	--	17.0	--	--	--	--	--
JUN											
06...	1620	6430	650	--	20.0	21.0	--	--	--	--	--
JUL											
21...	1610	5380	--	--	26.0	--	--	--	--	--	--
AUG											
28...	1730	2180	590	7.9	20.0	19.0	260	55	56	29	32

DATE	PERCENT SODIUM (00932)	SODIUM AD- SORP- TION RATIO (00931)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)
APR											
07...	11	0.4	7.4	140	77	12	0.2	14	308	280	0.42
AUG											
28...	21	0.9	5.2	200	79	31	0.1	13	396	370	0.54

DATE	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)
APR										
07...	3	80	20	<1	18	20	0.1	2	<1	230
AUG										
28...	5	90	10	<1	27	10	0.6	4	1	250

RED RIVER OF THE NORTH BASIN

05094000 SOUTH BRANCH TWO RIVERS AT LAKE BRONSON, MN

LOCATION.--Lat 48°43'50", long 96°39'50", in SW¹/₄SW¹/₄ sec.30, T.161 N., R.46 W., Kittson County, Hydrologic Unit 09020312, on left bank 70 ft upstream from culvert on U.S. Highway 59 at town of Lake Bronson and 3.4 mi downstream from dam at outlet of Bronson Lake.

DRAINAGE AREA.--444 mi².

PERIOD OF RECORD.--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 1981, April 1985 to current year. Monthly discharge only for some periods, published in WSP 1308. October 1981 to March 1985, annual maximums only. Published as South Fork Two Rivers at Bronson prior to 1941.

REVISED RECORDS.--WSP 1308: 1929(M), 1931(M), 1936(M), 1944(M), 1947(M).

GAGE.--Water-stage recorder. Datum of gage is 928.53 ft above National Geodetic Vertical Datum of 1929 (Minnesota Department of Transportation bench mark). Prior to Nov. 23, 1953, nonrecording 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.

REMARKS.--Estimated daily discharges: Nov. 8 to Mar. 22. Records good except those for period with ice effect, Nov. 8 to Mar. 22, which are fair. Flow partly regulated since 1937 by Bronson Lake, usable capacity, 3,700 acre-ft.

AVERAGE DISCHARGE.--41 years (water years 1929-36, 1942, 1943, 1946, 1947, 1954-81, 1986), 89.3 ft³/s, 64,700 acre-ft/yr; median of yearly mean discharges, 57 ft³/s, 41,300 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,410 ft³/s, Apr. 5, 1966, gage height, 18.23 ft; no flow at times in 1937, 1941, 1960, 1973.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,510 ft³/s, Mar. 29, gage height, 11.47 ft; minimum, 1.9 ft³/s, Aug 27, gage height, 3.36 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	23	43	21	11	2.7	2.3	2460	1580	98	14	11	140
2	25	73	21	10	2.7	2.3	2390	1610	78	18	10	144
3	25	85	21	10	2.7	2.3	2120	1480	63	35	11	89
4	23	77	20	9.5	2.7	2.3	1800	1340	62	41	11	59
5	23	55	20	9.0	2.7	2.3	1560	1180	61	17	11	26
6	23	29	20	8.5	2.7	2.2	1370	878	60	13	10	20
7	20	30	19	8.0	2.7	2.2	1010	643	59	13	11	20
8	47	30	19	7.5	2.6	2.2	835	561	58	14	10	20
9	44	30	19	7.0	2.6	2.2	743	450	57	14	11	18
10	14	30	19	5.5	2.6	2.2	643	349	56	15	9.9	11
11	32	29	18	4.0	2.6	2.1	566	361	35	14	9.8	19
12	61	29	18	3.5	2.6	2.1	433	590	15	13	9.6	19
13	157	28	18	3.3	2.6	2.1	336	1130	16	12	9.7	19
14	535	27	18	3.2	2.6	2.1	208	1050	15	12	9.6	19
15	400	27	18	3.1	2.5	2.1	159	872	14	12	9.3	19
16	305	26	17	3.1	2.5	2.1	186	651	12	12	9.3	14
17	269	26	17	3.0	2.5	2.1	216	534	7.2	11	9.5	7.7
18	217	25	17	3.0	2.5	2.1	229	384	7.2	11	9.4	7.1
19	193	25	16	3.0	2.5	2.5	232	314	8.2	11	9.3	7.0
20	188	25	16	3.0	2.5	3.5	350	288	14	11	9.1	7.2
21	96	24	16	2.9	2.4	5.0	444	190	13	11	9.1	7.3
22	99	24	15	2.9	2.4	20	358	175	17	11	9.6	7.1
23	160	24	15	2.9	2.4	106	286	186	32	11	9.3	7.1
24	117	23	15	2.9	2.4	523	266	173	50	11	9.2	7.5
25	99	23	14	2.8	2.4	621	219	155	36	11	7.7	8.6
26	88	23	14	2.8	2.4	618	302	155	16	11	2.6	9.1
27	73	22	13	2.8	2.3	776	658	130	12	12	2.1	9.2
28	40	22	13	2.8	2.3	1350	1200	102	12	11	2.4	9.8
29	41	22	12	2.8	---	2320	1550	104	12	11	2.4	9.0
30	37	22	12	2.8	---	2400	1430	104	12	11	2.4	7.7
31	27	---	11	2.7	---	2430	---	101	---	11	7.0	---
TOTAL	3501	978	522	149.3	71.1	11214.3	24559	17820	1007.6	435	264.3	767.4
MEAN	113	32.6	16.8	4.82	2.54	362	819	575	33.6	14.0	8.53	25.6
MAX	535	85	21	11	2.7	2430	2460	1610	98	41	11	144
MIN	14	22	11	2.7	2.3	2.1	159	101	7.2	11	2.1	7.0
CFSM	.26	.07	.04	.01	.006	.82	1.85	1.30	.08	.03	.02	.06
IN.	.29	.08	.04	.01	.01	.94	2.06	1.49	.08	.04	.02	.06
AC-FT	6940	1940	1040	296	141	22240	48710	35350	2000	863	524	1520

WTR YR 1986 TOTAL 61289.0 MEAN 168 MAX 2460 MIN 2.1 CFSM .38 IN 5.14 AC-FT 121600

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER OF THE NORTH AT EMERSON, MAN
(National stream-quality accounting network station)
(International gaging station)

LOCATION.--Lat 49°00'30", long 97°12'40", in sec.2, T.1, R.2 E., on right bank 1,500 ft downstream from Canadian National Railway bridge in Emerson, 0.8 mi downstream from international boundary, 3.6 mi downstream from Pembina River, and at mile 154.3.

DRAINAGE AREA.--40,200 mi², approximately, includes 3,800 mi² in closed basins.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March to November 1902 (gage heights only), May 1912 to September 1929 (monthly discharge only, published in WSP 1308), October 1929 to current year.

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above National Geodetic Vertical Datum of 1929, by Survey of Canada. See WSP 1728 or 1913 for history of changes prior to Apr. 10, 1953.

REMARKS.--Records good. 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. Records provided by Water Survey of Canada.

AVERAGE DISCHARGE.--74 years (water years 1913-86), 3,390 ft³/s, 2,456,000 acre-ft/yr; median of yearly mean discharges, 2,870 ft³/s, 2,080,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 95,500 ft³/s, May 13, 1950, gage height, 90.89 ft; maximum gage height, 91.19 ft, May 1, 1979; minimum observed discharge, 0.9 ft³/s, Feb. 6-8, 1937.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 34,200 ft³/s, Apr. 7; minimum daily, 1,680 ft³/s, Mar. 3, 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4100	4130	2090	2090	1890	1700	30100	26300	9600	5830	4130	2310
2	4030	4100	2120	2070	1870	1690	30900	28100	9290	5540	3950	2390
3	3920	3960	2140	2080	1860	1680	32300	28900	9000	5300	3780	2510
4	3850	3880	2170	2070	1850	1680	33600	28600	8690	5080	3600	2610
5	3780	3780	2170	2070	1850	1690	33900	28700	8400	5090	3460	2580
6	3710	3710	2200	2070	1850	1720	34100	28700	8190	4980	3370	2570
7	3640	3640	2200	2050	1850	1740	34200	28800	8020	4940	3260	2610
8	3640	3570	2200	2030	1860	1770	34000	29000	7730	4870	3150	2600
9	3570	3410	2180	2020	1860	1780	33500	29200	7520	4770	3070	2660
10	3480	3370	2160	2010	1860	1800	32700	29300	7520	4660	2990	2790
11	3460	3020	2130	2020	1860	1830	30800	29200	7560	4730	2930	2920
12	3710	2510	2110	2010	1850	1850	28200	27900	7340	4730	2900	3030
13	4480	2530	2100	2010	1850	1870	26100	26100	7060	4630	2880	3070
14	5400	2620	2100	2000	1840	1900	24700	24800	6990	4590	2840	3060
15	5900	2380	2110	1980	1830	1950	23700	23800	6670	4630	2770	2970
16	6040	2220	2110	1970	1830	2000	23000	23000	6430	4870	2700	2870
17	5930	2180	2120	1970	1810	2070	22600	22300	6290	5300	2640	2770
18	5690	2250	2130	1980	1800	2190	22200	21700	6180	5610	2580	2680
19	5510	2510	2120	1980	1790	2340	22100	21200	6140	5680	2540	2600
20	5330	2450	2110	1980	1780	2510	21800	20600	6210	5680	2500	2560
21	5120	2360	2100	1990	1770	2750	21800	20100	6570	5610	2490	2540
22	4980	2380	2080	2000	1760	3060	21900	19500	7130	5510	2500	2540
23	4870	2390	2070	2050	1760	4940	22200	18700	7520	5330	2500	2550
24	4800	2340	2060	2050	1740	7060	22500	17700	7450	5160	2480	2570
25	4770	2240	2050	2030	1730	9150	22700	16400	7380	5010	2400	2710
26	4700	2150	2030	2020	1720	12200	22900	14900	7340	4870	2340	3000
27	4660	2040	2010	2010	1710	14800	23100	13500	7200	4730	2310	3570
28	4560	2010	1990	1990	1710	18300	23500	12300	6890	4560	2290	4130
29	4410	2040	1970	1970	---	23000	24300	11400	6530	4450	2280	4660
30	4310	2060	1960	1940	---	26900	25100	10700	6180	4410	2270	5090
31	4170	---	1950	1910	---	28900	---	10100	---	4270	2280	---
TOTAL	140520	84230	65040	62420	50740	188820	804500	691500	221020	155420	88180	87520
MEAN	4533	2808	2098	2014	1812	6091	26820	22310	7367	5014	2845	2917
MAX	6040	4130	2200	2090	1890	28900	34200	29300	9600	5830	4130	5090
MIN	3460	2010	1950	1910	1710	1680	21800	10100	6140	4270	2270	2310
AC-FT	278700	167100	129000	123800	100600	374500	1596000	1372000	438400	308300	174900	173600
CAL YR 1985	TOTAL	1934060		MEAN	5299	MAX	16700	MIN	1130	AC-FT	3836000	
WTR YR 1986	TOTAL	2639910		MEAN	7233	MAX	34200	MIN	1680	AC-FT	5236000	

WATER-QUALITY RECORDS

WATER TEMPERATURE: October 1977 to current year.

WATER TEMPERATURES: Maximum daily mean, 26.0°C July 13, 14, 1981; minimum daily mean, 0.0°C on many days during winter months.

WATER TEMPERATURES: Maximum daily mean, 24.0°C July 24; minimum daily mean, 0.0°C on many days during winter months.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

		STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOC- CI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
DATE	TIME										
NOV											
05...	1300	3780	638	7.8	12.0	3.0	--	12.2	95	<1	K10
JAN											
23...	1010	2110	655	7.6	-13.0	0.0	10	13.2	91	56	K10
MAR											
04...	1000	1680	578	7.3	-2.5	0.0	4.6	14.0	99	30	K4
APR											
29...	1340	23400	608	8.1	8.5	9.0	--	10.1	90	20	K56
MAY											
27...	1045	13500	742	7.8	28.5	18.0	--	7.9	85	--	--
JUL											
16...	1230	4840	680	7.7	24.0	24.5	160	10.0	124	--	53
AUG											
22...	1100	2500	602	8.3	20.0	19.5	97	8.8	100	K8	24
SEP											
23...	1205	2470	648	8.0	17.5	13.5	--	9.1	91	--	--

[illegible]

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER AT EMERSON, MANITOBA--Continued

WATER-QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SiO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTITUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70303)	SOLIDS, DIS- SOLVED (TONS PER DAY) (70302)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
JAN 23...	60	36	0.2	17	391	390	0.53	2230	--	--
MAR 04...	51	22	0.2	17	358	350	0.49	1620	<0.01	0.35
APR 29...	--	--	--	--	--	--	--	--	0.02	1.0
JUL 16...	130	23	0.2	15	428	450	0.58	5590	--	--
AUG 22...	92	25	0.2	13	513	370	0.70	3460	<0.01	<0.10
DATE	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS NH4) (71846)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)
MAR 04...	0.10	0.09	0.12	0.8	0.07	0.05	0.04	<10	2	90
APR 29...	0.17	0.11	0.14	1.2	0.20	0.16	0.13	--	--	--
JUL 16...	0.11	--	--	1.7	0.31	--	--	--	--	--
AUG 22...	0.04	0.03	0.04	1.8	0.15	0.07	0.08	20	4	100
DATE	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)
MAR 04...	<1	<1	<1	<3	2	14	5	21	16	<0.1
AUG 22...	<0.5	<1	1	<3	2	9	<5	32	2	0.1
DATE	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SEDI- MENT, DIS- CHARGE, SUS- PENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 05...	--	--	--	--	--	--	--	41	418	100
JAN 23...	--	--	--	--	--	--	--	6	36	100
MAR 04...	<10	<1	<1	<1	190	<6	32	10	46	97
APR 29...	--	--	--	--	--	--	--	150	9450	100
JUL 16...	--	--	--	--	--	--	--	147	1920	100
AUG 22...	<10	2	<1	<1	220	<6	12	163	1100	100

RED RIVER OF THE NORTH BASIN

05102500 RED RIVER AT EMERSON, MANITOBA--Continued

SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	531	590	617	506	562	544	377	625	677	589	700	619
2	530	598	621	508	557	541	356	618	666	614	702	594
3	536	592	607	511	553	544	346	602	656	635	707	566
4	530	580	597	510	554	543	347	594	652	645	714	575
5	532	573	602	515	549	544	358	602	650	633	709	597
6	521	574	601	556	553	540	360	578	654	658	682	611
7	505	578	596	574	550	541	360	570	652	664	695	589
8	495	563	590	575	552	543	373	600	647	672	699	563
9	492	550	592	574	552	539	417	625	659	675	705	565
10	480	568	603	574	551	538	445	662	655	654	713	574
11	478	568	632	578	551	542	454	690	637	649	672	588
12	507	551	624	581	553	548	468	677	643	650	646	619
13	509	559	615	588	560	548	487	675	664	644	655	615
14	485	583	604	606	560	553	510	704	672	656	627	613
15	491	585	609	604	555	561	523	706	642	669	615	595
16	525	591	587	600	551	561	551	680	652	663	613	597
17	542	619	567	599	551	565	595	660	660	646	617	607
18	545	664	569	599	546	568	640	641	645	655	631	602
19	565	646	595	598	532	566	639	631	642	660	622	617
20	605	648	586	595	537	584	602	633	638	650	618	628
21	676	650	582	590	542	653	598	637	640	629	613	644
22	705	641	576	590	546	644	605	653	644	627	600	673
23	709	638	572	593	550	592	577	661	614	630	571	631
24	687	615	579	595	550	581	532	672	621	642	580	629
25	668	600	582	590	547	545	525	702	576	660	585	608
26	635	617	584	590	548	497	553	732	587	683	584	591
27	625	647	577	590	545	481	580	738	575	691	600	579
28	599	637	556	591	544	480	585	725	583	734	609	565
29	600	633	532	587	---	465	593	723	---	741	604	550
30	585	630	518	583	---	435	610	703	---	716	595	583
31	582	---	507	572	---	403	---	690	---	697	596	---
MEAN	564	603	586	575	550	542	499	658	---	659	641	600
MAX	709	664	632	606	562	653	640	738	---	741	714	673
MIN	478	550	507	506	532	403	346	570	---	589	571	550

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11.5	7.0	.5	.0	.0	.5	2.5	7.5	15.0	22.0	21.5	17.5
2	10.5	6.5	.0	.0	.0	.5	2.5	7.5	15.5	22.0	22.0	17.0
3	10.0	6.5	.5	.0	.0	.5	3.0	7.5	15.5	22.0	22.0	17.0
4	9.0	6.0	.5	.0	.0	.5	3.5	7.5	15.5	22.5	22.0	16.5
5	8.0	5.5	.5	.0	.0	.5	4.0	7.5	16.0	22.5	22.5	16.0
6	7.5	5.5	.5	.0	.0	.5	4.5	8.0	16.0	22.5	23.0	15.0
7	6.5	5.5	.5	.0	.0	.0	4.5	8.0	16.0	23.0	22.5	14.5
8	5.5	5.0	.5	.0	.0	.0	5.0	8.5	17.0	22.5	22.5	14.0
9	5.0	4.5	.5	.0	.0	.5	5.0	9.0	19.0	22.5	22.0	14.5
10	4.5	4.0	.5	.0	.0	.5	5.0	9.5	19.5	23.0	20.5	14.0
11	4.5	3.5	1.0	.0	.0	.5	5.0	9.5	19.5	22.0	20.0	14.0
12	5.5	3.5	.5	.0	.0	.0	5.0	10.5	19.5	21.5	20.5	14.0
13	5.5	3.5	.5	.0	.0	.0	5.0	10.5	19.5	21.5	20.5	14.0
14	5.5	3.5	.5	.0	.0	.0	5.0	11.0	19.5	21.5	21.0	14.0
15	5.5	3.5	.5	.0	.5	.0	5.0	11.0	20.0	21.5	21.5	13.5
16	6.0	3.0	.5	.0	.5	.5	5.0	11.0	20.0	23.0	21.5	13.0
17	6.0	3.0	.5	.0	.5	.5	5.5	11.0	20.0	23.0	21.0	13.0
18	6.5	2.5	.5	.0	.5	.5	5.5	12.0	20.0	23.5	20.5	12.5
19	6.5	2.5	.5	.0	.5	.0	5.5	13.0	20.5	23.5	20.5	12.5
20	6.5	2.5	.5	.0	.5	.0	6.0	13.5	20.5	22.5	20.5	12.5
21	7.0	2.0	.5	.0	.5	.0	6.0	14.5	21.0	22.5	19.5	12.5
22	7.5	1.5	.5	.0	.5	.5	6.0	15.0	21.0	22.5	19.5	12.5
23	7.5	1.5	.5	.5	.5	.5	6.0	15.0	21.5	23.5	19.5	13.0
24	8.0	1.5	.5	.0	.5	.5	6.0	15.0	21.5	24.0	19.0	13.0
25	7.5	1.5	.5	.0	.5	.5	6.5	15.0	21.5	23.5	18.5	13.0
26	7.5	1.5	.0	.0	.5	.5	6.5	15.0	21.5	23.0	18.0	13.0
27	7.5	1.5	.0	.0	.5	.5	7.0	15.0	22.0	22.5	18.0	13.0
28	7.0	1.0	.0	.0	.5	.5	7.0	15.0	22.0	22.5	18.0	13.5
29	7.5	1.0	.0	.0	---	1.0	7.5	15.5	---	21.5	17.5	13.5
30	7.5	1.0	.0	.0	---	1.0	7.5	15.5	---	21.5	18.0	13.0
31	7.5	---	.0	.0	---	2.0	---	15.5	---	21.0	18.0	---
MEAN	7.0	3.5	.5	.0	.5	.5	5.5	11.5	---	22.5	20.5	14.0
MAX	11.5	7.0	1.0	.5	.5	2.0	7.5	15.5	---	24.0	23.0	17.5
MIN	4.5	1.0	.0	.0	.0	.0	2.5	7.5	---	21.0	17.5	12.5

RED RIVER OF THE NORTH BASIN

05104500 ROSEAU RIVER BELOW SOUTH FORK NEAR MALUNG, MN

LOCATION.--Lat 48°47'30", long 95°44'40", in NW¼SW¼ sec.6, T.161 N., R.39 W., Roseau County, Hydrologic Unit 09020314, on left bank 0.3 mi downstream from South Fork and 1.5 mi northwest of Malung.

DRAINAGE AREA.--573 mi².

PERIOD OF RECORD.--October 1946 to current year.

REVISED RECORDS.--WSP 2113: 1948, 1950, 1951, 1956(M), 1957(M), 1962(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 1,029.67 ft, adjustment of 1912.

REMARKS.--Estimated daily discharges: March 25-28. Records good except those for period of ice effect, Mar. 25-28, which are fair. Some flow bypasses the gaging station through a natural overflow channel 0.8 mi upstream and returns to river 0.5 mi downstream. Overflow begins at stage of about 13.0 ft, discharge, 1,800 ft³/s. These records include any flow in the overflow channel.

AVERAGE DISCHARGE.--40 years, 147 ft³/s, 106,500 acre-ft/yr; median of yearly mean discharges, 128 ft³/s, 92,700 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,750 ft³/s, July 18, 1968, gage height, 22.32 ft; maximum gage height, 23.37 ft, Apr. 3, 1966 (backwater from ice); no flow for part of Jan. 15, 1952 (caused by construction of concrete control), July 23 to Sept. 8, 1961, Dec. 22 to Mar. 10, 1977, and Sept. 9-11, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,450 ft³/s, Mar. 30, gage height, 17.38 ft; minimum, 0.04 ft³/s, Aug. 31 and Sept. 1, gage height, 4.24 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	140	113	31	19	15	15	2640	2460	48	8.3	6.7	.04
2	129	107	31	18	15	16	2500	2550	40	11	8.4	.06
3	123	103	31	18	15	16	2070	2200	38	8.5	5.5	.12
4	117	99	31	18	15	16	1610	1700	37	9.2	4.9	.31
5	109	95	30	18	16	16	1310	1380	34	8.6	4.9	.33
6	108	96	30	17	16	15	1110	1150	29	7.9	4.5	.33
7	107	91	30	16	15	15	970	949	29	6.6	4.1	.38
8	112	83	30	17	16	16	850	788	26	6.2	4.1	.34
9	128	63	31	17	16	16	733	680	26	6.4	3.6	.32
10	161	77	30	16	15	17	645	625	25	5.3	3.5	.33
11	230	65	31	16	14	17	582	600	24	5.8	3.4	.34
12	364	67	29	16	14	17	523	668	22	7.4	3.3	.32
13	517	62	28	16	14	17	459	696	20	7.4	3.0	.31
14	583	52	28	17	13	17	399	623	20	8.4	2.6	.33
15	600	46	28	17	13	16	356	560	21	6.7	2.0	.34
16	580	46	28	17	13	17	326	492	24	5.6	1.5	.34
17	538	43	28	17	13	17	289	415	22	5.4	1.1	.36
18	466	36	29	17	13	16	255	337	22	4.8	.69	.37
19	383	27	28	17	14	15	269	282	22	5.9	.52	.45
20	328	26	27	17	14	15	385	241	27	4.0	.53	.42
21	287	38	26	17	13	17	489	208	26	4.4	.45	.38
22	256	37	26	16	14	18	485	181	25	5.6	.40	.37
23	236	35	25	16	14	19	455	155	23	6.0	.35	.38
24	218	35	24	16	14	23	420	136	19	6.6	.31	.42
25	200	36	23	16	14	25	378	128	15	5.6	.28	.48
26	183	35	22	15	15	40	504	123	12	4.8	.26	.51
27	165	33	22	15	15	150	684	118	11	9.1	.25	.60
28	151	31	21	15	15	800	1130	105	9.8	8.3	.24	.70
29	140	31	20	15	---	2990	1570	91	8.6	8.7	.19	.81
30	129	35	19	15	---	3300	1830	80	8.3	8.2	.06	1.1
31	120	---	19	15	---	2990	---	69	---	7.1	.06	---
TOTAL	7908	1743	836	512	403	10694	26226	20790	713.7	213.8	71.69	11.89
MEAN	255	58.1	27.0	16.5	14.4	345	874	671	23.8	6.90	2.31	.40
MAX	600	113	31	19	16	3300	2640	2550	48	11	8.4	1.1
MIN	107	26	19	15	13	15	255	69	8.3	4.0	.06	.04
CFSM	.45	.10	.05	.03	.03	.60	1.53	1.17	.04	.01	.004	.001
IN.	.51	.11	.05	.03	.03	.69	1.70	1.35	.05	.01	.00	.00
AC-FT	15690	3460	1660	1020	799	21210	52020	41240	1420	424	142	24
CAL YR 1985	TOTAL	106225.00	MEAN 291	MAX 5010	MIN 3.4	CFSM .51	IN 6.90	AC-FT 210700				
WTR YR 1986	TOTAL	70123.08	MEAN 192	MAX 3300	MIN .04	CFSM .34	IN 4.55	AC-FT 139100				

RED RIVER OF THE NORTH BASIN

05106500 ROSEAU RIVER AT ROSEAU LAKE, MN

LOCATION.--Lat 48°54'22", long 95°49'55", in SW 1/4 sec.28, T.163 N., R.40 W., Roseau County, Hydrologic Unit 09020314, at downstream side of bridge on County Road 123 at Roseau Lake, 3.5 mi upstream from Pine Creek, 3.8 mi downstream from Sprague Creek, and 7 mi northwest of Roseau.

PERIOD OF RECORD.--November 1939 to current year (incomplete).

GAGE.--Water-stage recorder. Datum of gage is 1,018.59 ft, adjustment of 1928 (levels by Geodetic Survey of Canada); gage readings have been reduced to elevations, adjustment of 1928. Prior to Aug. 26, 1970, and Oct. 18, 1979 to Sept. 30, 1980, nonrecording gage at same site and datum.

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation observed, 1,036.86 ft, May 13, 1950; minimum observed, 1,019.75 ft, Aug. 16, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in July 1919 reached an elevation of about 1,034 ft.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,034.49 ft, May 8; minimum observed, 1,021.16 ft, Aug. 27, but may have been less during period of no gage-height record, July 22 to Sept. 30.

GAGE HEIGHT, IN FEET, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25.19	24.84	---	---	---	---	---	33.14	29.23	22.19	---	---
2	24.97	24.76	---	---	---	---	33.44	33.53	28.77	22.18	---	---
3	24.82	24.63	---	---	---	---	33.72	33.82	28.30	22.18	---	---
4	24.80	24.38	---	---	---	---	33.92	34.02	27.70	22.18	---	---
5	24.59	---	---	---	---	---	34.01	34.22	26.87	22.24	---	---
6	24.47	---	---	---	---	---	34.02	34.38	25.94	22.88	---	---
7	24.41	---	---	---	---	---	34.03	34.45	25.34	22.97	---	---
8	24.55	---	---	---	---	---	33.99	34.49	24.85	22.67	---	---
9	24.83	---	---	---	---	---	33.86	34.45	24.42	22.43	---	---
10	25.22	---	---	---	---	---	33.76	34.39	24.09	22.43	---	---
11	25.68	---	---	---	---	---	33.61	34.29	23.77	22.56	---	---
12	26.74	---	---	---	---	---	33.47	34.28	23.45	22.56	---	---
13	27.97	---	---	---	---	---	33.25	34.25	23.20	22.55	---	---
14	28.26	---	---	---	---	---	33.07	34.18	23.04	22.50	---	---
15	28.24	---	---	---	---	---	32.86	34.05	22.94	22.43	---	---
16	28.10	---	---	---	---	---	32.63	33.91	22.95	22.36	---	---
17	27.89	---	---	---	---	---	32.40	33.72	22.97	22.29	---	---
18	27.66	---	---	---	---	---	32.16	33.53	22.90	22.29	---	---
19	27.44	---	---	---	---	---	32.02	33.32	22.69	22.28	---	---
20	27.25	---	---	---	---	---	31.92	33.09	22.39	22.23	---	---
21	27.03	---	---	---	---	---	31.78	32.84	22.44	22.21	---	---
22	26.82	---	---	---	---	---	31.62	32.58	22.43	---	---	---
23	26.63	---	---	---	---	---	31.46	32.29	22.30	---	---	---
24	26.44	---	---	---	---	---	31.30	32.01	22.24	---	---	---
25	26.23	---	---	---	---	---	31.12	31.72	22.22	---	---	---
26	25.99	---	---	---	---	---	31.15	31.40	22.21	---	---	---
27	25.77	---	---	---	---	25.31	31.34	31.06	22.20	---	---	---
28	25.53	---	---	---	---	28.09	31.76	30.72	22.20	---	---	---
29	25.32	---	---	---	---	31.31	32.28	30.36	22.20	---	---	---
30	25.14	---	---	---	---	32.09	32.66	30.00	22.19	---	---	---
31	24.96	---	---	---	---	---	---	29.62	---	---	---	---
MEAN	26.1	---	---	---	---	---	---	33.0	23.9	---	---	---
MAX	28.26	---	---	---	---	---	---	34.49	29.23	---	---	---
MIN	24.41	---	---	---	---	---	---	29.62	22.19	---	---	---

NOTE: Add 1,000 ft to obtain elevations in adjustment of 1928.

RED RIVER OF THE NORTH BASIN

05107500 ROSEAU RIVER AT ROSS, MN

LOCATION.--Lat 48°54'37", long 95°55'18", in NE¼SE¼ sec.27, T.163 N., R.41 W., Roseau County, Hydrologic Unit 09020314, on left bank 300 ft downstream from highway bridge, 0.2 mi north of Ross, and 2.3 mi downstream from Pine Creek.

DRAINAGE AREA.--1,220 mi², approximately.

PERIOD OF RECORD.--July 1928 to current year.

REVISED RECORDS.--WSP 1055: 1945. WSP 1175: Drainage area. WSP 1308: 1936(M). WSP 1508: 1948-49(P).

GAGE.--Water-stage recorder. Datum of gage is 1,018.44 ft, adjustment of 1928 (levels by Geodetic Survey of Canada). Prior to Mar. 13, 1929, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 22 to Mar. 31 and Sept. 3-27. Records good except those for period with ice effect, Nov. 22 to Mar. 31, and those for period of indefinite stage-discharge relation, Sept. 3-27, which are poor. High flow affected by natural storage in Roseau Lake.

AVERAGE DISCHARGE.--58 years, 268 ft³/s, 194,200 acre-ft/yr; median of yearly mean discharges, 239 ft³/s, 173,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,560 ft³/s, May 12, 1950, gage height, 18.25 ft; no flow Aug. 29, 30, 1961, Jan. 3 to Mar. 3, 1977, Aug. 23-25, 1977 and Aug. 3, 1980.

EXTREMES OUTSIDE PERIOD OF RECORD.--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.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,800 ft³/s, May 8, gage height, 15.38 ft; minimum, 8.1 ft³/s, Aug. 18, gage height, 1.23 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	352	331	76	44	27	24	1900	2100	1140	34	47	12
2	323	320	74	43	27	24	2130	2250	1040	32	36	17
3	300	305	73	43	26	24	2300	2380	943	32	31	16
4	284	278	72	42	26	24	2440	2490	838	41	27	15
5	271	248	70	42	26	24	2500	2620	700	82	24	15
6	256	234	69	41	26	24	2510	2650	558	143	20	15
7	247	229	68	41	26	24	2500	2730	462	159	16	14
8	257	207	67	40	26	24	2490	2790	395	135	18	14
9	288	194	66	39	26	24	2460	2770	332	113	21	14
10	338	196	65	38	26	24	2430	2710	282	112	24	13
11	396	164	64	37	25	24	2370	2680	247	126	19	13
12	545	157	63	36	25	24	2300	2650	214	125	19	13
13	763	145	62	35	25	24	2250	2650	187	125	17	12
14	840	137	61	35	25	24	2190	2620	166	122	15	12
15	848	124	60	34	25	24	2110	2570	155	115	12	12
16	830	113	60	34	24	24	2040	2470	153	105	11	12
17	795	107	60	33	24	24	1960	2430	156	97	10	11
18	757	103	59	33	24	24	1900	2360	150	97	8.5	11
19	719	100	58	32	24	24	1840	2290	133	95	12	11
20	687	97	56	32	24	25	1800	2210	105	90	13	11
21	649	92	55	31	24	26	1780	2130	113	72	18	11
22	617	90	54	31	24	27	1720	2050	112	61	36	12
23	588	88	52	30	24	29	1680	1950	98	63	31	17
24	560	86	51	30	24	33	1640	1860	86	56	25	22
25	532	84	50	29	24	36	1610	1780	72	47	20	29
26	493	83	49	29	24	40	1580	1680	63	42	17	35
27	460	82	48	28	24	60	1620	1600	57	41	17	33
28	425	80	47	28	24	140	1700	1510	50	67	16	31
29	398	78	46	28	---	400	1810	1410	44	87	15	29
30	374	77	45	27	---	1200	1940	1320	36	76	14	26
31	348	---	45	27	---	1500	---	1220	---	59	13	---
TOTAL	15540	4629	1845	1072	699	3972	61500	68930	9087	2651	622.5	508
MEAN	501	154	59.5	34.6	25.0	128	2050	2224	303	85.5	20.1	16.9
MAX	848	331	76	44	27	1500	2510	2790	1140	159	47	35
MIN	247	77	45	27	24	24	1580	1220	36	32	8.5	11
CFSM	.41	.13	.05	.03	.02	.11	1.68	1.82	.25	.07	.02	.01
IN.	.47	.14	.06	.03	.02	.12	1.88	2.10	.28	.08	.02	.02
AC-FT	30820	9180	3660	2130	1390	7880	122000	136700	18020	5260	1230	1010
CAL YR 1985 TOTAL	192294.3		MEAN 527	MAX 2010	MIN 7.0	CFSM .43	IN 5.86	AC-FT 381400				
WTR YR 1986 TOTAL	171055.5		MEAN 469	MAX 2790	MIN 8.5	CFSM .38	IN 5.22	AC-FT 339300				

RED RIVER OF THE NORTH BASIN

05112000 ROSEAU RIVER BELOW STATE DITCH 51, NEAR CARIBOU, MN
(International gaging station)

LOCATION.--Lat 48°58'54", long 96°27'46", in SE¼SW¼ sec.34, T.164 N., R.45 W., Kittson County, Hydrologic Unit 09020314, on left bank 400 ft downstream from State ditch 51 (known locally as Caribou cutoff ditch) and 0.6 mi west of Caribou.

DRAINAGE AREA.--1,570 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April to October 1917, April 1920 to current year (no winter records in water years 1931, 1932, 1934-36, 1938-40, 1944-72). 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.

REVISED RECORDS.--WSP 1308: 1938(M). WSP 1508: 1917(M), 1920, 1932(M), 1934-35(M). WSP 1913: 1954(M).

GAGE.--Water-stage recorder. Datum of gage is 1,002.14 ft, 1928 datum, (levels by Geodetic Survey of Canada). Prior to Apr. 1, 1929, nonrecording gage at site at Caribou 0.6 mi upstream at datum 0.95 ft lower.

REMARKS.--Estimated daily discharges: Nov. 9 to Apr. 1, and May 1-5. Records fair except those for period with ice effect, Nov. 9 to Apr. 1, which are poor. Satellite telemeter at station. Occasionally, at high stages, there is some natural diversion of flow above station to headwaters of Two Rivers.

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

AVERAGE DISCHARGE.--29 years (water years 1921-30, 1933, 1937, 1941-43, 1973-86), 297 ft³/s, 215,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,080 ft³/s, May 19, 1950, gage height, 11.81 ft; no flow Aug. 13, 1936.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of 1916 is reported to have reached a stage of about 15.5 ft at former site.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,370 ft³/s, May 13, gage height, 9.62 ft; minimum, 7.4 ft³/s, Aug. 21; minimum gage height, 1.50 ft, Sept. 19, 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	781	508	102	44	26	24	1400	2100	1790	112	92	13
2	698	486	98	43	27	24	1560	2100	1740	100	76	16
3	636	466	94	42	28	24	1600	2100	1710	90	62	16
4	586	446	90	41	29	25	1640	2100	1670	94	51	14
5	547	421	86	41	29	26	1700	2100	1630	124	44	15
6	519	393	82	40	29	28	1780	2130	1580	189	38	16
7	494	372	79	40	30	32	1860	2150	1550	220	32	16
8	500	355	76	39	30	40	1920	2180	1470	240	27	14
9	495	340	73	39	29	50	2010	2230	1360	220	25	15
10	513	320	70	38	29	60	2110	2280	1200	189	25	16
11	561	300	68	38	29	74	2220	2310	1010	185	25	14
12	657	280	66	37	28	74	2280	2360	823	189	25	15
13	797	260	64	37	28	64	2320	2360	675	191	29	14
14	916	245	62	36	27	56	2340	2340	569	187	27	14
15	971	230	60	36	27	50	2350	2330	495	179	24	13
16	989	220	58	35	26	48	2360	2310	461	168	19	11
17	997	210	57	34	26	48	2350	2270	420	157	16	11
18	995	200	56	34	26	48	2350	2250	382	144	13	11
19	980	190	55	33	25	48	2350	2230	351	143	11	9.6
20	958	180	54	33	25	50	2320	2210	335	145	9.7	9.3
21	932	170	53	33	25	52	2250	2180	339	138	8.1	10
22	900	160	52	33	24	56	2200	2150	313	118	8.1	14
23	862	150	51	33	24	66	2160	2130	287	102	8.4	13
24	814	140	50	33	24	80	2090	2110	276	96	12	12
25	770	133	49	33	24	100	2040	2080	241	96	29	11
26	722	127	49	32	24	140	2070	2040	211	86	29	16
27	680	122	48	30	24	200	2040	2000	185	85	24	37
28	640	117	47	26	24	300	2070	1960	161	88	19	65
29	600	112	46	24	---	600	2020	1930	140	86	17	52
30	561	107	45	24	---	1000	2060	1890	124	96	16	44
31	529	---	45	24	---	1300	---	1850	---	107	14	---
TOTAL	22600	7760	1985	1085	746	4787	61820	66760	23498	4364	855.3	546.9
MEAN	729	259	64.0	35.0	26.6	154	2061	2154	783	141	27.6	18.2
MAX	997	508	102	44	30	1300	2360	2360	1790	240	92	65
MIN	494	107	45	24	24	24	1400	1850	124	85	8.1	9.3
CFSM	.46	.17	.04	.02	.02	.10	1.31	1.37	.50	.09	.02	.01
IN.	.54	.18	.05	.03	.02	.11	1.46	1.58	.56	.10	.02	.01
AC-FT	44830	15390	3940	2150	1480	9500	122600	132400	46610	8660	1700	1080

RED RIVER OF THE NORTH BASIN

05112000 ROSEAU RIVER BELOW STATE DITCH 51 NEAR CARIBOU, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
NOV 05...	1150	420	455	425	8.0	7.9	9.5	3.0	2.0	720
JAN 28...	1020	27	530	569	7.2	7.4	-10.0	0.0	5.8	718
MAY 06...	1130	2130	336	348	7.9	7.9	9.0	13.0	1.2	724
AUG 26...	1030	29	388	380	8.2	8.2	11.0	17.5	25	747

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
NOV 05...	13.1	K7	K19	55	22	5.5	1.0	262	0
JAN 28...	4.3	K1	K4	71	30	9.8	1.9	356	0
MAY 06...	6.4	26	53	43	16	4.0	3.3	176	0
AUG 26...	8.2	K760	240	49	21	7.4	1.8	246	0

DATE	ALKA- LINITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA- LINITY, FIXED ENDPT, FIELD (MG/L AS CAC03) (00410)	ALKA- LINITY LAB (MG/L AS CAC03) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
NOV 05...	215	214	211	19	3.9	0.1	8.0	290	<0.01
JAN 28...	292	288	284	20	4.0	0.1	20	346	0.02
MAY 06...	144	144	153	31	4.8	0.1	5.2	229	<0.01
AUG 26...	202	195	198	15	2.6	0.2	12	264	<0.01

RED RIVER OF THE NORTH BASIN

05112000 ROSEAU RIVER BELOW STATE DITCH 51 NEAR CARIBOU, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE		NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV										
05...		<0.10	0.05	0.04	0.9	0.03	0.02	0.01	10	89
JAN										
28...		0.50	0.18	0.18	0.9	0.05	0.03	0.03	12	100
MAY										
06...		<0.10	0.03	0.03	1.0	0.04	0.02	<0.01	10	69
AUG										
26...		<0.10	0.05	0.04	0.9	0.06	0.03	0.02	47	99

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
NOV											
05...	1150	50	1	40	<0.5	<1	<1	<3	1	99	6
JAN											
28...	1020	<10	1	45	<0.5	<1	<1	<3	<1	160	3
AUG											
26...	1030	30	3	45	<0.5	<1	<1	<3	2	23	<5

DATE		LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
NOV											
05...		8	35	<0.1	<10	2	<1	<1	110	<6	<3
JAN											
28...		14	74	<0.1	<10	<1	<1	<1	160	<6	18
AUG											
26...		18	24	0.3	<10	3	<1	<1	110	<6	9

LAKE OF THE WOODS BASIN
05124480 KAWISHIWI RIVER NEAR ELY, MN
(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'22", long 91°32'06", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.24, T.63 N., R.10 W., Lake County, Hydrologic Unit 09030001, in Superior National Forest, on left bank upstream from rapids, 2 mi upstream from South Kawishiwi River, 2.2 mi southwest of Fernberg Lookout Tower and 14 mi east of Ely.

DRAINAGE AREA.--253 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,450 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 9-15, and Nov. 20 to Jan. 7. Records good except those for periods of no gage-height record, Nov. 9-15, and Nov. 20 to Jan. 7, which are fair.

AVERAGE DISCHARGE.--20 years, 216 ft³/s, 11.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,720 ft³/s, Apr. 24, 1976, gage height, 5.92 ft; minimum, 4.5 ft³/s, Jan. 30 to Feb. 2, 1977, gage height, 2.14 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 876 ft³/s, all or part of each day May 3-6, gage height, 5.11 ft; minimum, 52 ft³/s, all or part of each day Mar. 20-29, gage height, 2.97 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	108	158	132	86	69	59	69	841	407	193	233	147
2	113	158	132	86	69	59	77	861	387	186	237	161
3	128	155	132	86	69	59	83	874	364	178	233	168
4	139	153	132	86	69	58	87	876	348	182	228	189
5	143	151	132	86	67	58	93	876	329	182	229	185
6	148	154	132	86	67	59	101	865	310	178	223	184
7	153	156	130	86	65	58	111	847	299	170	221	182
8	177	150	128	86	64	58	126	825	289	165	225	179
9	185	149	126	86	65	58	135	818	272	164	220	175
10	185	148	126	86	64	58	148	801	262	159	216	172
11	185	147	124	85	64	58	164	781	256	158	209	173
12	193	146	121	85	64	58	185	767	243	165	202	172
13	202	145	118	84	63	56	205	772	232	165	201	165
14	202	144	115	82	62	56	229	787	223	158	204	159
15	196	142	112	81	62	56	252	787	219	156	201	152
16	186	140	109	80	62	56	275	787	265	154	196	147
17	183	138	106	79	60	56	303	780	254	168	191	156
18	181	138	103	77	60	56	335	754	249	177	184	160
19	178	146	100	77	60	56	373	737	244	182	178	158
20	175	142	97	77	64	52	407	703	236	188	177	160
21	172	140	94	78	64	52	439	674	231	196	172	159
22	170	138	91	77	64	52	469	651	227	196	172	156
23	170	136	88	76	64	52	504	623	220	201	177	150
24	170	134	88	76	62	52	529	596	211	210	171	148
25	169	134	88	77	60	52	548	578	207	210	164	147
26	167	134	88	76	60	52	570	553	217	210	159	144
27	163	134	88	75	60	52	619	531	239	212	153	138
28	160	134	88	73	59	52	690	504	228	225	147	137
29	158	134	88	72	---	53	741	480	211	230	141	136
30	158	134	88	70	---	56	797	455	203	226	137	133
31	158	---	88	69	---	60	---	431	---	231	134	---
TOTAL	5175	4312	3384	2486	1782	1729	9664	22215	7882	5775	5935	4792
MEAN	167	144	109	80.2	63.6	55.8	322	717	263	186	191	160
MAX	202	158	132	86	69	60	797	876	407	231	237	189
MIN	108	134	88	69	59	52	69	431	203	154	134	133
CFSM	.66	.57	.43	.32	.25	.22	1.27	2.83	1.04	.74	.76	.63
IN.	.76	.63	.50	.37	.26	.25	1.42	3.27	1.16	.85	.87	.70
AC-FT	10260	8550	6710	4930	3530	3430	19170	44060	15630	11450	11770	9500

CAL YR 1985 TOTAL 60482 MEAN 166 MAX 669 MIN 34 CFSM .66 IN 8.89 AC-FT 120000
WTR YR 1986 TOTAL 75131 MEAN 206 MAX 876 MIN 52 CFSM .81 IN 11.05 AC-FT 149000

LAKE OF THE WOODS BASIN

05124480 KAWISHIWI RIVER NEAR ELY, MN--Continued
(Hydrologic bench-mark station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
OCT 16...	1230	186	29	30	6.8	6.6	5.0	6.0	1.3	729
FEB 19...	1230	62	23	36	6.5	7.4	-7.0	1.0	1.0	712
MAY 12...	1400	788	23	34	6.9	7.5	16.0	11.5	2.0	725
AUG 06...	1145	225	29	31	7.4	7.4	23.0	22.5	1.0	725

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
OCT 16...	10.2	K2	K7	3.0	1.4	1.0	0.4	13	0
FEB 19...	12.1	K1	--	3.3	1.5	1.2	0.4	12	0
MAY 12...	10.2	<1	K6	3.2	1.3	1.1	0.4	13	0
AUG 06...	7.7	K1	K630	2.9	1.3	0.9	0.5	13	0

DATE	ALKA- LITY, IT-FLD (MG/L AS CACO3) (99430)	ALKA- LITY, FIXED ENDPT, FIELD (MG/L AS CACO3) (00410)	ALKA- LITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
OCT 16...	11	13	9.0	3.4	0.8	<0.1	3.3	29	<0.01
FEB 19...	10	11	9.0	9.2	0.8	<0.1	3.7	34	<0.01
MAY 12...	11	13	10	9.8	0.2	<0.1	4.0	34	<0.01
AUG 06...	11	13	11	8.5	0.5	0.3	2.9	28	<0.01

LAKE OF THE WOODS BASIN

05124480 KAWISHIWI RIVER NEAR ELY, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDEED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
OCT 16...	<0.10	<0.01	<0.01	0.6	0.01	<0.01	<0.01	3	100
FEB 19...	0.11	0.02	0.02	0.5	0.02	<0.01	<0.01	3	99
MAY 12...	<0.10	0.02	0.02	0.5	0.01	<0.01	<0.01	3	50
AUG 06...	<0.10	<0.01	<0.01	0.6	0.03	0.01	<0.01	1	82

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
OCT 16...	1230	50	2	10	2	1	20	<3	3	270	<1
FEB 19...	1230	30	<1	4	<0.5	<1	<1	<3	<1	190	<1

DATE	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
OCT 16...	<4	12	<0.1	<10	<1	<1	<1	12	<6	16
FEB 19...	<4	6	<0.1	<10	4	<1	<1	13	<6	18

RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	GROSS ALPHA, DIS- SOLVED (UG/L AS U-NAT) (80030)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	GROSS BETA, DIS- SOLVED (PCI/L AS CS-137) (03515)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, DIS- SOLVED (PCI/L AS SR/ YT-90) (80050)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/ YT-90) (80060)	RADIUM 226, DIS- SOLVED, RADON METHOD (PCI/L) (09511)
OCT 16...	1230	<0.4	<1.0	1.2	0.5	1.2	0.5	0.01

LAKE OF THE WOODS BASIN

05127000 KAWISHIWI RIVER NEAR WINTON, MN

LOCATION.--Lat 47°56'05", long 91°45'50", in NE¼NW¼ sec.20, T.63 N., R.11 W., Lake County, Hydrologic Unit 09030001, Superior National Forest, at powerplant of Minnesota Power Co., just upstream from Fall Lake, and 1.8 mi east of Winton.

DRAINAGE AREA.--1,229 mi².

PERIOD OF RECORD.--June 1905 to June 1907, October 1912 to September 1919 (fragmentary), September 1923 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WDR MN-77-1: Drainage area.

REMARKS.--No estimated daily discharges. Records poor. 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 Co., under general supervision of Geological Survey, in connection with a Federal Power Commission project.

AVERAGE DISCHARGE (unadjusted).--67 years (water years 1906, 1916-17, 1919, 1924-86), 1,037 ft³/s, 11.46 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16,000 ft³/s, May 18, 1950; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 4,820 ft³/s, May 5; minimum daily, 180 ft³/s, Feb. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1780	964	796	399	399	333	682	4030	1090	1340	1220	923
2	2050	964	796	431	367	366	824	4430	1150	1010	1230	859
3	2120	964	796	399	399	366	712	4540	1100	1060	1230	985
4	1890	964	764	464	399	410	786	4750	1350	993	1230	962
5	1830	964	796	399	180	433	1000	4820	1280	962	1390	1140
6	1770	932	764	399	277	521	950	4770	1060	962	1400	1270
7	1940	932	796	431	399	441	1080	4310	1250	897	1430	1230
8	2220	932	732	399	367	441	1240	3800	1190	865	1340	1120
9	2910	898	731	432	367	473	1280	3540	1010	833	1130	1160
10	2350	897	796	400	367	662	1370	3560	899	928	1230	1060
11	2440	930	764	368	399	597	1310	3430	963	960	1030	1180
12	2270	930	731	368	367	661	1180	3550	994	928	993	1230
13	2130	897	698	400	367	629	1190	3430	930	928	960	1130
14	2200	903	665	335	367	604	1280	3300	865	928	962	1160
15	1950	831	729	368	334	536	1180	3140	897	898	1060	1160
16	2090	794	793	367	334	665	1280	3530	1470	821	962	1140
17	1800	794	566	334	367	463	1260	3500	1400	957	962	1350
18	1740	826	663	334	334	661	1380	3550	1350	817	994	1230
19	1710	891	494	367	367	564	1590	3510	1220	1100	930	1300
20	1670	794	495	367	398	530	1870	3460	1350	1030	962	1260
21	1460	795	495	367	366	516	2250	3410	1180	1120	962	1260
22	1310	828	495	399	398	440	2570	3410	1090	1060	930	1380
23	1160	796	464	367	366	505	2690	3290	1190	1140	930	1360
24	1260	828	496	399	366	440	2650	2510	1190	1500	865	1620
25	1230	777	431	399	366	408	2620	2510	1120	1740	897	1650
26	1070	828	463	399	366	505	2550	2380	1350	1660	865	1450
27	1030	796	581	334	366	440	2850	2350	1740	1580	911	1310
28	1090	796	399	367	366	440	3340	1800	1620	1490	883	1230
29	995	796	431	399	---	440	3590	1650	1610	1290	794	1230
30	1030	796	431	300	---	440	3870	1280	1400	1230	794	1230
31	932	---	399	367	---	550	---	1220	---	1160	795	---
TOTAL	53427	26037	19450	11858	10115	15480	52424	102760	36308	34187	32271	36569
MEAN	1723	868	627	383	361	499	1747	3315	1210	1103	1041	1219
MAX	2910	964	796	464	399	665	3870	4820	1740	1740	1430	1650
MIN	932	777	399	300	180	333	682	1220	865	817	794	859
Δ	-1	-74	-152	-71	-86	-252	+661	-4	-31	0	-33	+47
Mean Δ	1722	794	475	312	275	247	2408	3311	1179	1103	1008	1266
CFSM \$	1.40	.65	.39	.25	.22	.20	1.96	2.69	.96	.90	.82	1.03
IN. \$	1.62	.72	.45	.29	.23	.23	2.19	3.11	1.07	1.03	.95	1.15

CAL YR 1985 TOTAL 399414 MEAN 1094 MAX 3760 MIN 97 MEAN \$ 1085 CFSM \$.88 IN \$ 11.98
WTR YR 1986 TOTAL 430886 MEAN 1181 MAX 4820 MIN 180 MEAN \$ 1180 CFSM \$.96 IN \$ 13.03

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

\$ Adjusted for change in reservoir content.

LAKE OF THE WOODS BASIN

05127500 BASSWOOD RIVER NEAR WINTON, MN

(International gaging station)

LOCATION.--Lat 48°04'57", long 91°39'09", in SE¼SE¼ sec.30, T.65 N., R.10 W., Lake County, Hydrologic Unit 09030001, in Superior National Forest, on island in Jackfish Bay of Basswood Lake, used to determine discharge at outlet [lat 48°06'21", long 91°38'51", in sec.19, T.65 N., R.10 W., on international boundary 14 mi northeast of Winton].

DRAINAGE AREA.--1,740 mi², approximately (above outlet of Basswood Lake).

PERIOD OF RECORD.--March to June 1924, September 1925 to March 1928, January 1930 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 955: Drainage area. WSP 1145: 1935, 1937.

GAGE.--Water-stage recorder. Datum of gage is 1,296.80 ft, 1928 datum, (levels by Geodetic Survey of Canada). Prior to Oct. 27, 1938, nonrecording gages at several sites in vicinity of gage, at datum 3.0 ft higher. Oct. 28, 1938, to Sept. 30, 1966, water-stage recorder at datum 3.0 ft higher.

REMARKS.--No estimated daily discharges. Records good. Satellite telemeter at station. Some regulation by powerplant on Kawishiwi River at Winton, and by many lakes located upstream from station.

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

AVERAGE DISCHARGE.--58 years (water years 1926, 1927, 1931-86), 1,403 ft³/s, 10.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,600 ft³/s, May 24, 1950, gage height 9.94 ft, present datum; minimum, 55 ft³/s, Nov. 18, 1976, gage height, 1.67 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,110 ft³/s, May 13, gage height, 6.00 ft; minimum, 570 ft³/s, Feb. 17, 18, gage height, 2.95 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1120	1660	1250	851	651	613	733	3500	3170	1880	1580	1220		
2	1190	1620	1240	834	646	605	765	3740	2960	1870	1560	1290		
3	1280	1590	1240	819	644	603	804	3990	2770	1830	1540	1330		
4	1370	1550	1230	809	638	596	846	4210	2620	1820	1570	1400		
5	1440	1530	1230	799	636	609	902	4430	2500	1800	1640	1400		
6	1510	1510	1220	788	625	613	968	4590	2390	1720	1630	1400		
7	1580	1500	1210	777	615	620	1030	4750	2350	1660	1630	1400		
8	1720	1480	1200	769	605	621	1100	4860	2280	1630	1620	1400		
9	1810	1470	1190	754	599	621	1170	4930	2210	1600	1620	1420		
10	1930	1430	1190	745	596	621	1230	4970	2140	1560	1610	1430		
11	2070	1410	1180	735	592	621	1280	5000	2110	1540	1580	1430		
12	2200	1390	1180	730	588	625	1330	4970	2000	1520	1550	1420		
13	2290	1360	1170	728	587	629	1360	5070	1900	1480	1520	1420		
14	2340	1350	1170	718	580	635	1400	5060	1850	1450	1520	1420		
15	2350	1340	1160	711	580	680	1430	5000	1830	1430	1490	1420		
16	2350	1330	1140	703	580	693	1440	5010	1950	1410	1450	1420		
17	2340	1310	1130	693	577	693	1470	4980	1940	1480	1410	1480		
18	2280	1310	1130	684	583	693	1500	4970	1940	1460	1380	1500		
19	2240	1350	1120	679	589	696	1560	4950	1930	1430	1350	1510		
20	2220	1310	1110	674	605	708	1630	4910	1900	1410	1350	1530		
21	2180	1310	1100	678	605	719	1710	4860	1870	1390	1340	1530		
22	2160	1310	1070	683	611	724	1830	4810	1860	1360	1340	1520		
23	2120	1300	1040	677	613	712	1970	4700	1840	1390	1330	1520		
24	2070	1290	1020	680	609	712	2080	4570	1820	1440	1320	1530		
25	2010	1280	990	685	605	707	2220	4440	1820	1450	1290	1570		
26	1950	1290	980	682	612	698	2320	4300	1840	1480	1260	1610		
27	1880	1280	960	682	613	695	2520	4180	1880	1570	1230	1620		
28	1840	1260	940	674	613	693	2780	4020	1870	1640	1200	1620		
29	1790	1260	930	665	---	694	3020	3810	1880	1650	1180	1630		
30	1750	1250	910	665	---	707	3250	3590	1900	1640	1150	1610		
31	1700	---	880	657	---	715	---	3390	---	1600	1130	---		
TOTAL	59080	41630	34510	22428	16997	20571	47648	140560	63320	48590	44370	44000		
MEAN	1906	1388	1113	723	607	664	1588	4534	2111	1567	1431	1467		
MAX	2350	1660	1250	851	651	724	3250	5070	3170	1880	1640	1630		
MIN	1120	1250	880	657	577	596	733	3390	1820	1360	1130	1220		
CFSM	1.10	.80	.64	.42	.35	.38	.91	2.61	1.21	.90	.82	.84		
IN.	1.26	.89	.74	.48	.36	.44	1.02	3.01	1.35	1.04	.95	.94		
AC-FT	117200	82570	68450	44490	33710	40800	94510	278800	125600	96380	88010	87270		
CAL YR 1985	TOTAL	530535	MEAN	1454	MAX	3530	MIN	469	CFSM	.84	IN	11.34	AC-FT	1052000
WTR YR 1986	TOTAL	583704	MEAN	1599	MAX	5070	MIN	577	CFSM	.92	IN	12.48	AC-FT	1158000

LAKE OF THE WOODS BASIN

05128000 NAMAKAN RIVER AT OUTLET OF LAC LA CROIX, ONTARIO

(International gaging station)

LOCATION.--Lat 48°21'14", long 92°13'01", at Campbell's Camp, on Lac La Croix Lake, used to determine discharge at outlet [Lat 48°23'00", long 92°10'40", 2.5 mi east of Campbell's Camp].

DRAINAGE AREA.--5,170 mi².

PERIOD OF RECORD.--September 1921 to January 1922, April 1922 to current year, in reports of Geological Survey. Monthly discharge only for some periods, published in WSP 1308. August 1921 to current year, in reports of Water Survey of Canada.

GAGE.--Water-stage recorder. Gage readings have been reduced to elevations, United States and Canada Boundary Survey datum. Prior to October 1933, nonrecording gages at various sites on Lac la Croix. October 1933 to Mar. 13, 1963, nonrecording gage at present site and datum.

REMARKS.--No estimated daily discharges. Records good. Satellite telemeter at station.

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

AVERAGE DISCHARGE.--64 years (water years 1923-86), 3,845 ft³/s, 10.10 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 28,200 ft³/s, May 31 to June 2, 1950, elevation, 1,193.30 ft; minimum, 535 ft³/s at times in February, March and April 1924, elevation, 1,181.50 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 13,000 ft³/s, May 22, elevation, 1,188.44 ft; minimum, 1,930 ft³/s, Mar. 23, elevation, 1,183.11 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3870	6610	4420	3370	2570	2190	2070	7410	11300	6620	3900	2910
2	4020	6490	4380	3310	2560	2180	2110	7790	11000	6530	3850	2990
3	4140	6360	4340	3300	2540	2170	2160	8150	10700	6420	3810	3000
4	4230	6270	4320	3280	2520	2150	2210	8470	10500	6350	3790	2980
5	4330	6180	4280	3240	2500	2170	2310	8850	10200	6260	3780	2950
6	4470	6130	4240	3190	2470	2140	2440	9100	9880	6060	3750	2950
7	4650	5970	4210	3160	2440	2130	2560	9500	9610	5950	3670	2890
8	4920	5940	4160	3150	2420	2140	2710	9880	9360	5880	3600	2870
9	5150	5830	4140	3100	2400	2130	2890	10200	9130	5770	3580	2880
10	5410	5720	4070	3080	2390	2120	3050	10600	8870	5670	3530	2880
11	5650	5630	4040	3060	2360	2100	3220	11000	8680	5580	3490	2860
12	5890	5510	3990	3030	2350	2090	3380	11400	8380	5480	3470	2810
13	6100	5400	3920	3000	2340	2080	3540	11700	8150	5320	3440	2800
14	6310	5310	3880	2960	2310	2080	3690	11900	7930	5230	3420	2800
15	6420	5240	3860	2930	2290	2070	3830	12200	7790	5150	3410	2790
16	6610	5120	3820	2910	2280	2050	3980	12400	7730	5050	3360	2800
17	6750	5030	3790	2890	2260	2050	4130	12500	7570	5000	3320	2840
18	6860	4990	3750	2850	2270	2030	4270	12700	7440	4890	3300	2850
19	7000	5000	3730	2820	2250	2000	4400	12800	7290	4750	3270	2860
20	7080	4890	3700	2800	2260	2000	4580	12800	7100	4650	3250	2860
21	7120	4840	3670	2770	2250	2000	4790	12800	6910	4530	3250	2890
22	7230	4780	3660	2730	2250	1980	4960	12800	6910	4460	3250	2870
23	7220	4740	3620	2710	2230	1970	5140	12800	6870	4410	3230	2880
24	7130	4680	3570	2720	2220	1980	5300	12700	6760	4340	3200	2900
25	7160	4620	3550	2710	2220	1980	5550	12600	6680	4270	3140	2950
26	7050	4620	3570	2670	2220	1990	5700	12500	6730	4220	3080	2960
27	7040	4560	3530	2650	2200	1980	5950	12400	6980	4150	3030	2920
28	7020	4510	3480	2650	2190	1970	6310	12200	6910	4120	2970	2920
29	6900	4490	3450	2630	---	1990	6660	12000	6850	4100	2930	2950
30	6850	4440	3440	2610	---	2010	7030	11800	6760	4030	2910	2920
31	6770	---	3390	2580	---	2030	---	11500	---	3930	2870	---
TOTAL	187350	159900	119970	90860	65560	63950	120820	347450	246970	159170	104850	86730
MEAN	6044	5330	3870	2931	2341	2063	4031	11210	8232	5135	3382	2891
MAX	7230	6610	4420	3370	2570	2190	7030	12800	11300	6620	3900	3000
MIN	3870	4440	3390	2580	2190	1970	2070	7410	6680	3930	2870	2790
CFSM	1.17	1.03	.75	.57	.45	.40	.78	2.17	1.59	.99	.65	.56
IN.	1.35	1.15	.86	.65	.47	.46	.87	2.50	1.78	1.15	.75	.62
AC-FT	371600	317200	238000	180200	130000	126800	239800	689200	489900	315700	208000	172000
CAL YR 1985	TOTAL	1683650	MEAN	4613	MAX	10600	MIN	1350	CFSM	.89	IN	12.11
WTR YR 1986	TOTAL	1753680	MEAN	4805	MAX	12800	MIN	1970	CFSM	.93	IN	12.62
									AC-FT			3478000

LAKE OF THE WOODS BASIN

05128200 VERMILION LAKE NEAR SOUDAN, MN

LOCATION.--Lat 47°49'52", long 92°16'20", in SW¼SE¼ sec.20, T.62 N., R.15 W., St. Louis County, Hydrologic Unit 09030002, on south shore of Vermilion Lake, 2 mi northwest of Soudan.

PERIOD OF RECORD.--October 1913 to July 1915, July 1941 to November 1942, June 1946 to current year (fragmentary during 1947).

GAGE.--Water-stage recorder. Datum of gage is 1,355.10 ft National Geodetic Vertical Datum of 1929. October 1913 to July 1915, nonrecording gage at Tower, 2 mi southwest of present gage, at datum about 1,354.60 ft. July 1941 to November 1942, and June 1946 to June 1951, nonrecording gage approximately 13 mi northwest at Vermilion Dam near Tower, at same datum. All gage readings have been reduced to elevations above National Geodetic Vertical Datum of 1929.

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation observed, 1,359.52 ft May 16, 1950; minimum observed, 1356.02 ft, Jan. 29, 1942; minimum 1,355.96 ft, Dec. 14, 1976, result of wind action.

EXTREMES OUTSIDE PERIOD OF RECORD.--Elevation on June 6, 1913 was 1,359.94 ft, determined from reference point set by local observers.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,358.76 ft, May 16, result of wind action; maximum daily, 1,358.72 ft, May 16; minimum, 1,357.05 ft, Mar. 29, result of wind action; minimum daily, 1,357.08, Mar. 27-29.

MONTHEND ELEVATION, IN FEET NGVD, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Oct. 31	1,357.68	Feb. 28	1,357.17	June 30	1,357.99
Nov. 30	1,357.55	Mar. 31	1,357.10	July 31	1,357.62
Dec. 31	1,357.34	Apr. 30	1,358.27	Aug. 31	1,357.14
Jan. 31	1,357.22	May 31	1,358.23	Sept.30	1,357.66

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

LAKE OF THE WOODS BASIN

05129115 VERMILION RIVER NEAR CRANE LAKE, MN

LOCATION.--Lat 48°15'53", long 92°33'57", in NE 1/4 sec. 30, T.67 N., R.17 W., St. Louis County, Hydrologic Unit 09030002, in Superior National Forest, on left bank 350 ft downstream from bridge on Forest Route 491, 3.5 mi upstream from mouth, and 3.5 mi west of village of Crane Lake.

PERIOD OF RECORD.--August 1979 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,180 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Apr. 2-7. Records fair.

AVERAGE DISCHARGE.--7 years, 658 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,360 ft³/s, Apr. 25, 1985, gage height, 15.20 ft; minimum, 38 ft³/s, Aug. 13, 14, 1980, gage height, 3.68 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1979 reached a stage of 15.15 ft, from high-water mark, discharge, about 4,600 ft³/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,740 ft³/s, May 2, gage height, 12.68 ft; minimum, 235 ft³/s, Sept. 1, gage height, 5.51 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	774	877	538	378	301	295	1020	2650	1250	1110	547	252
2	824	853	531	378	310	293	1400	2710	1200	1030	520	328
3	914	821	520	379	317	291	1700	2670	1140	951	505	420
4	978	792	525	383	320	286	1900	2580	1080	914	492	503
5	975	777	530	384	320	284	2100	2470	1010	899	499	535
6	955	781	530	383	317	286	2100	2370	967	890	497	534
7	932	776	525	374	310	279	2100	2280	957	835	481	520
8	1170	757	518	365	307	274	2110	2200	930	793	465	492
9	1550	717	512	367	299	275	2080	2160	911	765	442	458
10	1580	685	505	376	286	277	2000	2160	900	738	424	436
11	1600	657	495	372	280	278	1890	2240	908	724	403	421
12	1590	650	484	368	276	279	1770	2390	906	724	387	423
13	1600	634	470	362	275	282	1670	2480	887	726	379	416
14	1570	613	457	357	276	284	1570	2510	856	718	377	416
15	1510	592	455	350	276	288	1500	2520	837	704	373	418
16	1440	588	448	347	276	289	1440	2500	901	685	363	414
17	1380	578	441	346	278	291	1390	2430	911	684	350	448
18	1310	573	432	343	286	292	1330	2350	912	690	335	482
19	1260	579	425	342	285	292	1330	2260	887	673	326	498
20	1200	580	423	335	290	284	1330	2170	857	647	344	532
21	1160	575	415	333	291	283	1330	2080	853	630	335	558
22	1140	574	420	331	292	286	1320	1990	896	616	324	584
23	1130	576	420	324	291	293	1310	1910	940	623	338	589
24	1100	571	414	319	291	294	1280	1840	913	752	337	582
25	1060	560	405	323	291	293	1240	1770	900	785	336	580
26	1030	572	402	327	295	294	1280	1700	921	758	321	596
27	986	565	401	323	297	294	1340	1630	1160	723	297	620
28	959	555	399	317	297	312	1680	1560	1260	689	284	622
29	944	546	392	315	---	362	2240	1490	1250	651	268	637
30	910	539	392	310	---	416	2490	1410	1190	613	255	650
31	887	---	386	286	---	624	---	1320	---	582	245	---
TOTAL	36418	19513	14210	10797	8230	9450	49240	66800	29490	23322	11849	14964
MEAN	1175	650	458	348	294	305	1641	2155	983	752	382	499
MAX	1600	877	538	384	320	624	2490	2710	1260	1110	547	650
MIN	774	539	386	286	275	274	1020	1320	837	582	245	252
AC-FT	72240	38700	28190	21420	16320	18740	97670	132500	58490	46260	23500	29680
CAL YR 1985	TOTAL	337471	MEAN	925	MAX	4300	MIN	146	AC-FT	669400		
WTR YR 1986	TOTAL	294283	MEAN	806	MAX	2710	MIN	245	AC-FT	583700		

LAKE OF THE WOODS BASIN

05129290 GOLD PORTAGE OUTLET FROM KABETOGRAMA LAKE NEAR RAY, MN

LOCATION.--Lat 48°31'28", long 93°04'29", in SW¼ sec.30, T.70 N., R.21 W., St. Louis County, Hydrologic Unit 09030003, on right bank in bay at head of Gold Portage Outlet from Kabetogama Lake, 9.8 mi northeast of Ray.

PERIOD OF RECORD.--October 1982 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,100 ft, adjustment of 1912 (U.S. Army Corps of Engineers bench mark), water surface transfer.

REMARKS.--Estimated daily discharges: Mar. 28-31. Records good. Flow completely regulated by outlet dam on Namakan Lake.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 863 ft³/s, June 25, 1985, gage height, 19.22 ft; no flow from approximately the middle of January to the first of May each year; minimum gage height, 10.54 ft, Apr. 2, 8, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 738 ft³/s, July 5, gage height, 18.56 ft; no flow Jan. 12 to Apr. 26; minimum gage height recorded, 9.95 ft, Apr. 1, but may have been less during period of no gage-height record Mar. 28-31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	635	347	203	11	.00	.00	.00	26	429	683	544	494
2	644	329	198	8.6	.00	.00	.00	45	427	687	538	511
3	636	317	199	7.7	.00	.00	.00	69	423	695	541	505
4	616	308	194	5.6	.00	.00	.00	95	414	702	537	501
5	595	312	178	3.8	.00	.00	.00	126	422	713	534	504
6	591	276	170	2.2	.00	.00	.00	139	429	681	540	530
7	591	255	161	1.6	.00	.00	.00	169	413	678	533	540
8	596	241	153	1.3	.00	.00	.00	196	415	687	517	552
9	579	242	143	.65	.00	.00	.00	221	431	685	517	574
10	599	235	132	.26	.00	.00	.00	236	426	685	506	581
11	608	237	122	.06	.00	.00	.00	253	430	684	506	576
12	606	227	111	.00	.00	.00	.00	271	427	682	517	553
13	590	214	103	.00	.00	.00	.00	290	424	656	524	547
14	577	209	98	.00	.00	.00	.00	315	447	651	524	543
15	547	209	88	.00	.00	.00	.00	330	476	639	524	528
16	554	200	80	.00	.00	.00	.00	338	476	629	514	529
17	549	191	73	.00	.00	.00	.00	351	504	624	507	525
18	529	187	67	.00	.00	.00	.00	371	526	606	513	513
19	518	195	61	.00	.00	.00	.00	395	542	595	521	511
20	510	185	55	.00	.00	.00	.00	406	563	593	512	505
21	500	195	53	.00	.00	.00	.00	420	570	594	521	505
22	501	203	47	.00	.00	.00	.00	434	567	595	529	502
23	483	198	40	.00	.00	.00	.00	442	576	608	523	491
24	448	195	35	.00	.00	.00	.00	444	598	591	535	491
25	449	202	33	.00	.00	.00	.00	450	618	584	518	509
26	419	206	30	.00	.00	.00	.00	452	622	597	506	497
27	411	202	24	.00	.00	.00	.39	453	634	592	501	483
28	419	203	22	.00	.00	.00	2.1	452	641	586	495	475
29	388	203	18	.00	---	.00	6.2	443	655	583	500	474
30	379	203	17	.00	---	.00	16	432	677	578	501	461
31	371	---	12	.00	---	.00	---	442	---	547	495	---
TOTAL	16438	6926	2920	42.77	.00	.00	24.69	9506	15202	19710	16093	15510
MEAN	530	231	94.2	1.38	.000	.000	.82	307	507	636	519	517
MAX	644	347	203	11	.00	.00	16	453	677	713	544	581
MIN	371	185	12	.00	.00	.00	.00	26	413	547	495	461
AC-FT	32600	13740	5790	85	.00	.00	49	18860	30150	39090	31920	30760
CAL YR 1985	TOTAL	109374.89	MEAN 300	MAX 817	MIN .00	AC-FT 216900						
WTR YR 1986	TOTAL	102372.46	MEAN 280	MAX 713	MIN .00	AC-FT 203100						

LAKE OF THE WOODS BASIN

05129400 RAINY LAKE NEAR FORT FRANCES, ONTARIO
(International gaging station)

LOCATION.--Lat 48°38'30", long 93°20'00", at Five Mile dock, approximately 5 mi northeast of town of Fort Frances.

PERIOD OF RECORD.--January 1910 to September 1917 and October 1934 to current year, in reports of Geological Survey. August 1911 to current year, in reports of Water Survey of Canada. Prior to October 1949, published as "at Ranier, Minn.", and as "at Fort Frances, Ontario" October 1949 to September 1964.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (United States and Canadian Boundary Survey). January 1910 to December 1949, nonrecording gage 3 mi northeast at Ranier, Minn., at same datum. January 1950 to October 1964, water-stage recorder on Government dock at Pither's Point at Fort Frances, and supplementary gage in town pumping station, 0.5 mi south, used during winter months, at same datum.

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

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation observed, 1,112.97 ft, July 5, 1950; minimum observed, 1,101.26 ft, Apr. 17, 1923, Apr. 2, 1930.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,108.28 ft, May 31; maximum daily elevation, 1,108.20 ft, Oct. 17, July 5; minimum, 1,104.81 ft, Mar. 29; minimum daily, 1,104.85 ft, Mar. 28.

MONTHEND ELEVATION, IN FEET NGVD, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

Oct. 31	1,107.83	Feb. 28	1,105.50	June 30	1,108.03
Nov. 30	1,107.63	Mar. 31	1,104.94	July 31	1,107.75
Dec. 31	1,106.91	Apr. 30	1,106.93	Aug. 31	1,107.32
Jan. 31	1,106.21	May 31	1,108.15	Sept. 30	1,107.46

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

LAKE OF THE WOODS BASIN
05130500 STURGEON RIVER NEAR CHISHOLM, MN

LOCATION.--Lat 47°40'25", long 92°54'00", in NE¼NW¼ sec.20, T.60 N., R.20 W., St. Louis County, Hydrologic Unit 09030005, on left bank 1,000 ft upstream from highway bridge, 0.6 mi downstream from East Branch Sturgeon River, and 11.5 mi north of Chisholm.

DRAINAGE AREA.--187 mi².

PERIOD OF RECORD.--August 1942 to current year.

REVISED RECORDS.--WSP 1438: 1946.

GAGE.--Water-stage recorder. Datum of gage is 1,305.7 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 24, 1944, nonrecording gage at site 1,000 ft downstream at different datum. Aug. 25, 1944, to Sept. 30, 1975, at present site at datum 1.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 22 to Mar. 30. Records good except those for period with ice effect, Nov. 22 to Mar. 30, which are fair.

AVERAGE DISCHARGE.--44 years, 125 ft³/s, 9.08 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,630 ft³/s, May 7, 1950, gage height, 7.41 ft, present datum, from rating curve extended above 1,600 ft³/s, on basis of slope-area measurement of peak flow; minimum daily, 3.8 ft³/s, Jan. 31 to Feb. 3, 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base of 500 ft³/s and maximum (*):

Date	Time	Discharge (ft ³ /s)	Gage height (ft)
Apr. 3	2200	*863	*4.61
May 1	0330	754	4.40
May 14	0230	774	4.44

Minimum daily discharge, 26 ft³/s, Feb. 14 to Mar. 17; minimum gage height, 1.73 ft, Mar. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	156	141	90	52	33	26	563	748	110	78	48	50
2	181	137	90	51	32	26	702	693	104	69	45	54
3	197	130	85	50	32	26	841	606	105	60	44	62
4	203	126	85	49	31	26	800	512	115	60	41	70
5	199	124	85	49	31	26	745	435	103	58	40	83
6	181	132	80	48	30	26	668	381	94	60	38	91
7	164	138	80	48	30	26	616	339	113	57	39	86
8	259	141	80	47	29	26	567	317	123	59	43	77
9	304	136	75	47	29	26	519	324	119	61	40	69
10	329	141	75	46	28	26	470	363	119	64	42	72
11	315	120	75	45	28	26	421	503	143	72	45	78
12	311	114	70	45	27	26	381	620	149	114	40	80
13	302	113	70	44	27	26	345	748	143	150	42	82
14	293	111	70	44	26	26	319	766	127	167	54	84
15	277	105	70	43	26	26	296	696	114	163	63	80
16	251	106	65	43	26	26	280	594	112	187	68	73
17	227	106	65	42	26	26	268	492	101	301	69	87
18	207	106	65	42	26	27	248	416	89	297	61	111
19	191	112	65	41	26	28	263	355	80	258	56	137
20	179	102	60	41	26	29	287	306	73	206	59	166
21	169	102	60	40	26	30	288	272	69	164	58	175
22	161	105	60	39	26	31	276	241	76	133	58	178
23	160	105	60	38	26	32	258	220	79	112	65	169
24	155	105	60	38	26	33	244	203	72	100	69	145
25	151	105	55	37	26	35	234	193	70	87	70	136
26	148	100	55	37	26	38	242	183	75	76	65	138
27	145	100	55	36	26	40	262	169	87	67	60	143
28	141	95	55	36	26	50	398	158	91	62	55	145
29	138	95	55	35	---	60	577	148	94	58	50	147
30	135	95	54	35	---	150	689	137	87	56	51	136
31	134	---	53	34	---	340	---	121	---	52	49	---
TOTAL	6363	3448	2122	1322	777	1365	13067	12259	3036	3508	1627	3204
MEAN	205	115	68.5	42.6	27.8	44.0	436	395	101	113	52.5	107
MAX	329	141	90	52	33	340	841	766	149	301	70	178
MIN	134	95	53	34	26	26	234	121	69	52	38	50
CFSM	1.10	.62	.37	.23	.15	.24	2.33	2.11	.54	.60	.28	.57
IN	1.27	.69	.42	.26	.15	.27	2.60	2.44	.60	.70	.32	.64
AC-FT	12620	6840	4210	2620	1540	2710	25920	24320	6020	6960	3230	6360
CAL YR 1985	TOTAL	52348	MEAN 143	MAX 1460	MIN 16	CFSM .77	IN 10.41	AC-FT 103800				
WTR YR 1986	TOTAL	52098	MEAN 143	MAX 841	MIN 26	CFSM .77	IN 10.36	AC-FT 103300				

LAKE OF THE WOODS BASIN

05131500 LITTLE FORK RIVER AT LITTLEFORK, MN

LOCATION.--Lat 48°23'45", long 93°32'57", in NE¼SE¼ sec.9, T.68 N., R.25 W., Koochiching County, Hydrologic Unit 09030005, on right bank at town of Littlefork, 0.9 mi upstream from bridge on State Highway 217, 2.8 mi upstream from Beaver Creek, and 19 mi upstream from mouth.

DRAINAGE AREA.--1,730 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--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 current year.

REVISED RECORDS.--WSP 955: Drainage area. WSP 1508: 1913, 1916, 1928-32, 1934. WRD MN-74: 1963.

GAGE.--Water-stage recorder. Datum of gage is 1,083.59 ft above National Geodetic Vertical Datum of 1929. June 23, 1909, to Mar. 4, 1917, nonrecording gage and July 21, 1937, to Oct. 23, 1979, water-stage recorder at site 1.2 mi downstream at datum 10.53 ft lower; Mar. 5 to Sept. 30, 1917, and June 22, 1928, to July 20, 1937, nonrecording gage at site 1.18 mi downstream at datum 10.53 ft lower.

REMARKS.--Estimated daily discharges: Nov. 24 to Apr. 4. Records good except those for period with ice effect, Nov. 24 to Apr. 4, which are fair.

AVERAGE DISCHARGE.--63 years (water years 1912-16, 1929-86), 1,068 ft³/s, 8.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 25,000 ft³/s, Apr. 18, 1916, May 11, 1950, gage height, 37.00 ft, site and datum then in use; minimum observed, 21 ft³/s, Aug. 26, 27, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,350 ft³/s, Apr. 30, gage height 12.56 ft; maximum gage height, 13.51 ft, Apr. 4 (backwater from ice); minimum daily discharge, 180 ft³/s, Feb. 13 to Mar. 15; minimum gage height, 2.34 ft, Sept. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1910	1000	480	280	200	180	2500	8840	760	1160	607	200		
2	2030	978	480	280	200	180	5000	8030	699	1020	564	193		
3	2430	932	470	280	200	180	7500	7590	654	938	503	410		
4	2600	904	470	270	195	180	9000	6550	604	884	465	574		
5	2530	872	460	270	190	180	7930	5520	573	1060	439	733		
6	2350	884	450	270	190	180	6740	4700	553	1100	408	757		
7	2170	911	440	260	190	180	5950	4110	547	964	378	735		
8	2640	907	430	260	190	180	5600	3620	557	832	367	675		
9	4470	769	420	260	190	180	5270	3380	563	770	460	619		
10	5020	652	410	260	190	180	4760	3340	634	724	404	561		
11	4690	647	400	250	190	180	4330	3410	679	693	361	513		
12	4170	769	400	250	190	180	3920	4180	715	785	339	488		
13	4170	823	390	250	180	180	3560	5080	745	1230	312	481		
14	4290	748	390	240	180	180	3200	5120	781	1520	294	477		
15	3960	657	380	240	180	180	2940	4840	776	1600	290	492		
16	3450	651	380	240	180	190	2680	4410	747	1480	282	506		
17	3010	714	370	240	180	190	2460	3970	725	1330	274	502		
18	2600	695	360	230	180	190	2290	3480	721	1650	277	503		
19	2300	598	360	230	180	200	2210	3020	729	2070	283	550		
20	2040	597	350	230	180	210	2470	2580	708	1900	277	604		
21	1830	563	340	220	180	210	2710	2180	700	1600	268	799		
22	1690	521	330	220	180	220	2710	1880	671	1320	245	959		
23	1580	522	330	220	180	230	2530	1640	627	1110	234	1060		
24	1510	520	320	210	180	240	2380	1460	723	1090	231	1030		
25	1430	520	320	210	180	250	2250	1310	730	1030	237	951		
26	1350	520	310	210	180	260	2590	1230	771	848	229	911		
27	1270	510	310	210	180	270	3480	1140	817	739	226	889		
28	1180	500	300	200	180	300	5140	1050	1190	662	228	878		
29	1130	500	300	200	---	400	8370	961	1410	647	220	886		
30	1080	490	290	200	---	800	9150	882	1370	578	212	1000		
31	1030	---	290	200	---	1500	---	824	---	528	206	---		
TOTAL	77910	20874	11730	7390	5195	8360	131620	110327	22479	33862	10120	19936		
MEAN	2513	696	378	238	186	270	4387	3559	749	1092	326	665		
MAX	5020	1000	480	280	200	1500	9150	8840	1410	2070	607	1060		
MIN	1030	490	290	200	180	180	2210	824	547	528	206	193		
CFSM	1.45	.40	.22	.14	.11	.16	2.54	2.06	.43	.63	.19	.38		
IN.	1.68	.45	.25	.16	.11	.18	2.83	2.37	.48	.73	.22	.43		
AC-FT	154500	41400	23270	14660	10300	16580	261100	218800	44590	67170	20070	39540		
CAL YR 1985	TOTAL	645360	MEAN	1768	MAX	19600	MIN	100	CFSM	1.02	IN	13.88	AC-FT	1280000
WTR YR 1986	TOTAL	459803	MEAN	1260	MAX	9150	MIN	180	CFSM	.73	IN	9.89	AC-FT	912000

LAKE OF THE WOODS BASIN

05131500 LITTLE FORK RIVER AT LITTLEFORK, MN--Continued
(National stream-quality accounting network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1969, 1971, 1973 to September 1986. (discontinued)

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
NOV										
12...	1600	818	130	123	7.5	7.1	3.0	1.0	5.0	734
FEB										
04...	1230	195	210	237	7.1	8.0	-1.0	0.0	10	724
MAY										
05...	1230	5600	75	88	7.6	7.9	27.0	11.0	25	718
SEP										
08...	1500	694	162	172	7.9	7.9	17.0	15.0	11	741

DATE	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS. / 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. / PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
NOV									
12...	12.9	K1	K5	17	5.8	2.0	1.0	67	0
FEB									
04...	5.7	K3	K7	29	10	4.8	1.8	128	0
MAY									
05...	10.0	K11	19	11	3.4	1.8	1.2	49	0
SEP									
08...	8.5	22	24	23	7.6	2.7	1.3	95	0

DATE	ALKA- LINITY, IT-FLD (MG/L AS CACO3) (99430)	ALKA- LINITY, FIXED ENDPT, FIELD (MG/L AS CACO3) (00410)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
NOV									
12...	55	58	56	0	2.6	<0.1	6.6	115	<0.01
FEB									
04...	105	103	100	15	2.7	0.1	13	147	<0.01
MAY									
05...	40	41	41	13	4.1	<0.1	4.9	93	<0.01
SEP									
08...	78	77	76	13	2.2	0.1	7.6	148	0.02

LAKE OF THE WOODS BASIN

05131500 LITTLE FORK RIVER AT LITTLEFORK, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV 12...	<0.10	0.06	0.06	0.9	0.03	0.02	0.01	10	97
FEB 04...	0.22	0.09	0.09	0.4	0.03	0.02	0.01	6	100
MAY 05...	<0.10	0.05	0.04	0.9	0.06	0.02	<0.01	85	95
SEP 08...	<0.10	0.10	0.05	1.1	0.06	0.03	<0.01	24	87

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
NOV 12...	1600	<10	<1	17	<0.5	<1	<1	<3	3	540	3
FEB 04...	1230	50	1	24	<0.5	<1	<1	<3	<1	980	<1
SEP 08...	1500	90	1	27	<0.5	<1	<1	<3	3	460	<5

DATE	LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
NOV 12...	16	33	<0.1	<10	3	<1	<1	39	<6	5
FEB 04...	6	28	0.2	<10	1	<1	<1	81	<6	19
SEP 08...	6	31	<0.1	<10	1	<1	<1	60	<6	18

LAKE OF THE WOODS BASIN

05132000 BIG FORK RIVER AT BIG FALLS, MN

LOCATION.--Lat 48°11'45", long 93°48'25", in SW¼ sec.35, T.155 N., R.25 W., Koochiching County, Hydrologic Unit 09030006, on left bank at village of Big Falls, 700 ft downstream from falls, 0.3 mi downstream from bridge on U.S. Highway 71, and 4.8 mi upstream from Sturgeon River.

DRAINAGE AREA.--1,460 mi², approximately.

PERIOD OF RECORD.--August to November 1909, April to November 1910, April 1911 to September 1912 (gage heights and discharge measurements only), June 1928 to September 1979. October 1979 to September 1982, annual maximums only. October 1982 to current year.

REVISED RECORDS.--WSP 1308: 1935(M).

GAGE.--Water-stage recorder. Datum of gage is 1,144.71 ft above National Geodetic Vertical Datum of 1929. Prior to June 10, 1911, nonrecording gage at railroad bridge about 0.4 mi upstream at different datum. June 10, 1911, to Sept. 30, 1912, and June 22, 1928, to Dec. 17, 1937, nonrecording gage at site 200 ft upstream at same datum. October 1979 to September 1982, crest-stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 24 to Apr. 7. Records fair. Prior to 1971, a powerplant, located 0.3 mi upstream, caused some diurnal fluctuation at low flows.

AVERAGE DISCHARGE.--55 years (water years 1929-79, 1983-86), 736 ft³/s, 6.85 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,800 ft³/s, May 8, 9, 1950; maximum gage height, 17.08 ft, May 8, 1950; minimum discharge recorded, 7 ft³/s, Aug. 7, 1939.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,080 ft³/s, Apr. 30, gage height, 11.38 ft; minimum daily, 300 ft³/s, Feb. 11 to Mar. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	1510	1200	750	450	325	300	2000	7540	856	1340	596	406		
2	1640	1180	740	440	325	300	3000	6350	794	1310	569	443		
3	1710	1160	730	440	325	300	4000	5300	742	1170	548	516		
4	1660	1140	720	430	320	300	4700	4530	712	1260	523	596		
5	1600	1110	710	430	320	300	4500	3940	701	1380	506	648		
6	1520	1100	700	420	320	300	4300	3490	696	1270	494	629		
7	1460	1100	690	420	310	300	4100	3170	692	1110	478	603		
8	1870	1120	680	410	310	300	4000	2940	703	987	461	573		
9	2540	1020	670	410	310	300	3680	2880	707	951	460	535		
10	2650	868	660	400	310	300	3330	2850	676	930	454	505		
11	2610	697	650	400	300	300	2990	2840	646	960	441	496		
12	2520	549	640	400	300	300	2740	2840	631	1210	427	509		
13	2420	868	630	390	300	300	2500	2850	615	1450	415	517		
14	2340	942	620	390	300	300	2310	2750	592	1540	402	519		
15	2210	937	610	380	300	300	2170	2610	567	1460	397	519		
16	2050	883	590	380	300	310	2050	2460	540	1320	390	508		
17	1900	957	580	370	300	315	1950	2310	516	1320	388	500		
18	1770	974	570	370	300	320	1870	2160	501	2080	385	528		
19	1650	956	560	360	300	330	1920	2010	634	2170	382	555		
20	1560	879	550	360	300	340	2080	1860	733	1920	381	611		
21	1500	917	540	360	300	350	2190	1730	1070	1500	388	682		
22	1450	764	530	350	300	360	2200	1610	1310	1170	382	770		
23	1410	802	520	350	300	370	2070	1500	1560	1020	392	813		
24	1400	830	510	340	300	380	1960	1420	1750	991	399	803		
25	1380	840	500	340	300	400	1920	1360	1650	888	395	788		
26	1350	830	490	340	300	420	2410	1290	1540	804	394	792		
27	1320	810	480	330	300	450	2960	1210	1790	747	394	803		
28	1280	790	470	330	300	480	4460	1140	2140	725	386	817		
29	1240	780	470	330	---	520	6840	1070	1910	699	383	855		
30	1220	770	460	330	---	600	7950	999	1560	663	385	952		
31	1200	---	450	325	---	1100	---	925	---	633	390	---		
TOTAL	53940	27773	18470	11775	8575	11545	95150	81934	29534	36978	13385	18791		
MEAN	1740	926	596	380	306	372	3172	2643	984	1193	432	626		
MAX	2650	1200	750	450	325	1100	7950	7540	2140	2170	596	952		
MIN	1200	549	450	325	300	300	1870	925	501	633	381	406		
CFSM	1.19	.63	.41	.26	.21	.26	2.17	1.81	.67	.82	.30	.43		
IN.	1.37	.71	.47	.30	.22	.29	2.42	2.09	.75	.94	.34	.48		
AC-FT	107000	55090	36640	23360	17010	22900	188700	162500	58580	73350	26550	37270		
CAL YR 1985	TOTAL	499813	MEAN	1369	MAX	9850	MIN	160	CFSM	.94	IN	12.73	AC-FT	991400
WTR YR 1986	TOTAL	407850	MEAN	1117	MAX	7950	MIN	300	CFSM	.77	IN	10.39	AC-FT	809000

LAKE OF THE WOODS BASIN
05133500 RAINY RIVER AT MANITOU RAPIDS, MN

(International gaging station)

LOCATION.--Lat 48°38'04", long 93°54'47", in NW 1/4 sec. 36, T.160 N., R.26 W., Koochiching County, Hydrologic Unit 09030004, on left bank at Manitou Rapids, 4 mi west of Indus.

DRAINAGE AREA.--19,400 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--July 1928 to current year. 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 U.S. Army Corps of Engineers. Published as "near Birchdale" 1932-34.

GAGE.--Water-stage recorder. Datum of gage is 1,062.48 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 10, 1934, nonrecording gage at site near Birchdale, 7 mi. downstream at different datum.

REMARKS.--Estimated daily discharges: Nov. 24 to Mar. 18. Records good. Satellite telemeter at station. Diurnal fluctuation caused by powerplant at International Falls. Some regulation at low and medium flows by Rainy and Namakan Lakes.

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

AVERAGE DISCHARGE.--58 years, 13,000 ft³/s, 9.10 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 71,600 ft³/s, May 12, 1950, gage height, 21.04 ft; minimum daily, 928 ft³/s, Dec. 26, 1929.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 38,900 ft³/s, May 3, gage height, 14.15 ft; minimum, 4,720 ft³/s, Sept. 1, gage height, 2.43 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	31300	28100	20200	14400	12100	10300	14800	36300	29900	13300	10900	4950		
2	31100	27900	20000	14000	12100	10300	18300	35900	29400	10900	10800	5010		
3	31100	27800	19900	14200	12100	9500	21600	38600	28500	11700	10800	6100		
4	31300	27600	20000	14300	12000	9500	24000	37700	27800	13600	10700	6520		
5	31300	26800	20000	14300	11700	9500	27000	35500	27400	17600	10700	6240		
6	31000	23500	20100	14300	12000	10000	26500	33100	25000	19800	10600	6380		
7	30600	22400	20100	14300	12200	10300	25200	32900	22300	20200	10500	6450		
8	31000	21800	20100	14200	12200	10400	24100	34500	21200	19900	10500	6490		
9	33000	18400	20000	14200	12200	10500	23100	34700	20900	19300	10300	6300		
10	35000	16700	20100	14100	12100	10500	22100	34900	20800	18900	10200	6040		
11	35300	16100	20100	13500	12100	10500	21100	35600	20900	18700	10300	5870		
12	35000	15800	20000	12500	12000	10500	20100	36100	20500	18600	10300	5750		
13	34500	15900	19700	12500	12000	10500	19200	37200	18700	18300	10300	5710		
14	34200	15700	17200	12500	12000	10500	18200	38000	15000	18800	10200	5690		
15	33900	15700	14500	12500	12000	10500	17600	38000	13100	18600	10100	5640		
16	33600	16000	14400	12500	12000	10500	17200	37500	12600	18000	9880	5650		
17	34400	16200	14600	12500	12000	10500	16700	36600	12500	17500	9740	5700		
18	34000	16300	14200	12500	12000	10500	16300	35900	12400	17200	9730	6090		
19	33500	16200	14300	12500	12000	10700	16200	35100	12300	18700	9700	6810		
20	32900	16100	13400	12500	10800	10700	16600	34300	12200	19600	9850	7080		
21	32400	16300	14200	12400	10200	10800	17200	33600	12200	18800	9740	7260		
22	32000	16500	14400	12400	10200	10800	17500	33100	12500	14700	9150	7920		
23	31600	16900	14200	12400	10200	10800	17400	32700	12900	12900	8660	9150		
24	31300	16600	14400	12300	10200	10900	17000	32300	13200	12300	8450	10100		
25	30900	16400	14300	12300	10200	10100	16700	32000	13400	12300	7380	10400		
26	30500	16000	14000	12300	10200	9130	17500	31600	13300	12100	6630	10300		
27	30300	15000	14800	12200	10300	9190	19200	31400	13300	11800	6440	10500		
28	30000	14500	14300	12200	10300	9280	23700	31100	13400	11500	6080	11200		
29	29700	15500	14400	12200	---	10900	29900	30800	14000	11000	5600	11100		
30	29500	19200	14400	12200	---	12900	34200	30400	14100	10600	5340	11000		
31	28600	---	14300	12100	---	12800	---	30100	---	10700	5350	---		
TOTAL	994800	563900	520600	403300	321400	323800	616200	1067500	535700	487900	284920	219400		
MEAN	32090	18800	16790	13010	11480	10450	20540	34440	17860	15740	9191	7313		
MAX	35300	28100	20200	14400	12200	12900	34200	38600	29900	20200	10900	11200		
MIN	28600	14500	13400	12100	10200	9130	14800	30100	12200	10600	5340	4950		
CFSM	1.65	.97	.87	.67	.59	.54	1.06	1.78	.92	.81	.47	.38		
IN.	1.91	1.08	1.00	.77	.62	.62	1.18	2.05	1.03	.94	.55	.42		
AC-FT	1973000	1118000	1033000	799900	637500	642300	1222000	2117000	1063000	967700	565100	435200		
CAL YR 1985	TOTAL	7665330	MEAN	21000	MAX	60700	MIN	6200	CFSM	1.08	IN	14.70	AC-FT	15200000
WTR YR 1986	TOTAL	6339420	MEAN	17370	MAX	38600	MIN	4950	CFSM	.90	IN	12.16	AC-FT	12570000

LAKE OF THE WOODS BASIN

05133500 RAINY RIVER AT MANITOU RAPIDS, MN--Continued
(National stream-quality network station)

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1968-70, 1978 to current year.

REMARKS.--Letter K indicates non-ideal colony count.

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	STREAM- FLOW, MEAN DAILY (CFS) (00060)	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE, AIR (DEG C) (00020)	TEMPER- ATURE (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)
NOV										
13...	1545	--	15900	95	68	7.2	6.9	1.0	2.0	2.5
FEB										
04...	0845	12000	--	120	111	7.2	7.4	-5.0	0.5	1.7
MAR										
25...	1300	--	10000	120	72	7.0	7.2	5.0	1.0	2.0
MAY										
05...	1530	--	35200	61	75	7.4	8.2	32.0	9.5	10
JUN										
12...	1030	--	20800	80	62	7.4	7.7	22.0	18.0	1.2
SEP										
09...	1100	--	6280	100	92	7.6	7.6	10.0	15.0	--

DATE	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
NOV										
13...	736	13.0	K350	79	7.6	2.3	2.5	0.8	26	0
FEB										
04...	722	8.6	>600	190	13	3.9	3.0	1.0	59	0
MAR										
25...	722	12.6	210	K35	7.5	2.1	3.1	1.0	27	0
MAY										
05...	717	10.5	K210	130	8.8	2.7	2.0	0.9	34	0
JUN										
12...	727	8.1	50	K40	6.5	1.9	2.2	0.7	15	0
SEP										
09...	737	8.2	130	67	--	--	--	--	50	0

DATE	ALKA- LINITY, IT-FLD (MG/L AS CAC03) (99430)	ALKA- LINITY, FIXED ENDPT, FIELD (MG/L AS CAC03) (00410)	ALKA- LINITY LAB (MG/L AS CAC03) (90410)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
NOV									
13...	22	24	23	4.8	3.4	<0.1	3.4	53	<0.01
FEB									
04...	49	47	43	9.6	3.3	<0.1	5.1	77	<0.01
MAR									
25...	22	25	22	10	4.2	<0.1	3.6	62	<0.01
MAY									
05...	28	28	30	11	2.6	<0.1	3.6	68	<0.01
JUN									
12...	12	14	21	8.7	2.6	<0.1	2.9	53	<0.01
SEP									
09...	41	47	--	--	--	--	--	--	<0.01

LAKE OF THE WOODS BASIN

05133500 RAINY RIVER AT MANITOU RAPIDS, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE		NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS- PHORUS, TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, DIS- SOLVED (MG/L AS P) (00666)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	SEDI- MENT, SUS- PENDEED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
NOV										
13...		<0.10	0.03	0.03	0.5	0.02	0.01	0.01	6	76
FEB										
04...		0.12	0.02	0.02	0.2	0.03	0.01	<0.01	2	100
MAR										
25...		0.12	<0.01	<0.01	0.5	0.02	0.02	0.01	2	82
MAY										
05...		<0.10	0.05	0.05	0.8	0.04	0.02	<0.01	29	91
JUN										
12...		<0.10	0.01	0.01	0.5	0.03	0.01	<0.01	6	84
SEP										
09...		<0.10	0.09	0.09	0.6	0.03	0.01	<0.01	8	75

DATE	TIME	ALUM- INUM, DIS- SOLVED (UG/L AS AL) (01106)	ARSENIC DIS- SOLVED (UG/L AS AS) (01000)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, DIS- SOLVED (UG/L AS BE) (01010)	CADMIUM DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COBALT, DIS- SOLVED (UG/L AS CO) (01035)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)
NOV											
13...	1545	50	<1	10	<0.5	<1	2	<3	4	140	10
MAR											
25...	1300	40	<1	10	<0.5	<1	<1	<3	3	120	1

DATE		LITHIUM DIS- SOLVED (UG/L AS LI) (01130)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	MOLYB- DENUM, DIS- SOLVED (UG/L AS MO) (01060)	NICKEL, DIS- SOLVED (UG/L AS NI) (01065)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	SILVER, DIS- SOLVED (UG/L AS AG) (01075)	STRON- TIUM, DIS- SOLVED (UG/L AS SR) (01080)	VANA- DIUM, DIS- SOLVED (UG/L AS V) (01085)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
NOV											
13...		<4	6	<0.1	<10	4	<1	<1	21	<6	14
MAR											
25...		<4	8	<0.1	<10	1	<1	<1	23	<6	16

LAKE OF THE WOODS BASIN

05140520 LAKE OF THE WOODS AT WARROAD, MN

(International gaging station)

LOCATION.--Lat 48°54'15", long 95°18'57", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.163 N., R.36 W., Roseau County, Hydrologic Unit 09030009, on left bank of Warroad River in Warroad, 300 ft downstream from Canadian National railroad bridge, 1,000 ft downstream from bridge on State Highway 11, and 4,000 ft upstream from mouth of Warroad River.

DRAINAGE AREA.--27,200 mi².

PERIOD OF RECORD.--April to September 1978 (monthend elevations only), October 1978 to current year. Records collected prior to April 1978 are in reports of the Water Survey of Canada.

GAGE.--Water-stage recorder. Datum of gage is 1,000.00 ft, Lake of the Woods datum.

REMARKS.--Runoff conditions of the Warroad River can affect water levels obtained at this station. Water level subject to fluctuation caused by change in direction and velocity of wind and seiches.

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

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 62.36 ft, Sept. 12, 1978; maximum daily, 61.84 ft, Sept. 12, 1978; minimum gage height recorded, 55.94 ft, Sept. 4, 1980; minimum daily recorded, 56.52 ft, Apr. 15, 1981.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 62.12 ft, Oct. 7; maximum daily, 61.15 ft, Oct. 8; minimum, 58.46 ft, Mar. 28; minimum daily, 58.54 ft, Mar. 28.

GAGE HEIGHT, IN FEET ABOVE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	60.67	60.80	60.34	60.19	59.83	59.28	58.85	59.99	61.03	60.48	60.46	60.24
2	60.56	60.93	60.32	60.21	59.80	59.24	58.70	60.04	60.68	60.55	60.43	59.97
3	60.63	60.91	60.37	60.19	59.79	59.21	58.70	60.10	60.66	60.35	60.38	59.88
4	60.72	60.86	60.35	60.15	59.77	59.20	58.75	60.16	60.88	60.45	60.42	59.73
5	60.61	60.67	60.35	60.12	59.75	59.18	58.79	60.41	60.84	60.38	60.47	59.91
6	60.71	60.70	60.36	60.13	59.74	59.11	58.82	60.28	60.70	59.98	60.44	59.93
7	61.12	60.57	60.36	60.14	59.70	59.12	58.84	60.59	60.66	60.41	60.31	59.66
8	61.15	60.75	60.36	60.11	59.68	59.13	58.91	60.73	60.72	60.57	60.35	59.86
9	60.72	60.86	60.36	60.07	59.68	59.09	58.97	60.67	60.64	60.60	60.24	59.94
10	60.62	60.75	60.36	60.08	59.67	59.04	59.01	60.60	60.71	60.70	60.38	59.93
11	60.72	60.62	60.37	60.04	59.65	59.02	59.07	60.67	60.78	60.78	60.30	59.80
12	60.85	60.49	60.36	60.04	59.62	59.00	59.04	60.60	60.42	60.84	60.23	59.61
13	60.61	60.44	60.36	60.07	59.61	58.98	59.09	60.69	60.44	60.64	60.24	59.76
14	60.72	60.50	60.37	60.07	59.59	58.94	59.13	60.74	60.54	60.57	60.28	59.74
15	60.84	60.46	60.34	60.04	59.57	58.91	59.10	60.74	60.69	60.60	60.17	59.83
16	60.95	60.43	60.32	60.04	59.58	58.88	59.15	60.63	60.58	60.59	60.23	59.72
17	60.90	60.34	60.31	59.98	59.54	58.85	59.16	60.83	60.54	60.66	60.28	59.64
18	60.82	61.12	60.31	59.99	59.51	58.82	59.18	60.85	60.55	60.57	60.19	59.71
19	60.94	60.90	60.32	59.99	59.50	58.79	59.15	60.85	60.57	60.58	60.14	59.78
20	60.87	60.41	60.30	59.97	59.48	58.76	59.25	60.85	60.61	60.61	60.22	59.70
21	60.91	60.40	60.30	59.93	59.49	58.74	59.28	60.88	60.53	60.49	60.21	59.71
22	60.86	60.41	60.26	59.93	59.44	58.67	59.21	60.91	60.42	60.64	60.20	59.51
23	60.75	60.37	60.28	59.94	59.43	58.66	59.24	60.88	60.61	60.51	60.16	59.58
24	60.72	60.38	60.23	59.95	59.42	58.67	59.30	60.88	60.49	60.50	60.03	59.70
25	60.88	60.39	60.25	59.87	59.40	58.63	59.68	60.88	60.42	60.57	60.05	59.96
26	60.76	60.37	60.24	59.88	59.36	58.57	59.49	60.86	60.56	60.55	60.27	59.92
27	60.94	60.36	60.21	59.91	59.33	58.57	59.52	60.86	60.45	60.63	60.08	59.73
28	60.88	60.35	60.20	59.88	59.30	58.54	59.53	60.85	60.47	60.50	59.90	59.69
29	60.84	60.35	60.20	59.84	---	58.63	59.66	60.78	60.54	60.53	59.83	59.62
30	60.82	60.35	60.21	59.84	---	58.76	59.88	60.82	60.48	60.42	59.91	59.60
31	60.83	---	60.18	59.85	---	58.86	---	60.99	---	60.32	59.93	---
MEAN	60.80	60.57	60.30	60.01	59.58	58.90	59.15	60.66	60.61	60.53	60.22	59.78
MAX	61.15	61.12	60.37	60.21	59.83	59.28	59.88	60.99	61.03	60.84	60.47	60.24
MIN	60.56	60.34	60.18	59.84	59.30	58.54	58.70	59.99	60.42	59.98	59.83	59.51
CAL YR 1985	MEAN 60.11		MAX 61.79	MIN 58.34								
WTR YR 1986	MEAN 60.10		MAX 61.15	MIN 58.54								

LAKE OF THE WOODS BASIN

05140521 LAKE OF THE WOODS AT SPRINGSTEEL ISLAND NEAR WARROAD, MN

LOCATION.--Lat 48°56'45", long 95°18'24", in SW¼SW¼ sec.9, T.163 N., R.36 W., Roseau County, Hydrologic Unit 09030009, at Springsteel Resort on Springsteel Island, 2.8 mi north of Warroad.

DRAINAGE AREA.--27,200 mi².

PERIOD OF RECORD.--June 1985 to current year.

GAGE.--Water-stage recorder. Datum at gage is 1,000.00 ft, Lake of the Woods datum.

REMARKS.--Satellite telemeter at station. Water level subject to fluctuation caused by changes in direction and velocity of wind and seiches.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 62.12 ft, July 3, 1985; maximum daily, 61.81 ft, July 6, 7, 1985; minimum, 58.48 ft, Mar. 29, 1986; minimum daily, 58.55 ft, Mar. 30, 1986.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 61.80 ft, Oct. 7; maximum daily, 61.07 ft, Nov. 18; minimum, 58.48 ft, Mar. 29; minimum daily, 58.55 ft, Mar. 30.

GAGE HEIGHT, IN FEET ABOVE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	60.66	60.79	60.31	60.16	59.80	59.32	58.58	59.94	60.97	60.47	60.45	60.20
2	60.57	60.90	60.29	60.17	59.77	59.28	58.66	60.02	60.71	60.54	60.40	60.00
3	60.63	60.89	60.35	60.15	59.75	59.25	58.68	60.11	60.67	60.39	60.36	59.92
4	60.69	60.86	60.35	60.11	59.73	59.23	58.73	60.19	60.84	60.47	60.42	59.76
5	60.59	60.71	60.32	60.09	59.73	59.22	58.78	60.43	60.80	60.43	60.47	59.89
6	60.69	60.69	60.35	60.08	59.71	59.14	58.82	60.31	60.72	60.03	60.43	59.92
7	61.03	60.55	60.35	60.08	59.67	59.14	58.85	60.57	60.63	60.43	60.31	59.67
8	61.04	60.71	60.36	60.08	59.65	59.17	58.92	60.70	60.69	60.57	60.35	59.85
9	60.71	60.80	60.37	60.04	59.64	59.15	58.97	60.70	60.63	60.59	60.24	59.92
10	60.63	60.70	60.36	60.05	59.63	59.11	59.02	60.63	60.66	60.71	60.35	59.91
11	60.73	60.61	60.36	60.02	59.61	59.09	59.07	60.69	60.72	60.80	60.29	59.79
12	60.85	60.47	60.35	60.01	59.60	59.05	59.04	60.64	60.41	60.84	60.24	59.61
13	60.63	60.43	60.34	60.04	59.58	59.04	59.09	60.71	60.42	60.62	60.26	59.74
14	60.72	60.48	60.35	60.03	59.55	59.00	59.13	60.76	60.50	60.56	60.30	59.73
15	60.82	60.45	60.33	60.00	59.54	58.97	59.13	60.75	60.63	60.57	60.21	59.79
16	60.93	60.42	60.31	59.99	59.56	58.96	59.17	60.66	60.53	60.57	60.24	59.74
17	60.88	60.33	60.30	59.95	59.54	58.93	59.18	60.81	60.51	60.63	60.27	59.65
18	60.82	61.07	60.29	59.95	59.49	58.91	59.20	60.83	60.53	60.55	60.20	59.70
19	60.92	60.89	60.29	59.95	59.49	58.90	59.19	60.85	60.52	60.55	60.18	59.78
20	60.88	60.39	60.28	59.94	59.47	58.85	59.25	60.84	60.59	60.58	60.22	59.71
21	60.92	60.38	60.28	59.88	59.49	58.84	59.28	60.85	60.48	60.47	60.21	59.73
22	60.92	60.40	60.25	59.86	59.45	58.76	59.25	60.89	60.36	60.62	60.20	59.56
23	60.80	60.36	60.29	59.87	59.42	58.73	59.28	60.87	60.52	60.53	60.16	59.61
24	60.73	60.35	60.19	59.89	59.42	58.74	59.31	60.85	60.45	60.50	60.03	59.72
25	60.89	60.36	60.22	59.82	59.42	58.70	59.61	60.85	60.40	60.56	60.12	60.00
26	60.76	60.34	60.22	59.82	59.39	58.63	59.49	60.84	60.48	60.55	60.22	59.95
27	60.93	60.32	60.19	59.85	59.35	58.62	59.52	60.84	60.37	60.62	60.06	59.76
28	60.90	60.32	60.17	59.82	59.32	58.57	59.53	60.84	60.42	60.51	59.91	59.73
29	60.83	60.31	60.17	59.79	---	58.56	59.66	60.79	60.53	60.54	59.84	59.65
30	60.82	60.31	60.18	59.79	---	58.55	59.86	60.81	60.48	60.42	59.92	59.63
31	60.83	---	60.14	59.80	---	58.59	---	60.98	---	60.31	59.94	---
MEAN	60.80	60.55	60.29	59.97	59.56	58.94	59.14	60.66	60.57	60.53	60.22	59.79
MAX	61.04	61.07	60.37	60.17	59.80	59.32	59.86	60.98	60.97	60.84	60.47	60.20
MIN	60.57	60.31	60.14	59.79	59.32	58.55	58.58	59.94	60.36	60.03	59.84	59.56

WTR YR 1986 MEAN 60.09 MAX 61.07 MIN 58.55

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

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

Measurements of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. 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 when continuous records are available, will give a picture of the low-flow potentiality of a 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 1986

Station No.	Station name	Location	Drainage area (mi ²)	Period of record	Measurements	
					Date	Discharge (ft ³ /s)
Lake Superior Basin						
04010530	Reservation River near Hovland, MN	Lat 47°53'38", long 89°51'45", in SW¼ sec.6, T.62 N., R.5 E., Cook County, Hydrologic Unit 04010101 at bridge on U.S. Highway 61, 0.2 mile upstream from mouth, 4 miles northeast of Hovland.	-	1974, 1984, 1986	7- 8-86	2.42
04011000	Brule River near Hovland, MN	Lat 47°49'06", long 90°03'04", in SE¼SW¼ sec.27, T.62 N., R.3 E., Cook County, Hydrologic Unit 04010101 at bridge on U.S. Highway 61, 0.3 mile upstream from mouth, 4.5 miles southwest of Hovland.	a264	1912, 1970-71, 1974, 1976, 1986	7- 8-86	127
04012500	Poplar River at Lutsen, MN	Lat 47°38'23", long 90°42'31", in SW¼NE¼ sec.33, T.60 N., R.3 W., Cook County, Hydrologic Unit 04010101, 350 ft upstream from bridge on U.S. Highway 61 at Lutsen, and 0.3 mile upstream from mouth.	112	1912-17, 1928-47, 1952-61, 1962-63, 1970-84\$, 1986\$	7- 8-86	89.6
04012600	Temperance River near Tofte, MN	Lat 47°48'04", long 90°50'43", in NE¼NW¼ sec.4, T.61 N., R.4 W., Cook County, Hydrologic Unit 04010101, at bridge on National Forest Development Road 165, 1.8 miles downstream from Sawbill Creek, 16 miles north of Tofte.	87.6	1970-71, 1974, 1976, 1980, 1983, 1986	7- 8-86	49.9
04013000	Cross River at Schroeder, MN	Lat 47°32'40", long 90°54'10", in NE¼NE¼ sec.1 T.58 N., R.5 W., Hydrologic Unit 04010101 Cook County, at bridge on U.S. Highway 61, at Schroeder.	a91	1911-12, 1930-32#, 1974, 1984, 1986	7- 8-86	45.6
04015090	Split Rock River near Beaver Bay, MN	Lat 47°11'02", long 91°24'32", in NW¼NW¼ sec.7, T.54 N., R.8 W., Lake County, Hydrologic Unit 0401012 above culvert on Highway 61, 4 miles northeast of Gooseberry Falls State Park, at edge of Split Rock Lighthouse State Park.	-	1974, 1986	7- 9-86	26.8
04015260	Silver Creek near Two Harbors, MN	Lat 47°03'52", long 91°36'18", in SE¼NE¼ sec.21, T.53 N., R.10 W., Lake County, Hydrologic Unit 04010102, at culvert on U.S. Highway 61, 4.3 miles northeast of Two Harbors.	a25	1911, 1984-86	7- 9-86	1.86

"See footnotes at end of the table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at low-flow partial-record stations during water year 1986--Continued

04013300	Manitou River near Little Marais, MN	Lat 47°26'40", long 91°04'07", in SE½SE¼ sec.3, T.57 N., R.6 W., Lake County, Hydrologic Unit 04010101 at bridge on U.S. Highway 61, 0.3 mile upstream from mouth, 3 miles northeast of Little Marais.	98.2	1911-12, 1970-71, 1974-76, 1986	7- 9-86	56.2
04015340	Sucker River near Duluth, MN	Lat 46°55'27", long 91°51'02", in SE½SW¼ sec.3, T.51 N., R.12 W., St. Louis County, Hydrologic Unit 04010102, at culvert on County Highway 61, 0.2 mile upstream from mouth, 15 miles northeast of aerial bridge in Duluth.	38.5	1970-71, 1974, 1976, 1980, 1986	7-10-86	8.05
04015350	French River near Duluth, MN	Lat 46°53'59", long 91°53'32", in NE½SW¼ sec.17, T.51 N., R.12 W., St. Louis County, Hydrologic Unit 04010102, at bridge on County Highway 61, at mouth, 12.7 miles northeast of aerial bridge in Duluth.	18.4	1970-71, 1974, 1976, 1980, 1986	7-10-86	10.2
04015387	Amity Creek at Duluth, MN	Lat 46°50'39", long 92°00'36", in SE½NE¼ sec.5, T.50 N., R.13 W., St. Louis County, Hydrologic Unit 04010102, at bridge on Parkway Road, 0.4 mile upstream from Lester River, 6 miles northeast of aerial bridge in Duluth.	16.2	1970-71, 1974, 1976, 1980, 1983, 1986	7-10-86	3.86
04015390	Lester River at Duluth, MN	Lat 46°50'12", long 92°00'21", in NE½NE¼ sec.8, T.50 N., R.13 W., St. Louis County, Hydrologic Unit 04010102, at bridge on U.S. Highway 61, at mouth, 5.7 miles northeast of aerial bridge in Duluth.	53.1	1970-71, 1974, 1976, 1980, 1983, 1986	7-10-86	15.4
Red River of the North Basin						
05075700	Mud River near Grygla, MN	Lat 48°19'31", long 95°44'35", in SE½SE¼ sec.14, T.156 N., R.40 W., Marshall County, Hydrologic Unit 09020304 at bridge on State Highway 89, 6 miles west of Grygla.	170	1937, 1966, 1968, 1970-73, 1976, 1979-80, 1986	7-18-86 8-27-86	16.2 1.46
05085500	Snake River at Warren, MN	Lat 48°11'50", long 96°46'45", in SE¼ sec.36, T.155 N., R.48 W., Marshall County, Hydrologic Unit 0902039 at bridge on Minnesota Street in Warren.	175	1945, 1946-49, 1953-56#, 1970-72, 1974-76, 1978-80, 1983, 1986	7-17-86 8-28-86	0.90 0.04
05086000	Snake River at Alvarado, MN	Lat 48°11'50", long 97°00'20" on line between sec.6, T.154 N., R.49 W., and sec.31, T.155 N., R.49 W., Marshall County, Hydrologic Unit 09020309, at bridge on State Highway 1, at west edge of Alvarado.	a309	1945#, 1946, 1948-51, 1954-56#, 1978-80, 1983, 1986	7-17-86 8-28-86	0.41 0.02
05102900	Roseau River near Skime, MN	Lat 48°38'30", long 95°35'47", in SE½SW¼ sec.30, T.160 N., R.38 W., Roseau County, Hydrologic Unit 09020314, at bridge on County Highway 4, 6.5 miles north of Skime, about 11 miles southeast of Malung.	134	1971-73, 1975-77, 1979-80, 1986	7-14-86 8-25-86	7.12 0.18

"See footnotes at end of table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at low-flow partial-record stations during water year 1986--Continued

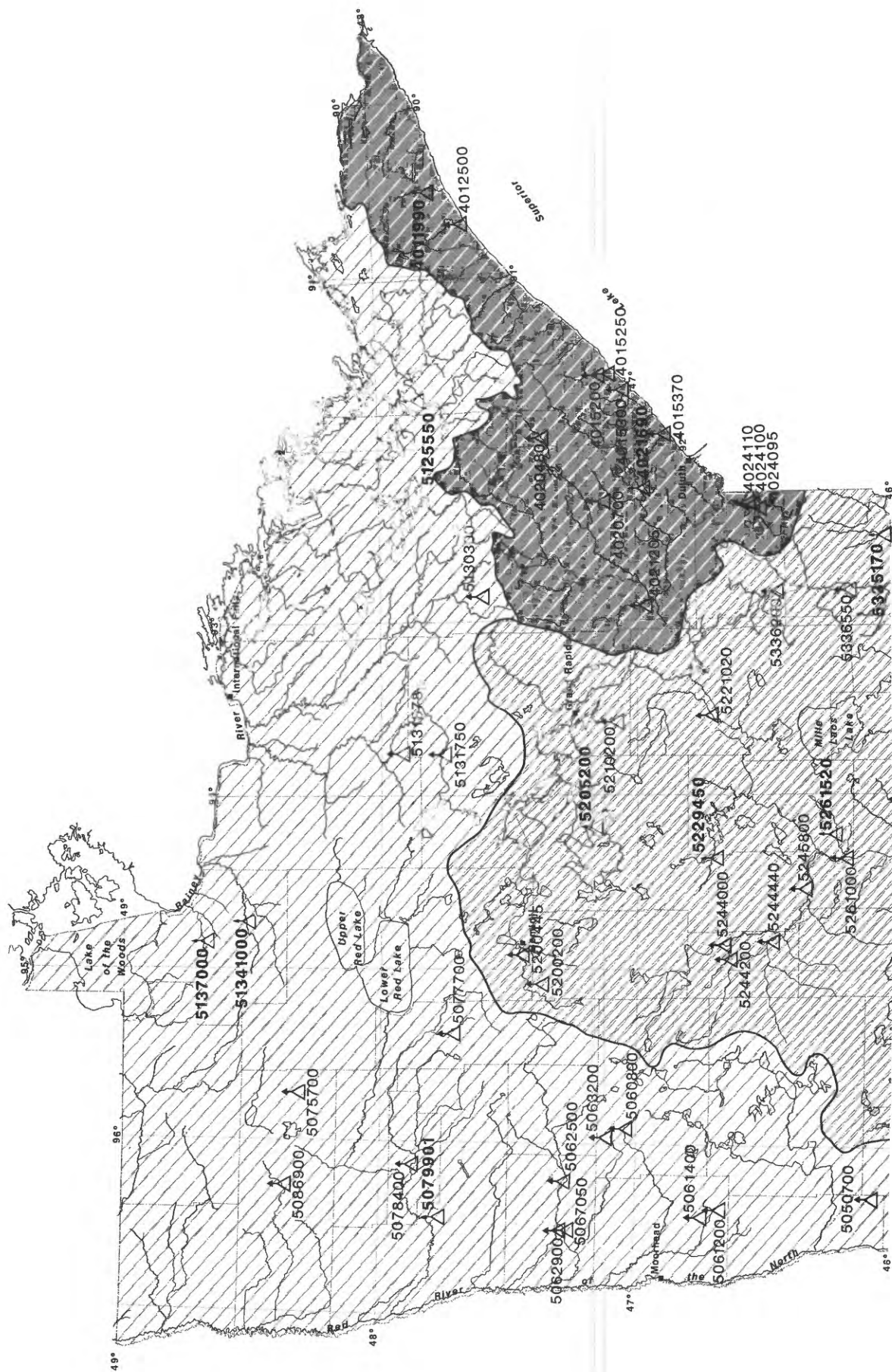
Red River of the North Basin

05104000	South Fork Roseau River near Malung, MN	Lat 48°47'00", long 95°44'00", in NE½SW¼ sec.7, T.161 N., R.39 W., Roseau County, Hydrologic Unit 09020314, below bridge on County Highway 2, 500 ft downstream from Sucker Creek, 0.5 mile upstream from mouth, and 1.1 miles northwest of Malung.	312	1911-14#, 1928-46#, 1947-48, 1986	7-14-86 8-25-86	1.84 0.03
05105200	Hay Creek near Salol, MN	Lat 48°51'39", long 95°35'39", in SE½SE¼ sec.7, T.162 N., R.38 W., Roseau County, Hydrologic Unit 09020314, at culvert on State Highway 11, 1.3 miles southwest of Salol, about 8.5 miles northeast of Malung.	66.1	1971-73, 1976-77, 1979-80, 1983, 1986	7-14-86 8-25-86	1.09 0.20
05106000	Sprague Creek near Sprague, Manitoba	Lat 48°59'33", long 95°39'43", in NE¼ sec.34, T.164 N., R.39 W., Roseau County, Hydrologic Unit 09020314, on left bank 0.5 mile, south of international boundary, 3.5 miles south of Sprague, Manitoba, 8 miles upstream from mouth, and 10.5 miles northeast Roseau, MN.	169	1928-81#, 1986	7-15-86 8-27-86	74.7 10.2
05107000	Pine Creek near Pine Creek, MN	Lat 48°59'35", long 95°55'04", in SW¼SW¼ sec.26, T.164 N., R.41 W., Roseau County, Hydrologic Unit 09020314, at culvert, 0.5 mile south of international boundary, 2 miles northeast of Pine Creek.	74.6	1928-53#, 1974, 1986	7-15-86	1.19
05109000	Badger Creek near Badger, MN	Lat 48°48'15", long 96°01'44", in NE¼ sec.2, T.161 N., R.42 W., Roseau County, Hydrologic Unit 09020314, at bridge on county road, just downstream from Skunk Creek Ditch, 7 miles northwest of Badger.	a2.2	1929-30#, 1931, 1932-38#, 1986	7-15-86 8-26-86	0 0
05110500	Roseau River at head of state ditch 51, near Oak Point, MN	Lat 48°56'53", long 96°22'56" in NE¼NE¼ sec.18, T.163 N., R.44 W., at head of state ditch 51 (known locally as Caribou cut-off ditch), 2 miles southeast of Oak Point.	---	1933-42#, 1986	7-16-86 8-26-86	169 23.5
05134100	North Branch Rapid River near Baudette, MN	Lat 48°31'56", long 94°38'50", in NW¼SW¼ sec.4, T.158 N., R.31 W., Lake of the Woods County, Hydrologic Unit 09030007 at bridge on County Highway 1, 13 miles southwest of Baudette.	180	1969-72, 1975-76, 1986§	6-13-86 7-30-86 9- 3-87	35.4 8.91 0.38

Operated as a continuous-record gaging station.

§ Operated as a high-flow partial record station.

a Approximate



EXPLANATION

- △ Partial-record high-flow station
- Volume I
- Hudson Bay basin
 - Great Lakes basin
- Volume II
- Upper Mississippi River basin
 - Missouri River basin

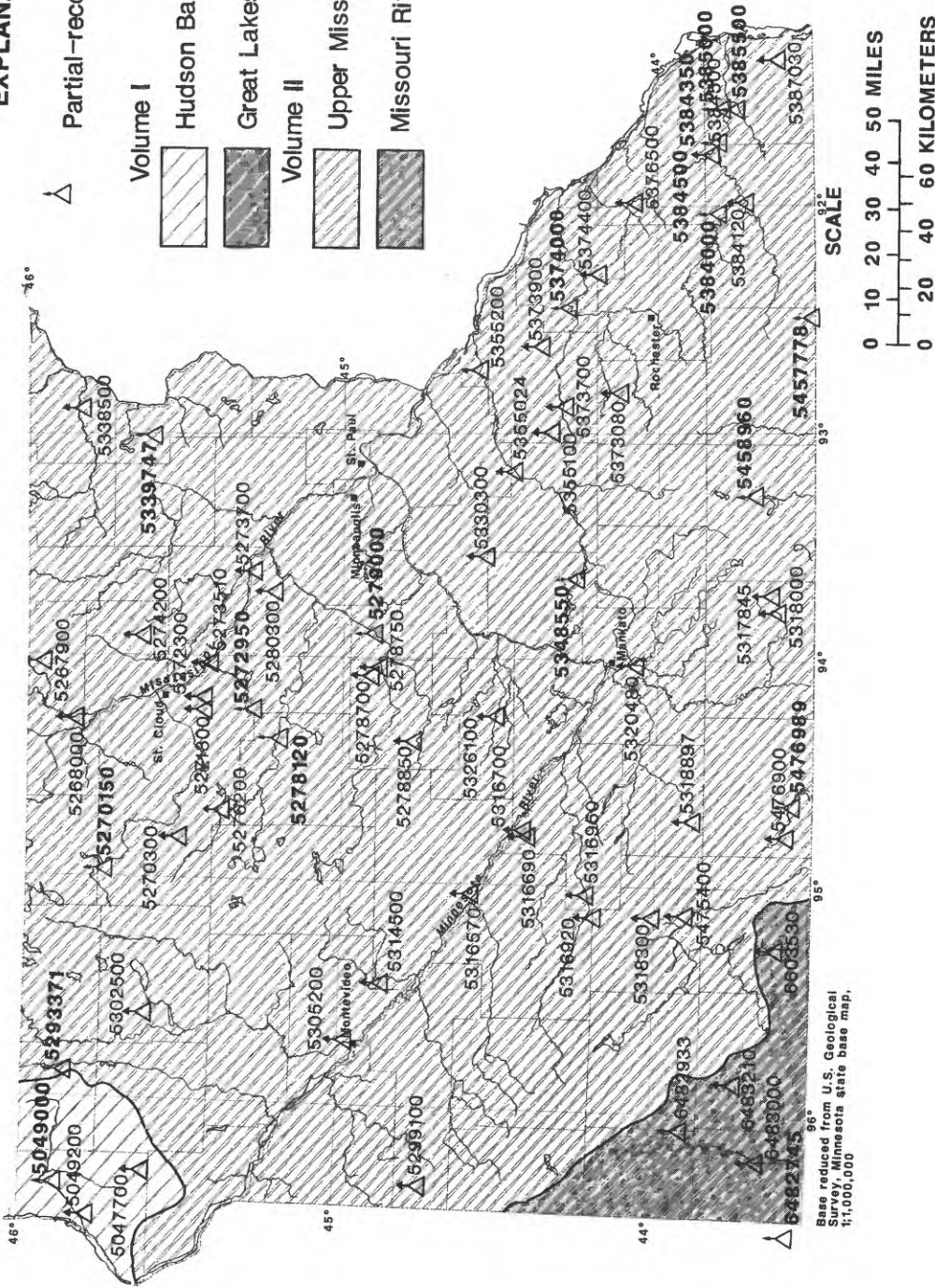


Figure 10.--Location of high-flow partial-record stations

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

High-flow partial-record stations

The following table contains annual maximum discharge for high-flow stations. A high-flow partial-record station is equipped with a crest-stage gage, 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, and discharge measurements may have been made for purposes of establishing the stage-discharge relation, but these are 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 high-flow partial-record stations during water year 1986

Station No.	Station name	Location	Drainage area (mi ²)	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft ³ /s)
Streams tributary to Lake Superior							
04011990	Cascade River near Grand Marais, MN	Lat 47°47'24", long 90°31'35", in SE¼ sec.1, T.61 N., R.2 W., Cook County, Hydrologic Unit 04010101, at bridge on Forest Road 45, 6.6 miles upstream from mouth, 9.5 miles west of Grand Marais.	-	1985-86	a5-31-85 4-28-86	10.72 11.81	500 1,110
04012500	Poplar River at Lutsen, MN	Lat 47°38'23", long 90°42'31", in SW¼NE¼ sec.33, T.60 N., R.3 W., Cook County, Hydrologic Unit 04010101, 350 ft upstream from bridge on U.S. Highway 61 at Lutsen, 0.3 mile upstream from mouth.	112	1912-17#, 1928-47#, 1952-61#, 1972-86	4-28-86	5.19	1,030
04015200	Encampment River tributary at Silver Creek, MN	Lat 47°07'01", long 91°36'04", in NE¼SE¼ sec.33, T.54 N., R.10 W., Lake County, Hydrologic Unit 04010102, at culvert on County Highway 3, 0.3 mile north of Silver Creek, 1.4 miles upstream from mouth.	.96	1960-86	9-25-86	8.93	\$
04015250	Silver Creek tributary near Two Harbors, MN	Lat 47°04'40", long 91°36'49", in SW¼NE¼ sec.16, T.53 N., R.10 W., Lake County, Hydrologic Unit 04010102, at culvert on County Highway 3, 1.0 mile upstream from mouth, 4.5 miles northeast of Two Harbors.	3.72	1965-86	9-25-86	8.36	590
04015300	Little Stewart River near Two Harbors, MN	Lat 47°03'52", long 91°40'03", in SE¼NE¼ sec.24, T.53 N., R.11 W., Lake County, Hydrologic Unit 04010102, at culvert on county highway, 2.0 miles upstream from mouth, 2.7 miles north of Two Harbors.	5.54	1960-86	9-25-86	9.68	\$
04015370	Talmadge River at Duluth, MN	Lat 46°53'20", long 91°55'21", in SE¼NE¼ sec.24, T.51 N., R.13 W., St. Louis County, Hydrologic Unit 04010102, at culvert on U.S. Highway 61, 0.6 mile upstream from mouth, 0.5 mile northeast of Duluth city limits.	5.79	1964-86	7-19-86	14.49	223
04020480	North Branch Whiteface River near Fairbanks, MN	Lat 47°22'20", long 91°56'28", at common corner of secs.35, 36, 1, and 2, along line between T.57 N., and T.56 N., R.13 W., St. Louis County, Hydrologic Unit 04010201, on right downstream wing wall of double box culvert on County Highway 16, 2 miles upstream from the mouth of Jenkins Creek, 0.7 mile west of Fairbanks.	17.1	1979-86	4-28-86	b12.68	113

"See footnotes at end of the table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at high-flow partial-record stations during water year 1986--Continued

Station No.	Station name	Location	Drainage area (mi ²)	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft ³ /s)
Streams tributary to Lake Superior--Continued							
04020700	Bug Creek at Shaw, MN	Lat 47°06'40", long 92°21'03", in SW¼SE¼ sec.34, T.54 N., R.16 W., St. Louis County, Hydrologic Unit 04010201, at left bank on downstream side of culverts on County Road 15 at Shaw, and 7.5 miles upstream from mouth.	24.0	1979-86	4-28-86	b13.65	240
04021205	Floodwood River above Floodwood, MN	Lat 46°17'15", long 92°53'40", in NE¼NW¼ sec.32, T.52 N., R.20 W., St. Louis County, Hydrologic Unit 04010201, at bridge on County Highway 835, 500 ft west of State Highway 73, and 2 miles north of Floodwood.	198	1972-86	4-28-86	c18.60	1,620
04021690	Cloquet River near Toimi, MN	Lat 47°21'00", long 91°39'30", in NE¼SW¼ sec.7, T.56 N., R.10 W., Lake County, Hydrologic Unit 04010201, at bridge on County Highway 2, 5.8 miles southeast of Toimi, 23 miles north of Two Harbors.	-	1986	4-28-86	6.12	362
04024095	Nemadji River near Holyoke, MN	Lat 46°31'04", long 92°23'22", in NE¼NE¼ sec.32, T.47 N., R.16 W., Carlton County, Hydrologic Unit 04010301, at bridge on State Highway 23, 3.5 miles north of Holyoke.	118	1972-86	4-28-86	15.00	3,100
04024100	Rock Creek near Blackhoof, MN	Lat 45°32'10", long 92°22'12", in SW¼SE¼ sec.21, T.47 N., R.16 W., Carlton County, Hydrologic Unit 04010301, at culvert on State Highway 23, 4.0 miles upstream from mouth, 4.4 mile east of Blackhoof.	4.94	1961-65, 1967-86	4-27-86	18.63	610
04024110	Rock Creek tributary near Blackhoof, MN	Lat 46°32'14", long 92°22'05", in NE¼SE¼ sec.21, T.47 N., R.16 W., Carlton County, Hydrologic Unit 04010301, at culvert on State Highway 23, 0.1 mile upstream from mouth, 4.5 miles east of Blackhoof.	.20	1961-86	4-27-86	d15.88	48
Red River of the North basin							
05047700	West Branch Mustinka River tributary near Graceville, MN	Lat 45°36'53", long 96°19'47", in NE¼NW¼ sec.28, T.125 N., R.45 W., Traverse County, Hydrologic Unit 09020102, at culvert on county highway, 6.0 miles northeast of Graceville.	3.37	1964-86	5- 9-86	7.60	39
05049000	Mustinka River above Wheaton, MN	Lat 45°49'15", long 96°29'25", in SW¼ sec.8, T.127 N., R.46 W., Traverse County, Hydrologic Unit 09020102, at bridge on U.S. Highway 75, one mile upstream from Chicago, Milwaukee and St. Paul railroad bridge, 0.5 mile north of Wheaton, about 8 miles above Lake Traverse.	834	1915-24#, 1930-58#, 1985-86	a5-31-85 3-29-86	9.37 18.91	1,190 5,500
05049200	Eighteenmile Creek near Wheaton, MN	Lat 45°47'18", long 96°31'52", on west quarter of line between secs.24 and 25, T.127 N., R.47 W., Traverse County, Hydrologic Unit 09020102, at culvert on County Highway 67, 1.4 miles upstream from mouth, 2.0 miles southwest of Wheaton.	68.5	1965-68, 1970-86	6-10-86	8.56	510

"See footnotes at end of the table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at high-flow partial-record stations during water year 1986--Continued

Station No.	Station name	Location	Drainage area (mi ²)	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft ³ /s)
Red River of the North basin--Continued							
05050700	Rabbit River near Nashua, MN	Lat 46°04'30", long 96°18'24", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.15, T.130 N., R.45 W., Wilkin County, Hydrologic Unit 09020101, at right downstream piling of bridge on County Road 19, 2.6 miles north of Nashua, 4.8 miles upstream from mouth of South Fork Rabbit River.	56.1	1979-86	9-21-86	14.27	1,280
05060800	Buffalo River near Callaway, MN	Lat 47°01'17", long 95°54'43", in SW $\frac{1}{4}$ SE $\frac{1}{4}$, T.141 N., R.41 W., Becker County, Hydrologic Unit 09020106, at culvert on U.S. Highway 59, 2.7 miles north of Callaway.	94.5	1960-86	4-14-86	13.21	198
05061200	Whiskey Creek at Barnesville, MN	Lat 46°39'35", long 96°23'54", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.20, T.137 N., R.45 W., Clay County, Hydrologic Unit 09020106, at culvert on State Highway 34, 0.7 mile upstream from Blue Eagle Lake, 1.0 mile northeast of Barnesville.	25.3	1961-64, 1965-66#, 1967-86	6-18-86	e5.79	232
05061400	Spring Creek above Downer, MN	Lat 46°44'37", long 96°25'12", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.30, T.138 N., R.45 W., Clay County, Hydrologic Unit 09020106, at culvert on county road, 3.1 miles east of Downer.	5.81	1961-86	6-17-86	13.78	839
05062500	Wild Rice River at Twin Valley, MN	Lat 47°16'00", long 96°14'40", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.27, T.144 N., R.44 W., Norman County, Hydrologic Unit 09020108 on left bank, 100 ft upstream from highway bridge 0.8 mile northeast of village of Twin Valley.	888	1909-17#, 1930-83#, 1985-86	5-13-86	8.38	1,960
05062900	Wild Rice River near Ada, MN	Lat 47°17'29", long 96°26'09", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.13, T.144 N., R.46 W., Norman County, Hydrologic Unit 09020108, at bridge on County Highway 24, 3.2 miles southeast of Ada.	-	1985-86	3-29-86	c21.66	3,900
05067050	Marsh River Ditch near Ada, MN	Lat 47°17'46", long 96°26'09", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.13, T.144 N., R.46 W., Norman County, Hydrologic Unit 09020108, at bridge on County Highway 24, 3.5 miles southeast of Ada.	-	1985-86	3-28-86	c15.32	600
05063200	Spring Creek tributary near Ogema, MN	Lat 47°07'22", long 95°57'35", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.11, T.142 N., R.42 W., Becker County, Hydrologic Unit 09020108, at culvert on county highway, 2.0 miles northwest of Ogema.	4.99	1963-86	3-28-86	c8.39	64
05075700	Mud River near Grygla, MN	Lat 48°19'31", long 95°44'35", at common corner of secs.13, 14, 23, and 24, T.156 N., R.40 W., Hydrologic Unit 09020304, Marshall County, at bridge on State Highway 89, 6 miles west of Grygla.	170	1979-86	3-30-86	f17.47	960
05077700	Ruffy Brook near Gonvick, MN	Lat 47°44'50", long 95°24'45", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.5, T.149 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, on downstream side of bridge on County Highway 17, 4.0 miles upstream from mouth, 4.8 miles east of Gonvick.	45.2	1960-78#, 1979-85, 1986#	3-29-86	f4.61	190

"See footnotes at end of the table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at high-flow partial-record stations during water year 1986--Continued

Station No.	Station name	Location	Drainage area (mi ²)	Period of Record	Date	Annual maximum Gage height (feet)	Dis-charge (ft ³ /s)
Red River of the North basin--Continued							
05078400	Clearwater River tributary near Plummer, MN	Lat 47°52'34", long 96°08'35", in SE½SE¼ sec.22, T.151 N., R.43 W., Red Lake County, Hydrologic Unit 09020305, at culvert on county highway, 1.2 miles upstream from mouth, 5.3 miles south-west of Plummer.	6.51	1961-86	5- 1-86	b15.73	\$
05079901	Burnham Creek near Crookston, MN	Lat 47°43'59", long 96°39'52", in SE½SW¼ sec.10, T.149 N., R.47 W., Polk County, Hydrologic Unit 09020303, at culvert on U.S. Highway 75, 0.75 mile northeast of Girard, 3 miles southwest of Crookston, 7 miles above mouth.	g111	1986	3-29-86	17.04	\$
05086900	Middle River near Newfolden, MN	Lat 48°22'04", long 96°16'47", in NE½NE¼ sec.3, T.156 N., R.44 W., Marshall County, Hydrologic Unit 09020309, at bridge on township road, 2.0 miles northeast of Newfolden.	91.1	1979-86	5- 1-86	14.37	282
Lake of the Woods basin							
05125550	Stony River near Babbitt, MN	Lat 47°41'39", long 91°45'38", in SW¼SW¼ sec.8, T.60 N., R.11 W., Lake County, Hydrologist Unit 09030001, in Superior National Forest, at bridge on Forest Route 424, 4.7 miles upstream from mouth, 8.5 miles south-east of Babbitt.	219	1975-80#, 1986	5- 1-86	5.87	770
05130300	Boriin Creek near Chisholm, MN	Lat 47°36'14", long 92°51'58", in SE½SE¼ sec.9, T.59 N., R.20 W., St. Louis County, Hydrologic Unit 09030005, at culvert on State Highway 73, 1.3 miles upstream from mouth, 7.8 miles north of Chisholm.	13.7	1959-86	4- 3-86	b12.65	110
05131750	Big Fork River near Bigfork, MN	Lat 47°44'56", long 93°46'31", in SW¼NE¼ sec.27, T.61 N., R.27 W., Itasca County, Hydrologic Unit 09030006, at bridge on State Highway 6, 5.5 miles west of Bigfork.	602	1973-86	4-28-86	13.76	1,950
05131878	Bowerman Brook near Craigville, MN	Lat 47°55'29", long 93°45'34", in NE¼NW¼ sec.26, T.63 N., R.27 W., Koochiching County, Hydrologic Unit 09030006, on left downstream wing wall of bridge on State Highway 6, 2.4 miles upstream from mouth, 7.0 miles west of Craigville.	25.0	1979-86	4-28-86	14.01	440
05134100	North Branch Rapid River near Baudette, MN	Lat 48°31'56", long 94°38'50", in NW¼SW¼ sec.4, T.158 N., R.31 W., Lake of the Woods County, Hydrologic Unit 09030007, at bridge on County Highway 1, 12.7 miles southwest of Baudette.	-	1986	3-31-86	11.16	1,000
05137000	Winter Road River near Baudette, MN	Lat 48°42'39", long 94°41'52", in NW¼NE¼ sec.1, T.160 N., R.32 W., Lake of the Woods County, Hydrologic Unit 09030008, at bridge on State Highway No. 11, 4.5 miles west of Baudette, 1.8 miles east of Pitt, 5 miles upstream of mouth.	-	1986	3-31-86	14.30	\$

Operated as a continuous-record gaging station.

\$ Discharge not determined.

a Not previously published.

b Affected by beaver dam.

c Affected by shifting control.

d Adjusted for inflow to storage

e Backwater from aquatic growth and debris.

f Backwater from ice.

g Approximate.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements at miscellaneous sites

Measurements of streamflow at points other than gaging stations are given in the following table. The measurements of base flow are designated by an asterisk (*); measurements of peak flow by a dagger (§).

Discharge measurements made at miscellaneous sites during water year 1986

Stream	Tributary to	Location	Drainage area (mi ²)	Measured previously (water years)	Date	Measurements Dis-charge (ft ³ /s)
Red River of the North basin						
Otter Tail River below Dayton Hallow Dam	Red River of the North	Lat 46°13'45", long 96°07'00", in SW¼ sec.20, T.132 N., R.43 W., Otter Tail County, Hydrologic Unit 09020103, 500 ft below Dayton Hollow Dam of Otter Tail Power Company, 3 miles southwest of Fergus Falls (05045500).	1,610	1904-11#, 1934-53#, 1985	4-17-85 5-15-85 6-18-85 7-24-85 8-29-85 9-24-85 1- 3-86 2-27-86 4- 2-86 5- 2-86	*346 1,110 1,200 1,130 946 874 *546 *496 959 1,280
Ruffy Brook	Clearwater River	Lat 47°47'39", long 95°22'55", in NW¼SW¼ sec.22, T.150 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, at mouth, 7.0 miles northeast of Clearbrook.	--	--	5-21-86 6-23-86 7-22-86 8-27-86 9-30-86 10-14-86 10-28-86	53.2 14.8 20.9 *3.92 *8.57 *5.66 *4.53
Clearwater River	Red Lake River	Lat 47°48'16", long 95°23'06", in NW¼NW¼ sec.22, T.150 N., R.37 W., Clearwater River, Hydrologic Unit 09020305, at southwest corner of Red Lake Indian Reservation Boundary, 7.8 miles north-east of Clearbrook.	--	--	5-21-86 6-23-86 7-22-86 8-27-86 9-30-86 10-14-86 10-28-86	201 85.4 83.8 *38.6 *103 *78.2 *69.8
Butcher Knife Creek	Clearwater River	Lat 47°49'18", long 95°23'50", in SW¼SE¼ sec.9, T.150 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, below concrete dam, at mouth of creek, 9.0 miles north of Clearbrook.	--	--	5-21-86 6-23-86 7-22-86 8-27-86 9-30-86 10-14-86 10-28-86	33.2 *3.46 *2.03 a*0.1 a* .5 a*0.9 a*0.8
Clearwater River	Red Lake River	Lat 47°49'18", long 95°23'50", in SW¼SE¼ sec.9, T.150 N., R.37 W., Clearwater County, Hydrologic Unit 09020305 in Clearwater River near mouth of Butcher Knife Creek, 9.0 miles north of Clearbrook.	--	--	10-14-86	*79.2
Clearwater River	Red Lake River	Lat 47°49'58", long 95°25'36", in NW¼NW¼ sec.8, T.150 N., R.37 W., Clearwater County, Hydrologic Unit 09020305, at County Highway 5, 9.5 miles north of Clearbrook.	--	--	5-21-86 6-23-86 7-22-86 8-27-86 9-30-86 10-14-86 10-28-86	270 98.9 101 *39 *107 *73.7 *67.7
Clearwater River	Red Lake River	Lat 47°52'58", long 95°29'12", in NE¼SE¼ sec.23, T.151 N., R.3 W., Clearwater County, Hydrologic Unit 09020305, just upstream of Ke-Wa-Say reservoir outlet, 4.4 miles east of Clearwater-Polk County line, near northwest corner of Ke-Wa-Say reservoir.	--	--	5-21-86 6-23-86 7-22-86 8-27-86 9-30-86 10-14-86 10-28-86	234 108 102 *44.1 *104 *77.3 *73.2

"See footnotes at end of table."

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at miscellaneous sites during water year 1986

Stream	Tributary to	Location	Drainage area (mi ²)	Measured previously (water years)	Measurements Dis- charge Date (ft ³ /s)
Red River of the North basin--Continued					
Ke-Wa-Say reservoir outlet	Clearwater River	Lat 47°52'58", long 95°29'09", in NE&SE& sec.23, T.151 N., R.3 W., Clearwater County, Hydrologic Unit 09020305, at outlet to Ke-Wa-Say reservoir, 4.4 miles east of Clearwater-Polk County line near northwest corner of Ke-Wa-Say reservoir.	--	--	5-21-86 69
					6-23-86 a*1
					7-22-86 *0
					8-27-86 a*0.1
					9-30-86 a*0.1
					10- 1-86 *0
Clearwater River	Red Lake River	Lat 47°55'33", long 95°34'54", in NW&SW& sec.6. T. 151 N., R.39 W., Clearwater County, Hydrologic Unit 09030002, near end of unimproved road on Clearwater- Polk County line, on southwest boundary of Indian reservation, 6 miles down- stream of Ke-Wa-Say reservoir.	--	--	10-14-86 *0.
					10-28-86 a*0.5
					5-21-86 317
					6-23-86 121
					7-22-86 138
					8-27-86 *46.8
Vermilion River	Crane Lake	Lat 47°57'41", long 92°28'33", in SE&SW& sec.2, T.63 N., R.17 W., St. Louis County, Hydrologic Unit 09030002, on left bank 200 ft downstream from dam at outlet of Vermilion Lake, 4.4 miles upstream from Two Mile Creek, 14.2 miles northwest of Tower, MN (05129000).	483	1911-17#, 1928-81#, 1982	10-23-86 357
Rapid River	Rainy River	Lat 48°32'10", long 94°33'45", in SE&NE& sec.1, T.158 N., R.31 W., Lake of the Woods County, Hydrologic Unit 09030007, on left bank 20 ft upstream from bridge on State Highway 72, 1.2 miles down- stream from North Branch Rapid River, 12 miles south of Baudette (05134200).	543	1956-85#	11-27-85 *159
					12-18-85 *148
					2- 6-86 *63

Operated as a continuous-record gaging station.

a Estimate.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

Water-quality partial record stations are particular sites where chemical-quality, biological and (or) sediment data are collected systematically over a period of years for use in hydrologic analyses.

461215096100205 ORWELL LAKE SITE 5 NEAR FERGUS FALLS, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	RESER- VOIR DEPTH (FEET) (72025)	TUR- BID- ITY (NTU) (00076)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	ALKA- LINITY FIXED ENDPT, (MG/L AS CACO3) (00410)	ALKA- LINITY IT-FLD (MG/L AS CACO3) (99430)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
MAY									
01...	1414	4.4	9.8	6.3	0.67	174	174	207	2
JUL									
22...	1348	2.6	6.6	3.0	0.4	212	213	196	26

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, DIS- TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
MAY							
01...	<0.10	0.04	0.6	0.06	<0.01	74.0	1.50
JUL							
22...	<0.10	0.04	1.0	0.37	0.06	690	6.40

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
MAY							
01...	1415	2.00	502	8.3	9.0	12.4	767
01...	1416	5.00	503	8.3	9.0	11.8	767
01...	1417	9.00	503	8.4	9.0	11.6	767
JUL							
22...	1345	1.00	610	9.3	28.5	22.1	758
22...	1346	3.00	637	8.9	25.5	8.3	758
22...	1347	5.60	650	8.7	25.0	4.5	758

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461215096100205 ORWELL LAKE SITE 5 NEAR FERGUS FALLS, MN-Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	MAY 01, 86 1414	JUL 22, 86 1348
TOTAL CELLS/ML	3000	1700
	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)		
.BACILLARIOPHYCEAE		
.BACILLARIALES		
...NITZSCHACEAE		
...NITZSCHIA		
.....N.ACICULARIS	49 2	--
.....N.AMPHIBIA	25 <1	15 <1
.....N.FRUSTULUM	25 <1	--
..EUPODISCALES		
...COSCIDISCAEAE		
...CYCLOTELLA		
.....C.KUTZINGIANA	--	15 <1
.....C.MENEGHINIANA	49 2	250 15
.....C.PSEUDOSTELLIGERA	--	30 2
...MELOSIRA		
.....M.AMBIGUA	--	15 <1
.....M.GRANULATA	49 2	--
...STEPHANODISCUS		
.....S.ASTREA V.MINUTULA	& 1100 37	& 930 55
.....S.HANTZSCHII	890 30	130 8
..FRAGILARIALES		
...FRAGILARIACEAE		
...DIATOMA		
.....D.TENUE V. ELONGATUM	49 2	--
...FRAGILARIA		
.....F.CAPUCINA V.MESOLEPTA.	--	30 2
...SYNEDRA		
.....S.ULNA	74 2	30 2
..NAVICULALES		
...CYMBELLACEAE		
...AMPHORA		
.....A.OVALIS	25 <1	--
...NAVICULACEAE		
...NAVICULA		
.....N.CRYPTOCEPHALA V.VENETA	--	15 <1
CHLOROPHYTA (GREEN ALGAE)		
.CHLOROPHYCEAE		
..CHLOROCOCCALES		
...MICRACCTINIACEAE		
...MICRACCTINIUM	--	15 <1
...OOCYSTACEAE		
.....ANKISTRODESMUS	320 11	15 <1
...CHODATELLA	25 <1	15 <1
...OOCYSTIS	--	15 <1
...SCENEDESMACEAE		
...SCENEDESMUS	220 7	89 5
CHRYSOPHYTA (YELLOW-GREEN ALGAE)		
.BACILLARIOPHYCEAE		
..PENNALES		
...ACHNANTHACEAE		
...ACHNANTHES	--	15 <1
...NAVICULACEAE		
...NAVICULA	--	30 2
..CHRYSOPHYCEAE		
...CHROMULINALES		
...CHROMULINACEAE		
...CHRYSOCOCCLUS	25 <1	--
CYANOPHYTA (BLUE-GREEN ALGAE)		
.CYANOPHYCEAE		
..OSCILLATORIALES		
...OSCILLATORIAEAE		
...OSCILLATORIA	25 <1	--
EUGLENOPHYTA (EUGLENOIDS)		
.EUGLENOPHYCEAE		
..EUGLENALES		
...EUGLENACEAE		
...TRACHELOMONAS	25 <1	15 <1

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461254096090001 ORWELL LAKE SITE 1 NEAR FERGUS FALLS, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	RESER- VOIR DEPTH (FEET) (72025)	TUR- BID- ITY (NTU) (00076)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	ALKA- LINIT FIXED ENDPT, (MG/L AS CACO3) (00410)	ALKA- LINIT LINIT, IT-FLD (MG/L AS CACO3) (99430)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
------	------	--	--	---	--	--	---	---	--

FEB									
26...	1400	--	7.1	1.9	--	217	214	261	0
MAY									
01...	1344	5.2	20.0	5.2	0.79	187	187	228	0
JUL									
22...	1306	7.2	18.1	1.6	1.10	177	180	207	6

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, DIS- TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
------	--	--	--	--	---	--	--

FEB							
26...	0.13	0.12	0.7	0.03	<0.01	1.30	<0.10
MAY							
01...	0.10	0.06	0.6	0.03	<0.01	6.40	0.40
JUL							
22...	<0.10	0.04	0.6	0.06	0.02	39.0	5.10

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
------	------	---	--	---	--	--	---

FEB							
26...	1345	4.0	414	8.0	0.0	11.7	750
26...	1348	6.0	414	8.0	0.0	11.7	750
26...	1350	6.5	414	7.9	0.0	11.7	750
MAY							
01...	1345	2.0	395	8.3	10.0	10.8	767
01...	1346	10.0	395	8.3	10.0	10.6	767
01...	1347	15.0	395	8.3	10.0	10.6	767
01...	1348	19.5	396	8.3	10.0	10.6	767
JUL							
22...	1300	1.0	380	8.7	27.0	10.9	758
22...	1301	3.0	380	8.6	26.0	10.5	758
22...	1302	6.0	383	8.4	26.0	9.1	758
22...	1303	10.0	384	8.4	25.5	8.6	758
22...	1304	15.0	384	8.2	25.0	7.5	758
22...	1305	17.0	384	8.2	25.0	7.3	758

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461254096090001 ORWELL LAKE SITE 1 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	FEB 26, 86 1400	MAY 01, 86 1344	JUL 22, 86 1306
TOTAL CELLS/ML	400	2500	6700
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)			
..BACILLARIOPHYCEAE			
...ACHNANTHALES			
....ACHNANTHACEAE			
.....ACHNANTHES			
.....A. CLEVEI	10 3	--	--
.....A. EXIGUA	5 1	--	--
.....A. LANCEOLATA	5 1	--	--
.....A. MINUTISSIMA	10 3	27 1	--
....COCCONEIS			
.....C. PEDICULUS	5 1	--	--
.....C. PLACENTULA	29 7	55 2	--
..BACILLARIALES			
...NITZSCHIACEAE			
....NITZSCHIA			
.....N. ACICULARIS	5 1	& 330 13	190 3
.....N. AMPHIBIA	15 4	--	--
.....N. CAPITELLATA	5 1	--	--
.....N. DISSIPATA	10 3	--	--
.....N. MICROCEPHALA	5 1	--	--
.....N. PALEA	--	55 2	140 2
.....N. SIGMOIDEA	--	27 1	--
...EUPODISCALES			
....COSCINODISCACEAE			
.....CYCLOTELLA			
.....C. KUTZINGIANA	--	--	48 <1
.....C. MENEHINIANA	5 1	27 1	48 <1
.....C. PSEUDOSTELLIGERA	--	--	& 1900 29
.....C. STELLIGERA	--	27 1	--
....MELOSIRA			
.....M. GRANULATA	5 1	--	48 <1
.....M. VARIANS	10 3	--	--
....STEPHANODISCUS			
.....S. ASTREA V. MINUTULA	--	110 4	1100 17
.....S. HANTZSCHII	--	270 11	--
..FRAGILARIALES			
...FRAGILARIAACEAE			
....DIATOMA			
.....D. TENUE V. ELONGATUM	5 1	55 2	--
.....D. VULGARE	24 6	27 1	--
....FRAGILARIA			
.....F. BREUISTRIATA	5 1	--	--
.....F. CONSTRUENS	5 1	--	--
.....F. CONSTRUENS V. VENTER	5 1	27 1	--
.....F. PINNATA	5 1	55 2	--
.....F. VAUCHERIAE	15 4	27 1	--
....SYNEDRA			
.....S. RADIANS	--	220 9	48 <1
.....S. ULNA	5 1	27 1	--
..NAVICULALES			
...CYMBELLACEAE			
....AMPHORA			
.....A. OVALIS	--	27 1	--
.....A. PERPUSILLA	10 3	27 1	95 1
....CYMBELLA			
.....C. MINUTA	15 4	--	--
...GOMPHONEMACEAE			
....GOMPHONEMA			
.....G. ANGUSTATUM	10 3	--	--
.....G. OLIVACEUM	& 44 11	110 4	48 <1
...NAVICULACEAE			
....NAVICULA			
.....N. CAPITATA	--	27 1	--
.....N. CRYPTOCEPHALA	29 7	--	--
.....N. CRYPTOCEPHALA V. VENETA	5 1	160 6	--
.....N. GREGARIA	--	27 1	--
.....N. MENISCULUS V. UPSALIEN.	--	27 1	--
.....N. MINIMA	10 3	--	--
.....N. RADIOSA	5 1	--	--
.....N. RHYNCHOCEPHALA	--	27 1	--
.....N. SEMINULUM	5 1	--	--
.....N. TRIPUNCTATA	5 1	--	--

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461254096090001 ORWELL LAKE SITE 1 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	FEB 26, 86 1400	MAY 01, 86 1344	JUL 22, 86 1306
TOTAL CELLS/ML	400	2500	6700
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
CHLOROPHYTA (GREEN ALGAE)			
.CHLOROPHYCEAE			
..CHLOROCOCCALES			
...OOCYSTACEAE			
....ANKISTRODESMUS	--	82 3	140 2
....CLOSTERIOPSIS	--	--	48 <1
....SELENASTRUM	--	27 1	48 <1
...SCENEDESMACEAE			
....CRUCIGENIA	--	27 1	95 1
....SCENEDESMUS	--	27 1	190 3
....TETRASTRUM	--	--	48 <1
..VOLVOCALES			
...CHLAMYDOMONADACEAE			
....CHLAMYDOMONAS	--	--	240 4
CHRYSOPHYTA (YELLOW-GREEN ALGAE)			
.BACILLARIOPHYCEAE			
..CENTRALES			
...COSCINODISCACEAE			
....CYCLOTELLA	--	27 1	--
....MELOSIRA	5 1	--	--
..PENNALES	10 3	--	--
...ACHNANTHACEAE			
....RHOICOSPHEINIA			
.....R.CURVATA	5 1	55 2	--
...FRAGILARIACEAE			
....SYNEDRA	--	55 2	--
...NAVICULACEAE			
....NAVICULA	15 4	--	48 <1
....PINNULARIA	--	27 1	--
...NITZSCHIA			
....NITZSCHIA	20 5	54 2	140 2
.CHRYSOPHYCEAE			
..CHROMULINALES			
...CHROMULINACEAE			
....CHRYSOCOCCLUS	5 1	55 2	--
....KEPHYRION	--	27 1	--
CYANOPHYTA (BLUE-GREEN ALGAE)			
.CYANOPHYCEAE			
..OSCILLATORIALES			
...NOSTOCACEAE			
....ANABAENA	--	--	95 1
...OSCILLATORIACEAE			
....OSCILLATORIA	--	27 1	--
EUGLENOPHYTA (EUGLENOIDS)			
.CRYPTOPHYCEAE			
..CRYPTOMONIDALES			
...CRYPTOCHRYSIDACEAE			
....CHROOMONAS	--	--	48 <1
....RHODOMONAS	--	82 3	1000 15
...CRYPTOMONODACEAE			
....CRYPTOMONAS	--	27 1	620 9
.EUGLENOPHYCEAE			
..EUGLENALES			
...EUGLENACEAE			
....PHACUS	--	--	95 1
....TRACHELOMONAS	--	55 2	48 <1

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461302096080802 ORWELL LAKE SITE 2 NEAR FERGUS FALLS, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	RESER- VOIR DEPTH (FEET) (72025)	TUR- BID- ITY (NTU) (00076)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	ALKA- LINITY, FIXED ENDPT, (MG/L AS CAC03) (00410)	ALKA- LINITY, IT-FLD (MG/L AS CAC03) (99430)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
MAY									
01...	1319	5.2	17.5	4.7	0.79	187	193	235	0
JUL									
22...	1220	5.2	11.0	2.2	0.8	177	185	226	0

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, ORTHO, DIS- TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
MAY							
01...	0.11	0.06	0.6	0.04	<0.01	5.90	0.40
JUL							
22...	0.15	0.05	0.9	0.07	0.03	16.0	2.60

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
MAY							
01...	1320	2.0	392	8.4	10.5	10.8	767
01...	1325	5.0	393	8.4	10.5	10.7	767
01...	1330	10.0	394	8.4	10.5	10.6	767
01...	1331	15.0	394	8.4	10.5	10.6	767
01...	1332	17.0	394	8.4	10.5	10.6	767
JUL							
22...	1215	1.0	383	8.0	26.5	8.6	758
22...	1216	3.0	384	8.0	26.0	8.3	758
22...	1217	5.0	384	8.0	25.0	7.7	758
22...	1218	8.0	383	7.9	25.0	7.2	758
22...	1219	10.0	383	7.9	25.0	6.9	758

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461302096080802 ORWELL LAKE SITE 2 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	MAY 01, 86 1545	JUL 22, 86 1500
TOTAL CELLS/ML	1400	2000
	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)		
..BACILLARIOPHYCEAE		
...ACHNANTHALES		
....ACHNANTHACEAE		
.....ACHNANTHES		
.....A.CLEVEI	16 1	22 <1
.....A.LANCEOLATA	16 1	22 <1
.....A.MINUTISSIMA	64 4	--
....COCCONEIS		
.....C.PEDICULUS	16 1	--
.....C.PLACENTULA	32 2	66 3
..BACILLARIALES		
...NITZSCHIA		
.....NITZSCHIA		
.....N.ACICULARIS	180 11	66 3
.....N.AMPHIBIA	--	22 <1
.....N.DISSIPATA	32 2	22 <1
.....N.FONTICOLA	16 1	--
.....N.FRUSTULUM	16 1	22 <1
.....N.LINEARIS	16 1	22 <1
.....N.PALEA	--	22 <1
..EUNOTIALES		
...EUNOTIACEAE		
.....EUNOTIA		
.....E.ELEGANS	--	22 <1
..EUPODISCALES		
...COSCINODISCACEAE		
....CYCLOTELLA		
.....C.KUTZINGIANA	16 1	--
.....C.MENEGHINIANA	32 2	22 <1
.....C.PSEUDOSTELLIGERA	--	200 9
....MELOSIRA		
.....M.GRANULATA	--	44 2
.....M.GRANULATA V.AUGUSTISS.	16 1	--
....STEPHANODISCUS		
.....S.ASTREA V.MINUTULA	80 5	22 <1
.....S.HANTZSCHII	80 5	--
..FRAGILARIALES		
...FRAGILARIACEAE		
....ASTERIONELLA		
.....A.FORMOSA	32 2	--
....DIATOMA		
.....D.VULGARE	32 2	--
....FRAGILARIA		
.....F.CONSTRUENS V. VENTER	--	22 <1
.....F.PINNATA	--	22 <1
....SYNEDRA		
.....S.RADIANS	& 210 13	--
.....S.ULNA	80 5	--
..NAVICULALES		
...CYMBELLACEAE		
....AMPHORA		
.....A.OVALIS	--	22 <1
.....A.PERFUSILLA	64 4	--
...GOMPHONEMACEAE		
....GOMPHONEMA		
.....G.ANGUSTATUM	16 1	44 2
.....G.OLIVACEUM	64 4	--
.....G.TENELLUM	--	22 <1

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461302096080802 ORWELL LAKE SITE 2 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	MAY 01, 86 1545	JUL 22, 86 1500
TOTAL CELLS/ML	1400	2000
	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)--Continued		
....NAVICULA	--	22 <1
....N.CRYPTOCEPHALA	96 6	22 <1
....N.CRYPTOCEPHALA V.VENETA	16 1	--
....N.MINIMA	16 1	--
....N.RHYNCHOCEPHALA	16 1	22 <1
....N.TRIPUNCTATA (5) (D.)	16 1	22 <1
CHLOROPHYTA (GREEN ALGAE)		
..CHLOROPHYCEAE		
..CHLOROCOCCALES		
..HYDRODICTYACEAE		
....PEDIASTRUM	--	22 <1
....OOCYSTACEAE		
....ANKISTRODESMUS	16 1	88 4
....SELENASTRUM	--	66 3
....TETRAEDRON	--	22 <1
....SCENEDESMACEAE		
....CRUCIGENIA	--	22 <1
....SCENEDESMUS	32 2	66 3
..VOLVOCALLES		
..CHLAMYDOMONADACEAE		
....CHLAMYDOMONAS	--	66 3
CHRYSOPHYTA (YELLOW-GREEN ALGAE)		
..BACILLARIOPHYCEAE		
..CENTRALES		
..COSCINODISCACEAE		
....CYCLOTELLA	16 1	--
..FENNALES		
..ACHNANTHACEAE		
....RHOICOSPHEA		
....R.CURVATA	16 1	--
..FRAGILARIACEAE		
....SYNEDRA	16 1	--
..GOMPHONEMACEAE		
....GOMPHONEMA	16 1	--
..NITZSCHACEAE		
....NITZSCHIA	32 2	22 <1
..CHRYSOPHYCEAE		
..CHROMULINACEAE		
....CHRYSOCCUS	32 2	--
....KEPHYRION	48 3	--
CYANOPHYTA (BLUE-GREEN ALGAE)		
..CYANOPHYCEAE		
..OSCILLATORIALES		
....NOSTOCACEAE		
....ANABAENA	--	22 <1
EUGLENOPHYTA (EUGLENOIDS)		
..CRYPTOPHYCEAE		
..CRYPTOMONIDALES		
....CRYPTOCHRYSIDACEAE		
....CHROOMONAS	--	160 7
....RHODOMONAS	96 6	420 18
....CRYPTOMONODACEAE		
....CRYPTOMONAS	32 2	& 490 21
..EUGLENOPHYCEAE		
..EUGLENALES		
..EUGLENACEAE		
....TRACHELOMONAS	--	22 <1

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461307096092803 ORWELL LAKE SITE 3 NEAR FERGUS FALLS, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	RESER- VOIR DEPTH (FEET) (72025)	TUR- BID- ITY (NTU) (00076)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	ALKA- LILITY, FIXED ENDPT, (MG/L AS CACO3) (00410)	ALKA- LILITY, IT-FLD (MG/L AS CACO3) (99430)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
FEB									
26...	1500	--	10.9	1.4	--	223	222	271	0
MAY									
01...	1502	5.4	27.0	7.4	0.82	188	190	232	0
JUL									
22...	1436	6.6	17.2	1.5	1.00	186	187	204	12

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, DIS- TOTAL (MG/L AS P) (00665)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
FEB							
26...	0.13	0.12	0.6	0.02	<0.01	0.60	<0.10
MAY							
01...	<0.10	0.04	0.5	0.05	<0.01	19.0	0.60
JUL							
22...	<0.10	0.06	0.9	0.06	0.02	15.0	1.30

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
FEB							
26...	1445	3.0	411	8.0	0.0	11.3	750
26...	1446	6.0	412	8.0	0.0	11.3	750
26...	1447	10.0	418	7.9	0.5	11.3	750
MAY							
01...	1503	2.0	398	8.3	9.5	11.6	767
01...	1504	10.0	396	8.3	9.5	11.3	767
01...	1505	20.0	398	8.3	9.5	11.1	767
01...	1506	26.0	398	8.3	9.5	10.9	767
JUL							
22...	1430	1.0	376	8.7	28.0	12.2	759
22...	1431	3.0	378	8.7	28.0	12.3	759
22...	1432	6.0	379	8.7	26.0	11.8	759
22...	1433	10.0	382	8.5	26.0	9.6	759
22...	1434	14.0	384	8.5	25.5	8.8	759
22...	1435	16.0	384	8.5	25.5	8.9	759

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461307096092803 ORWELL LAKE SITE 3 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	FEB 26, 86 1500	MAY 01, 86 1602	JUL 22, 86 1436
TOTAL CELLS/ML	230	1700	9300
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)			
.BACILLARIOPHYCEAE			
..ACHNANTHALES			
...ACHNANTHACEAE			
....ACHNANTHES			
.....A. CLEVEI	3 1	14 <1	--
.....A. LANCEOLATA	5 2	14 <1	71 <1
.....A. MINUTISSIMA	16 6	--	--
....COCCONEIS			
.....C. DISCUIUS	3 1	--	--
.....C. PEDICULUS	3 1	14 <1	--
.....C. PLACENTULA	13 5	14 <1	--
..BACILLARIALES			
...NITZSCHIACEAE			
....NITZSCHIA			
.....N. ACICULARIS	3 1	120 7	71 <1
.....N. DISSIPATA	16 6	--	--
.....N. FRUSTULUM	3 1	--	--
.....N. LINEARIS	3 1	--	--
.....N. PALEA	5 2	--	--
..EPITHEMIALES			
...EPITHEMIAEAE			
....EPITHEMIA			
.....E. HYNDMANII	--	14 <1	--
.....E. SOREX	5 2	--	--
..EUPODISCALES			
...COSCONODISCACEAE			
....CYCLOTELLA			
.....C. KUTZINGIANA	--	--	140 2
.....C. MENECHINIANA	3 1	14 <1	--
.....C. PSEUDOSTELLIGERA	--	--	2400 26
....MELOSIRA			
.....M. AMBIGUA	3 1	120 7	--
.....M. GRANULATA	--	27 2	--
.....M. VARIANS	--	14 <1	--
...STEPHANODISCUS			
.....S. ASTREA V. MINUTULA	--	300 18	1100 12
.....S. HANTZSCHII	--	& 570 34	--
..FRAGILARIALES			
...FRAGILARIAEAE			
....DIATOMA			
.....D. TENUE V. ELONGATUM	3 1	--	--
.....D. VULGARE	8 3	14 <1	--
....FRAGILARIA			
.....F. CONSTRUENS	5 2	--	--
.....F. CONSTRUENS V. VENTER	3 1	14 <1	--
.....F. PINNATA	3 1	--	--
.....F. VAUCHERIAE	3 1	14 <1	--
....SYNEDRA			
.....S. PARASITICA	3 1	--	--
.....S. RADIANIS	3 1	--	--
.....S. RUMPENS	5 2	--	--
.....S. ULNA	8 3	41 2	--
..NAVICULALES			
...CYMBELLACEAE			
....AMPHORA			
.....A. PERPUSILLA	13 5	27 2	71 <1
....CYMBELLA			
.....C. MINUTA	3 1	27 2	--
...GOMPHONEMACEAE			
....GOMPHONEMA			
.....G. OLIVACEUM	& 27 11	27 2	71 <1
.....G. TENELLUM	3 1	--	--

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461307096092803 ORWELL LAKE SITE 3 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	FEB 26, 86 1500	MAY 01, 86 1602	JUL 22, 86 1436
TOTAL CELLS/ML	230	1700	9300
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)--Continued			
.BACILLARIOPHYCEAE			
..NAVICULALES			
...NAVICULACEAE			
....NAVICULA			
.....N.COCCONEIFORMIS	3 1	--	--
.....N.CRYPTOCEPHALA	5 2	--	--
.....N.CRYPTOCEPHALA V.VENETA	19 8	14 <1	71 <1
.....N.DECUSSIS (5) OSTR	--	14 <1	--
.....N.RHYNCHOCEPHALA	3 1	--	--
.....N.TRIPUNCTATA	3 1	--	--
CHLOROPHYTA (GREEN ALGAE)			
.CHLOROPHYCEAE			
..CHLOROCOCCALES			
...OOCYSTACEAE			
....ANKISTRODESMUS	--	41 2	140 2
....SELENASTRUM	--	--	71 <1
...SCENEDESMACEAE			
....SCENEDESMUS	--	27 2	71 <1
..TETRASPORALES			
...PALMELLACEAE			
....SPHAEROCYSTIS	--	--	71 <1
..VOLVOCALES			
...CHLAMYDOMONADACEAE			
....CHLAMYDOMONAS	--	--	430 5
CHRYSOPHYTA (YELLOW-GREEN ALGAE)			
.BACILLARIOPHYCEAE			
..CENTRALES			
...COSCINODISCEAE			
....CYCLOTELLA	--	27 2	--
..PENNALES	3 1	--	--
...ACHNANTHACEAE			
....RHOICOSPHEA			
.....R.CURVATA	3 1	55 3	--
...NAVICULACEAE			
....NAVICULA	6 3	--	--
...NITZSCHIAEAE			
....NITZSCHIA	8 3	--	--
.CHRYSOPHYCEAE			
..CHROMULINALES			
...CHROMULINACEAE			
....CHRYSOCCUS	--	68 4	--
....KEPHYRION	5 2	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)			
.CYANOPHYCEAE			
..OSCILLATORIALES			
...NOSTOCACEAE			
....ANABAENA	--	--	140 2
....APHANIZOMENON	3 1	--	--
EUGLENOPHYTA (EUGLENOIDS)			
.CRYPTOPHYCEAE			
..CRYPTOMONIDALES			
...CRYPTOCHRYSIDACEAE			
....RHODOMONAS	--	14 <1	& 3000 32
...CRYPTOMONODACEAE			
....CRYPTOMONAS	--	--	1400 15
.EUGLENOPHYCEAE			
..EUGLENALES			
...EUGLENACEAE			
....TRACHELOMONAS	--	55 3	--

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461308096102804 ORWELL LAKE SITE 4 NEAR FERGUS FALLS, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	RESER- VOIR DEPTH (FEET) (72025)	TUR- BID- ITY (NTU) (00076)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	ALKA- LINIT, Y, FIXED ENDPT, (MG/L AS CAC03) (00410)	ALKA- LINIT, Y, IT-FLD (MG/L AS CAC03) (99430)	BICAR- BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR- BONATE IT-FLD (MG/L AS CO3) (99445)
FEB 26...	1600	--	17.0	1.5	--	227	226	276	0
MAY 01...	1520	5.0	26.0	6.9	0.76	191	189	228	1
JUL 22...	1457	9.8	22.7	2.0	1.50	183	185	223	1

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS- PHORUS, ORTHO, DIS- SOLVED (MG/L AS P) (00671)	CHLOR-A PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO- PLANK- TON CHROMO FLUOROM (UG/L) (70954)
FEB 26...	0.13	0.13	0.7	0.02	<0.01	0.80
MAY 01...	<0.10	0.04	0.5	0.05	<0.01	25.0
JUL 22...	<0.10	0.05	0.7	0.06	0.02	35.0

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BARO- METRIC PRES- SURE (MM OF HG) (00025)
FEB 26...	1545	3.0	416	7.8	0.0	11.6	750
26...	1546	6.0	418	7.8	0.0	11.2	750
26...	1547	9.0	419	7.8	0.0	11.2	750
26...	1548	12.0	419	7.8	0.0	11.2	750
26...	1549	16.0	424	7.8	0.0	10.8	750
MAY 01...	1521	2.0	398	8.3	9.5	11.1	767
01...	1523	5.0	398	8.3	9.5	11.0	767
01...	1525	20.0	398	8.3	9.5	11.0	767
01...	1526	25.0	399	8.3	9.5	11.0	767
JUL 22...	1450	1.0	379	8.6	27.5	10.6	759
22...	1451	3.0	378	8.7	27.5	10.6	759
22...	1452	6.0	379	8.7	26.0	11.4	759
22...	1453	10.0	383	8.5	25.5	8.8	759
22...	1454	15.0	383	8.5	25.5	8.6	759
22...	1455	19.0	382	8.5	25.5	8.5	759
22...	1456	21.7	384	8.5	25.5	8.4	759

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461308096102804 ORWELL LAKE SITE 4 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	FEB 26, 86 1600	MAY 01, 86 1520	JUL 22, 86 1457
TOTAL CELLS/ML	140	2300	8800
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
BACILLARIOPHYTA (DIATOMS)			
.BACILLARIOPHYCEAE			
..ACHNANTHALES			
...ACHNANTHACEAE			
....ACHNANTHES			
.....A.CLEVEI	2 2	21 <1	--
.....A.HAUCKIANA	2 2	--	--
.....A.LANCEOLATA	7 5	--	--
.....A.LINEARIS	2 2	--	--
.....A.MINUTISSIMA	--	21 <1	--
...COCCONEIS			
....C.PLACENTULA	& 22 14	--	--
.BACILLARIALES			
..NITZSCHIAEAE			
...NITZSCHIA			
....N.ACICULARIS	--	230 10	--
....N.AMPHIBIA	2 2	41 2	--
....N.DISSIPATA	5 3	--	--
....N.FRUSTULUM	2 2	--	--
....N.LINEARIS	2 2	--	66 <1
....N.PALEA	--	--	200 2
.EUPODISCALES			
..COSCINODISCAEAE			
...CYCLOTELLA			
....C.COMTA	--	--	66 <1
....C.KUTZINGIANA	--	--	66 <1
....C.MENEHINIANA	5 3	21 <1	330 4
....C.PSEUDOSTELLIGERA	--	--	& 2900 33
...MELOSIRA			
....M.AMBIGUA	--	83 4	--
....M.GRANULATA	--	21 <1	--
....M.GRANULATA V.AUGUSTISS.	--	21 <1	--
....M.VARIANS	2 2	--	--
...STEPHANODISCUS			
....S.ASTREA V.MINUTULA	--	150 7	1900 22
....S.HANTZSCHII	--	& 1100 48	270 3
.FRAGILARIALES			
..FRAGILARIAEAE			
...DIATOMA			
....D.TENUE V. ELONGATUM	--	21 <1	--
....D.VULGARE	5 3	83 4	--
...FRAGILARIA			
....F.CONSTRUENS V.VENTER	2 2	--	--
...SYNEDRA			
....S.PARASITICA	3 2	--	--
....S.ULNA	10 6	--	--
.NAVICULALES			
..CYMBELLACEAE			
...AMPHORA			
....A.PERPUSILLA	5 3	21 <1	--
..GOMPHONEMACEAE			
...GOMPHONEMA			
....G.OLIVACEUM	13 8	21 <1	--
.NAVICULACEAE			
...NAVICULA			
....N.CRYPTOCEPHALA	5 3	--	--
....N.CRYPTOCEPHALA V.VENETA	8 5	21 <1	--
....N.DECUSSIS (5) OSTR	2 2	--	--
....N.GREGARIA	3 2	--	--
....N.MENISCULUS V.UPSALIEN.	2 2	--	--
....N.MINIMA	2 2	--	--
....N.PUPULA	3 2	--	--
....N.REINHARDTII (5) (GRU	--	21 <1	--
....N.TRIPUNCTATA (5) (D.	3 2	--	--
....N.VIRIDULA	2 2	--	--

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

461308096102804 ORWELL LAKE SITE 4 NEAR FERGUS FALLS, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE TIME	FEB 26, 86 1600	MAY 01, 86 1520	JUL 22, 86 1457
TOTAL CELLS/ML	140	2300	8800
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
CHLOROPHYTA (GREEN ALGAE)			
..CHLOROPHYCEAE			
..CHLOROCOCCALES			
...OOCYSTACEAE			
....ANKISTRODESMUS	--	21 <1	130 2
....OOCYSTIS	--	--	66 <1
....TETRAEDRON	2 2	--	200 2
...SCENEDESMACEAE			
....CRUCIGENIA	--	--	66 <1
....SCENEDESMUS	2 2	42 2	200 2
..ULOTRICHALES			
...ULOTRICHACEAE			
....ULOTHRIX	--	--	66 <1
..VOLVOCALES			
...CHLAMYDOMONADACEAE			
....CHLAMYDOMONAS	--	--	130 2
CHRYSOPHYTA (YELLOW-GREEN ALGAE)			
..BACILLARIOPHYCEAE			
...CENTRALES			
...COSCINODISCACEAE			
....CYCLOTELLA	--	21 <1	--
..PENNALES	2 2	--	--
...ACHNANTHACEAE			
....RHOICOSPHENIA			
....R. CURVATA	2 2	--	--
...GOMPHONEMATAACEAE			
....GOMPHONEMA	--	21 <1	--
...NAVICULACEAE			
....NAVICULA	5 3	--	66 <1
...NITZSCHIACEAE			
....NITZSCHIA	2 2	--	66 <1
..CHRYSOPHYCEAE			
...CHROMULINALES			
...CHROMULINACEAE			
....CHRYSOCCUS	--	210 9	--
....KEPHYRION	--	21 <1	--
CYANOPHYTA (BLUE-GREEN ALGAE)			
..CYANOPHYCEAE			
...OSCILLATORIALES			
...NOSTOCACEAE			
....ANABAENA	--	--	270 3
....APHANIZOMENON	3 2	--	--
...OSCILLATORIACEAE			
....OSCILLATORIA	2 2	--	--
EUGLENOPHYTA (EUGLENOIDS)			
..CRYPTOPHYCEAE			
...CRYPTOMONIDALES			
...CRYPTOCHRYSIDACEAE			
....RHODOMONAS	--	62 3	1400 16
...CRYPTOMONODACEAE			
....CRYPTOMONAS	2 2	21 <1	130 2
..EUGLENOPHYCEAE			
...EUGLENALES			
...EUGLENACEAE			
....TRACHELONAS	--	21 <1	66 <1
PYRRHOPHYTA (FIRE ALGAE)			
..DINOPHYCEAE			
...PERIDINIALES			
...CERATIAACEAE			
....CERATIMUM	--	--	130 2

& Biological organism estimated as dominant.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

470405095420001 STRAWBERRY LAKE NEAR PONSFORD, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING DEPTH (FEET) (000003)	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED AS CA (MG/L) (00915)	MAGNE- SIUM, DIS- SOLVED AS MG (MG/L) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)
------	------	--	---	---	--	---	---	---	---

AUG									
06...	0930	--	10	286	8.7	5	24	21	162
06...	1100	39.0	--	291	8.5	5	24	21	168

DATE	NITRO- GEN, NITRITE TOTAL (MG/L) AS N (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L) AS N (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L) AS N (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L) AS P (70507)	ARSENIC TOTAL (UG/L) AS AS (01002)	BARIUM, DIS- SOLVED (UG/L) AS BA (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L) AS BE (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L) AS CD (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L) AS CR (01034)
------	---	---	---	--	--	---	--	--	---

AUG									
06...	<0.01	<0.10	<0.01	0.04	1	55	<10	<1	5
06...	<0.01	<0.10	<0.01	0.19	2	55	<10	<1	8

DATE	COPPER, TOTAL RECOV- ERABLE (UG/L) AS CU (01042)	IRON, DIS- SOLVED (UG/L) AS FE (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L) AS PB (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L) AS HG (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L) AS NI (01067)	SELE- NIUM, TOTAL RECOV- ERABLE (UG/L) AS SE (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L) AS AG (01077)	CYANIDE TOTAL (MG/L) AS CN (00720)
------	--	---	--	--	--	---	--	--

AUG								
06...	4	7	<5	0.3	<1	<1	<1	<0.01
06...	44	5	18	0.4	1	<1	<1	<0.01

470500095323001 MANY POINT LAKE NEAR PONSFORD, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING DEPTH (FEET) (000003)	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	CALCIUM DIS- SOLVED AS CA (MG/L) (00915)	MAGNE- SIUM, DIS- SOLVED AS MG (MG/L) (00925)
------	------	--	---	---	--	---	---	---	---

AUG									
12...	1500	--	10	281	8.6	5	743	29	19
12...	1530	80.0	--	332	8.1	30	743	38	19

DATE	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE TOTAL (MG/L) AS N (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L) AS N (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L) AS N (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L) AS P (70507)	ARSENIC TOTAL (UG/L) AS AS (01002)	BARIUM, DIS- SOLVED (UG/L) AS BA (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L) AS BE (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L) AS CD (01027)
------	---	---	---	---	--	--	---	--	--

AUG									
12...	176	<0.01	<0.10	<0.01	<0.01	2	<100	<10	<1
12...	216	<0.01	<0.10	0.42	0.10	--	<100	<10	<1

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

470500095323001 MANY POINT LAKE NEAR PONSFORD, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOVERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOVERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI) (01067)	SELENIUM, TOTAL RECOVERABLE (UG/L AS SE) (01147)	SILVER, TOTAL RECOVERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
AUG									
12...	3	6	20	5	<0.1	3	<1	<1	<0.01
12...	4	27	1700	5	<0.1	2	--	1	<0.01

470730095450001 WHITE EARTH LAKE NEAR WHITE EARTH, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMPLING DEPTH (FEET) (00003)	SAMPLING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	SPECIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)
AUG									
06...	1430	--	10	301	8.7	5	--	21	176
06...	1530	85.0	--	334	8.0	5	35	20	197

DATE	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L AS P) (70507)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, TOTAL RECOVERABLE (UG/L AS BE) (01012)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD) (01027)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)
AUG									
06...	<0.01	<0.10	<0.01	<0.01	--	<100	<10	<1	--
06...	<0.01	<0.10	0.02	<0.01	2	71	<10	<1	2

DATE	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOVERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOVERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI) (01067)	SELENIUM, TOTAL RECOVERABLE (UG/L AS SE) (01147)	SILVER, TOTAL RECOVERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
AUG								
06...	3	<10	<5	0.2	2	<1	<1	
06...	20	100	12	0.4	<1	<1	<0.01	

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

470830095330001 ELBOW LAKE NEAR PONSFORD, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)
------	------	---	--	---	--	---	---	---	---

AUG									
07...	1100	--	10	309	8.6	5	36	19	180
07...	1200	46.0	--	373	7.7	30	45	20	221

DATE	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L AS P) (70507)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)
------	---	---	---	--	--	---	--	--	---

AUG									
07...	<0.01	<0.10	<0.01	<0.01	1	59	<10	<1	--
07...	<0.01	0.10	0.50	0.10	5	89	<10	1	3

DATE	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL RECOV- ERABLE (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
------	--	---	--	--	--	---	--	--

AUG								
07...	4	6	<5	0.2	4	<1	<1	<0.01
07...	49	1100	15	3.5	2	<1	<1	<0.01

470830095363001 TULLABY LAKE NEAR PONSFORD, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE TOTAL (MG/L AS N) (00615)
------	------	--	---	--	---	---	---	---	---

AUG									
13...	1000	5	285	8.7	5	29	20	180	<0.01

DATE	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L AS P) (70507)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)
------	---	---	--	--	---	--	--	---

AUG								
13...	<0.10	<0.01	<0.01	2	<100	<10	<1	4

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

470830095363001 TULLABY LAKE NEAR PONSFORD, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
AUG 13...	3	<10	<5	<0.1	3	<1	1	<0.01

471530095383001 NORTH TWIN LAKE NEAR NAYTAHWAUSCH, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, TOTAL (MG/L AS N) (00615)
AUG 13...	1200	5	295	8.6	5	29	22	197	<0.01

DATE	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L AS P) (70507)	ARSENIC TOTAL (UG/L AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L AS BA) (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L AS BE) (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) (01034)
AUG 13...	<0.10	<0.01	<0.01	3	<100	<10	<1	4

DATE	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
AUG 13...	6	<10	<5	0.1	4	<1	<1	<0.01

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

471900095330001 ROY LAKE NEAR NAYTAHWAUSCH, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L) AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L) AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE TOTAL (MG/L) AS N) (00615)
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AUG	13...	1400	5	284	8.9	5	15	25	169	<0.01
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DATE	NITRO- GEN, NO2+NO3 TOTAL (MG/L) AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L) AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L) AS P) (70507)	ARSENIC TOTAL (UG/L) AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L) AS BA) (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L) AS BE) (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L) AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L) AS CR) (01034)
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AUG	13...	<0.10	<0.01	<0.01	2	<100	<10	<1	3
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DATE	COPPER, TOTAL RECOV- ERABLE (UG/L) AS CU) (01042)	IRON, DIS- SOLVED (UG/L) AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L) AS PB) (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L) AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L) AS NI) (01067)	SELE- NIUM, TOTAL RECOV- ERABLE (UG/L) AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L) AS AG) (01077)	CYANIDE - TOTAL (MG/L) AS CN) (00720)
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AUG	13...	4	10	<5	<0.1	5	<1	1	<0.01
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472700095390001 ISLAND LAKE NEAR EBRO, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMP- LING INTER- VAL, DIST. FROM WS (FEET) (xxxxxx)	SPE- CIFIC CON- DUCT- ANCE LAB (US/CM) (90095)	PH LAB (STAND- ARD UNITS) (00403)	COLOR (PLAT- INUM- COBALT UNITS) (00080)	CALCIUM DIS- SOLVED (MG/L) AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L) AS MG) (00925)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NITRITE TOTAL (MG/L) AS N) (00615)
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AUG	13...	1700	5	286	8.6	5	27	20	187	<0.01
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DATE	NITRO- GEN, NO2+NO3 TOTAL (MG/L) AS N) (00630)	NITRO- GEN, AMMONIA TOTAL (MG/L) AS N) (00610)	PHOS- PHORUS, ORTHO, TOTAL (MG/L) AS P) (70507)	ARSENIC TOTAL (UG/L) AS AS) (01002)	BARIUM, DIS- SOLVED (UG/L) AS BA) (01005)	BERYL- LIUM, TOTAL RECOV- ERABLE (UG/L) AS BE) (01012)	CADMIUM TOTAL RECOV- ERABLE (UG/L) AS CD) (01027)	CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L) AS CR) (01034)
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AUG	13...	<0.10	<0.01	<0.01	1	<100	<10	<1	2
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ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

472700095390001 ISLAND LAKE NEAR EBRO, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) (01042)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) (01051)	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)	NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) (01067)	SELE- NIUM, TOTAL RECOV- ERABLE (UG/L AS SE) (01147)	SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) (01077)	CYANIDE TOTAL (MG/L AS CN) (00720)
AUG 13...	2	<10	<5	<0.1	4	<1	<1	<0.01

480000095000001 LOWER RED LAKE NEAR RED LAKE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)
* AUG		
08...	1000	0.1
08...	1030	<0.1
08...	1100	0.1
08...	1130	<0.1
08...	1200	<0.1
08...	1230	<0.1

480730094523001 UPPER RED LAKE NEAR RED LAKE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) (71900)
* AUG		
08...	1300	<0.1
08...	1330	<0.1
08...	1400	<0.1
08...	1430	<0.1

* Samples collected near the surface at different locations.

MISCELLANEOUS WATER QUALITY DATA COLLECTED AT CONTINUOUS-RECORD STATIONS

WATER QUALITY DATA AT STREAMFLOW STATIONS

Field determinations of water temperature and specific conductance are made at many streamflow stations in addition to those that are also regular water-quality stations. These data are usually collected at regular intervals during routine visits to the station. Additional data for each station are published elsewhere in this report.

WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)
04010500 PIGEON RIVER AT MIDDLE FALLS NEAR GRAND PORTAGE, MN							
OCT. 23, 1985.....	711	---	---	APR. 16.....	1,920	5.0	---
NOV. 14.....	486	.5	---	JUNE 04.....	562	16.5	110
JAN. 16, 1986.....	216	.0	100	JULY 09.....	274	19	---
JAN. 28.....	207	.5	---	JULY 14.....	386	19	---
MAR. 05.....	188	.0	103	JULY 14.....	379	19	---
MAR. 18.....	172	.5	---	AUG. 20.....	189	19.5	80
APR. 09.....	1,930	.5	---				
04014500 BAPTISM RIVER NEAR BEAVER BAY, MN							
OCT. 22, 1985.....	155	6.0	78	JUNE 03.....	46	13.5	72
DEC. 04.....	95	.0	---	JULY 09.....	95	16.5	75
JAN. 15, 1986.....	34	.0	103	AUG. 19.....	76	16.2	68
MAR. 04.....	25	.0	120	SEPT. 30.....	281	12.5	63
APR. 18.....	506	6.0	<50				
04015330 KNIFE RIVER NEAR TWO HARBORS, MN							
OCT. 24, 1985.....	152	6.0	108	APR. 08.....	595	2.0	62
DEC. 04.....	30	.0	135	JUNE 05.....	28	19.5	170
JAN. 17, 1986.....	1.4	.0	184	JULY 11.....	17	16.5	160
MAR. 04.....	.2	.0	200	AUG. 21.....	259	17	90
04015475 PARTRIDGE RIVER ABOVE COLBY LAKE NEAR HOYT LAKES, MN							
OCT. 18, 1985.....	149	5.0	65	APR. 10.....	434	3.0	<50
NOV. 26.....	41	.0	115	MAY 13.....	299	12	<50
JAN. 07, 1986.....	11	.0	95	JUNE 23.....	64	20.5	<50
FEB. 18.....	6.5	.0	---	AUG. 05.....	36	20.5	72
MAR. 31.....	52	.5	150	SEPT. 18.....	161	10.5	61
04016500 ST. LOUIS RIVER NEAR AURORA, MN							
OCT. 18, 1985.....	520	5.0	105	MAY 13.....	923	13.0	<50
NOV. 27.....	168	.0	390	JULY 02.....	179	23.5	50
JAN. 07, 1986.....	57	---	---	AUG. 05.....	158	20.5	72
FEB. 21.....	51	.0	---	SEPT. 18.....	444	10.5	116
APR. 10.....	978	---	---				

WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)
04018750 ST. LOUIS RIVER AT FORBES, MN							
OCT. 15, 1985.....	1,500	6.0	175	APR. 11.....	2,270	---	---
NOV. 27.....	403	.0	---	MAY 16.....	2,400	---	---
JAN. 09, 1986.....	418	---	---	JULY 03.....	413	21.5	196
JAN. 23.....	182	---	---	AUG. 05.....	368	19.5	230
FEB. 18.....	2.0	---	---	SEPT. 15.....	996	---	---
APR. 09.....	2,440	2.0	---				
04024000 ST. LOUIS RIVER AT SCANLON, MN							
OCT. 21, 1985.....	3,530	6.0	150	JUNE 02.....	1,520	20.5	100
DEC. 03.....	2,040	.0	190	JUNE 06.....	1,620	---	---
JAN. 14, 1986.....	1,480	.0	140	JULY 07.....	2,250	---	---
MAR. 03.....	1,580	.0	153	AUG. 18.....	1,900	22.5	160
APR. 07.....	12,700	3.0	82				
04024098 DEER CREEK NEAR HOLYOKE, MN							
OCT. 30, 1985.....	3.93	2.5	250	JUNE 25.....	5.93	14.5	200
JAN. 09, 1986.....	1.90	.0	---	AUG. 21.....	14.6	---	---
FEB. 19.....	1.70	.0	300				
MAY 14.....	23.5	---	180				
05046000 OTTER RAIL RIVER BELOW ORWELL DAM NEAR FERGUS FALLS, MN							
NOV. 27, 1985.....	599	.0	400	MAY 12.....	1,540	12.0	480
JAN. 09, 1986.....	602	.0	440	JULY 17.....	953	25.0	430
MAR. 11.....	587	2.0	540	AUG. 15.....	682	25.0	490
APR. 10.....	921	9.0	500	SEPT. 23.....	554	15.5	480
05050000 BOIS DE SIOUX RIVER NEAR WHITE ROCK, SOUTH DAKOTA							
NOV. 27, 1985.....	4.4	.0	1,770	APR. 29.....	1,230	21.0	700
FEB. 13, 1986.....	6.9	.0	6,020	MAY 22.....	1,150	---	---
MAR. 26.....	217	1.5	1,720	JULY 18.....	701	26.5	1,130
APR. 10.....	1,040	12.5	1,000	AUG. 13.....	130	---	---
APR. 17.....	271	6.5	700	SEPT. 23.....	78	18.0	810
05061000 BUFFALO RIVER NEAR HAWLEY							
OCT. 22, 1985.....	114	---	---	APR. 08.....	411	10.0	750
NOV. 22.....	56	.0	700	MAY 28.....	164	22.0	670
DEC. 19.....	46	.0	---	JULY 17.....	84	26.0	580
JAN. 28, 1986.....	36	.0	700	AUG. 12.....	28	18.5	780
MAR. 24.....	317	1.5	530				

WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)
05061500 SOUTH BRANCH BUFFALO RIVER AT SABIN, MN							
OCT. 23, 1985.....	31	9.5	920	APR. 08.....	751	10.0	930
NOV. 22.....	14	.0	1,240	MAY 09.....	180	12.0	890
DEC. 19.....	6.6	.0	1,340	JUNE 19.....	640	---	400
JAN. 27, 1986.....	4.7	.0	570	JULY 24.....	48	28.0	760
MAR. 24.....	666	1.0	650	AUG. 12.....	12	22.0	750
MAR. 28.....	1,710	---	---				
05062000 BUFFALO RIVER NEAR DILWORTH, MN							
OCT. 23, 1985.....	163	10	710	APR. 08.....	1,580	10.0	790
NOV. 22.....	68	.0	880	MAY 17.....	1,160	7.0	750
DEC. 19.....	56	.0	750	MAY 09.....	538	12.0	920
JAN. 27, 1986.....	45	.0	750	MAY 28.....	294	22.0	760
FEB. 25.....	44	.0	930	JUNE 19.....	1,040	---	290
MAR. 24.....	301	1.0	470	JULY 24.....	128	27.0	700
MAR. 28.....	3,430	3.5	535	AUG. 21.....	47	21.0	730
				SEPT. 25.....	486	17.0	810
05064000 WILD RICE RIVER AT HENDRUM, MN							
NOV. 06, 1985.....	246	4.0	530	MAY 22.....	1,190	---	---
DEC. 09.....	128	.0	630	JUNE 25.....	537	---	---
JAN. 23, 1986.....	121	.0	---	AUG. 13.....	86	21	475
FEB. 26.....	100	.0	---	SEPT. 24.....	173	---	---
APR. 02.....	3,410	6.0	550				
05067500 MARSH RIVER NEAR SHELLY, MN							
NOV. 06, 1985.....	2.6	4.0	710	MAY 22.....	30	15	760
DEC. 10.....	.58	.5	780	JUNE 25.....	53	21	480
JAN. 23, 1986.....	.44	.5	---	AUG. 12.....	5.6	16	325
FEB. 26.....	.39	---	---	SEPT. 23.....	.82	---	---
NOV. 02.....	381	---	---				
05069000 SANDHILL RIVER AT CLIMAX, MN							
NOV. 05, 1985.....	48	3.0	700	MAY 20.....	216	16	570
DEC. 10.....	41	.0	620	JUNE 25.....	84	22	590
JAN. 23, 1986.....	29	.0	---	AUG. 12.....	24	18	575
FEB. 26.....	21	.0	---	SEPT. 23.....	41	14	620
APR. 02.....	924	6.0	400				

WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1984 TO SEPTEMBER 1985

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)
05074500 RED LAKE RIVER NEAR RED LAKE, MN							
NOV. 06, 1985.....	984	4.5	320	APR. 17.....	995	4.0	270
DEC. 19.....	764	.0	---	MAY 22.....	1,370	15.5	400
JAN. 31, 1986.....	798	---	---	JULY 18.....	1,270	23	265
MAR. 14.....	751	.5	315	AUG. 29.....	884	16	---
05075000 RED LAKE AT HIGH LANDING NEAR GOODRIDGE, MN							
NOV. 06, 1985.....	1,170	4.0	323	APR. 01.....	1,710	---	---
DEC. 18.....	772	.0	350	MAY 30.....	1,490	22	265
JAN. 30, 1986.....	820	.0	280	JULY 17.....	1,070	---	---
MAR. 13.....	844	.0	280	AUG. 27.....	860	---	---
05076000 THIEF RIVER NEAR THIEF RIVER FALLS, MN							
NOV. 06, 1985.....	340	3.0	520	APR. 02.....	2,360	4.0	325
DEC. 18.....	42	.0	720	MAY 20.....	1,100	16	675
JAN. 30, 1986.....	3.2	.0	800	JULY 17.....	28	25	570
MAR. 14.....	2.6	.0	1,200	AUG. 27.....	.19	---	---
MAR. 27.....	670	---	---				
05078000 CLEARWATER RIVER AT PLUMMER, MN							
NOV. 04, 1985.....	129	4.0	520	APR. 01.....	1,100	---	---
DEC. 09.....	96	.5	425	APR. 03.....	918	4.5	440
JAN. 21, 1986.....	62	.0	410	MAY 20.....	398	16	660
FEB. 12.....	71	---	---	JUNE 23.....	107	23	490
FEB. 24.....	73	.0	500	AUG. 11.....	134	18.5	800
MAR. 13.....	120	.0	475	SEPT. 22.....	79	15	525
MAR. 27.....	486	---	---				
05078230 LOST RIVER AT OKLEE, MN							
NOV. 04, 1985.....	43	2.5	700	APR. 29.....	1,100	---	---
DEC. 09.....	32	.5	595	MAY 20.....	145	17	510
JAN. 21, 1986.....	19	.0	650	JUNE 24.....	34	21	750
FEB. 24.....	15	.0	565	JULY 23.....	21	---	---
MAR. 27.....	731	---	---	AUG. 11.....	14	18	740
MAR. 31.....	1,080	---	---	SEPT. 22.....	27	13.5	480

WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)
05078500 CLEAR WATER RIVER AT RED LAKE FALLS, MN							
NOV. 05, 1985.....	278	2.5	580	MAY 20.....	958	15.5	730
DEC. 10.....	178	.5	500	JUNE 24.....	157	20	540
JAN. 22, 1986.....	121	.0	580	AUG. 11.....	186	21	690
FEB. 27.....	130	.0	550	SEPT. 23.....	119	13.5	560
APR. 03.....	2,540	4.5	470				
05079000 RED LAKE RIVER AT CROOKSTON, MN							
NOV. 05, 1985.....	1,730	4.5	395	MAY 19.....	3,860	15.5	389
DEC. 10.....	1,040	.0	350	JUNE 24.....	1,580	21.5	360
JAN. 22, 1986.....	979	.0	392	AUG. 12.....	1,210	21	357
FEB. 27.....	928	.0	280	SEPT. 23.....	1,100	14.5	335
APR. 02.....	9,730	6.0	410				
05087500 MIDDLE RIVER AT ARGYLE, MN							
NOV. 05, 1985.....	12	4.0	735	APR. 02.....	922	6.0	375
DEC. 18.....	3.5	.0	---	MAY 29.....	36	22	660
JAN. 29, 1986.....	3.9	---	---	JULY 17.....	3.1	---	---
MAR. 13.....	2.7	.0	880	AUG. 28.....	.12	---	---
MAR. 27.....	350	---	---				
05094000 SOUTH BRANCH TWO RIVERS AT LAKE BRONSON, MN							
NOV. 05, 1985.....	42	5.5	575	MAR. 26.....	600	---	---
DEC. 17.....	17	.0	---	MAY 28.....	102	22	480
JAN. 29, 1986.....	2.8	---	---	JULY 16.....	8.9	23	500
MAR. 13.....	2.1	1.0	820	AUG. 28.....	2.2	---	---
05104500 ROSEAU RIVER BELOW SOUTH FORK RIVER NEAR MALUNG, MN							
NOV. 04, 1985.....	104	2.0	410	APR. 03.....	2,040	---	---
DEC. 16.....	28	.0	433	MAY 27.....	121	21	365
JAN. 28, 1986.....	15	---	---	JULY 14.....	11	20.5	375
MAR. 12.....	16	.0	680	AUG. 25.....	.28	---	---
05107500 ROSEAU RIVER AT ROSS, MN							
NOV. 05, 1985.....	252	2.0	415	MAY 28.....	1,530	22	345
DEC. 17.....	60	.0	500	JULY 15.....	120	19	285
JAN. 27, 1986.....	28	---	---	JULY 15.....	111	---	---
MAR. 13.....	24	.0	605	AUG. 26.....	17	18	370
APR. 03.....	2,440	4.0	240				

WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCT- TANCE (MICRO- SIEMANS)
05112000 ROSEAU RIVER BELOW STATE DITCH 51 NEAR CARIBOU, MN							
NOV. 05, 1985.....	442	3.0	455	MAY 06.....	2,120	13	335
DEC. 17.....	57	.0	560	MAY 28.....	1,960	24	350
JAN. 28, 1986.....	26	.0	530	JUNE 10.....	1,190	19	---
MAR. 12.....	73	.0	---	JULY 16.....	167	23	330
APR. 03.....	1,530	3.0	235	AUG. 18.....	13	23	---
MAY 05.....	2,140	13	335	AUG. 26.....	29	17	388
05124480 KAWISHIWI RIVER NEAR ELY, MN							
OCT. 16, 1985.....	187	6.0	29	JULY 01.....	187	---	---
JAN. 08, 1986.....	99	---	---	AUG. 06.....	227	22.5	29
FEB. 19.....	62	1.0	23	SEPT. 19.....	161	---	---
MAY 12.....	775	12	23				
05127000 KAWISHIWI RIVER NEAR WINTON, MN							
MAY 14, 1986.....	3,410	14	<50	SEPT. 16.....	891	---	---
05127500 BASSWOOD RIVER NEAR WINTON, MN							
MAY 15, 1986.....	5,040	---	---	JUNE 10.....	2,210	18	---
05128000 NAMAKAN RIVER AT OUTLET OF LAC LA CROIX, ONTARIO							
MAY 27, 1986.....	12,500	14	---	JUNE 18.....	7,150	---	---
05129115 VERMILLION RIVER NEAR CRANE LAKE, MN							
OCT. 16, 1985.....	1,390	5.0	65	APR. 14.....	1,560	---	---
NOV. 26.....	568	---	---	MAY 06.....	2,380	---	---
JAN. 06, 1986.....	372	---	---	JUNE 30.....	1,230	22	62
MAR. 05.....	284	.5	---	AUG. 04.....	511	22.5	70
APR. 08.....	2,150	2.0	<50	SEPT. 15.....	428	14	65
05129290 GOLD PORTAGE OUTLET FROM KABETOGAMA LAKE NEAR RAY, MN							
OCT. 02, 1985.....	615	10	90	JUNE 17.....	501	17	90
NOV. 13.....	220	2.0	90	JULY 29.....	588	23	85
MAY 06, 1986.....	138	11	130	SEPT. 10.....	568	---	---
05130500 STURGEON RIVER NEAR CHISHOLM, MN							
OCT. 15, 1985.....	276	6.0	65	APR. 07.....	516	2.0	70
NOV. 25.....	104	.5	115	JUNE 30.....	89	20.5	100
JAN. 09, 1986.....	47	.5	50	AUG. 04.....	42	20	110
FEB. 19.....	26	---	---	SEPT. 15.....	80	10	72
APR. 09.....	602	2.0	70				

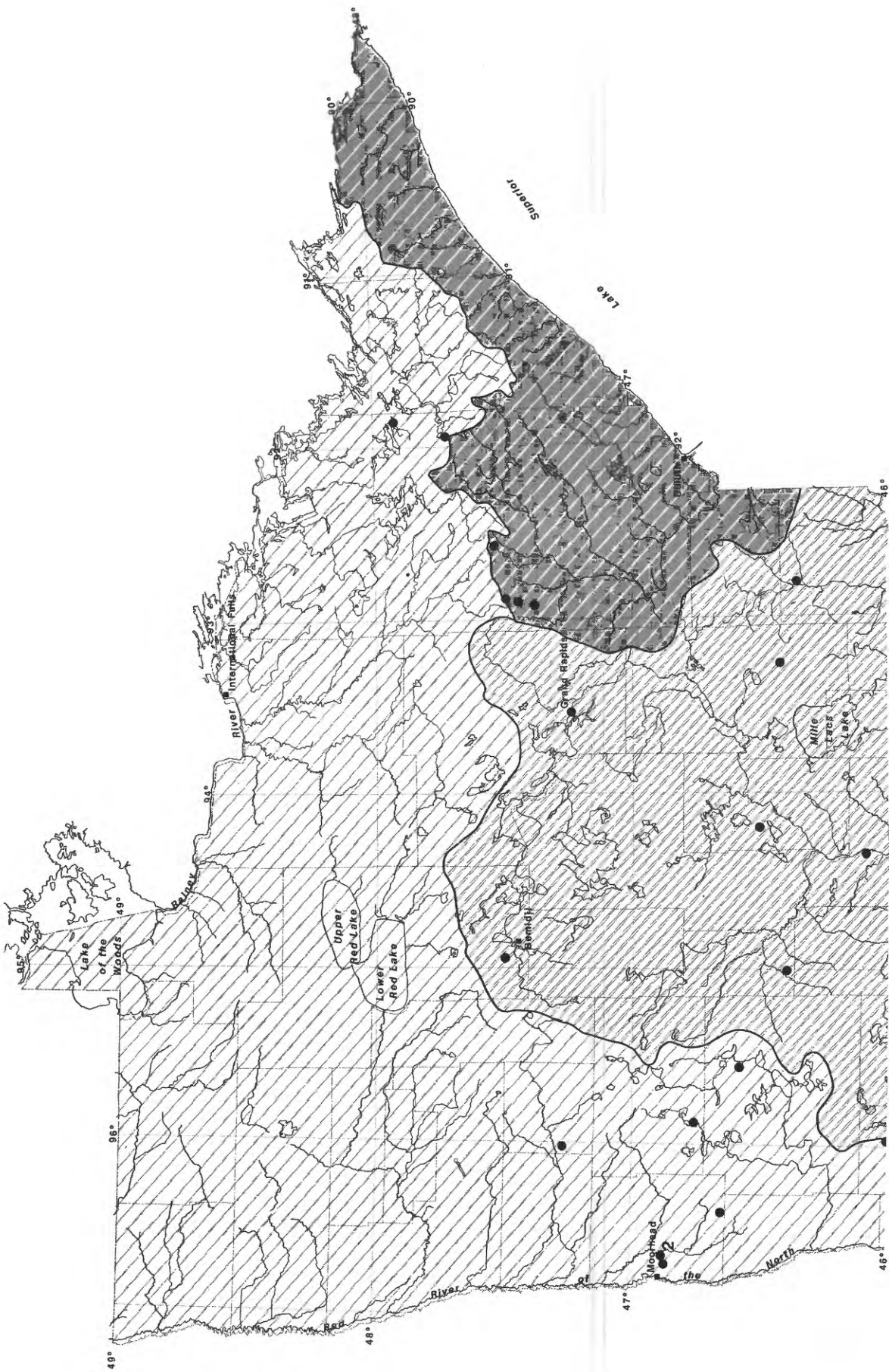
WATER QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCTANCE (MICRO- SIEMANS)	DATE	MEASURED DISCHARGE (ft ³ /s)	TEMPERA- TURE (°C)	SPECIFIC CONDUCTANCE (MICRO- SIEMANS)
05131500 LITTLE FORK RIVER AT LITTLEFORK, MN							
OCT. 01, 1985.....	1,860	8.0	90	APR. 08.....	5,820	2.0	70
NOV. 12.....	814	1.0	130	MAY 05.....	5,520	11	75
DEC. 17.....	369	.0	70	JUNE 17.....	729	17	135
FEB. 04, 1986.....	195	.0	210	JULY 28.....	631	24	145
MAR. 24.....	239	.0	250	SEPT. 08.....	655	15	162
05132000 BIG FORK RIVER AT BIG FALLS, MN							
OCT. 01, 1985.....	1,460	7.0	150	APR. 07.....	4,050	---	---
NOV. 12.....	548	1.0	195	MAY 05.....	4,020	13.5	120
DEC. 16.....	589	---	---	JUNE 16.....	604	18	240
FEB. 03, 1986.....	324	.5	280	JULY 28.....	765	23.5	195
MAR. 24.....	375	.0	---	SEPT. 08.....	502	---	---
05133500 RAINY RIVER AT MANITOU RAPIDS, MN							
OCT. 02, 1985.....	30,400	10	70	JUNE 09.....	20,400	19	---
MAR. 25, 1986.....	10,300	1.0	120	JULY 29.....	11,000	25	100

Ground-Water Records



Collecting a soil sample
St. Joseph's, Minnesota wetlands
November 1985



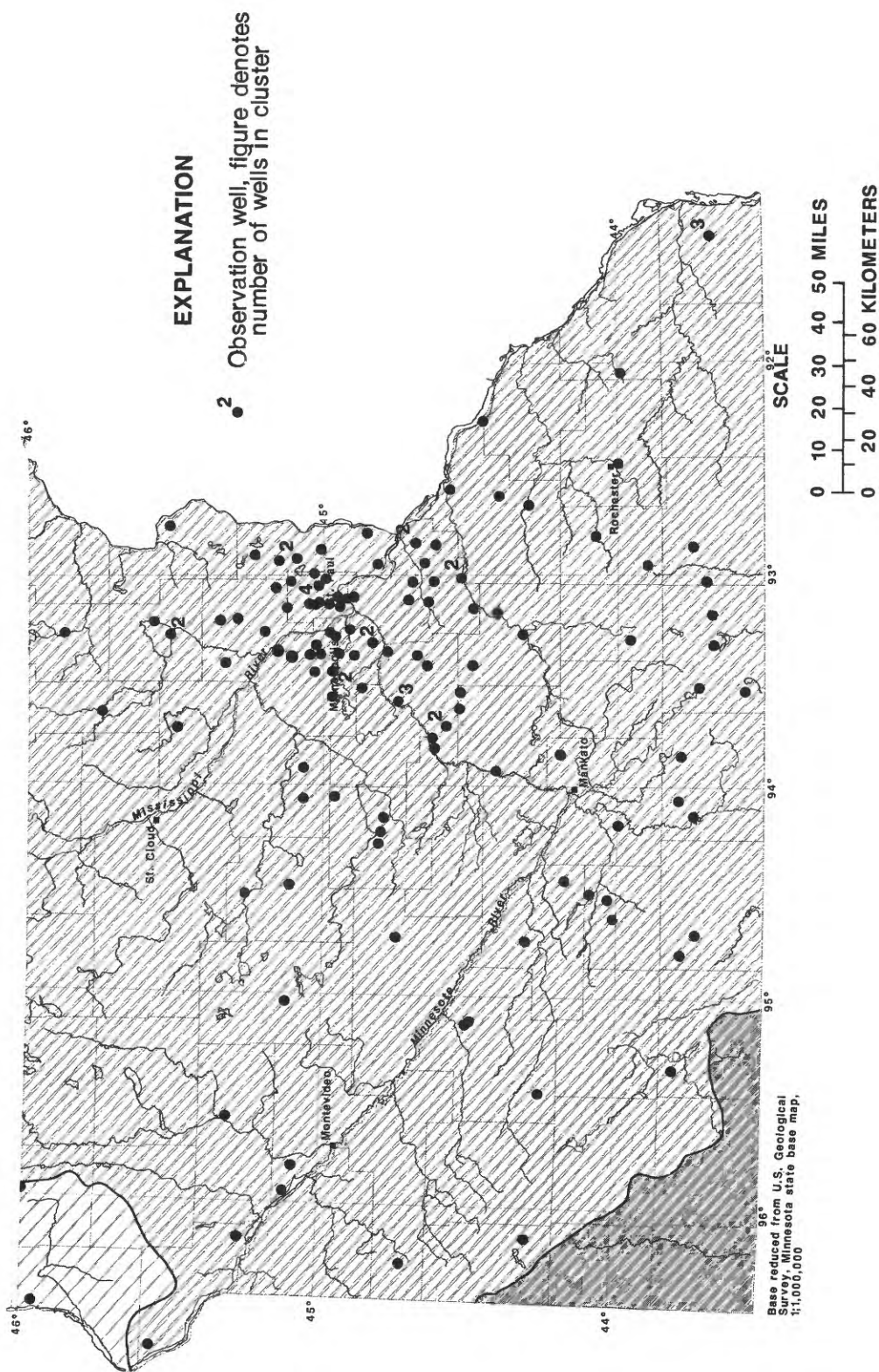


Figure 11.--Location of ground-water wells

GROUND-WATER LEVELS

BECKER COUNTY

464613095524801. Local number, 138N41W17ADA01.

LOCATION.--Lat 46°46'13", long 95°52'48", in NE¼SE¼NE¼ sec.17, T.138 N., R.41 W., Hydrologic Unit 09020103, east shore of Lake Sallie.

Owner: U.S. Geological Survey.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in (0.15 m), depth 234 ft (71.3 m), screened 222 to 234 ft (67.7 to 71.3 m).

DATUM.--Land-surface datum is 1,333.2 ft (406.4 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 4.40 ft (1.34 m) above land-surface datum.

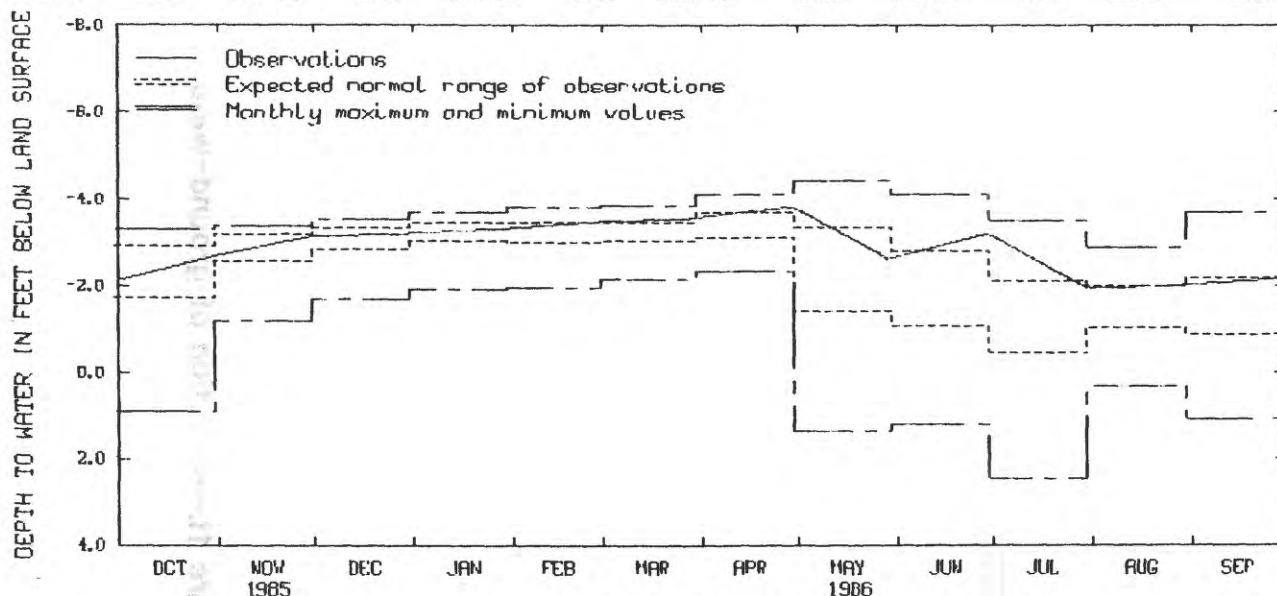
REMARKS.--Water level affected by pumping of nearby well.

PERIOD OF RECORD.--March 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 4.44 ft (1.35 m) above land-surface datum, May 23, 27, 1975; lowest, 2.47 ft (0.75 m) below land-surface datum, July 25, 1977.

WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 31	2.70	DEC 30	3.20	FEB 28	3.45	APR 30	3.80	JUN 30	3.20	AUG 29	2.00
NOV 29	3.10	JAN 31	3.30	MAR 28	3.55	MAY 30	2.62	JUL 31	1.90	SEP 30	2.15



138N41W17AD001

CLAY COUNTY

463854096250701. Local number, 137N45W30CDB01.

LOCATION.--Lat 46°38'54", long 96°25'07", in NW¼SE¼SW¼ sec.30, T.137 N., R.45 W., Hydrologic Unit 09020106, in Barnesville.

Owner: City of Barnesville, well 3.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 10 in (0.25 m), depth 73 ft (22.2 m).

DATUM.--Altitude of land-surface datum is 1,022 ft (312 m). Measuring point: Top of casing, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--January 1949 to January 1975, May 1980 to current year.

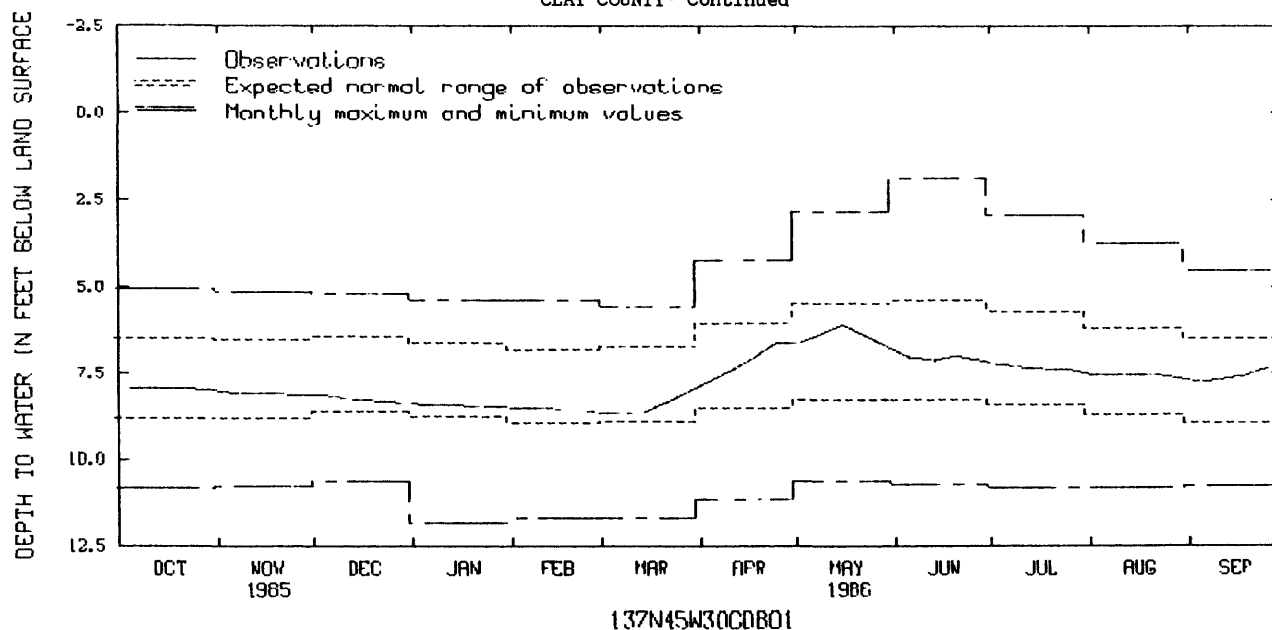
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.86 ft (0.57 m) below land-surface datum, June 9, 1962; lowest, 11.86 ft (3.61 m) below land-surface datum, June 3, 1970.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	7.94	NOV 29	8.14	FEB 7	8.52	APR 11	7.40	JUN 13	7.15	AUG 1	7.57
18	7.95	DEC 6	8.16	14	8.55	18	7.07	20	7.05	22	7.56
25	7.97	13	8.28	21	8.56	25	6.65	JUL 3	7.25	SEP 5	7.80
NOV 1	8.03	20	8.32	28	8.65	MAY 2	6.63	11	7.38	12	7.72
8	8.13	27	8.37	MAR 7	8.68	16	6.12	18	7.40	19	7.60
15	8.10	JAN 3	8.42	14	8.66	JUN 6	7.06	25	7.40	26	7.36
22	8.13	31	8.52	21	8.38						

GROUND-WATER LEVELS

CLAY COUNTY--Continued



465237096383901. Local number, 139N47W05CDC01.

LOCATION.--Lat 46°52'37", long 96°38'39", in SW¼SE¼SW¼ sec.5, T.139 N., R.47 W., Hydrologic Unit 09020104, 2.4 mi (3.9 km) east of Dilworth.

Owner: City of Moorhead, MS-1.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 8 in (0.20 m), depth 131 ft (39.9 m), slotted 91 to 107 ft (27.7 to 32.6 m).

DATUM.--Land-surface datum is 916.7 ft (279.4 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder floor, 3.60 ft (1.10 m) above land-surface datum.

REMARKS.--Water level affected by pumping from nearby wells.

PERIOD OF RECORD.--January 1947 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 12.19 ft (3.72 m) below land-surface datum, July 15, 1947; lowest, 31.59 ft (9.63 m) below land-surface datum, Aug. 3, 1984.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 22	29.99	DEC 19	29.46	FEB 25	29.62	APR 17	29.53	JUN 19	29.18	AUG 12	28.88

GROUND-WATER LEVELS

GRANT COUNTY

455932095582601. Local number, 129N42W09CCC01.

LOCATION.--Lat 45°59'32", long 95°58'26", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.129 N., R.42 W., Hydrologic Unit 09020102, in Elbow Lake.

Owner: City of Elbow Lake, old well 2.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 214 ft (65.2 m), screened 200 to 220 ft (61.0 to 67.1 m).

DATUM.--Altitude of land-surface datum is 1,222 ft (372 m). Measuring point: Top of platform, 1.40 ft (0.43 m) above land-surface datum.

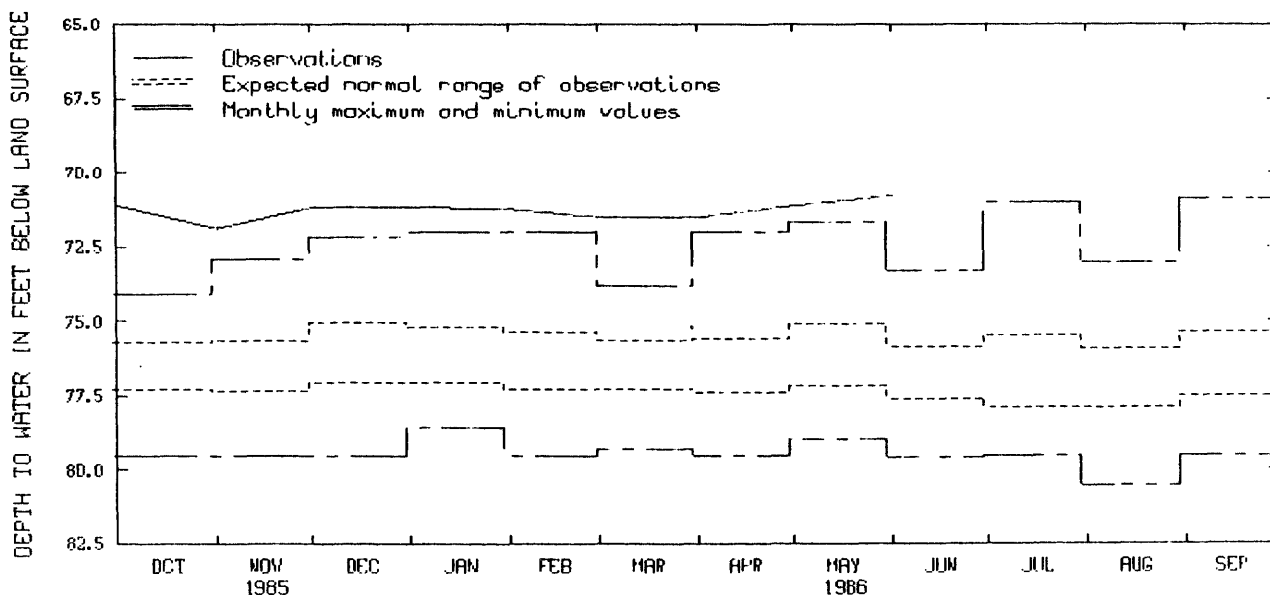
REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--February 1964 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 70.80 ft (21.57 m) below land-surface datum, June 4, 1986; lowest, 80.54 ft (24.55 m) below land-surface datum, Aug. 31, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 1	71.10	DEC 2	71.20	FEB 3	71.30	APR 4	71.50	APR 30	71.20	JUN 4	70.80
NOV 1	71.90	26	71.20	28	71.50						



129N42W09CCC01

ITASCA COUNTY

473840093515101. Local number, 148N25W08DDD01.

LOCATION.--Lat 47°38'40", long 93°51'51", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.8, T.148 N., R.25 W., Hydrologic Unit 09030006, at Spring Lake.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 10 ft (3.0 m), screened 8 to 10 ft (2.4 to 3.0 m).

DATUM.--Altitude of land-surface datum is 1,350 ft (411 m). Measuring point: Top of casing, 3.40 ft (1.04 m) above land-surface datum.

PERIOD OF RECORD.--September 1970 to current year.

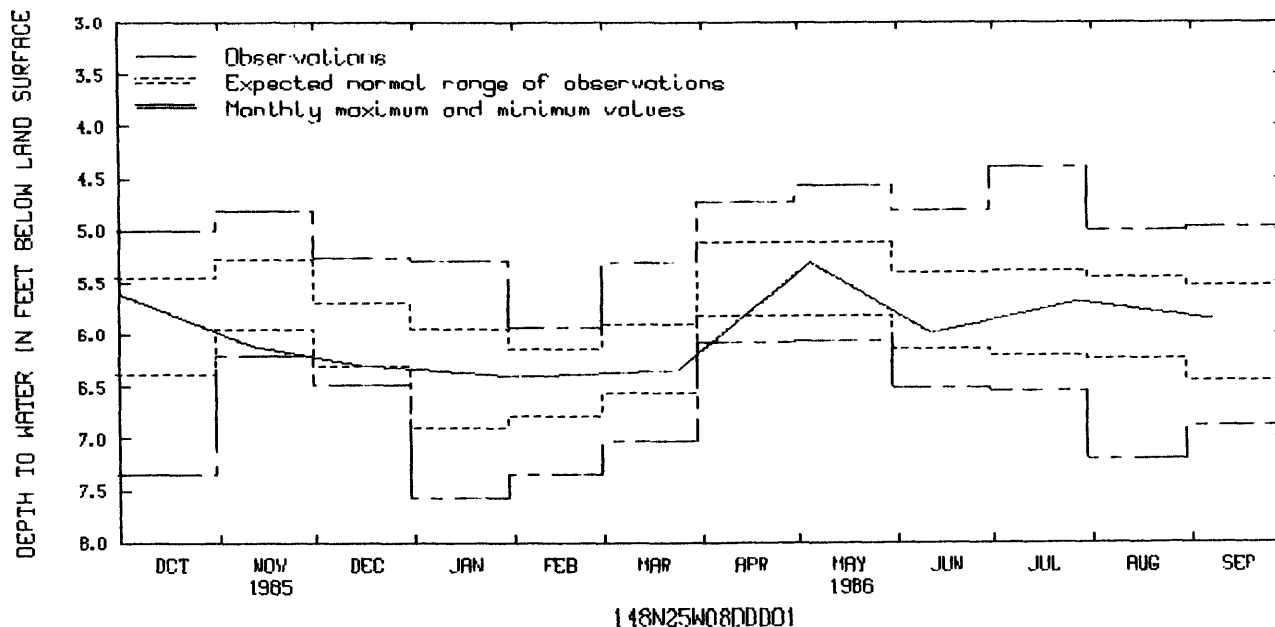
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 4.40 ft (1.34 m) below land-surface datum, July 13, 1979; lowest, 7.57 ft (2.30 m) below land-surface datum, Jan. 22, 1985.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 1	5.62	DEC 16	6.31	MAR 24	6.35	JUN 12	6.00	JUL 28	5.70	SEP 8	5.87
NOV 12	6.12	FEB 3	6.42	MAY 5	5.31						

GROUND-WATER LEVELS

ITASCA COUNTY--Continued



MAHNOMEN COUNTY

471653096020301. Local number, 144N42W20BBA01.

LOCATION.--Lat 47°16'53", long 96°02'03", in NE1/4NW1/4 sec.20, T.144 N., R.42 W., Hydrologic Unit 09020108, about 3 mi (4.8 km) southwest of Mahanomen.

Owner: Tom Wendt.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in (0.10 m), depth 130 ft (39.6 m).

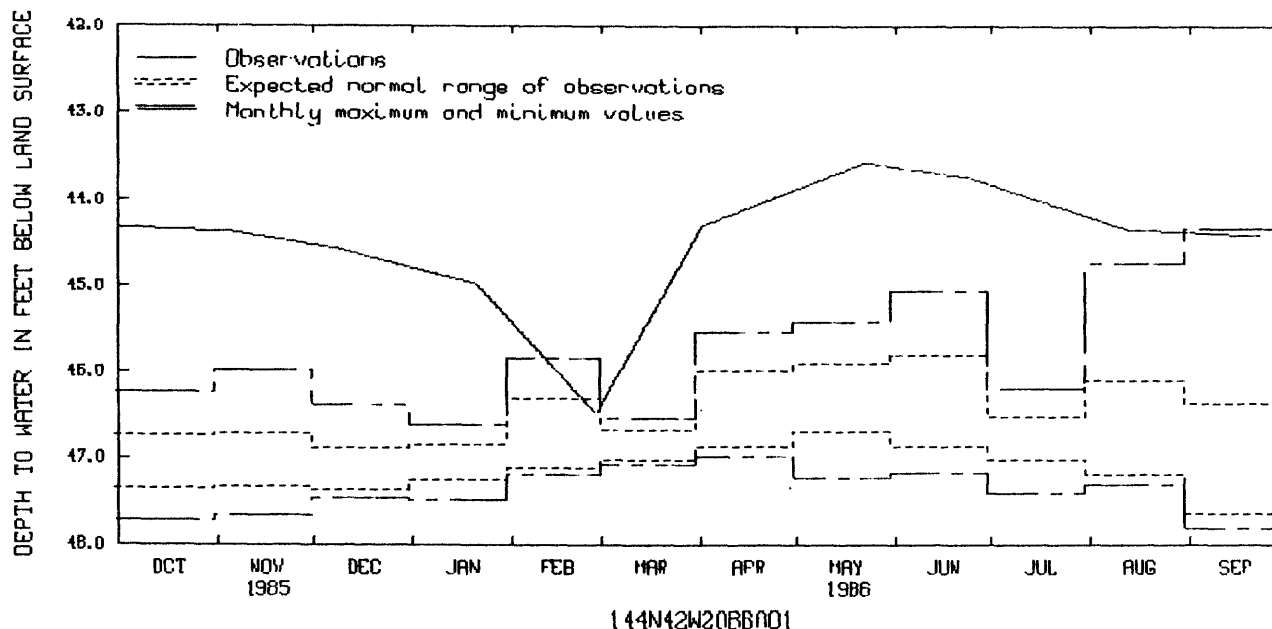
DATUM.--Altitude of land-surface datum is 1,197 ft (365 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--August 1964 to September 1969, August 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 43.58 ft (13.58 m) below land-surface datum, May 22, 1986; lowest, 47.81 ft (14.57 m) below land-surface datum, Sept. 16, 1981.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 6	44.39	JAN 21	44.99	APR 1	44.31	JUN 25	43.75	SEP 24	44.42
DEC 9	44.58	FEB 27	46.49	MAY 22	43.58	AUG 13	44.35		



GROUND-WATER LEVELS

175

OTTER TAIL COUNTY

463956095352601. Local number, 137N39W22ACD01.

LOCATION.--Lat 46°39'56", long 95°35'26", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.22, T.137 N., R.39 W., Hydrologic Unit 09020103, 4.5 mi (7.2 km) north of Perham.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in (0.10 m), depth 24 ft (7.3 m), screened 21 to 24 ft (6.4 to 7.3 m).

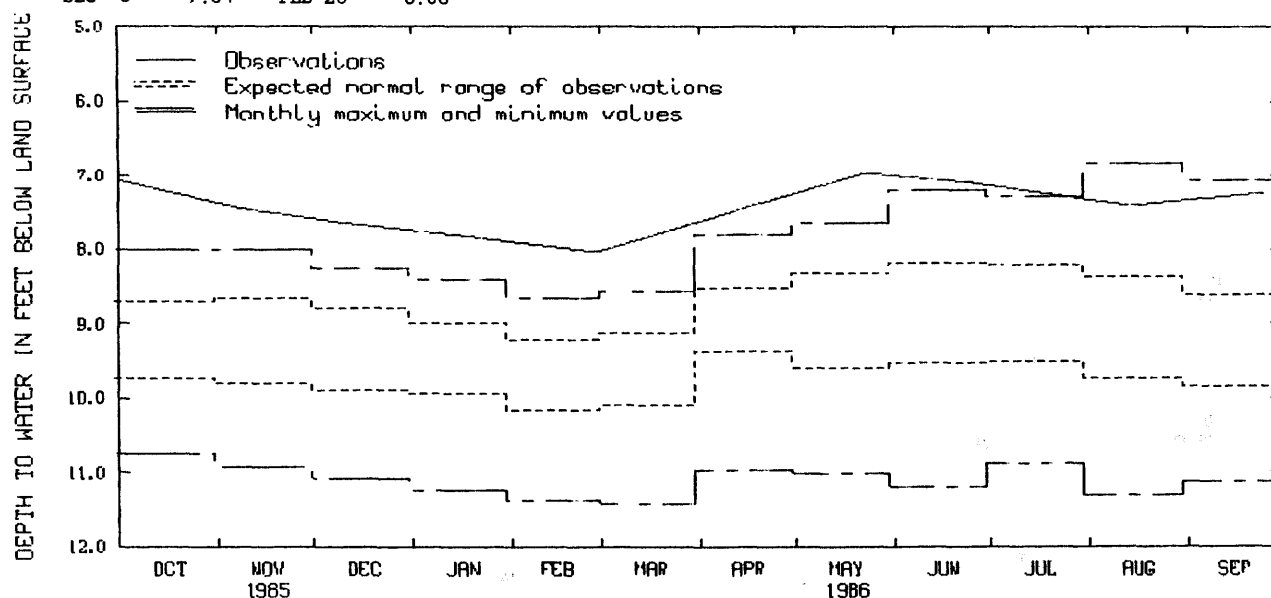
DATUM.--Altitude of land-surface datum is 1,370 ft (418 m). Measuring point: Top of casing, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--December 1967 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 6.84 ft (2.08 m) below land-surface datum, Aug. 12, 1985; lowest, 11.41 ft (3.48 m) below land-surface datum, Mar. 10, 15, 1977.

WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	7.44	JAN 21	7.86	MAY 23	6.97	JUN 26	7.10	AUG 14	7.42	SEP 25	7.24
DEC 9	7.64	FEB 28	8.06								



137N39W22ACD01

ST. LOUIS COUNTY

472638092533601. Local number, 057N20W05DAD01.

LOCATION.--Lat 47°26'38", long 92°53'36", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.5, T.57 N., R.20 W., Hydrologic Unit 04010201, 2.5 mi (4.0 km) east of Hibbing.

Owner: Burlington Northern, Inc.

AQUIFER.--Biwabik Iron Formation of Middle Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 430 ft (131 m), cased to 315 ft (96.0 m).

DATUM.--Altitude of land-surface datum is 1,470 ft (448 m). Measuring point: Top of platform, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--August 1955 to current year.

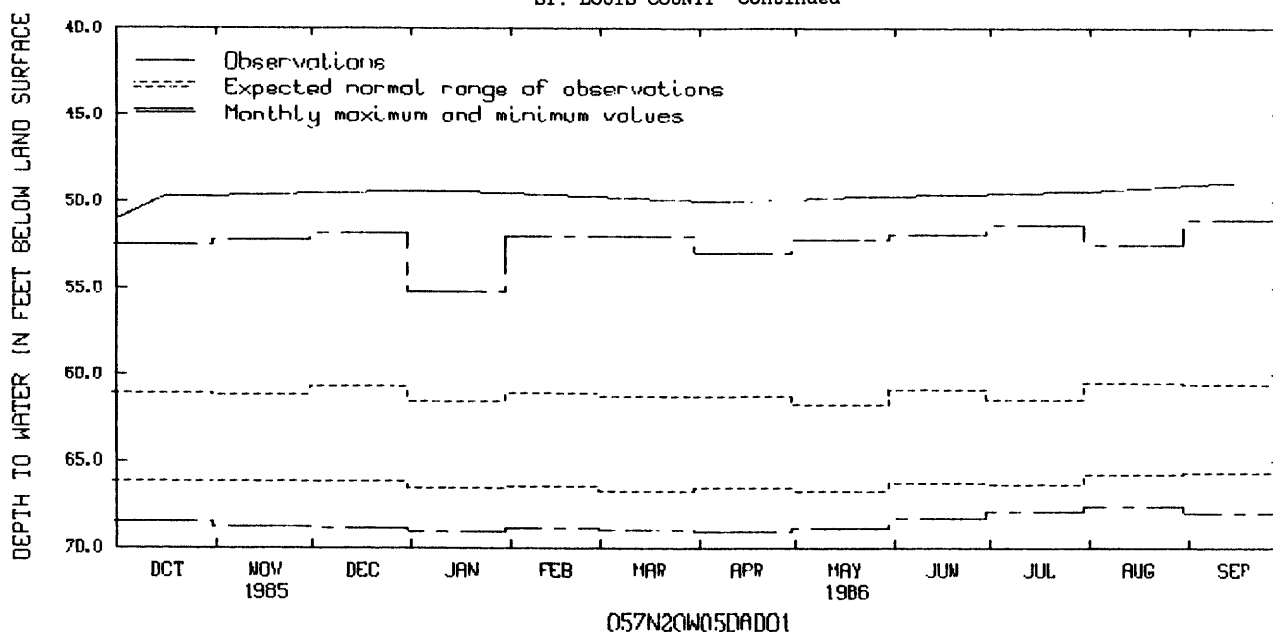
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 48.99 ft (14.93 m) below land-surface datum, Sept. 15, 1986; lowest, 69.07 ft (21.05 m) below land-surface datum, Jan. 15, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 15	49.77	JAN 9	49.47	APR 11	50.10	JUN 30	49.64	AUG 4	49.40	SEP 15	48.99
NOV 26	49.58	FEB 19	49.70	MAY 16	49.84						

GROUND-WATER LEVELS

ST. LOUIS COUNTY--Continued



472230092561001. Local number, 057N20W31D001.

LOCATION.--Lat 47°22'30", long 92°56'10", in SW¼NW¼SE¼ sec.31, T.57 N., R.20 W., Hydrologic Unit 04010201, 1.4 mi (2.25 km) south of Hibbing.

Owner: Mesaba County Club.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian and water-table well, diameter 18 in (0.46 m), depth 92 ft (28.0 m), screened 82 to 92 ft (25.0 to 28.0 m).

DATUM.--Altitude of land-surface datum is 1,391 ft (424 m). Measuring point: Hole east side of pump base, 3.00 ft (0.91 m) above land-surface datum.

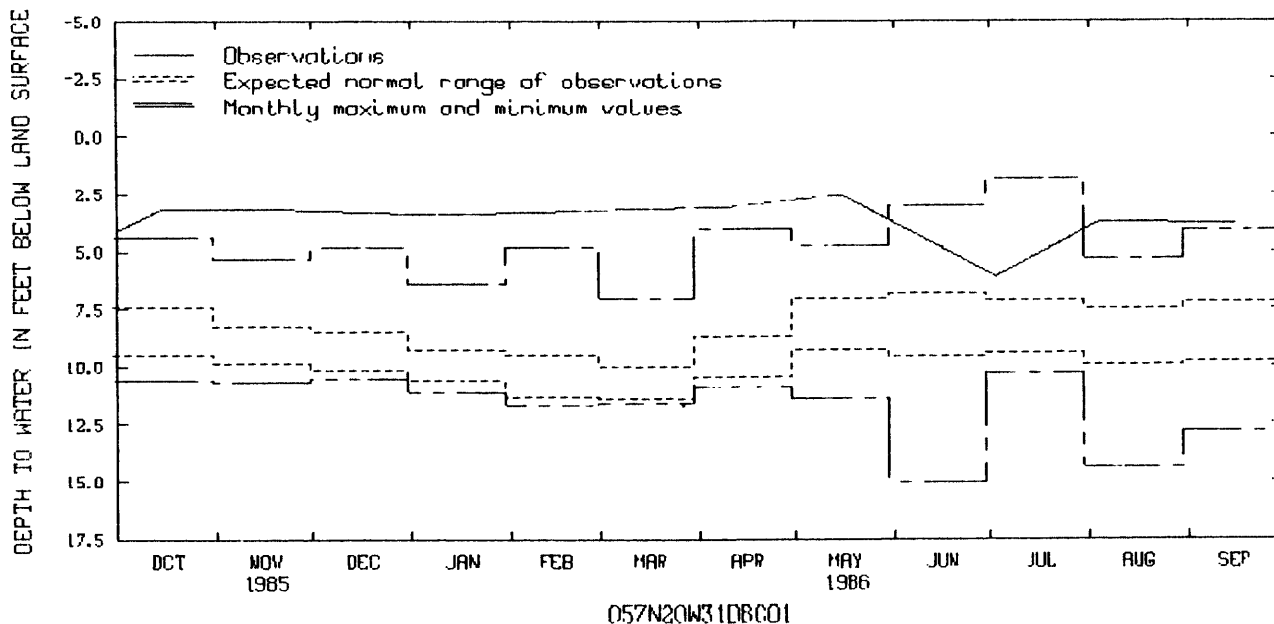
REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--February 1958 to March 1965, July 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.82 ft (0.55 m) below land-surface datum, July 26, 1985; lowest, 15.05 ft (3.56 m) below land-surface datum, June 30, 1980.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 15	3.14	JAN 9	3.45	MAY 16	2.60	JUL 3	6.10	AUG 4	3.73	SEP 16	3.91
NOV 26	3.22	APR 11	3.05								



GROUND-WATER LEVEL

ST. LOUIS COUNTY--Continued

473102092345001. Local number, 058N18W12CCC01.

LOCATION.--Lat 47°31'02", long 92°34'50", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.12, T.58 N., R.18 W., Hydrologic Unit 04010201, 1 mi (1.6 km) west of Virginia.

Owner: U.S. Steel Corp.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in (0.15 m), depth 97 ft (29.6 m), slotted casing between 67 to 97 ft (20.4 to 29.6 m).

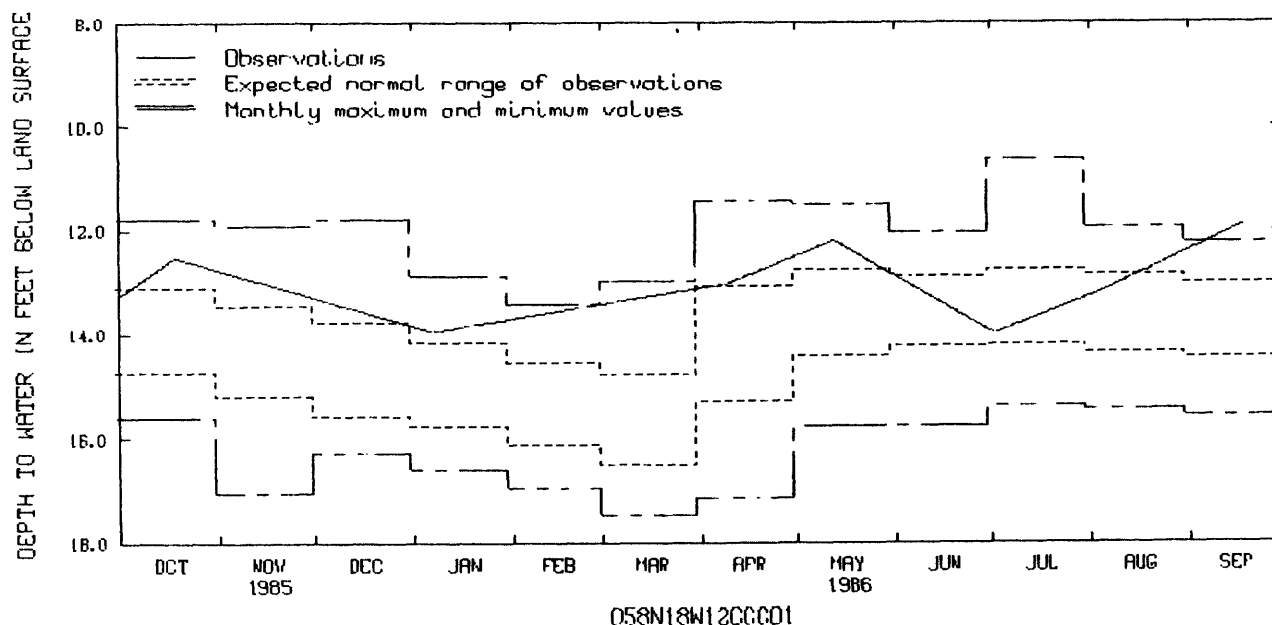
DATUM.--Land-surface datum is 1,427.5 ft (435.1 m) National Geodetic Vertical Datum of 1929. Measuring point: Edge of vent pipe, 1.90 ft (0.58 m) above land-surface datum.

PERIOD OF RECORD.--December 1954 to July 1964, July 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.64 ft (3.24 m) below land-surface datum, July 20, 1957; lowest, 17.47 ft (5.32 m) below land-surface datum, Apr. 2, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 18	12.52	FEB 8	13.65	MAY 13	12.19	JUL 2	14.01	AUG 4	13.18	SEP 18	11.91
JAN 7	13.97	APR 9	13.04								



473011092524301. Local number, 058N20W16DBC01.

LOCATION.--Lat 47°30'11", long 92°52'43", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.16, T.58 N., R.20 W., Hydrologic Unit 04010201, in Chisholm.

Owner: City of Chisholm.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in (0.30 m), depth 40 ft (12.2 m), screened 30 to 40 ft (9.1 to 12.2 m).

DATUM.--Altitude of land-surface datum is 1,500 ft (457 m). Measuring point: Top of wood platform, 1.70 ft (0.52 m) above land-surface datum.

REMARKS.--Water level affected by pumping. Water-level subject to freezing during winter months.

PERIOD OF RECORD.--August 1953 to current year.

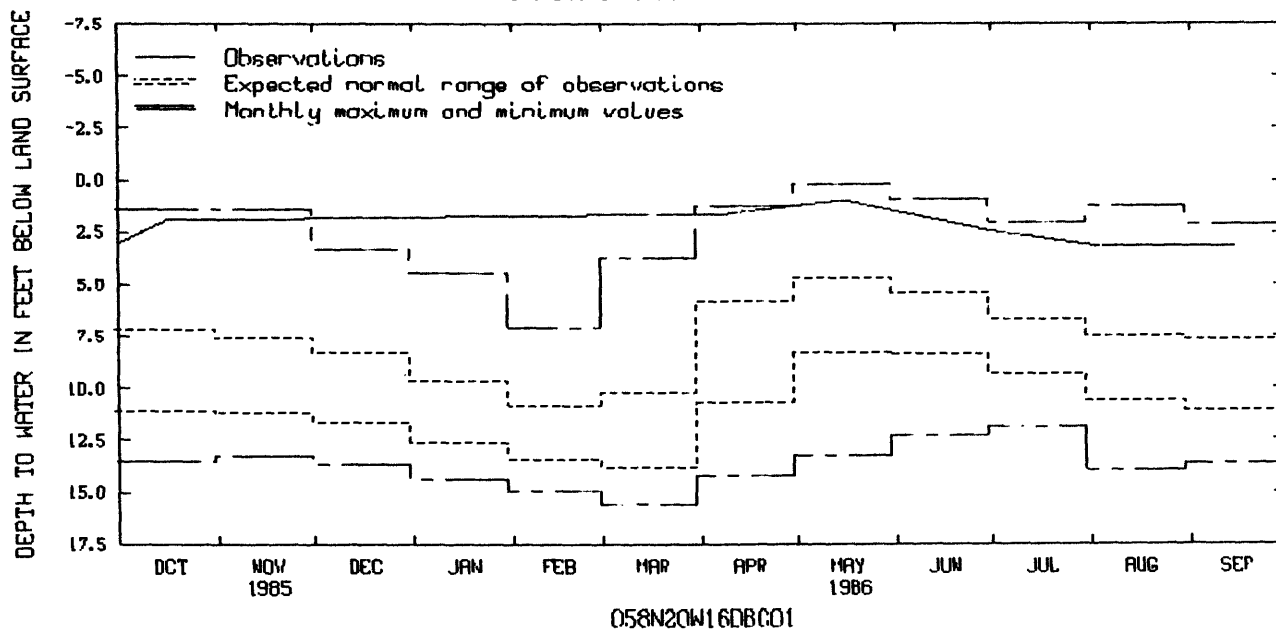
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 0.23 ft (0.07 m) below land-surface datum, May 10, 1954; lowest, 15.60 ft (4.75 m) below land-surface datum, Mar. 23-24, 1957.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 15	1.93	MAY 16	0.99	AUG 4	3.21	SEP 15	3.13
APR 9	1.62	JUN 30	2.45				

GROUND-WATER LEVEL

ST. LOUIS COUNTY--Continued



474253091574101. Local number, 060N13W01BBA01.

LOCATION.--Lat 47°42'53", long 91°57'41", in NE¼NW¼ sec.1, T.60 N., R.13 W., Hydrologic Unit 09030001, at Babbitt water tower.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in (0.05 m), depth 30 ft (9.1 m), screened 27 to 30 ft (8.2 to 9.1 m).

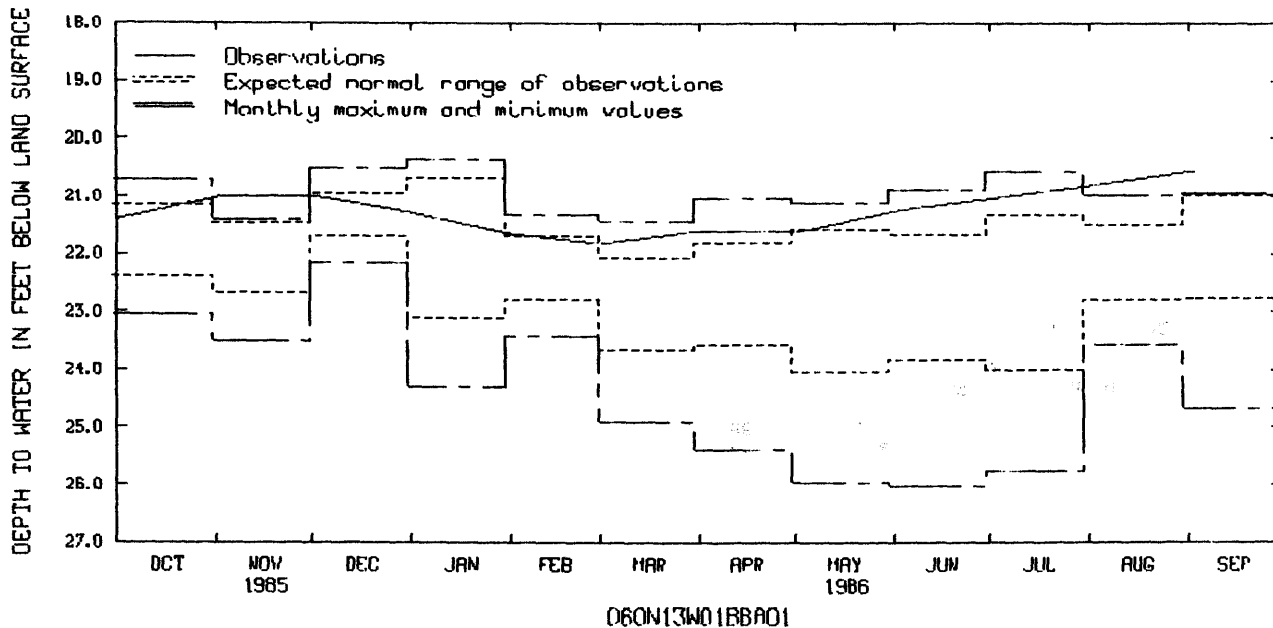
DATUM.--Altitude of land-surface datum is 1,485 ft (453 m). Measuring point: Top of 3 in (0.08 m) pipe, 4.00 ft (1.22 m) above land-surface datum.

PERIOD OF RECORD.--October 1975 to June 1978, July 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 20.38 ft (6.21 m) below land-surface datum, Jan. 1, 1983; lowest, 26.03 ft (7.93 m) below land-surface datum, June 14, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 1	21.42	DEC 1	21.00	FEB 1	21.67	APR 1	21.62	JUN 2	21.25	AUG 1	20.83
NOV 1	21.04	JAN 1	21.29	MAR 1	21.83	MAY 1	21.63	JUL 7	21.00	SEP 3	20.58



GROUND-WATER LEVELS

ST. LOUIS COUNTY--Continued

475502091494601. Local number, 063N12W26ABB01.

LOCATION.--Lat 47°55'02", long 91°49'46", in NW¼NW¼NE¼ sec.26, T.63 N., R.12 W., Hydrologic Unit 09030001, at Ely.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

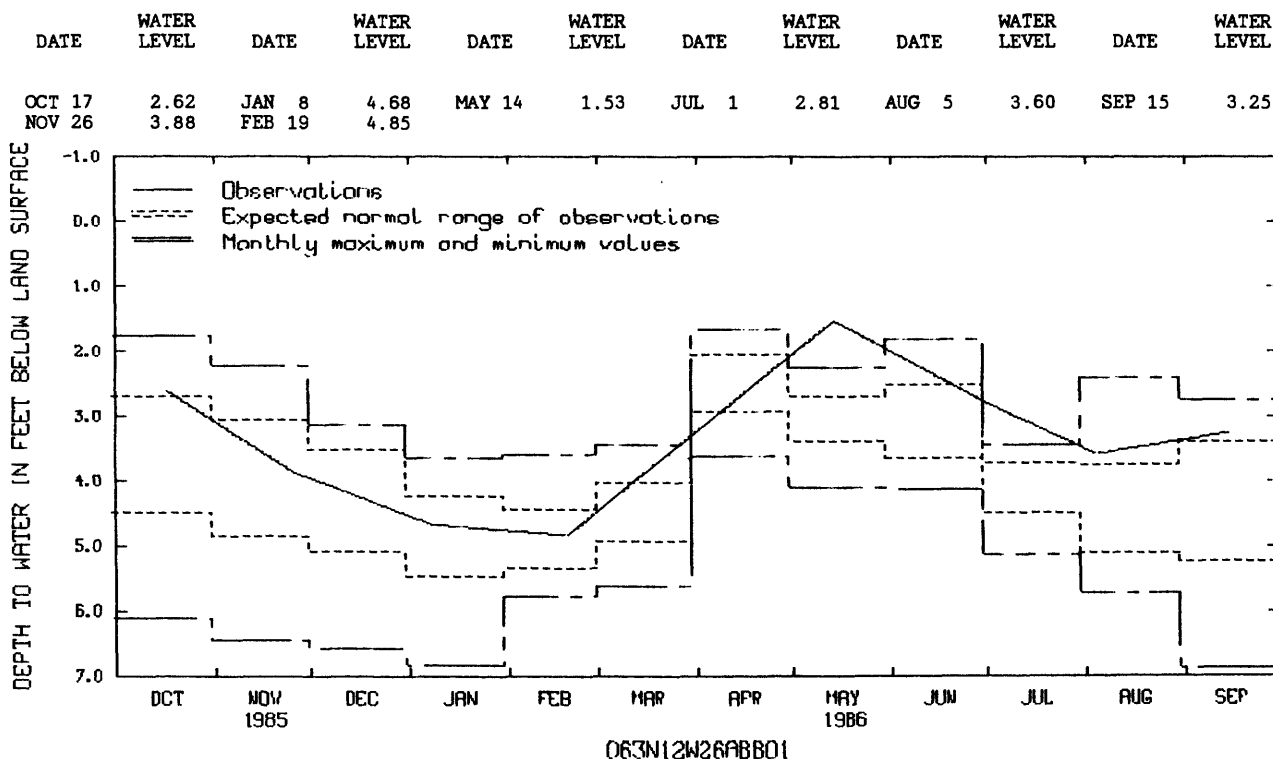
WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 9 ft (2.7 m), screened 7 to 9 ft (2.1 to 2.7 m).

DATUM.--Altitude of land-surface datum is 1,342 ft (409 m). Measuring point: Top of casing, 4.00 ft (1.22 m) above land-surface datum.

PERIOD OF RECORD.--October 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.53 ft (0.46 m) below land-surface datum, May 14, 1986; lowest, 6.87 ft (2.09 m) below land-surface datum, Sept. 27, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986



TRAVERSE COUNTY

455700096314001. Local number, 129N47W25CDC01.

LOCATION.--Lat 45°57'00", long 93°31'40", in SW¼SE¼SW¼ sec.25, T.129 N., R.47 W., Hydrologic Unit 09020101, 9 mi (14.5 km) north of Wheaton.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in (0.03 m), depth 39 ft (11.9 m), open end.

DATUM.--Altitude of land-surface datum is 1,010 ft (308 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--October 1965 to current year.

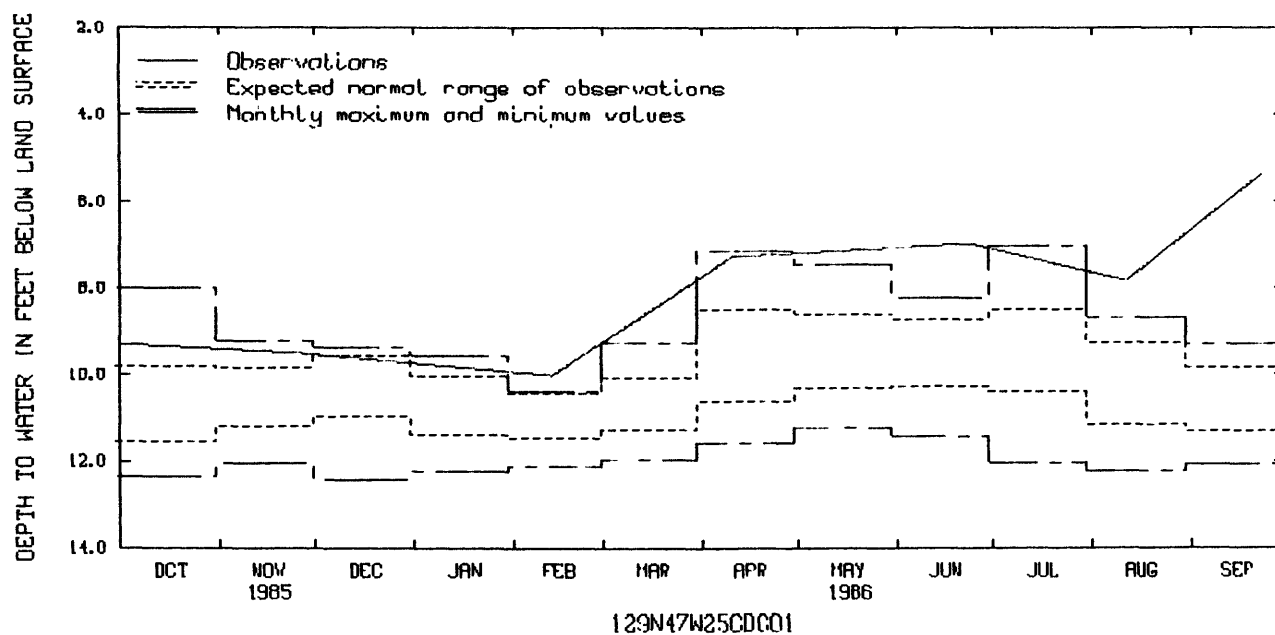
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.39 ft (1.64 m) below land-surface datum, Sept. 23, 1986; lowest, 12.42 ft (3.79 m) below land-surface datum, Dec. 2, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 27	9.53	FEB 13	10.03	APR 10	7.30	JUN 24	7.00	AUG 12	7.84	SEP 23	5.39

GROUND-WATER LEVELS

TRAVERSE COUNTY--Continued



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FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI). This report contains both the inch-pound and SI unit equivalents in the station manuscript descriptions.

Multiply inch-pound units	By	To obtain SI units
<i>Length</i>		
inches (in)	2.54×10^1	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^0	kilometers (km)
<i>Area</i>		
acres	4.047×10^3	square meters (m ²)
	4.047×10^{-1}	square hectometers (hm ²)
	4.047×10^{-3}	square kilometers (km ²)
square miles (mi ²)	2.590×10^0	square kilometers (km ²)
<i>Volume</i>		
gallons (gal)	3.785×10^0	liters (L)
	3.785×10^0	cubic decimeters (dm ³)
	3.785×10^{-3}	cubic meters (m ³)
million gallons	3.785×10^3	cubic meters (m ³)
	3.785×10^{-3}	cubic hectometers (hm ³)
cubic feet (ft ³)	2.832×10^1	cubic decimeters (dm ³)
	2.832×10^{-2}	cubic meters (m ³)
cfs-days	2.447×10^3	cubic meters (m ³)
	2.447×10^{-3}	cubic hectometers (hm ³)
acre-feet (acre-ft)	1.233×10^3	cubic meters (m ³)
	1.233×10^{-3}	cubic hectometers (hm ³)
	1.233×10^{-6}	cubic kilometers (km ³)
<i>Flow</i>		
cubic feet per second (ft ³ /s)	2.832×10^1	liters per second (L/s)
	2.832×10^1	cubic decimeters per second (dm ³ /s)
	2.832×10^{-2}	cubic meters per second (m ³ /s)
gallons per minute (gal/min)	6.309×10^{-2}	liters per second (L/s)
	6.309×10^{-2}	cubic decimeters per second (dm ³ /s)
	6.309×10^{-5}	cubic meters per second (m ³ /s)
million gallons per day	4.381×10^1	cubic decimeters per second (dm ³ /s)
	4.381×10^{-2}	cubic meters per second (m ³ /s)
<i>Mass</i>		
tons (short)	9.072×10^{-1}	megagrams (Mg) or metric tons

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