



# Water Resources Data Minnesota Water Year 1989

## Volume 2. Upper Mississippi and Missouri River Basins



U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN-89-2  
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

CALENDAR FOR WATER YEAR 1989

1988

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

1989

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

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

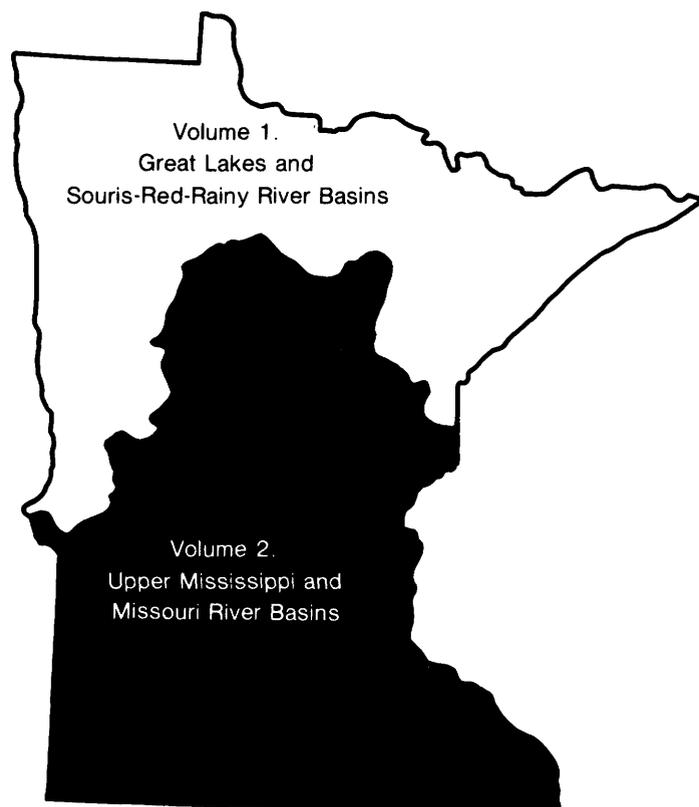
JULY							AUGUST							SEPTEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
						1			1	2	3	4	5						1	2
2	3	4	5	6	7	8	6	7	8	9	10	11	12	3	4	5	6	7	8	9
9	10	11	12	13	14	15	13	14	15	16	17	18	19	10	11	12	13	14	15	16
16	17	18	19	20	21	22	20	21	22	23	24	25	26	17	18	19	20	21	22	23
23	24	25	26	27	28	29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



# Water Resources Data Minnesota Water Year 1989

## Volume 2. Upper Mississippi and Missouri River Basins

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



**U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MN-89-2**  
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

MANUEL LUJAN, JR, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief, Water Resources Division  
U.S. Geological Survey  
702 Post Office Building  
St. Paul, Minnesota 55101

## 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:

Lan H. Tornes, Water-Quality Specialist, Minnesota District  
Alex Brietkrietz, Ground-Water Network Project Chief, Minnesota District

Most of the data were collected, processed, and tabulated by the following individuals:

### St. Paul District Office

Allan D. Arntson  
George H. Carlson  
Paul E. Felsheim  
Mark R. Have  
Joan M. Helms  
Rebecca A. Miller

Gregory B. Mitton  
George A. Roach  
Charles J. Smith  
Gregory W. Stratton  
Jeff Trionfante  
Duane A. Wicklund  
Thomas A. Winterstein

### Grand Rapids Field Headquarters

Howard D. Braden  
William A. Gothard  
Gregory R. Melhus

### Montevideo Field Headquarters

Roderick L. Johnson

This report was prepared in cooperation with the State of Minnesota and with other agencies under the general supervision of William J. Herb, District Chief, Minnesota.



CONTENTS

	Page
Preface .....	iii
List of gaging stations, in downstream order, for which records are published .....	vi
List of ground-water wells, by county, for which records are published .....	viii
Introduction .....	1
Cooperation .....	1
Summary of hydrologic conditions .....	1
Precipitation .....	1
Streamflow .....	3
Water quality .....	3
Ground-water levels .....	3
Special networks and programs .....	10
Explanation of the records .....	16
Station identification numbers .....	16
Downstream order system and station number .....	16
Latitude-longitude system for wells and miscellaneous sites .....	16
Records of stage and water-discharge .....	16
Data collection and computation .....	16
Data presentation .....	17
Identifying estimated daily discharge .....	18
Accuracy of the records .....	18
Other records available .....	18
Records of surface water-quality .....	19
Classification of records .....	19
Arrangement of records .....	19
Onsite measurement and collection .....	19
Water temperature .....	19
Sediment .....	19
Laboratory measurements .....	20
Data presentation .....	20
Remark codes .....	20
Records of ground-water levels .....	20
Data collection and computation .....	20
Data presentation .....	21
Records of ground-water quality .....	21
Data collection and computation .....	21
Data presentation .....	21
Access to WATSTORE data .....	21
Definition of terms .....	22
Publications on techniques of water-resources investigations .....	27
Discontinued gaging stations .....	30
Station records, surface water .....	38
Discharge at partial-record stations and miscellaneous sites .....	161
Low-flow partial-record stations .....	161
High-flow partial-record stations .....	171
Miscellaneous sites .....	183
Analyses of samples collected at water-quality partial-record stations .....	184
Analyses of samples collected at miscellaneous sites .....	221
Miscellaneous water-quality data collected at continuous-record stations .....	231
Station records, ground water .....	238
Ground-water levels .....	242
Quality of ground-water .....	297
Chemical quality of precipitation .....	326
Index .....	331

ILLUSTRATIONS

Figure 1. Map showing precipitation, in inches, during 1989 water year compared normal annual precipitation for Minnesota .....	2
2. Graph showing comparison of mean discharge for the 1989 water year with median discharge for 1951-80 at four long-term representative gaging stations .....	6
3. Graph showing comparisons between dissolved solids concentrations .....	8
4. Graph showing comparisons between nitrate plus nitrate concentrations .....	9
5a. Hydrographs showing comparisons of seasonal water levels during 1989 to long-term levels in two representative water-table wells .....	11
5b. Hydrographs showing comparison of water levels during 1989 to long-term levels in two representative buried drift wells .....	12
5c. Hydrographs showing comparison of water levels during 1989 to long-term levels in two representative bedrock wells in the Prairie du Chien aquifer .....	13
5d. Hydrographs showing comparison of water levels during 1989 to long-term levels in representative bedrock wells in the St. Peter and Iron-ton-Galesville aquifers .....	14
5e. Hydrographs showing comparison of water levels during 1989 to long-term levels in two representative bedrock wells in the Mount Simon-Hinckley aquifer .....	15

## ILLUSTRATIONS--Continued

	Page
6. Diagram showing system for numbering wells and miscellaneous sites.....	16
7. Map showing location of lake and stream-gaging stations.....	34
8. Map showing location of surface-water-quality stations.....	36
9. Map showing location of high-flow partial-record stations.....	172
10. Map showing location of ground-water wells.....	240

---

 TABLES
 

---

Table 1. Runoff at streamflow stations in representative basins in Minnesota.....	4
---	---

## GAGING 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)]*

## UPPER MISSISSIPPI RIVER BASIN

Mississippi River at Bemidji.....	(d - - - p)...	38
Schoolcraft River near Bemidji.....	(d - - - p)...	40
Mississippi River near Bemidji.....	(d - - - p)...	42
Winnibigoshish Lake near Deer River.....	(- e - - -)...	44
Mississippi River at Winnibigoshish Dam, near Deer River.....	(d - - - -)...	45
LEECH LAKE RIVER BASIN		
Williams Lake near Akeley.....	(- e - - -)...	46
Leech Lake at Federal Dam.....	(- e - - -)...	47
Leech Lake River at Federal Dam.....	(d - - - -)...	48
Pokegama Lake near Grand Rapids.....	(- e - - -)...	49
Mississippi River at Grand Rapids.....	(d - - - -)...	50
SWAN RIVER BASIN		
Swan River near Calumet.....	(d - - - -)...	51
SANDY RIVER BASIN		
Sandy Lake at Libby.....	(- e - - -)...	52
Sandy River at Sandy Lake Dam, at Libby.....	(d - - - -)...	53
Mississippi River below Sandy River, near Libby.....	(d - - - -)...	54
Mississippi River at Aitkin.....	(d - - - -)...	55
PINE RIVER BASIN		
Pine River Reservoir at Cross Lake.....	(- e - - -)...	56
Pine River at Cross Lake Dam, at Cross Lake.....	(d - - - -)...	57
Mississippi River at Brainerd.....	(d - - - -)...	58
CROW WING RIVER BASIN		
Shell River:		
Straight River at County Highway 125 near Osage.....	(d - - - -)...	59
Straight River at County Highway 115 near Park Rapids.....	(d - - - -)...	60
Straight River near Park Rapids.....	(d - - - -)...	61
Long Prairie River at Long Prairie.....	(d - - - -)...	62
Gull River:		
Gull Lake near Brainerd.....	(- e - - -)...	63
Gull River at Gull Lake Dam, near Brainerd.....	(d - - - -)...	64
Crow Wing River near Pillager.....	(d - - - -)...	65
Mississippi River near Fort Ripley.....	(d - - - -)...	66
Mississippi River near Royalton.....	(d - c b p)...	67
SAUK RIVER BASIN		
Ashley Creek near Sauk Centre.....	(d - c b p)...	70
Hoboken Creek at Sauk Centre.....	(d - c b p)...	72
Sauk River at Sauk Centre.....	(d - c b p)...	74
Mississippi River at St. Cloud.....	(d - - - -)...	76
CROW RIVER BASIN		
Crow River at Rockford.....	(d - - - -)...	77
RUM RIVER BASIN		
Mille Lacs Lake (head of Rum River) at Cove Bay near Onamia.....	(- e - - -)...	78
Rum River near St. Francis.....	(d - - - -)...	79
ELM CREEK BASIN		
Elm Creek near Champlin.....	(d - c b p)...	80
Mississippi River near Anoka.....	(d - - - p)...	83

GAGING STATIONS, IN DOWNSTREAM ORDER--Continued

UPPER MISSISSIPPI RIVER BASIN--Continued

MINNESOTA RIVER BASIN		
Whetstone River near Big Stone City, SD.....	(d - - - -)	86
Big Stone Lake at Ortonville.....	(- e - - -)	87
Minnesota River at Ortonville.....	(d - - - -)	88
Yellow Bank River near Odessa.....	(d - - - -)	89
Pomme de Terre River at Appleton.....	(d - - - -)	90
Lac qui Parle River near Lac qui Parle.....	(d - - - -)	91
Minnesota River near Lac qui Parle.....	(d - - - -)	92
Chippewa River near Milan.....	(d - - - -)	93
Minnesota River at Montevideo.....	(d - - - -)	94
Yellow Medicine River near Granite Falls.....	(d - - - -)	95
Redwood River near Marshall.....	(d - - - -)	96
Redwood River near Redwood Falls.....	(d - - - -)	97
Cottonwood River near New Ulm.....	(d - - - -)	98
Little Cottonwood River near Courtland.....	(d - - - -)	99
Blue Earth River:		
Watonwan River near Garden City.....	(d - - - -)	100
Blue Earth River near Rapidan.....	(d - - - -)	101
Le Sueur River near Rapidan.....	(d - - - -)	102
Minnesota River at Mankato.....	(d - - - p)	103
High Island Creek near Henderson.....	(d - - - -)	107
Minnesota River near Jordan.....	(d - c b p)	108
Mississippi River at St. Paul.....	(d - - - p)	111
Mississippi River at Fifth Street at Newport.....	(- - c - p)	114
Mississippi River at Grey Cloud Island near Cottage Grove.....	(- - c - p)	121
Mississippi River at Nininger.....	(- - c b p)	128
Mississippi River at lock and dam 2, at Hastings.....	(- - c - p)	130
ST. CROIX RIVER BASIN		
St. Croix River:		
Kettle River below Sandstone.....	(d - - - -)	137
Snake River:		
Knife River near Mora.....	(d - - - -)	138
St. Croix River at St. Croix Falls, WI.....	(d - - - -)	139
Mississippi River at Prescott, WI.....	(d - - - -)	140
VERMILLION RIVER BASIN		
Vermillion River near Empire.....	(d - c - p)	141
CANNON RIVER BASIN		
Cannon River:		
Straight River near Faribault.....	(d - - - -)	149
ZUMBRO RIVER BASIN		
South Fork Zumbro River at Rochester.....	(d - - - -)	150
Zumbro River at Kellogg.....	(d - - - -)	151
WHITEWATER RIVER BASIN		
North Fork Whitewater River near Elba.....	(d - c b p)	152
GARVIN BROOK BASIN		
Garvin Brook near Minnesota City.....	(d - - - -)	155
Mississippi River at Winona.....	(d - - - p)	156
ROOT RIVER BASIN		
Root River near Lanesboro.....	(d - - - -)	158
IOWA RIVER BASIN		
Iowa River:		
Cedar River near Austin.....	(d - - - -)	159
DES MOINES RIVER BASIN		
Des Moines River at Jackson.....	(d - - - -)	160

* * * * *		
Discharge at partial-record stations and miscellaneous sites.....		161
Low-flow partial-record stations.....		161
High-flow partial-record stations.....		171
Miscellaneous sites.....		183
Analysis of samples collected at water-quality partial-record stations.....		184
Analysis of samples collected at miscellaneous sites.....		221
Miscellaneous water quality data collected at continuous-record stations.....		231

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

GROUND-WATER LEVELS

ANOKA

Well 450927093033802	Local number	031N22W23CBC02	242
Well 451210093170201	Local number	031N24W01CBB01	242
Well 451742093122102	Local number	032N23W04AAD02	243
Well 452305093141501	Local number	033N23W05BAB01	243
Well 451938093223101	Local number	033N24W30ABB01	244

BELTRAMI

Well 473023094570901	Local number	147N34W35ADC01	244
----------------------	--------------	----------------	-----

BIG STONE

Well 451517096104501	Local number	121N44W27CCC01	245
Well 453330096420201	Local number	124N48W17AAA01	245

BLUE EARTH

Well 440050094102801	Local number	106N28W03DBA01	246
Well 441134093505301	Local number	108N25W04BBC01	246

BROWN

Well 441030094254501	Local number	108N30W09ADD01	246
Well 441800094434301	Local number	110N32W30DBD01	247

CHIPPEWA

Well 450447095490101	Local number	119N41W29DDD01	247
Well 450631095562201	Local number	119N42W17DDD01	248

CHISAGO

Well 453125092445401	Local number	035N19W17BDB01	248
----------------------	--------------	----------------	-----

CROW WING

Well 463006094131201	Local number	135N28W16CCD01	248
----------------------	--------------	----------------	-----

DAKOTA

Well 445044093102401	Local number	027N23W09ABD01	249
Well 445330093054301	Local number	028N22W19DCC02	249
Well 443146093002201	Local number	112N18W08ABA01	250
Well 443134093010601	Local number	112N18W08BBC01	250
Well 442830093085201	Local number	112N19W30DBD01	250
Well 443645093014701	Local number	113N18W07BAC01	251
Well 444205092500001	Local number	114N17W10AAA01	251
Well 444047092521901	Local number	114N17W16CBB01	251
Well 443827092521801	Local number	114N17W33BBC01	252
Well 444117092595701	Local number	114N18W17AAB01	252
Well 443801092571301	Local number	114N18W35CCB01	252
Well 444220093055001	Local number	114N19W04DAC01	253
Well 443934093043201	Local number	114N19W22DDD01	253

DODGE

Well 435336092553201	Local number	105N18W13DDD01	254
Well 440448092485501	Local number	107N17W13BBA01	254

FARIBAULT

Well 434558093540001	Local number	104N26W36CAC01	254
Well 434902094042901	Local number	104N27W16ABA01	255

FREEBORN

Well 433434093331201	Local number	101N23W02DAC01	255
Well 433846093220601	Local number	102N21W09CCB01	255
Well 434032093111801	Local number	103N20W36CCB01	256
Well 434308093322001	Local number	103N23W13CDA01	256

GOODHUE

Well 441737092400501	Local number	110N15W31BBD01	257
Well 442401092372501	Local number	111N15W21CDA01	257
Well 443012092362201	Local number	113N15W27BAB01	258

HENNEPIN

Well 444815093194901	Local number	027N24W30AAA01	259
Well 444801093202801	Local number	027N24W30BDA01	259
Well 445356093145301	Local number	028N24W23ADD01	259
Well 450116093205301	Local number	029N24W06CCC01	260
Well 445833093154301	Local number	029N24W26BAB01	260
Well 445829093162901	Local number	029N24W27ABD01	261
Well 445158093225101	Local number	116N21W07DAD01	261
Well 445618093211801	Local number	117N21W16CDB01	262
Well 445347093213901	Local number	117N21W32DAD01	262
Well 445646093395301	Local number	117N24W13BBC04	262
Well 445740093333001	Local number	117N23W11BBD01	263
Well 450223093231801	Local number	118N21W07DCB01	264
Well 445905093224401	Local number	118N21W32CBB01	264
Well 445857093223101	Local number	118N21W32CBD01	264
Well 450854093212801	Local number	119N21W04BBA01	265

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

ix

				Page
<u>HOUSTON</u>				
Well	433953091251801	Local number	102N50W03DCC01.....	266
Well	433935091252001	Local number	102N05W03DCC02.....	266
Well	443935091252901	Local number	102N05W03DCC03.....	266
<u>HUBBARD</u>				
Well	465142094433201	Local number	139N32W16AAA01.....	267
<u>ISANTI</u>				
Well	453125093181101	Local number	035N24W14BCD01.....	267
Well	453058093175901	Local number	035N24W14CDC01.....	267
Well	453410093140001	Local number	036N23W32ACB01.....	268
<u>ITASCA</u>				
Well	471450093322001	Local number	055N25W17ACD01.....	268
<u>JACKSON</u>				
Well	434742095191501	Local number	104N37W19DBD01.....	268
<u>KANABEC</u>				
Well	455236093172301	Local number	039N24W11DDC01.....	269
<u>LE SUEUR</u>				
Well	442522093543901	Local number	111N26W14ADA01.....	270
Well	443234093333501	Local number	112N23W02BAB01.....	270
Well	443147093374501	Local number	112N23W06DDD01.....	270
<u>LINCOLN</u>				
Well	441705096084501	Local number	110N44W33DCD01.....	271
<u>MARTIN</u>				
Well	434359094422201	Local number	103N32W08CCD01.....	271
Well	434725094483001	Local number	104N33W28BAB01.....	272
<u>MC LEOD</u>				
Well	444758094132101	Local number	115N28W05ACC01.....	272
Well	444819094164701	Local number	116N29W35DDC01.....	272
Well	445721094031201	Local number	117N27W10DAA01.....	273
<u>MEEKER</u>				
Well	450632094290801	Local number	119N30W19AAB01.....	273
Well	451542094322301	Local number	121N31W26BDC01.....	274
<u>MILLE LACS</u>				
Well	454450093395701	Local number	038N27W35ABC01.....	274
<u>MORRISON</u>				
Well	460444094212501	Local number	130N29W08DCC01.....	275
<u>MOWER</u>				
Well	434010093010801	Local number	102N18W05ACB01.....	275
Well	434417093521001	Local number	103N17W09DAA01.....	275
<u>OLMSTED</u>				
Well	445538092232601	Local number	105N13W04CAA01.....	276
Well	435920092273801	Local number	106N14W14ADB01.....	277
Well	435757092224201	Local number	106N13W22CCB01.....	277
<u>RAMSEY</u>				
Well	445955093011001	Local number	029N22W14CAB01.....	278
Well	445955093011002	Local number	029N22W14CAB02.....	278
Well	445955093011003	Local number	029N22W14CAB03.....	278
Well	450001093024701	Local number	029N22W16ADD01.....	279
Well	445918092590901	Local number	029N22W24ADA01.....	279
Well	445700093051001	Local number	029N22W31DDD01.....	279
Well	450026093084201	Local number	029N23W11CCC01.....	280
Well	445751093072301	Local number	029N23W25CCD01.....	281
Well	445739093081201	Local number	029N23W35BAD01.....	281
Well	450414093012701	Local number	030N22W23CBB01.....	281
Well	450238093082501	Local number	030N23W35BDC01.....	282
<u>REDWOOD</u>				
Well	441323095280701	Local number	109N38W30BBD01.....	282
<u>RICE</u>				
Well	441912093162901	Local number	110N20W19BDC01.....	282
Well	442543093113701	Local number	111N20W11CDC01.....	283
Well	442751093240701	Local number	112N21W31CBB01.....	283
<u>SCOTT</u>				
Well	443732093460301	Local number	113N24W06BCB01.....	284
Well	443352093423001	Local number	113N24W28DAA01.....	284
Well	443352093423002	Local number	113N24W28DAA02.....	284
Well	443715093480801	Local number	113N25W02CAC01.....	285
Well	444025093220801	Local number	114N21W20BAA01.....	285
Well	443752093254401	Local number	114N22W35DCC01.....	285
Well	444633093212901	Local number	115N21W09CCC01.....	286
Well	444427093353901	Local number	115N23W28BDD01.....	286
Well	444427093353902	Local number	115N23W28BDD02.....	286
Well	444427093353903	Local number	115N23W28BDD03.....	287

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

<u>SHERBURNE</u>			
Well 452938093432701	Local number	035N27W29DDB02.....	287
<u>STEELE</u>			
Well 435742093164001	Local number	106N20W30BAD01.....	288
<u>SWIFT</u>			
Well 451913095370201	Local number	121N39W06BDB01.....	288
<u>WABASHA</u>			
Well 442708092155401	Local number	111N12W04BED01.....	289
<u>WADENA</u>			
Well 462415095003001	Local number	134N34W19ADD01.....	289
<u>WASHINGTON</u>			
Well 445125092464001	Local number	027N20W02BCC01.....	290
Well 445125092464002	Local number	027N20W02BCC02.....	290
Well 445125092464003	Local number	027N20W02BCC03.....	290
Well 444751092563101	Local number	027N21W28BCC01.....	291
Well 445536092462401	Local number	028N20W11CAA01.....	291
Well 445220092465901	Local number	028N20W34ADA01.....	291
Well 450134092583101	Local number	029N21W06CAD01.....	292
Well 450027092552101	Local number	029N21W10CCC01.....	292
Well 450858092575001	Local number	031N21W28ABD01.....	293
Well 451355092532601	Local number	032N20W30BCD01.....	293
<u>WATONWAN</u>			
Well 440037194372601	Local number	106N32W01DDB01.....	293
Well 440409094304901	Local number	107N31W14DAC01.....	294
Well 440133094312501	Local number	107N31W35CAC01.....	294
<u>WINONA</u>			
Well 435746092034202	Local number	106N10W19DDA02.....	295
<u>WRIGHT</u>			
Well 450403093544501	Local number	119N26W35DDA01.....	295
<u>YELLOW MEDICINE</u>			
Well 444219096165501	Local number	114N45W04DCD01.....	296

COUNTIES WITH QUALITY OF GROUND WATER RECORDS

<u>ANOKA</u> .....	297
<u>BECKER</u> .....	299
<u>BELTRAMI</u> .....	300
<u>BLUE EARTH</u> .....	304
<u>CASS</u> .....	305
<u>CHIPPEWA</u> .....	315
<u>CLEARWATER</u> .....	316
<u>HUBBARD</u> .....	317
<u>ITASCA</u> .....	318
<u>LAC QUI PARLE</u> .....	319
<u>LE SUEUR</u> .....	319
<u>NICOLLET</u> .....	319
<u>POPE</u> .....	320
<u>RAMSEY</u> .....	323
<u>REDWOOD</u> .....	324
<u>RENVILLE</u> .....	324
<u>SCOTT</u> .....	325
<u>SIBLEY</u> .....	325

PRECIPITATION SITES, FOR WHICH CHEMICAL QUALITY RECORDS ARE PUBLISHED

Precipitation Station at Camp Ripley.....	326
---	-----

# WATER RESOURCES DATA FOR MINNESOTA, 1989

## 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 1989 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 57 gaging stations; stage and contents for 8 lakes and reservoirs; water quality for 13 stream stations, 1 partial-record stream station, 11 partial-record lake stations, 21 miscellaneous sites, 1 precipitation station, and 143 wells; and water levels for 129 observation wells. Also included are 65 high-flow partial-record stations and 93 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 or low-flow investigations. These data, together with the data in Volume 1, 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-89-2. 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, Ronald N. Nargang, director.

Minnesota Department of Transportation, Leonard W. Levine, commissioner.

Metropolitan Waste Control Commission of the Twin Cities Area, L. Baker-Kent, chairperson

Beltrami Soil and Water Conservation District, John Cronemiller, chairperson.

Elm Creek Conservation Commission, Fred G. Moore, chairperson.

Leech Lake Reservation Business Committee, Daniel Brown, chairperson.

Lower Red River Watershed Management Board, Donald Ogaard, chairman.

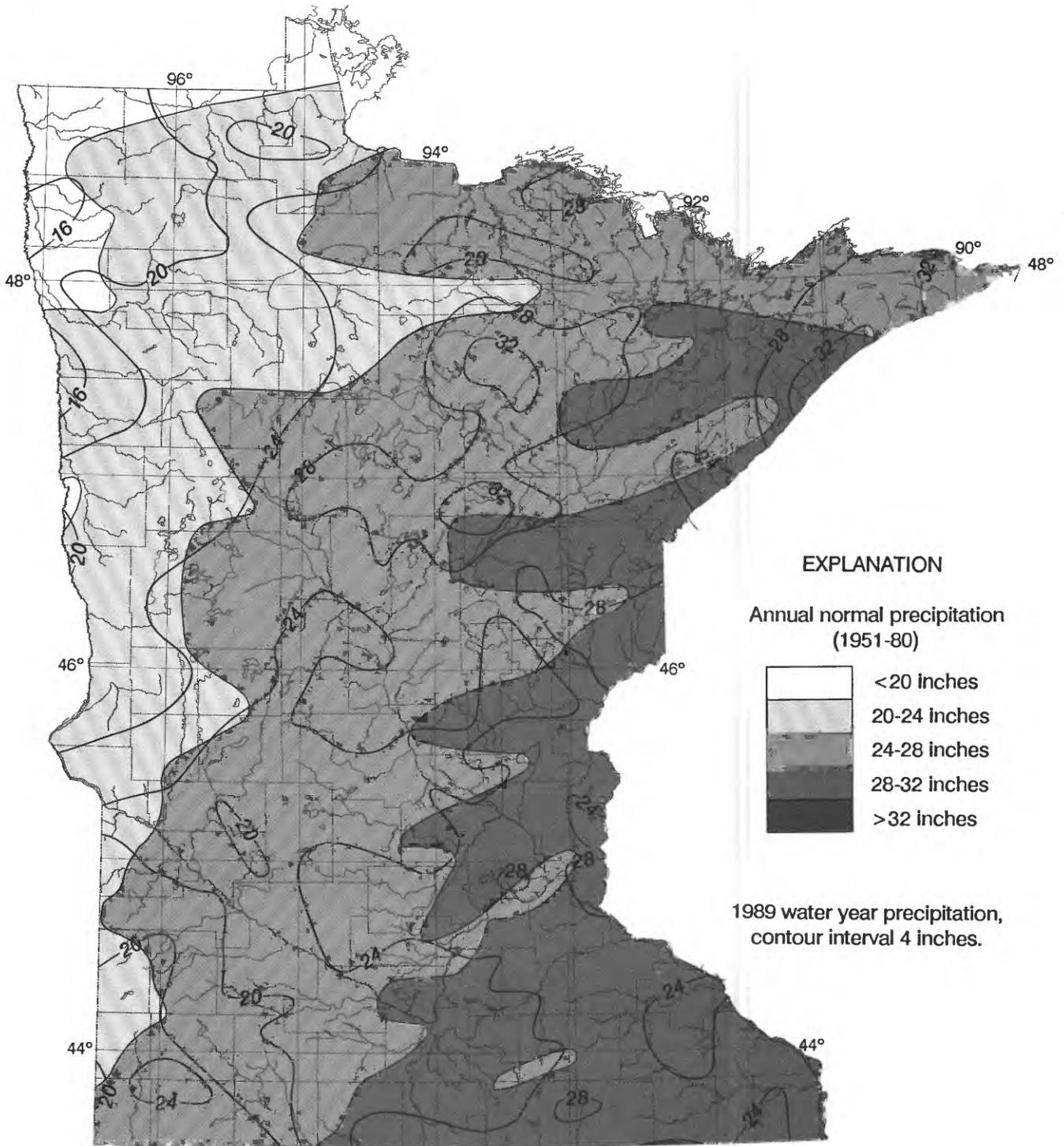
Rochester Public Utilities, Robert Pawelski, General Manager.

Assistance in the form of funds or services was given by the U.S. Army Corps of Engineers, in collecting records for 46 gaging stations and 12 water-quality stations published in this report of two volumes. 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

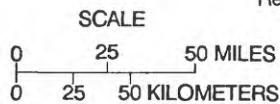
### PRECIPITATION

Precipitation during the 1989 water year ranged from 8 in. (inches) below normal (based on record period 1951-80) in large areas of southern and central Minnesota to 8 in. above normal in parts of north-central and northeastern 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 1989 ranged from less than 16 in. in a small area in the northwest to greater than 32 in. in small areas in the northeast.



Base from U.S. Geological Survey  
State base map, 1:500,000, 1965

Data from State Climatology Office,  
Minnesota Department of Natural  
Resources Division of Waters



**Figure 1.--Precipitation, in inches, during 1989 water year compared to normal annual precipitation in Minnesota.**

The 1989 water year began with a 4- to 8-in. precipitation deficit throughout much of northwestern, central, and southern Minnesota. However, in much of north-central and northeastern Minnesota, precipitation had been normal or above in the previous year so that some areas had a 4-in. precipitation excess at the beginning of the 1989 water year. The following is a summary of the precipitation that occurred during water year 1989:

October—below normal Statewide.

November—above normal Statewide.

December—below normal Statewide.

January—above normal in northern half and below normal in southern half.

February—below normal Statewide.

March—below normal in north-central, northeastern, and central regions and above normal in remaining regions.

April—below normal except lower one-third, where it was above normal.

May—below normal Statewide.

June—below normal Statewide.

July—below normal except for southwest, where it was above normal.

August—below normal except for northwest and central regions, where it was above normal.

September—above normal in northern half and below normal in southern half.

At the close of the 1989 water year, much of southern Minnesota as well as small areas in northwestern Minnesota had a 4- to 8-in. annual precipitation deficit, while much of north-central and parts of northeastern Minnesota had a 4- to 8-in. precipitation excess. As a result of precipitation deficits in parts of Minnesota for the past 3 years (1987-89), some areas now have a cumulative deficit equal to 1 year of normal precipitation. Paradoxically, "In 1989, Minnesota farmers harvested their best soybean crop and fifth largest corn crop" according to the State Climatology Office (Gregory Spoden, Assistant State Climatologist, oral communi., 1990). The meager precipitation occurred at critical times during the growing season, and temperatures were moderate, which allowed for optimum utilization of available moisture.

### STREAMFLOW

Average annual runoff in Minnesota ranges from 1 in. in the west to 14 in. in the northeast. Runoff in water year 1989 ranged from 0.4 in. in parts of north-central Minnesota to 19.1 in. in northeastern Minnesota (table 1). This translates to a low of 12 percent of average in a small part of north-central Minnesota to a high of 127 percent of average in northeastern Minnesota along the Canadian border. In water year 1988, runoff was less than half the long-term average at 60 percent of Minnesota's streamflow stations that are located in the Upper Mississippi and Missouri River basins; this percentage was reduced by half in water year 1989 when runoff at 30 percent of the stations was less than half the long-term average.

As a result of highly variable precipitation in central and southern Minnesota—near normal in some areas to below normal for the third consecutive year in other areas—runoff was average to much below average. Runoff ranged from a low of 13 percent of average in High Island Creek near Henderson in central and south-central Minnesota to a high of 115 percent in the Mississippi River at Grand Rapids in north-central Minnesota. Runoff in the Mississippi River at Aitkin, in east-central Minnesota, was 6.19 in., 96 percent of the 44-year average (1946-89) annual runoff of 6.48 in. and 2.45 in. greater than in the previous year. Runoff in the Crow River at

Rockford, in the southern part of central Minnesota, was 0.91 in. or 23 percent of the station's 64-year average (1910-17, 1931, 1935-89) annual runoff of 3.90 in. and 0.04 in. less than in the previous year. In west-central Minnesota, runoff in the Chippewa River near Milan was 1.08 in., which is 48 percent of the station's 52-year average (1938-89) annual runoff of 2.27 in. but almost double the 0.66 in. of runoff that occurred in the previous year. Runoff to the Des Moines River at Jackson, in southwestern Minnesota, was 0.55 in. or 15 percent of the station's 54-year average (1936-89) annual runoff of 3.60 in. and 40 percent of the 1.36 in. of runoff that occurred in the previous year. Figure 2 shows 1989 annual and monthly mean discharges for these stations compared to median discharges for a 30-year base period.

No new records of peak discharge were established during water year 1989 for any station published in this volume. However, record or near-record low flows occurred at several stations during the year. In the previous water year, flows in the Pomme de Terre River at Appleton, in west-central Minnesota, reached new lows-of-record during July, August, and September. This trend continued into the 1989 water year with new lows recorded for October and November; in fact, there was no flow during the entire month of October, a phenomenon that had not previously occurred in October during the period of record (1933-88).

The combined storage in the six Mississippi River Headwater Reservoirs (Winnibigoshish, Leech, Pokegama, Pine, Sandy, and Gull), in northern and central Minnesota, was 1,517,502 acre-feet at the end of the 1989 water year—a decrease of 28,386 acre-feet from the corresponding date in the 1988 water year.

### WATER QUALITY

Although the drought continued throughout most of southern Minnesota during the 1989 water year, its effects on water quality were not as evident as during the previous water year. Dissolved-solids concentrations in streams generally increase during drought because less surface runoff is available to dilute the higher mineralized ground water flowing into streams. Figure 3 shows the concentrations of dissolved solids measured during the 1989 water year compared to the historical median monthly concentrations at four stations sampled for national water-quality monitoring programs administered by the U.S. Geological Survey.

The bar graphs in figure 3 show that sampling results of dissolved-solids concentrations in selected streams in southern Minnesota during the 1989 water year are not substantially different from the median concentrations. Very little runoff from spring snowmelt entered the Minnesota River near Jordan during March resulting in very high dissolved-solids concentrations. Normally, dissolved-solids concentrations are noticeably diluted by spring runoff. Snowmelt runoff during March in the southeast part of Minnesota resulted in greater dilution of dissolved solids measured in the North Fork Whitewater River near Elba.

Nitrite plus nitrate nitrogen concentrations, an indicator of input from agricultural or human sources are shown in figure 4. Concentrations ranged from the detection limit of 0.1 mg/L (milligrams per liter) in the Mississippi River near Royalton to more than 4 mg/L in the Whitewater River near Elba. None of the concentrations exceeded the 10 mg/L maximum contaminant level (MCL) for drinking water established by the U.S. Environmental Protection Agency (USEPA). Nitrite plus nitrate nitrogen concentrations in samples collected in 1989 generally were near the median at most of the stations in figure 4 except in the Minnesota River near Jordan. Concentrations at Jordan were much less than the median, probably resulting from reduced runoff from agricultural sources which tend to have higher nitrate concentrations and increased dilution by ground water, which usually contains less nitrate.

Samples of ground water were collected from numerous wells throughout the part of Minnesota described in this report. Although most wells sampled by the U.S. Geological Survey are selected to represent ambient water-quality conditions, some wells were selected

Table 1.--Runoff at streamflow stations in 1989 compared with long-term average for river basins in Minnesota  
 [Average runoff for station is based on period of record. Maximum and minimum runoff and year of occurrence are shown. mi<sup>2</sup>, square miles.]

Station no.	Station name	Drainage area (mi <sup>2</sup> )	Runoff (inches)					Maximum runoff		Minimum runoff		Years of record
			1989		Average	Inches	Water year	Inches	Water year	Inches	Water year	
			Water year	Average								
05201500	Mississippi River at Winnibigoshish Dam near Deer River	1,442	5.46	4.92	4.92	11.61	1898*	0.85	1937*	105		
05206500	Leech Lake River at Federal Dam	1,163	4.16	4.34	4.34	9.52	1899*	.40	1936*	105		
05211000	Mississippi River at Grand Rapids	3,370	5.51	4.81	4.81	9.78	1906	.77	1934	106		
05216860	Swan River near Calumet	114	8.52	7.78	7.78	12.75	1966	3.57	1977	25		
05219000	Sandy River at Sandy Lake Dam at Libby	421	6.40	7.16	7.16	17.43	1986	.42	1931*	94		
05227500	Mississippi River at Aitkin	6,140	6.19	6.48	6.48	11.03	1966	1.76	1977	44		
05231000	Pine River at Cross Lake Dam at Cross Lake	562	5.23	5.32	5.32	13.48	1905*	.48	1931*	103		
05245100	Long Prairie River at Long Prairie	432	1.99	5.00	5.00	11.51	1972	.79	1977	18		
05247000	Gull River at Gull Lake Dam near Brainerd	287	5.27	5.16	5.16	10.79	1972	.76	1931*	78		
05267000	Mississippi River near Royalton	11,600	5.19	5.39	5.39	10.44	1986	1.42	1934	65		
05280000	Crow River at Rockford	2,520	.91	3.90	3.90	14.84	1986	.35	1931	64§		
05286000	Rum River near St. Francis	1,360	2.71	6.24	6.24	15.10	1986	.66	1934	57§		
05287890	Elm Creek near Champlin	84.9	1.31	4.89	4.89	12.01	1986	.73	1988	11		
05288500	Mississippi River near Anoka	19,100	4.18	5.63	5.63	12.62	1986	1.14	1934	58		
05291000	Wetstone River near Big Stone City	389	1.91	1.74	1.74	6.32	1986	.05	1934	58		
05292000	Minnesota River at Ortonville	1,160	.93	1.26	1.26	4.26	1986	.03	1977, 1981	51		
05293000	Yellow Bank River near Odessa	398	1.37	2.01	2.01	7.68	1986	.14	1981	50		
05294000	Pomme de Terre River at Appleton	905	1.02	1.68	1.68	5.45	1986	.32	1977	54		
05300000	Lac qui Parle River near Lac qui Parle	983	.97	1.81	1.81	6.42	1986	.00	1934	58§		
05301000	Minnesota River near Lac qui Parle	4,050	1.13	2.29	2.29	8.41	1986	.25	1959	47		
05304500	Chippewa River near Milan	1,870	1.08	2.27	2.27	9.49	1986	.33	1940	52		

Table 1.--Runoff at streamflow stations in 1989 compared with long-term average for river basins in Minnesota--Continued

Station no.	Station name	Drainage area (mi <sup>2</sup> )	Runoff (inches)			Maximum runoff		Minimum runoff		Years of record
			1989 Water year	Average	Inches	Water year	Inches	Water year	Inches	
05311000	Minnesota River at Montevideo	6,180	.85	1.63	6.51	1986	.01	1934	68§	
05313500	Yellow Medicine River near Granite Falls	653	1.16	2.54	9.98	1984	.17	1959	53§	
05315000	Redwood River near Redwood Falls	629	1.14	2.68	10.21	1983	.23	1959	55§	
05317000	Cottonwood River near New Ulm	1,280	1.12	3.36	12.63	1969	.44	1940	55§	
05317200	Little Cottonwood River near Courtland	230	.54	3.22	9.45	1983	.64	1977	16	
05319500	Watonwan River near Garden City	812	.73	5.27	13.83	1983	.86	1977	18§	
05320000	Blue Earth River near Rapidan	2,430	1.01	5.05	16.08	1983	.59	1940, 1977	46§	
05320500	Le Sueur River near Rapidan	1,100	1.37	5.64	16.53	1983	.63	1977	46§	
05325000	Minnesota River at Mankato	14,900	.99	2.71	8.44	1986	.12	1934	68§	
05327000	High Island Creek near Henderson	237	.63	4.83	13.54	1986	.53	1976	16	
05330000	Minnesota River near Jordan	16,200	1.07	3.13	8.94	1986	.58	1940	55	
05331000	Mississippi River at St. Paul	36,800	2.74	4.11	11.05	1986	.71	1934	91§	
05336700	Kettle River below Sandstone	863	7.45	11.24	21.87	1972	4.00	1977	22	
05337400	Knife River near Mora	102	6.62	8.35	17.97	1986	2.25	1988	15	
05340500	St. Croix River at St. Croix Falls	6,240	7.79	9.38	18.65	1986	3.82	1934	87	
05344500	Mississippi River at Prescott	44,800	3.53	5.20	11.68	1986	1.86	1931	61	
05345000	Vermillion River near Empire	110	5.38	6.73	13.72	1986	2.91	1977	17§	
05353800	Straight River near Fairbault	442	3.20	7.83	18.59	1983	1.35	1977	24	
05374900	Zumbro River at Kellogg	1,400	6.28	8.43	14.93	1983	4.02	1977	14	
05376000	North Fork Whitewater River near Elba	101	6.15	6.40	12.54	1974	2.61	1968	24§	
05378500	Mississippi River at Winona	59,200	4.81	6.36	13.04	1986	2.23	1934	61	
05384000	Root River near Lanesboro	615	4.63	7.77	17.80	1983	2.32	1964	53§	
05457000	Cedar River near Austin	425	4.80	6.61	18.15	1983	1.98	1958	50§	
05476000	Des Moines River at Jackson	1,220	.55	3.23	13.35	1983	.17	1956	54	

\* Calendar year  
 § Noncontinuous period

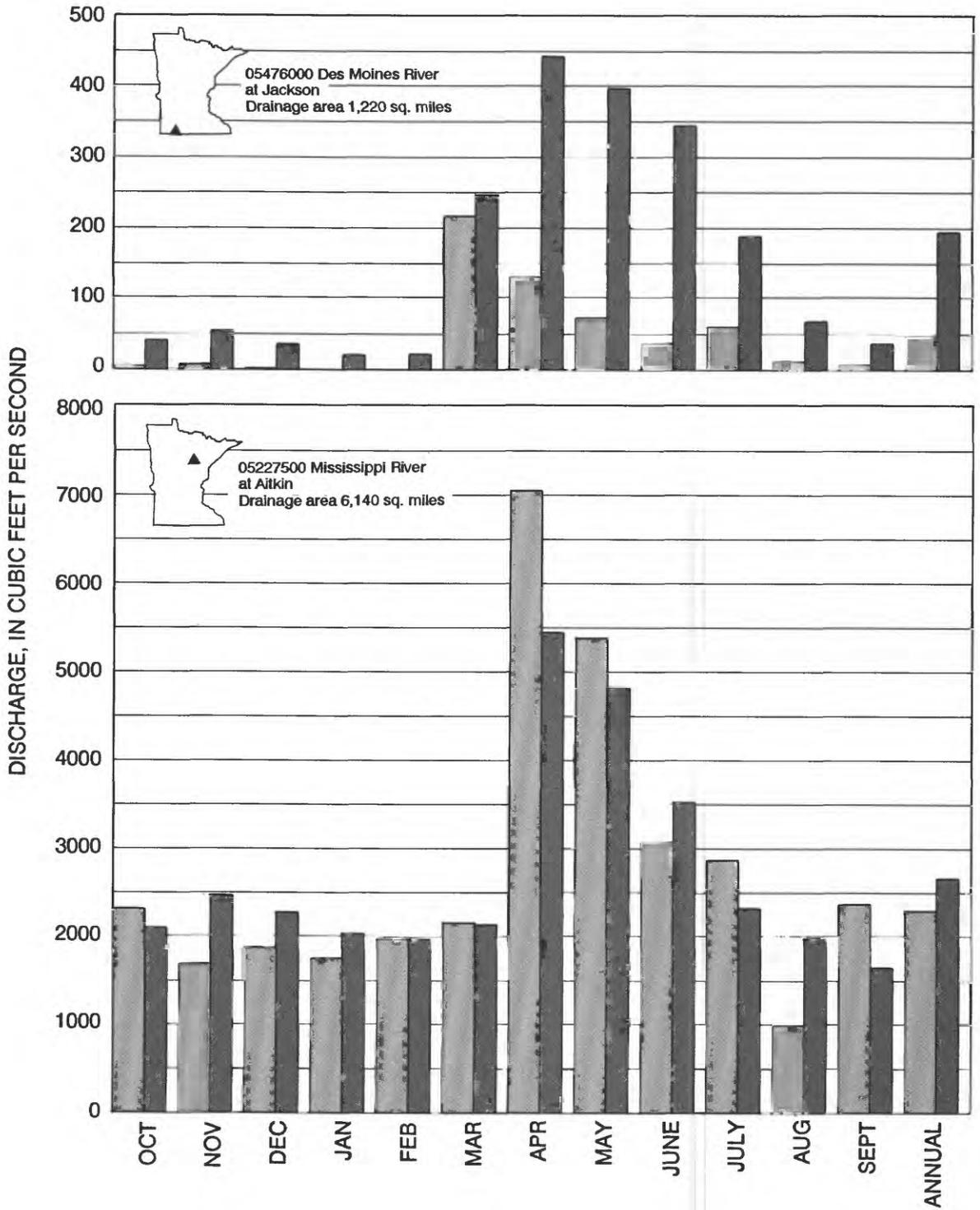
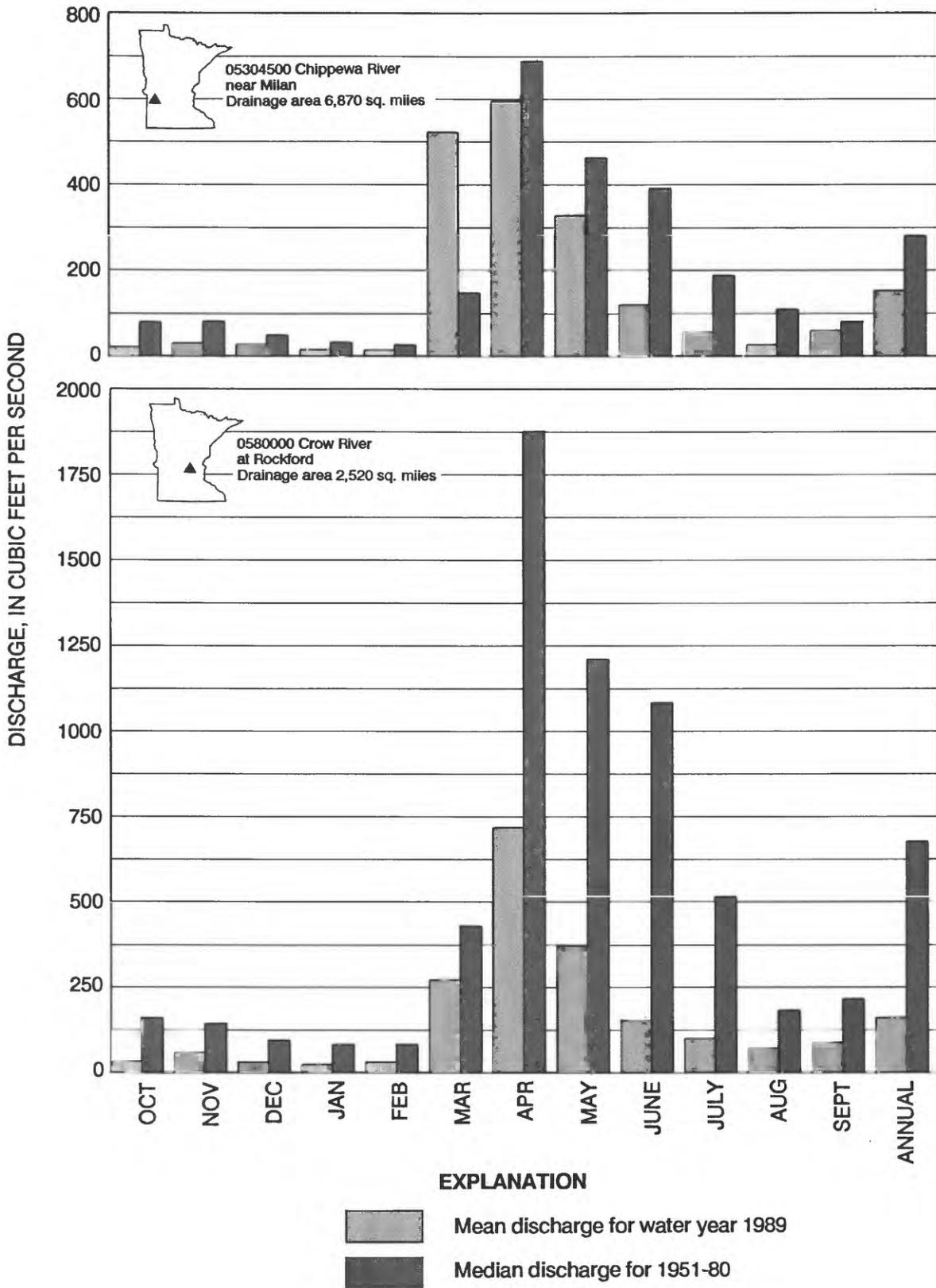
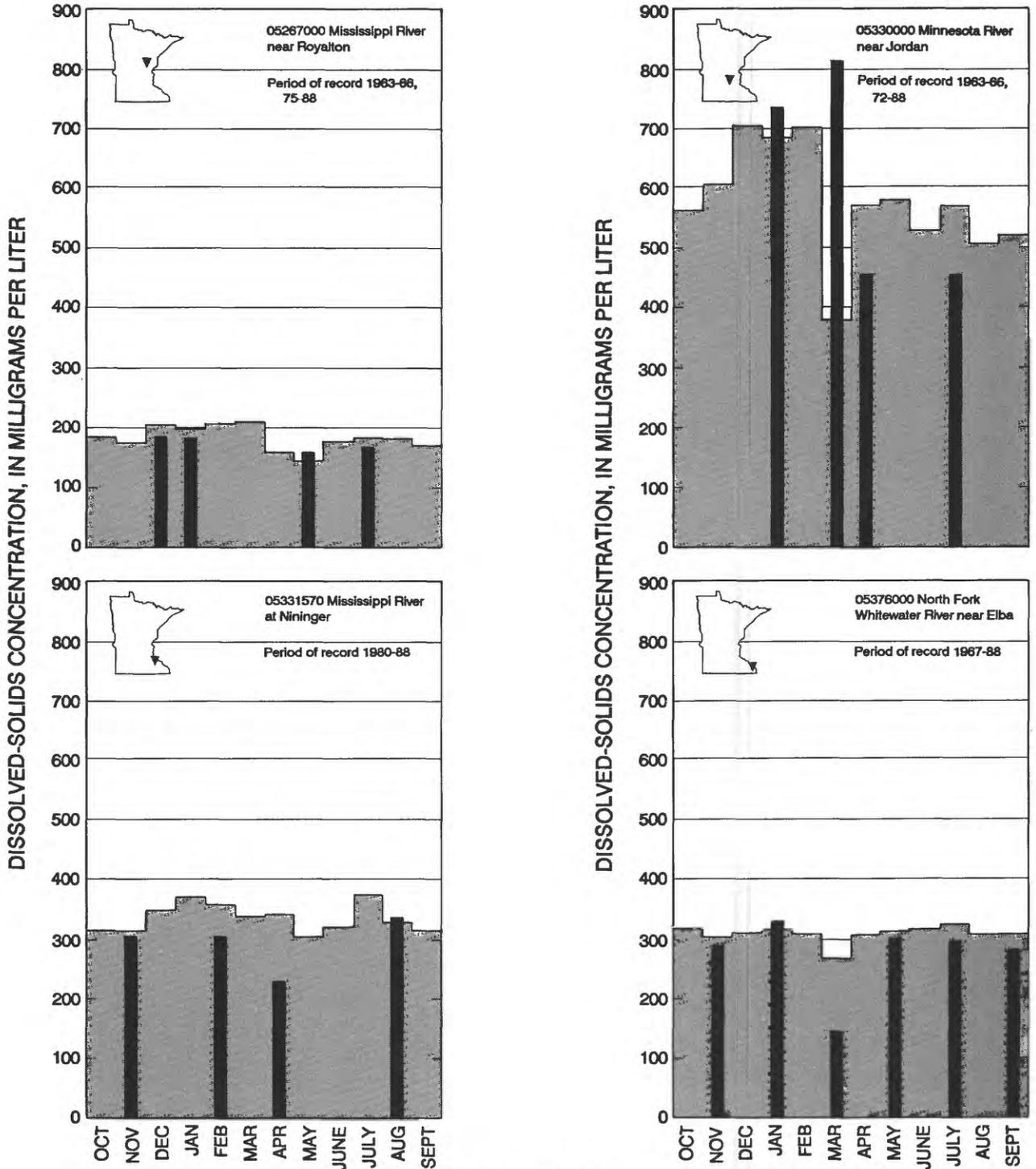


Figure 2.—Comparison of mean discharge for the 1989 water year with median



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



**EXPLANATION**

- Median monthly dissolved solids concentration for the period of record
- Dissolved-solids concentration, 1989 water year

**Figure 3.--Comparisons between dissolved-solids concentrations**

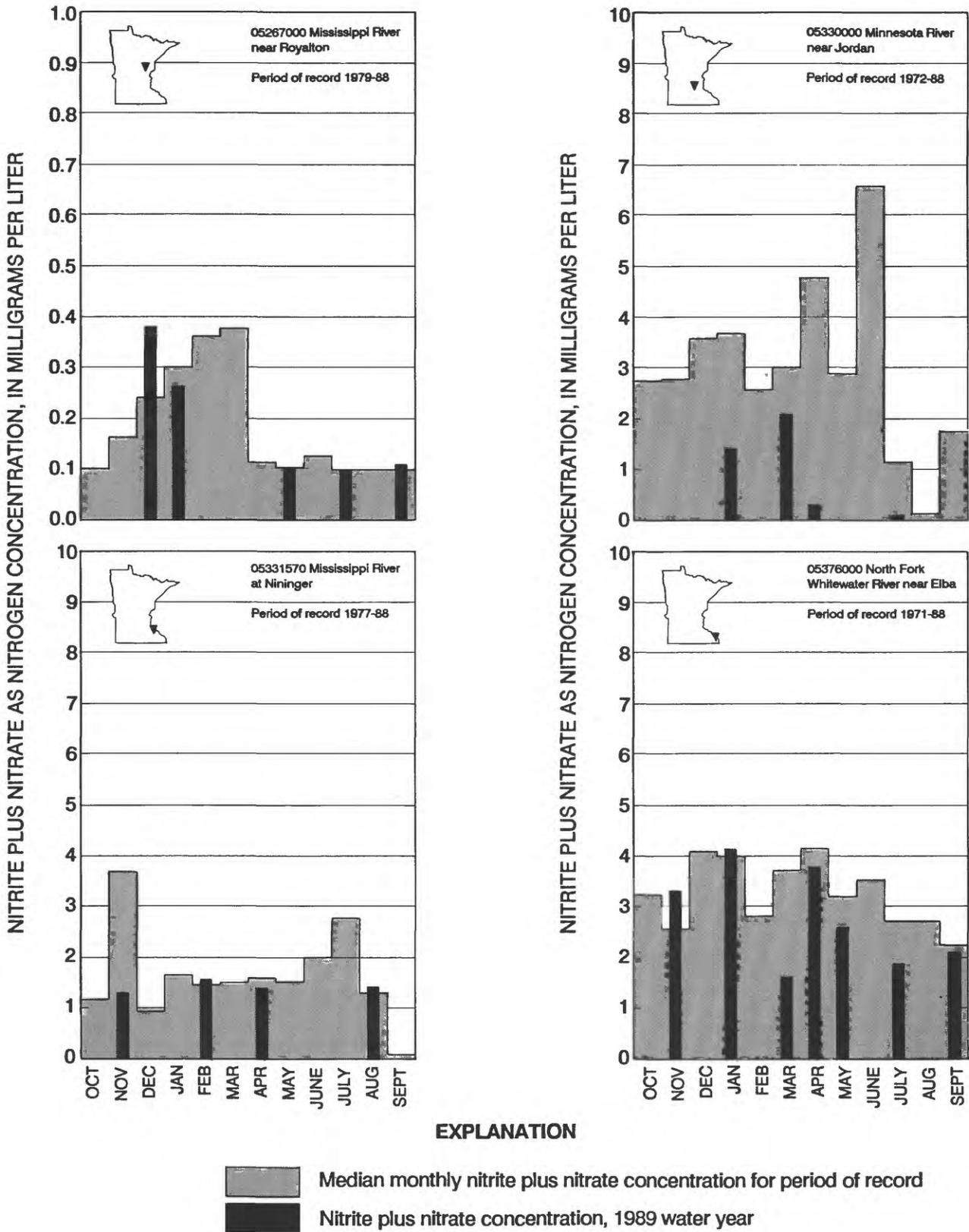


Figure 4.—Comparisons between nitrite plus nitrate concentrations.

to detect or define areas of contamination within limited study areas. Some of the analytical results reported here indicate contamination, but the contamination cannot be assumed to be widespread.

Nitrite plus nitrate nitrogen concentrations in ground water generally ranged from less than detectable (0.1 mg/L) to about 5 to 7 mg/L. However, in Pope County, located in west-central Minnesota, water from many wells contained concentrations that exceeded the USEPA'S MCL of 10 mg/L. Atrazine also was detected in some Pope County wells at concentrations of up to 0.2 ug/L (micrograms per liter). Possible contamination from salt is suggested by concentrations of chloride in ground water in Anoka, Itasca, and Ramsey Counties that ranged from 94 to 480 mg/L. Phenolic materials were found at concentrations ranging from 9 to 18 ug/L in Beltrami, Cass, and Clearwater Counties. Selected ground water wells were sampled for several pesticides and industrial organic chemicals, but none were detected.

### GROUND-WATER LEVELS

Of 20 unconfined surficial-drift wells in the ground-water network, water levels in seven wells reached new record-lows from February through September (fig. 5a). These record-low water levels reflect the continuation of the drought of 1987-88. Water levels in four wells, which have 20-25 years of record, ranged from 0.1 to 0.8 ft lower in water year 1989 than during the severe drought of 1976-77. However, the drought of 1976-77 was of shorter duration than the present drought. It is of interest to note that some parts of the State escaped recent drought conditions, and water levels were 1 to 3 ft higher in wells in these parts compared to the 1976-77 water levels.

Of the 20 confined buried-drift wells in the network (fig. 5b), water levels in five were at new record-lows in September. The five wells are in or near centers of pumping, and water-level declines are due to increased withdrawals of ground water. Water levels were from 1 to 4 ft lower than previous recorded lows. A steady water-level decline of 8 ft has occurred in one well since 1979. The well, located in Hennepin County, is in an area where pumping from the Prairie du Chien-Jordan aquifer has contributed to a decline in water levels in the overlying buried-drift aquifer. Water levels in confined-drift wells located many miles from pumping centers increased by up to 5 ft from their all-time recorded lows during the water year.

Water levels in 26 of 89 bedrock wells in the network were at new record lows. Of these wells with new low levels, five were in the upper carbonate aquifer of south-central and southeastern Minnesota, seven were in the Prairie du Chien-Jordan aquifer of the seven-county Twin Cities metropolitan area, seven were in the Mount Simon-Hinckley aquifer of the Hollandale embayment (covering parts of east-central, south-central, and all of southeastern Minnesota), and seven were completed in other bedrock aquifers including the Sioux quartzite of southwestern Minnesota. Water levels in the upper carbonate aquifer continued to decline from the previous water year as a result of deficient precipitation during water year 1989 that produced less-than-normal recharge to the aquifer. Water levels will continue to decline in this aquifer as long as withdrawals exceed recharge from precipitation. Increased ground water demand from the Prairie du Chien-Jordan aquifer (fig. 5c) in the seven-county metropolitan area caused water levels in some wells to decline to record lows. Some of these wells have 18 years of record. Most low levels occurred from July through September, a period of hot and exceptionally dry weather. Contrarily, some wells in pumping centers did not reach new lows. At these locations, mainly in suburban cities that use well water, water-conservation programs were adopted such as lawn-sprinkling bans. These programs were undoubtedly instrumental in conserving water in the aquifer and, in turn, maintaining local water levels higher than would normally be expected during a drought period. At centers of pumping, such as St. Paul and Minneapolis, the change in water level from highest to lowest was 49 ft in St. Paul and 78 ft in Minneapolis. Water levels rebounded considerably in September because of a decrease in pumping for cooling, and water levels rose 22 ft in St. Paul and 34 ft in Minneapolis. Water levels were actually 3 ft above average in St. Paul and 7 ft above in Minneapolis at the end of September.

Water levels in two of six wells in the St. Peter aquifer were at new record lows during March and July (fig. 5d). One of these wells, in south-central Minnesota, had record-low monthly water levels throughout the water year. The other well, located in the twin city area, had the lowest July level for the period of record (1974-89). Water levels in three other wells were lower than the average monthly levels at some time during the water year. Water levels in five of nine wells in the Iron-ton-Galesville aquifer, including the Franconian aquifer, reached new record lows in September, as a result of the continuation of the drought of 1988. Water levels in four other wells were below the average monthly levels for most of the water year (fig. 5d).

Water levels in 7 of 16 Mount Simon-Hinckley wells in the network were at new all-time record lows during July-September (fig. 5e). These low levels ranged from 0.3 ft to 9 ft lower than previous recorded lows. Wells within the seven-county metropolitan area experienced the greatest water level declines--5 to 10 ft because of heavy pumping from this aquifer. Water levels in this aquifer did not recover from summer pumping and, at the end of September were 33 feet below average in St. Paul and 41 feet below average in Minneapolis. All-time seasonal lows were also recorded in this aquifer. Water levels during the winter of 1989, were 15 ft lower in St. Paul and 25 ft lower in Minneapolis than previous record lows during the winter of 1988.

### SPECIAL NETWORKS AND PROGRAMS

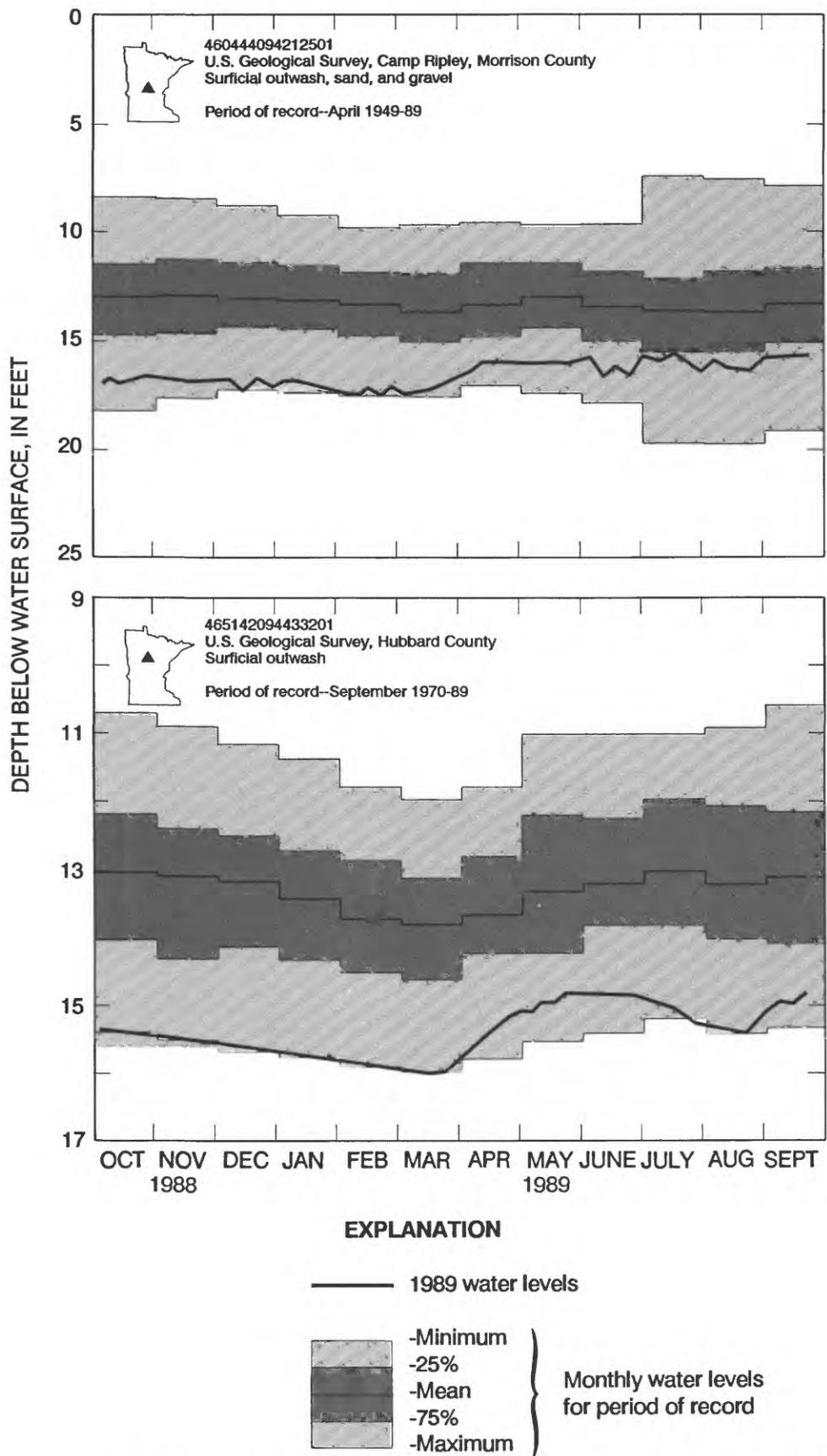
Hydrologic Bench-Mark Network is a network of 57 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis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

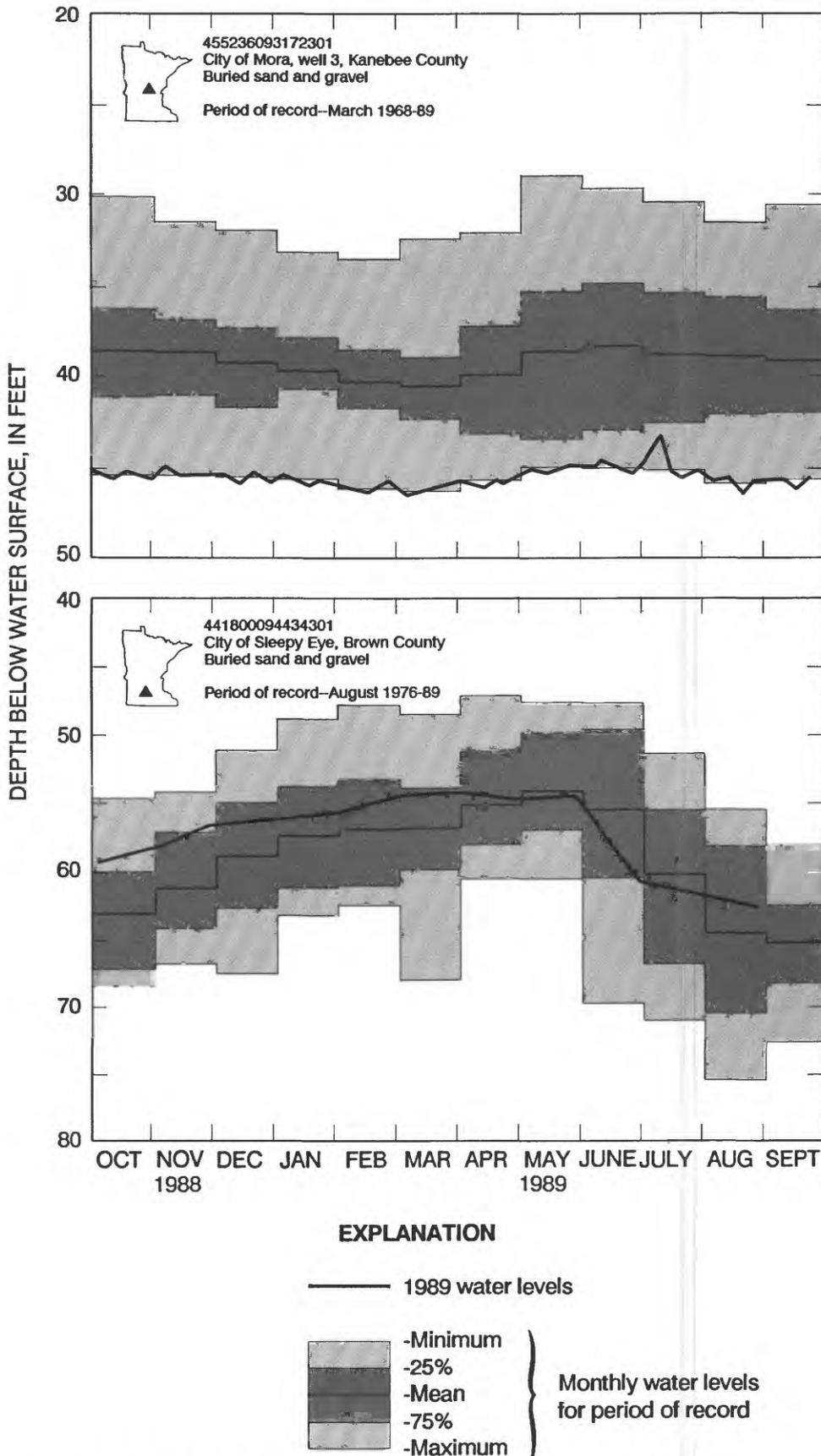
The National Trends Network (NTN) is a 150-station network for sampling atmospheric deposition in the United States. The purpose of the network is to determine the variability, both in location and in time, of the composition of atmospheric deposition, which includes snow, rain, dust particles, and aerosols, 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.



**Figure 5a.--Comparison of water levels during 1989 to long-term levels in two representative water-table wells**



**Figure 5b.--Comparison of water levels during 1989 to long-term levels in two representative buried drift wells**

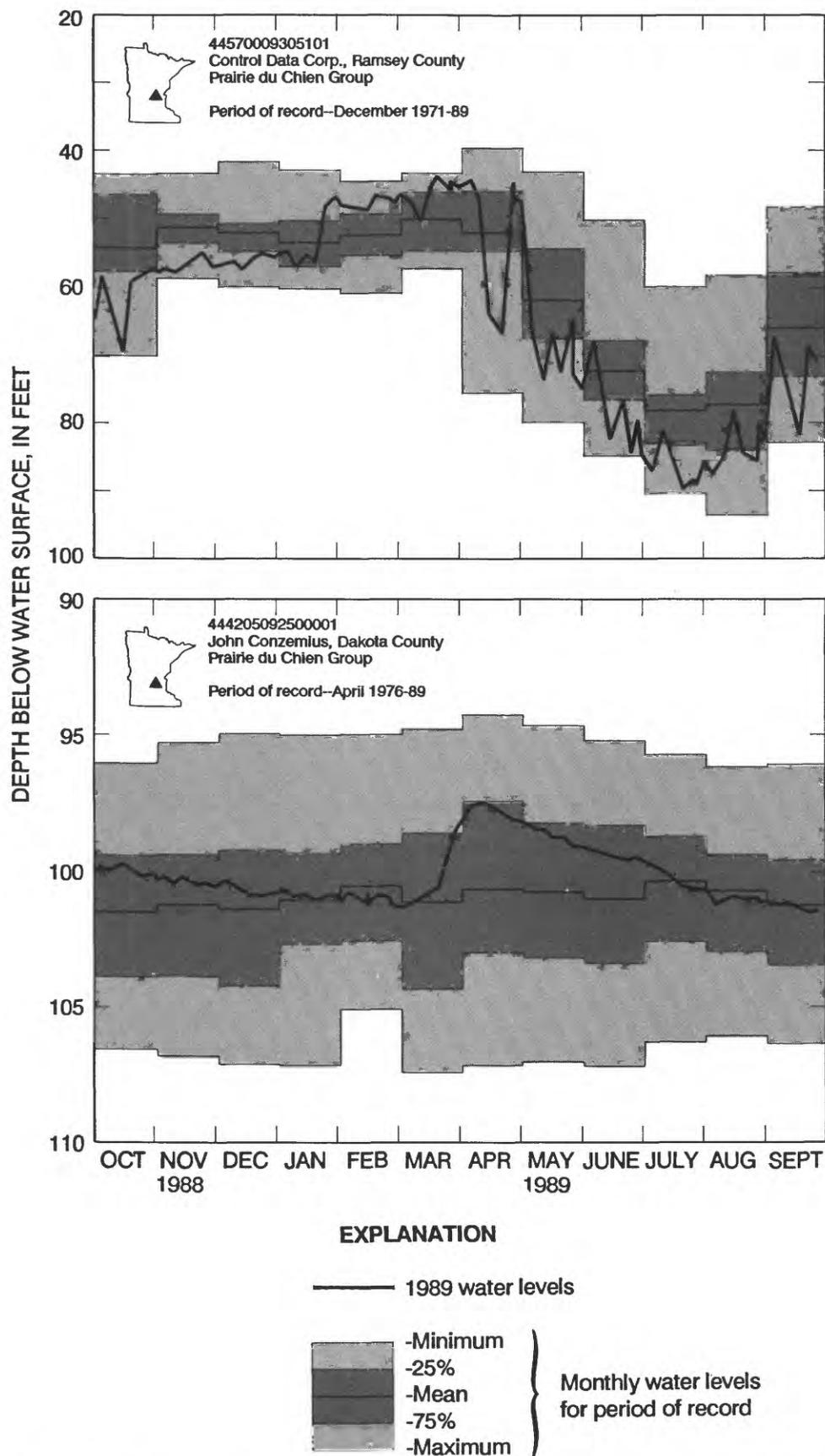


Figure 5c.--Comparison of water levels during 1989 to long-term levels in two representative bedrock wells in the Prairie du Chien aquifer

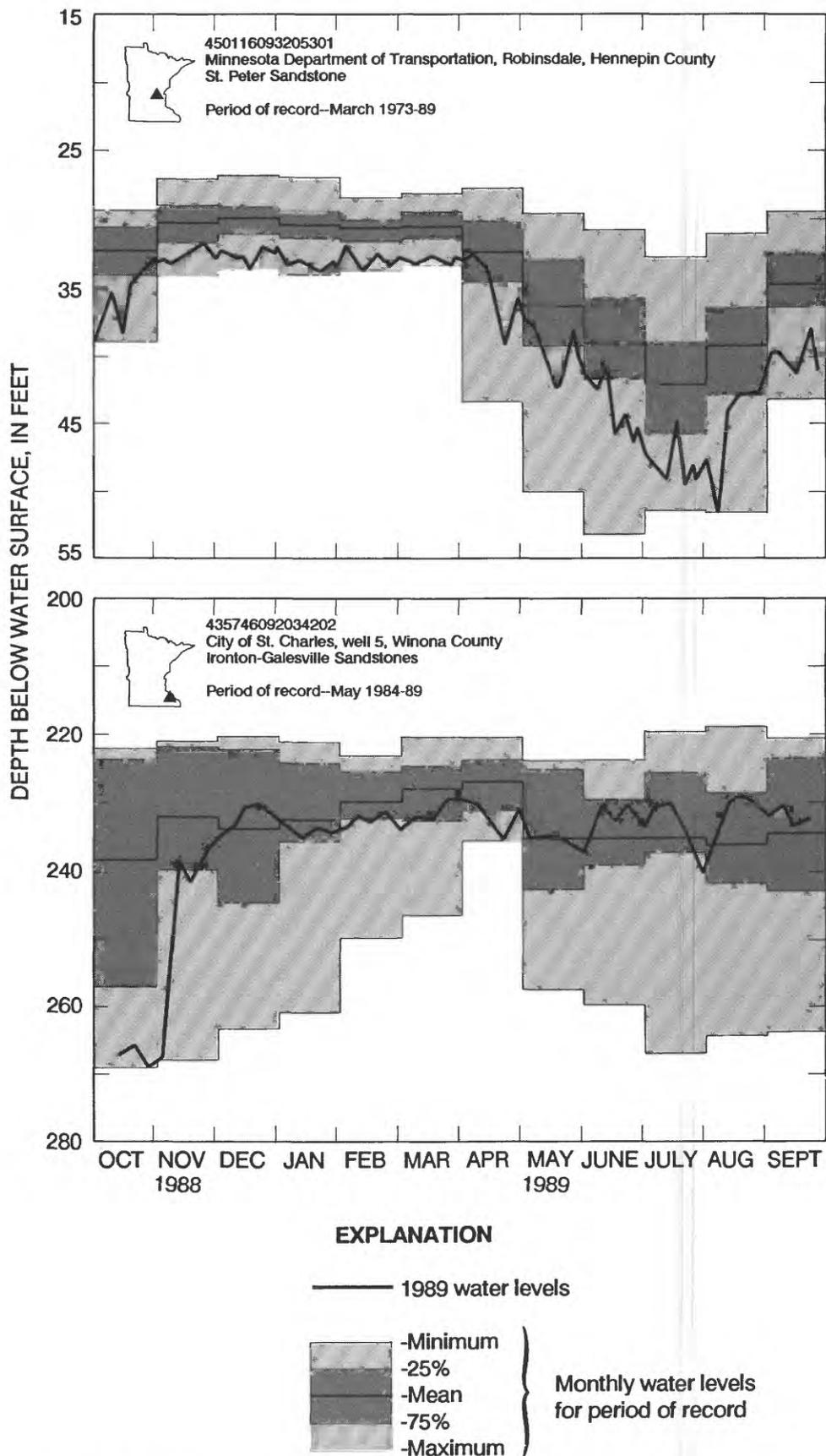


Figure 5d.--Comparison of water levels during 1989 to long-term levels in two representative bedrock wells in the St. Peter and Iron-ton-Galesville aquifers

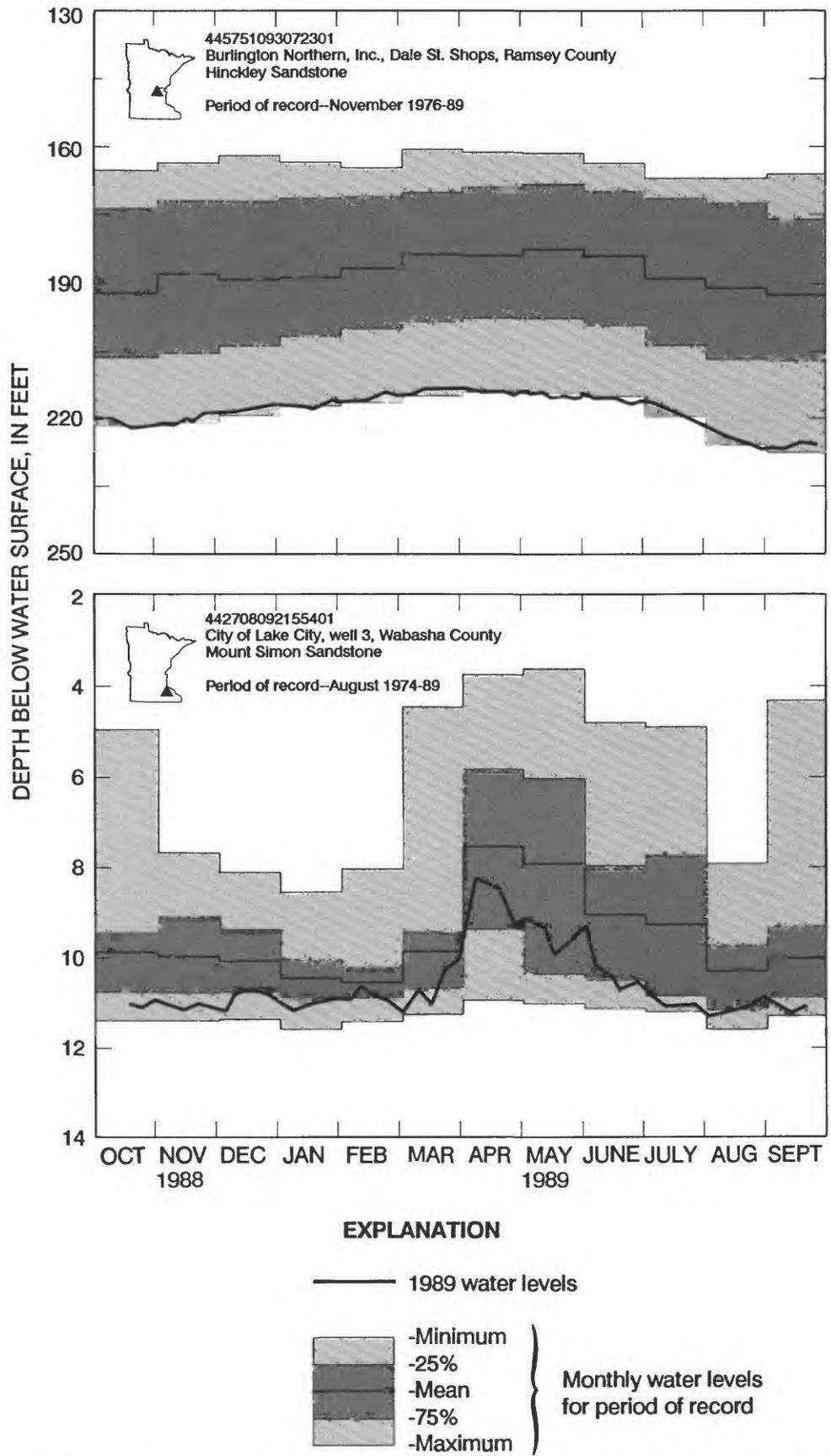


Figure 5e.--Comparison of water levels during 1989 to long-term levels in two representative bedrock wells in the Mount Simon-Hinkley aquifer

## EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1988 water year that began October 1, 1987, and ended September 30, 1988. 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 7, 8, 9, and 10. 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.

#### 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 6. 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.

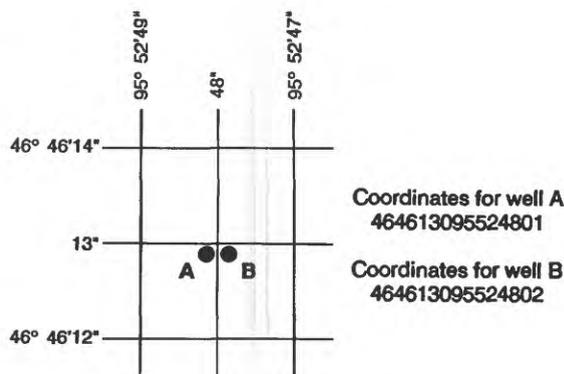


Figure 6.--Example of system for numbering wells and miscellaneous sites

### 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 7 and 9.

#### 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 datum 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 ft<sup>3</sup>/s; to the nearest tenth between 1.0 and 10 ft<sup>3</sup>/s; to whole numbers between 10 and 1000 ft<sup>3</sup>/s; and to 3 significant figures for more than 1000 ft<sup>3</sup>/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 8.

### 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.

### Onsite 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.

**RECORD 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:

#### PRINTED OUTPUT

#### REMARK

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 10.

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).

All water-level measurements are reported to the nearest hundredth of a foot. The error of water-level measurements is normally only a hundredth or a few hundredth of a foot.

Hydrographs showing water-level fluctuations are included for 24 representative wells; 8 in surficial-sand aquifers, 3 in buried-sand aquifers, and 13 in bedrock aquifers.

#### 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 preceding 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 ( $\text{g}/\text{m}^3$ ), and periphyton and benthic organisms in grams per square meter ( $\text{g}/\text{m}^2$ ).

**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<sup>3</sup>/s, ft<sup>3</sup>/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<sub>i</sub>' 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 (CaCO<sub>3</sub>).

**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 ( $1 \times 10^{-12}$ ) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields  $3.7 \times 10^{10}$  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 Q<sub>10</sub>)** 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 or regulation.

**Substrate** is the physical surface upon which an organism lived.

**Natural substrates** refers to any naturally occurring emerged 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.....Hexageria  
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 present 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-D2. *Application of seismic-refraction techniques to hydrologic studies*, by F. P. Haeni: USGS--TWRI Book 2, Chapter D2. 1988. 86 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.
- 2-F1. *Application of drilling, coring, and sampling techniques to test holes and wells*, by Eugene Shuter and Warren E. Teasdale: USGS--TWRI Book 2, Chapter F1. 1989. 97 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 in streams by dye tracing*, by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1989. 27 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-A12. *Fluorometric procedures for dye tracing*, by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS--TWRI Book 3, Chapter A12. 1986. 41 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-A16. *Measurement of discharge using tracers*, by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.
- 3-A17. *Acoustic velocity meter systems*, by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.
- 3-A18. *Determination of stream reaeration coefficients by use of tracers*, by F. A. Kilpatrick, R. E. Rathbun, N. Yotsukura, G. W. Parker, and L. L. DeLong: USGS--TWRI Book 3, Chapter A18. 1989. 52 pages.

## PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS--Continued

- 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 programmed 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.
- 3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction*, by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS--TWRI Book 3, Chapter B5. 1987. 15 pages.
- 3-B6. *The principle of superposition and its application in ground-water hydraulics*, by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS--TWRI Book 3, Chapter B6. 1987. 28 pages.
- 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. J. Fishman and L. C. Friedman: USGS--TWRI Book 5, Chapter A1. 1989. 545 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 the determination of organic substances in water and fluvial sediments*, edited by R. L. Wershaw, M. J. Fishman, R. R. Grabbe, and L. E. Lowe: USGS--TWRI Book 5, Chapter A3. 1987. 80 pages.
- 5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*, by L. J. Britton and P. E. Greeson, editors: USGS--TWRI Book 5, Chapter A4. 1989. 363 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.
- 6-A1. *A modular three-dimensional finite-difference ground-water flow model*, by M. G. McDonald and A. W. Harbaugh: USGS--TWRI Book 6, Chapter A1. 1988. 586 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.



Cableway view of Canada from the U.S.  
Rainy River at Manitou Rapids, June 1963

## 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 <sup>2</sup> )	Period of record
Upper Mississippi River basin			
05210000	Mississippi River near Deer River, MN	a3,190	1945-50
05212700	Prairie River near Taconite, MN	a360	1967-83
*05213000	Prairie River near Grand Rapids, MN	485	1909†, 1925-49
05216800	O'Brien Creek near Pengilly, MN	-	1963-68
05216820	Initial tailings basin outflow near Keewatin, MN	2.5	1982-85
05217000	Swan River near Warba, MN	254	1954-69
05217500	Swan River near Swan River, MN	a290	1929
05218000	Mississippi River above Sandy River near Libby (above Sandy River), MN	4,560	1895-1915, 1925-29
05221000	Willow River near Palisade, MN	442	1929
05226200	Ripple (Mud) River near Wealthwood, MN	-	1937-39
05232000	Pelican Brook (Long Lake) near Pequot Lakes, MN	-	1938-42, 1943-47
05241500	Rabbit River near Crosby, MN	8.38	1945-63
05242700	Little Sand Lake outlet (Sand Lake outlet) near Dorset, MN	a74	1930-41
*05244000	Crow Wing River at Nimrod, MN	a1,010	1910-14, 1930-81
05244500	Crow Wing River at Motley, MN	a2,140	1909†, 1913-17, 1930-31
05244980	Diversion from Long Prairie River near Osakis, MN	-	1939-47
05245000	Long Prairie River near Osakis, MN	-	1949-54
05245500	Long Prairie River near Motley, MN	973	1909-17, 1930-31
05246000	Crow Wing River at Pillager, MN	a3,230	1903†, 1909-13, 1925-50
*05261000	Mississippi River near Fort Ripley, MN	a11,010	1906, 1909-10, 1929
05261500	Nokasippi River near Fort Ripley, MN	210	1929
*05268000	Platte (Platt) River at Royalton, MN	338	1929-36
05269000	Mississippi River near Sauk Rapids, MN	a12,400	1903-06
05270000	Mississippi River at Sartell, MN	a12,450	1929, 1943-47†
05270500	Sauk River near St. Cloud, MN	925	1909-12, 1913, 1929, 1930, 1931, 1932, 1933, 1934-81
05273500	Clearwater River at Clearwater, MN	-	1937, 1940-42
05274500	Elk River above St. Francis River near Big Lake, MN	384	1929

"See footnotes at end of table."

## DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Upper Mississippi River basin--Continued			
05275000	Elk River near Big Lake	615	1911-17, 1931, 1932, 1933, 1934-87
05274700	St. Francis River at Santiago, MN	-	1965-70, 1980-81
05274750	St. Francis River above Zimmerman, MN	-	1980-84
05274900	St. Francis River near Big Lake, MN	-	1965-70
05275500	Mississippi River at Elk River, MN	a14,500	1915-56
05276000	North Fork Crow River near Regal, MN	215	1943-54
05277000	Middle Fork Crow River at New London, MN	-	1939-42, 1943-47
05277500	Middle Fork Crow River (Calhoun Lake Diversion) near Spicer, MN	-	1939, 1940-46
05278000	Middle Fork Crow River near Spicer, MN	179	1949-87
05278400	North Fork Crow River near Rockford, MN	-	1909-10
05278500	South Fork Crow River at Cosmos, MN	221	1945-64
05278930	Buffalo Creek near Glencoe, MN	374	1972-80
*05279000	South Fork Crow River near Mayer, MN	a1,170	1934-79
05279500	South Fork Crow River near Rockford, MN	a1,250	1909-12
05283500	Mississippi River at Anoka, MN	a17,100	1897, 1905-13
05284500	Rum River at Onamia, MN	414	1910-12
05284750	Rum River at Spencer Brook MN	-	1960-64
05285000	Rum River at Cambridge, MN	a1,160	1909-14
05285500	Rum River at St. Francis, MN	-	1903
05286500	Rum River near Anoka, MN	1,430	1905-06, 1909
05289000	Minnetonka Lake (head of Minnehaha Creek) near Wayzata (at Excelsior), MN	-	1938-64
05289500	Minnehaha Creek at Minnetonka Mills, MN	130	1953-64
Minnesota River basin			
05290000	Little Minnesota River near Peever, SD	447	1939-81
05292500	Minnesota River near Odessa, MN	a1,340	1909-12, 1944-63
05293500	Pomme de Terre River near Morris, MN	-	1937-39, 1940-47
05299500	Canby Creek at Canby, MN	-	1938-39, 1940-46
05300500	Ten Mile Creek near Boyd, MN	82.8	1949-51
05302000	Little Chippewa River near Lowry, MN	a54	1941
*05302500	Little Chippewa River near Starbuck, MN	111	1938-39
05303000	Chippewa River at diversion dam near Hancock, MN	-	1930-39, 1940-46

"See footnotes at end of table."

## DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Minnesota River basin--Continued			
05303500	Chippewa River at Benson, MN	a1,270	1949-51
05304000	Shakopee Creek near Benson, MN	352	1949-54
05305000	Chippewa River near Watson, MN	a2,050	1910-17, 1931-36
05311400	South Branch Yellow Medicine River at Minneota	111	1960-81, 1983-87
05311500	Yellow Medicine River near Cottonwood, MN	465	1945-46
05312000	Spring Creek near Clarkfield, MN	a89	1945-46
05312500	Spring Creek near Hazel Run, MN	101	1945-48
05313000	Yellow Medicine River near Hanley Falls, MN	606	1945-47
05313521	Hawk Creek at outlet of Eagle Lake near Willmar, MN	-	1972-73
05313560	Eagle Lake tributary No. 7 near Willmar, MN	-	1972-73
05313570	Eagle Lake tributary No. 8 near Willmar, MN	-	1972-73
05314000	Chetomba Creek near Maynard, MN	a200	1949-51
*05314500	Hawk Creek near Maynard, MN	474	1949-54
*05315200	Prairie Ravine near Marshall, MN	5.63	1959-64
05315500	Redwood River near Green Valley, MN	436	1945-57
05316000	Redwood River near Seaforth, MN	573	1945-46
05316770	Minnesota River at New Ulm, MN	9,536	1968-76
05316900	Dry Creek near Jeffers, MN	3.13	1982-85
05317500	Minnesota River at Judson, MN	a11,200	1938-50
*05318000	East Branch (East Fork) Blue Earth River near Bricelyn, MN	132	1951-70
05319000	South Fork Watonwan River at diversion dam near St. James, MN	-	1939, 1940-46
05321000	Blue Earth River at Mankato, MN	a3,550	1938-39, 1940-42
05330400	Sand Creek at diversion dam near Jordan, MN	-	1938-39, 1940-46
05330800	Purgatory Creek at Eden Prairie, MN	-	1975-80
05330900	Nine Mile Creek at Bloomington, MN	-	1963-73
St. Croix River basin			
*05336200	Glaisby Brook near Kettle River, MN	24.2	1959-70
05336500	Kettle River near Sandstone, MN	825	1908-16
05337000	Grindstone River at Hinckley, MN	-	1940-47
05337500	Snake River at Mora, MN	422	1909-13
05338000	Snake River at Sanatorium Bridge near Pine City, MN	-	1937-38
*05338500	Snake River near Pine City, MN	958	1913-17, 1951-81
05339500	St. Croix River near Rush City, MN	a5,120	1923-61
05340000	Sunrise River near Stacy, MN	167	1949-65
05340050	Sunrise River near Lindstrom	231	1965-85

"See footnotes at end of table."

## DISCONTINUED GAGING STATIONS

Station number	Station name	Drainage area (mi <sup>2</sup> )	Period of record
Lower Mississippi River basin			
05345500	Vermillion River at Empire (Empire City), MN	124	1942-44
05346000	Vermillion River at Hastings, MN	195	1942-47
*05355200	Cannon River at Welch, MN	a1,320	1909-14, 1930-71
05371500	Mississippi River at Wabasha, MN	a56,600	1934
*05372800	South Fork Zumbro River on Belt Line at Rochester, MN	155	1981
*05372930	Bear Creek at Rochester, MN	80.0	1981
*05372950	Silver Creek at Rochester, MN	17.3	1981
*05372990	Cascade Creek at Rochester, MN	35.8	1981
05373000	South Fork Zumbro River near Rochester, MN	304	1952-81
05373500	Zumbro River (South Branch) near Zumbro Falls, MN	821	1911-17
05374000	Zumbro River at Zumbro Falls, MN	-	1909-17, 1929-80
05374500	Zumbro River at Theilman, MN	a1,320	1938-56
*05376500	South Fork Whitewater River near Altura, MN	76.8	1939-71
05376800	Whitewater River near Beaver, MN	271	1975-85
05377000	Beaver Creek at Beaver, MN	15.4	1939-40
05377500	Whitewater River at Beaver, MN	288	1936-38 1939-56
05378230	Stockton Valley Creek at Stockton	-	1982-85
05378300	Straight Valley Creek near Rollingstone	5.16	1970-85
05379000	Gilmore Creek at Winona, MN	8.95	1939-63
05380500	Mississippi River at Lamoile, MN	a60,000	1930-31
05383500	Mississippi River at LaCrosse, WI	-	1929-55
05383600	North Branch Root River tributary near Stewartville, MN	0.73	1959-64
*05384500	Rush Creek near Rushford, MN	129	1942-79
b05385000	Root River near Houston, MN	a1,270	1909-17 1929 1930-83
b05385500	South Fork Root River near Houston, MN	275	1953-83
05386000	Root River below South Fork near Houston, MN	a1,560	1938-61
05456500	Turtle Creek near Austin, MN	144	1947-51
05475000	Heron Lake outlet near Heron Lake, MN	-	1930-43
Big Sioux River basin			
*06483000	Rock River at Luverne, MN	440	1911-14
06603000	Little Sioux River near Lakefield, MN	17.1	1948-63
06603500	Jackson County ditch No. 11 near Lakefield, MN	7.69	1948-61

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

† Stage records only.

a Approximately.

b Discharge measurements made to maintain a current rating.



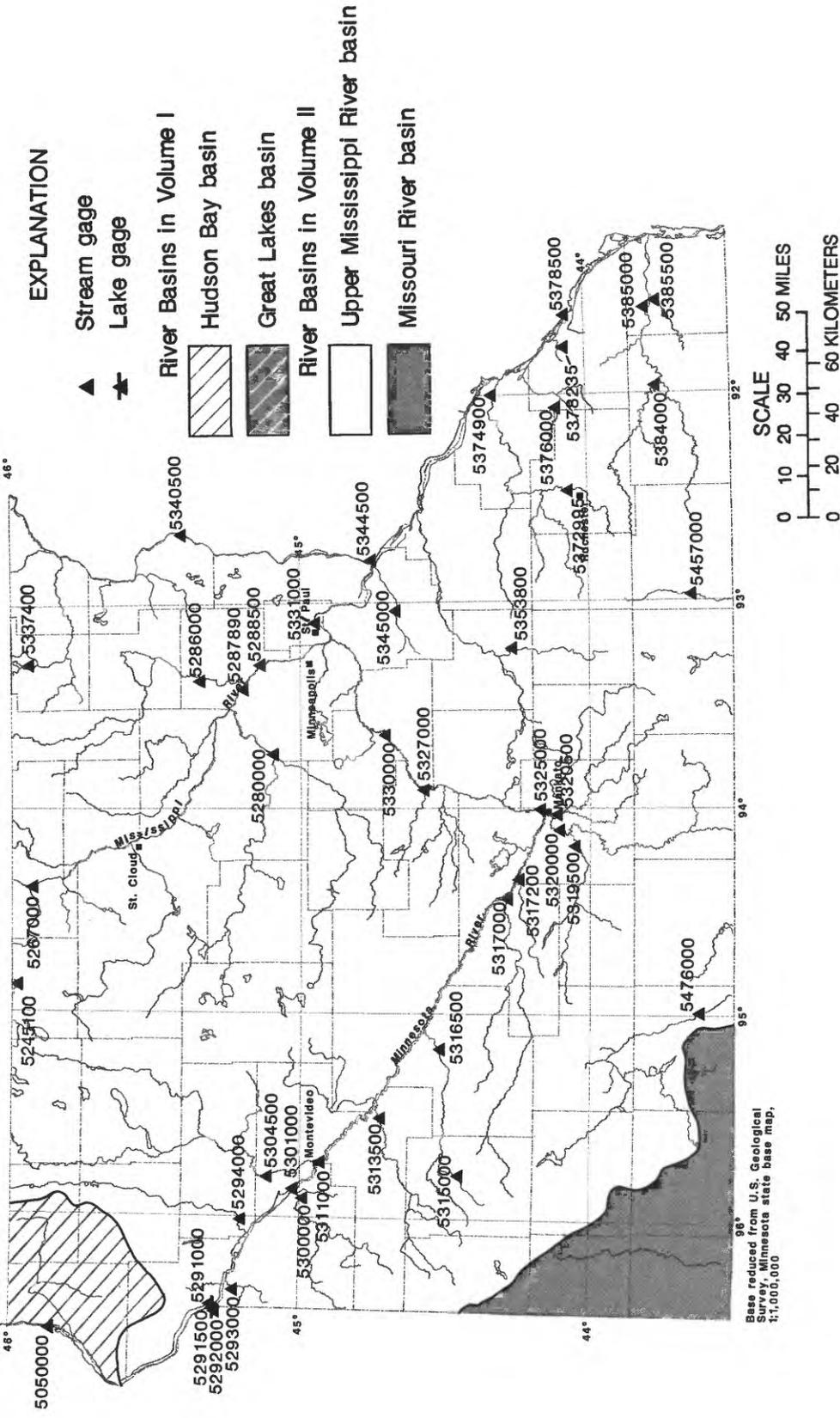


Figure 7.—Location of lake and stream-gaging stations



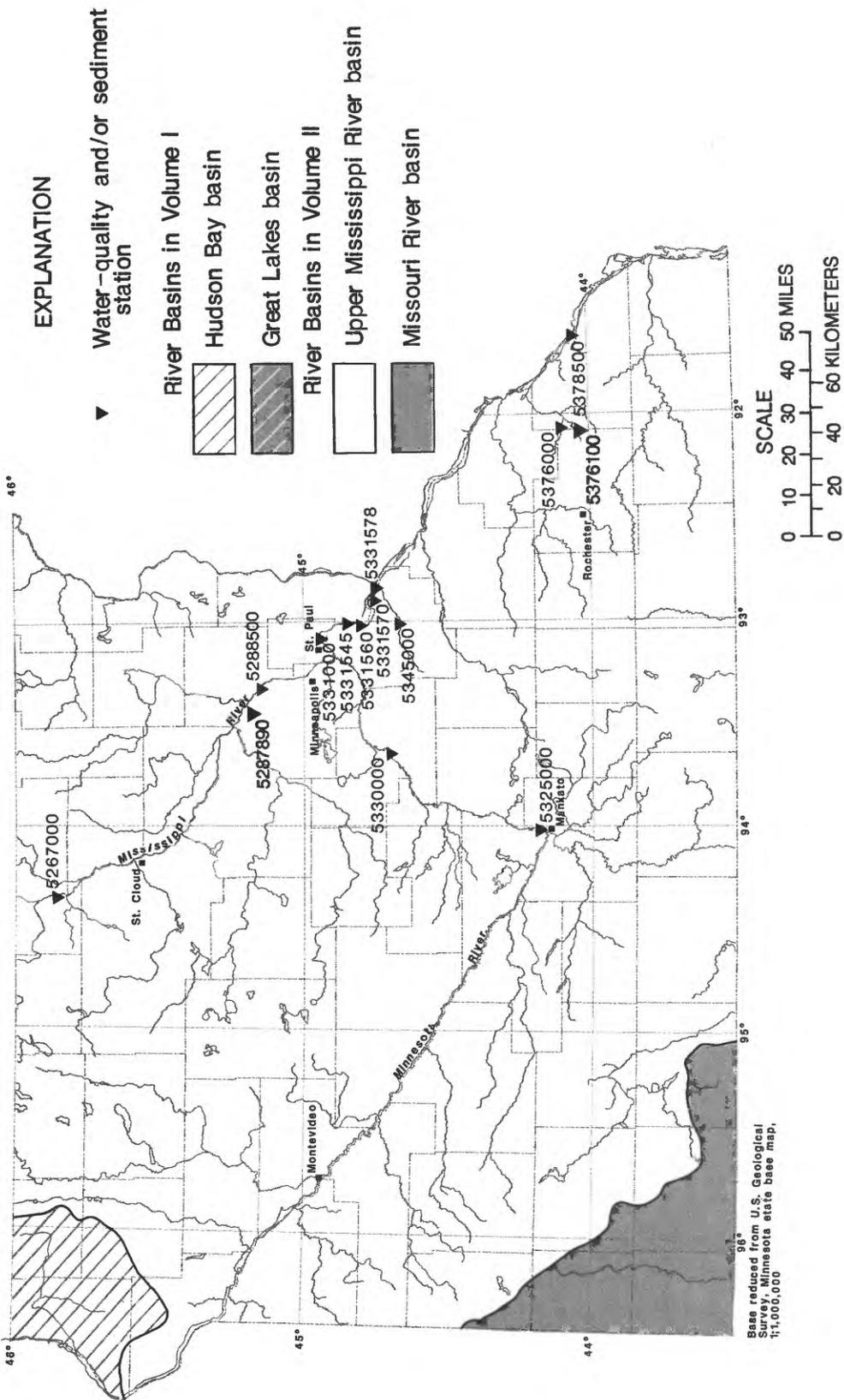


Figure 8.--Location of surface-water-quality stations

## MISSISSIPPI RIVER MAIN STEM

05200445 MISSISSIPPI RIVER AT BEMIDJI, MN

LOCATION.--Lat 47°27'04", long 94°54'23", in NW¼NW¼ sec.20, T.146 N., R.33 W., Beltrami County, Hydrologic Unit 07010101, at bridge on County Highway 11, 1.5 mi southwest of intersection of U.S. Highway 2 and County Highway 7 in Bemidji.

DRAINAGE AREA.--400 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--July to November 1987, April 1988 to September 1989 (Discontinued. Converted to high-flow partial-record station). October 1972 to June 1987, operated as a high-flow partial record station only. 1950, 1964-65 (miscellaneous measurements each year).

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 1,345 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 1, 1987, crest-stage gage only.

REMARKS.--Records fair except those for estimated daily discharges, which are poor.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 623 ft<sup>3</sup>/s, Apr. 10, 1988, gage height, 11.82 ft; maximum gage height, 12.12 ft, Apr. 12, 1989 (backwater from ice); minimum, 34 ft<sup>3</sup>/s, July 30, 31, Aug. 1, 1988, gage height, 7.63 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 616 ft<sup>3</sup>/s, Apr. 21, gage height, 11.74 ft; maximum gage height, 12.12 ft, Apr. 12 (backwater from ice); minimum, 36 ft<sup>3</sup>/s, Aug. 9, 10, 11, 12, 17, 18, 19; minimum gage height, 7.68 ft, Aug. 10, 11.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	143	97	e85	e75	e65	e70	e113	384	163	69	39	50
2	146	97	85	e75	e64	e70	e120	364	165	69	38	49
3	147	97	e84	e74	e64	e71	e130	346	165	74	38	50
4	147	98	e83	e74	e64	e72	e140	329	162	69	38	51
5	145	98	e83	e73	e64	e72	e150	317	159	66	37	49
6	143	98	e82	e73	e64	e73	e165	305	155	67	39	49
7	139	98	e82	e72	e65	e74	e180	288	149	64	38	49
8	136	e98	e82	e72	e65	e75	e190	277	144	61	37	49
9	132	e96	e82	e72	e65	e75	e200	262	137	60	37	49
10	129	e96	e82	e71	e65	e76	e220	247	128	58	37	49
11	124	e95	e82	e71	e65	e77	e240	231	119	56	36	51
12	120	e94	e82	e70	e65	e77	e270	215	117	54	37	52
13	117	e93	e81	e70	e66	e78	e300	201	116	52	38	52
14	114	e93	e81	e70	e66	e79	e320	190	114	50	38	52
15	111	e92	e80	e69	e67	e80	e360	180	106	49	37	52
16	109	e91	e80	e69	67	e81	e420	169	99	47	37	52
17	106	e91	e79	e69	e67	e82	e460	157	93	46	37	53
18	103	e90	e79	e69	e67	e83	e530	151	89	45	36	54
19	101	e90	e79	69	e67	e84	604	145	85	47	37	56
20	100	e89	e78	e69	e67	e85	608	140	81	46	37	58
21	99	e88	e78	e68	e68	e86	610	127	81	44	38	67
22	99	e88	e78	e68	e68	e88	607	126	86	43	41	72
23	99	e87	e78	e68	e68	e90	585	122	84	42	40	73
24	98	e87	e77	e67	e68	e92	562	122	81	41	39	73
25	97	e86	e77	e67	e69	e94	532	130	82	39	39	73
26	96	e86	e77	e67	e69	e95	505	133	82	39	40	74
27	96	e86	e77	e66	e69	e96	478	134	78	39	40	75
28	97	e86	e76	e66	e70	e98	449	137	75	39	43	75
29	97	e85	e76	e66	---	e100	426	146	72	39	45	75
30	97	e85	e76	e66	---	e103	406	153	71	40	44	76
31	90	---	e76	e65	---	105	---	159	---	39	50	---
TOTAL	3577	2755	2477	2160	1858	2581	10880	6387	3338	1593	1207	1759
MEAN	115	91.8	79.9	69.7	66.4	83.3	363	206	111	51.4	38.9	58.6
MAX	147	98	85	75	70	105	610	384	165	74	50	76
MIN	90	85	76	65	64	70	113	122	71	39	36	49
AC-FT	7090	5460	4910	4280	3690	5120	21580	12670	6620	3160	2390	3490
CFSM	.29	.23	.20	.17	.17	.21	.91	.52	.28	.13	.10	.15
IN.	.33	.26	.23	.20	.17	.24	1.01	.59	.31	.15	.11	.16

WTR YR 1989 TOTAL 40572 MEAN 111 MAX 610 MIN 36 AC-FT 80470 CFSM .28 IN. 3.77

e Estimated

MISSISSIPPI RIVER MAIN STEM  
 05200445 MISSISSIPPI RIVER AT BEMIDJI, MN--Continued  
 WATER QUALITY RECORDS

PERIOD OF RECORD.--May 1988 to current year.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	TEMPER- ATURE WATER (DEG C) (00010)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
MAY 02...	1050	373	7.0	41	11
AUG 04...	0820	38	24.0	10	100
SEP 14...	1320	53	13.5	5	84

## SCHOOLCRAFT RIVER BASIN

05200450 SCHOOLCRAFT RIVER NEAR BEMIDJI, MN

LOCATION.--Lat 47°24'48", long 94°54'46", in SW¼SE¼ sec.31, T.146 N., R.33 W., Beltrami County, Hydrologic Unit 07010101, on left bank 100 ft downstream of bridge on County Highway 2, 0.1 mi downstream from Lake Plantagenet outlet, and 4.6 mi south of Bemidji.

DRAINAGE AREA.--165 mi<sup>2</sup>.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1988 to September 1989 (discontinued). August 1947 to June 1987, operated as a low-flow partial-record station.

GAGE.--Water-stage recorder. Elevation of gage is 1,341 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records fair.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 189 ft<sup>3</sup>/s, Apr. 26, 27, 1989, gage height, 3.34 ft; minimum discharge, 11 ft<sup>3</sup>/s, July 30, 1988, gage height, 1.65 ft; minimum gage height, 1.63 ft, Aug. 21, Sept. 9.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 189 ft<sup>3</sup>/s, Apr. 26, 27, gage height, 3.34 ft; minimum discharge, 15 ft<sup>3</sup>/s, Aug. 13, gage height, 1.68 ft; minimum gage height, 1.63 ft, Aug. 21, Sept. 9.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	94	61	e66	e70	e60	e50	68	184	119	65	29	36
2	93	61	67	e70	e60	e50	71	181	117	65	28	37
3	91	60	e67	e70	e59	e50	76	178	116	69	26	32
4	89	59	e68	e70	e58	e50	86	175	111	67	27	20
5	88	57	e68	e70	e58	e50	89	175	109	66	26	20
6	86	57	e68	e70	e58	e50	95	171	105	66	23	20
7	85	57	e68	e70	e57	e50	102	167	102	64	20	19
8	83	57	e69	e69	e57	e50	109	166	99	62	17	18
9	83	e57	e70	e69	e56	e50	113	165	96	61	17	17
10	80	e57	e70	e68	e56	e50	118	161	93	59	18	18
11	77	e58	e70	e68	e55	e49	125	158	89	57	18	20
12	76	e58	e70	e68	e55	e49	130	153	90	56	18	19
13	75	e58	e70	e68	e54	e49	136	150	92	54	19	19
14	74	e58	e70	e67	e54	e49	141	146	94	52	18	19
15	74	e58	e71	e66	e53	e49	145	142	92	52	19	18
16	74	e58	e71	e66	52	e49	152	139	91	51	20	18
17	74	e58	e71	e65	e52	e49	160	135	87	50	20	20
18	73	e58	e71	e64	e52	e49	166	132	85	47	21	20
19	74	e59	e71	63	e52	e49	170	129	83	47	20	18
20	74	e60	e71	e63	e52	e49	174	127	81	46	19	19
21	73	e60	e71	e62	e52	e49	178	123	80	45	18	28
22	72	e60	e71	e62	e52	e49	181	121	82	44	21	35
23	71	e61	e71	e62	e52	e49	183	122	80	42	21	34
24	70	e62	e71	e62	e51	e49	185	121	78	41	21	35
25	68	e62	e71	e62	e51	e50	187	123	79	39	21	33
26	67	e63	e71	e61	e50	e52	188	119	77	38	22	34
27	67	e64	e71	e61	e50	e54	189	117	74	35	22	35
28	65	e64	e71	e60	e50	e56	188	117	72	32	25	34
29	63	e65	e70	e60	---	e60	186	120	70	31	27	36
30	62	e65	e70	e60	---	e65	186	120	67	29	26	37
31	61	---	e70	e60	---	67	---	119	---	28	34	---
TOTAL	2356	1792	2165	2026	1518	1590	4277	4456	2710	1560	681	768
MEAN	76.0	59.7	69.8	65.4	54.2	51.3	143	144	90.3	50.3	22.0	25.6
MAX	94	65	71	70	60	67	189	184	119	69	34	37
MIN	61	57	66	60	50	49	68	117	67	28	17	17
AC-FT	4670	3550	4290	4020	3010	3150	8480	8840	5380	3090	1350	1520
CFSM	.46	.36	.42	.40	.33	.31	.86	.87	.55	.30	.13	.16
IN.	.53	.40	.49	.46	.34	.36	.96	1.00	.61	.35	.15	.17

WTR YR 1989 TOTAL 25899 MEAN 71.0 MAX 189 MIN 17 AC-FT 51370 CFSM .43 IN. 5.84

e Estimated

MISSISSIPPI RIVER MAIN STEM  
 05200450 SCHOOLCRAFT RIVER NEAR BEMIDJI, MN--Continued  
 WATER QUALITY RECORDS

PERIOD OF RECORD.--May 1988 to current year.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	TEMPER- ATURE WATER (DEG C) (00010)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
MAY					
02...	0845	178	5.0	4	97
AUG					
03...	1600	25	29.0	4	93
SEP					
14...	1000	20	14.0	3	79

## MISSISSIPPI RIVER MAIN STEM

05200510 MISSISSIPPI RIVER NEAR BEMIDJI, MN

LOCATION.--Lat 47°29'00", long 94°43'40", in SE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.3, T.146 N., R.32 W., Beltrami County, Hydrologic Unit 07010101, 3.5 mi east of Bemidji on right bank 100 ft upstream of County Highway 12 and 400 ft downstream from Stump Lake dam.

DRAINAGE AREA.--610 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1987 to current year (no winter records).

GAGE.--Water-stage recorder. Elevation of gage is 1,315 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records fair. Some regulation by Stump Lake dam upstream from station.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 887 ft<sup>3</sup>/s, Apr. 27, 1989, gage height, 4.87 ft; minimum, 16 ft<sup>3</sup>/s, Sept. 26, 1988, gage height 2.02 ft.

EXTREME FOR CURRENT YEAR.--Maximum discharge, 887 ft<sup>3</sup>/s, Apr. 27, gage height, 4.87 ft; minimum, 35 ft<sup>3</sup>/s, Aug. 8, gage height, 2.25 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	393	169	---	---	---	---	276	735	369	185	86	72
2	389	177	---	---	---	---	275	724	368	188	92	72
3	389	176	---	---	---	---	275	716	365	189	92	72
4	389	191	---	---	---	---	292	693	364	189	93	78
5	384	197	---	---	---	---	312	700	362	188	94	75
6	351	195	---	---	---	---	311	662	359	191	90	73
7	317	195	---	---	---	---	302	646	351	192	86	75
8	303	195	---	---	---	---	284	648	348	191	55	76
9	317	---	---	---	---	---	285	592	414	190	38	74
10	317	---	---	---	---	---	287	578	469	189	38	71
11	315	---	---	---	---	---	287	578	455	192	38	74
12	236	---	---	---	---	---	288	580	404	190	39	76
13	122	---	---	---	---	---	278	622	359	189	40	73
14	125	---	---	---	---	---	266	598	358	86	50	72
15	125	---	---	---	---	---	269	585	357	97	58	71
16	124	---	---	---	---	---	270	530	354	96	57	71
17	163	---	---	---	---	---	272	481	354	94	56	71
18	217	---	---	---	---	---	307	469	352	83	54	70
19	176	---	---	---	---	---	345	466	300	80	56	76
20	195	---	---	---	---	---	385	468	192	83	57	75
21	190	---	---	---	---	---	439	460	110	84	53	83
22	188	---	---	---	---	---	444	412	141	85	57	92
23	190	---	---	---	---	---	447	234	189	86	55	85
24	280	---	---	---	---	---	499	189	188	83	54	80
25	328	---	---	---	---	---	595	192	187	73	54	83
26	302	---	---	---	---	---	651	195	187	69	57	79
27	272	---	---	---	---	---	761	194	185	67	57	77
28	278	---	---	---	---	---	771	196	183	68	60	82
29	272	---	---	---	---	---	757	201	186	68	69	99
30	272	---	---	---	---	---	740	207	185	68	65	93
31	237	---	---	---	---	278	---	294	---	73	69	---
TOTAL	8156	---	---	---	---	---	11970	14845	8995	3906	1919	2320
MEAN	263	---	---	---	---	---	399	479	300	126	61.9	77.3
MAX	393	---	---	---	---	---	771	735	469	192	94	99
MIN	122	---	---	---	---	---	266	189	110	67	38	70
AC-FT	16180	---	---	---	---	---	23740	29450	17840	7750	3810	4600
CFSM	.43	---	---	---	---	---	.65	.79	.49	.21	.10	.13
IN.	.50	---	---	---	---	---	.73	.91	.55	.24	.12	.14

## MISSISSIPPI RIVER MAIN STEM

05200510 MISSISSIPPI RIVER NEAR BEMIDJI, MN--Continued

## WATER QUALITY RECORDS

PERIOD OF RECORD.--May 1988 to current year.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	TEMPER- ATURE WATER (DEG C) (00010)	SEDI- MENT, SUS- PENDE (MG/L) (80154)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
MAY 02...	1400	720	6.0	3	80
AUG 04...	1130	93	24.0	1	80

UPPER MISSISSIPPI RIVER BASIN  
MISSISSIPPI RIVER MAIN STEM  
05201000 WINNIBIGOSHISH LAKE NEAR DEER RIVER, MN

LOCATION.--Lat 47°25'42", long 94°03'00", in sec.25, T.146 N., R.27 W., Itasca County, Hydrologic Unit 07010101, on Leech Lake Indian Reservation, at dam on Mississippi River, 1 mi northwest of Little Winnibigoshish Lake, 14 mi northwest of city of Deer River, and at mile 1,248 upstream from Ohio River.

DRAINAGE AREA.--1,442 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1884 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to September 1956.

REVISED RECORDS.--WSP 1308: 1905(M).

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to July 8, 1949, nonrecording gage at same site, and July 9, 1949, to July 10, 1973, water-stage recorder at same site and at datum of 1,288.94 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Reservoir is formed by Winnibigoshish Lake and several other natural lakes controlled by a concrete and timber dam, completed in 1884; storage began in 1884. Capacity between elevations 1,294.94 ft and 1,303.14 ft (maximum allowable range) is 668,737 acre-ft of which 439,636 acre-ft is controlled storage between elevations 1,294.94 ft and 1,300.94 ft (normal operating range). Contents shown herein are contents above elevation 1,286.00 ft. Prior to September 1978, published contents as contents above elevation 1,288.94 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents observed, 996,500 acre-ft, capacity table then in use, July 30, 1905, elevation, 1,303.39 ft; minimum observed, 33,680 acre-ft, below zero of capacity table then in use, Oct. 20, 1931, elevation, 1,288.25 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 744,590 acre-ft, Dec. 4, elevation, 1,298.87 ft; minimum, 615,830 acre-ft, Mar. 23, elevation, 1,296.91 ft.

MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,298.21	701,120	
Oct. 31 .....	1,298.15	697,180	-3,940
Nov. 30 .....	1,298.35	710,320	+13,140
Dec. 31 .....	1,297.96	684,710	-25,610
CAL YR 1988 .....			+56,440
Jan. 31 .....	1,297.56	658,450	-26,260
Feb. 28 .....	1,297.11	628,930	-29,520
Mar. 31 .....	1,297.05	624,990	-3,940
Apr. 30 .....	1,297.94	683,400	+58,410
May 31 .....	1,298.78	738,530	+55,130
June 30 .....	1,298.68	731,960	-6,570
July 31 .....	1,297.88	679,460	-52,500
Aug. 31 .....	1,297.85	677,490	-1,970
Sept. 30 .....	1,297.60	661,080	-16,410
WTR YR 1989 .....			-40,040

## MISSISSIPPI RIVER MAIN STEM

05201500 MISSISSIPPI RIVER AT WINNIBIGOSHISH DAM NEAR DEER RIVER, MN

LOCATION.--Lat 47°25'42", long 94°03'00", in SW $\frac{1}{4}$  sec.25, T.146 N., R.27 W., Itasca County, Hydrologic Unit 07010101, on Leech Lake Indian Reservation, at dam 1 mi northwest of Little Winnibigoshish Lake, 14 mi northwest of city of Deer River, and at mile 1,248 upstream from Ohio River.

DRAINAGE AREA.--1,442 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1884 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder on headwater and nonrecording gage on tailwater. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U. S. Army Corps of Engineers). Prior to June 30, 1973, gages at same sites with datum at 1,289.47 ft, adjustment of 1912. Prior to July 8, 1949, nonrecording headwater gage at same site and datum in use.

REMARKS.--Daily discharge is computed on the basis of modified weir formula and corrected to conform with discharge measurements, the head being determined from readings of headwater and tailwater gages. Flow completely regulated by Winnibigoshish Lake (station 05201000).

COOPERATION.--Daily discharge computed by U. S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--105 years, 522 ft<sup>3</sup>/s, 4.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 4,370 ft<sup>3</sup>/s, Aug. 6, 1905; no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,460 ft<sup>3</sup>/s, June 27; minimum daily, 100 ft<sup>3</sup>/s, Apr. 12-18, Aug. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	402	303	788	783	1010	955	445	202	710	1440	154	101
2	402	202	787	783	1010	909	445	202	800	1440	101	101
3	402	151	787	783	1010	863	445	202	898	1430	101	101
4	402	101	787	783	1010	963	390	202	988	1430	101	101
5	402	101	785	783	1010	864	343	202	988	1430	102	101
6	401	101	785	783	1000	864	294	202	986	1430	101	101
7	402	101	785	783	1000	817	248	202	985	1430	100	101
8	402	101	785	783	1000	769	199	202	985	1430	102	201
9	402	101	785	783	1000	726	199	202	985	1430	101	300
10	402	101	785	783	1000	678	199	202	983	1420	102	300
11	402	101	785	783	1000	632	150	150	981	1330	102	300
12	402	101	785	781	1000	633	100	203	981	1240	101	396
13	402	101	784	829	1000	633	100	300	981	1240	101	495
14	402	101	784	875	1000	634	100	398	981	1150	101	495
15	350	101	784	875	1000	634	100	398	981	1050	101	495
16	350	102	784	875	1000	634	100	304	981	1050	101	493
17	350	102	784	875	1000	634	100	202	1080	1050	101	492
18	353	201	784	920	1000	634	100	102	1080	960	101	492
19	353	201	784	967	1000	634	101	102	1080	865	101	492
20	353	201	784	1010	1000	634	101	102	1170	773	101	492
21	353	201	784	1010	1000	634	101	102	1170	680	101	493
22	354	300	784	1010	1000	634	101	102	1160	678	101	494
23	354	400	784	1010	1000	633	101	102	1280	678	101	494
24	354	502	784	1010	1000	586	101	102	1390	678	101	494
25	353	601	784	1010	1000	542	101	204	1390	584	101	493
26	353	598	784	1010	1000	542	151	307	1440	488	101	494
27	353	684	784	1010	1000	542	200	408	1460	383	101	494
28	354	684	784	1010	1000	542	200	408	1440	296	101	494
29	353	791	783	1010	---	487	200	509	1440	199	101	494
30	353	789	783	1010	---	445	201	508	1440	199	101	494
31	353	---	783	1010	---	445	---	607	---	200	101	---
TOTAL	11623	8245	24322	27730	28050	20776	5716	7640	33214	30091	3187	11088
MEAN	375	275	785	895	1002	670	191	246	1107	971	103	370
MAX	402	791	788	1010	1010	963	445	607	1460	1440	154	495
MIN	350	101	783	781	1000	445	100	102	710	199	100	101
AC-FT	23050	16350	48240	55000	55640	41210	11340	15150	65880	59680	6320	21980
CFSM	.26	.19	.54	.62	.69	.46	.13	.17	.77	.67	.07	.26
IN.	.30	.21	.63	.72	.72	.54	.15	.20	.86	.78	.08	.29

CAL YR 1988 TOTAL 109872 MEAN 300 MAX 791 MIN 100 AC-FT 217900 CFSM .21 IN. 2.83  
WTR YR 1989 TOTAL 211682 MEAN 580 MAX 1460 MIN 100 AC-FT 419800 CFSM .40 IN. 5.46

## LEECH LAKE RIVER BASIN

05202000 WILLIAMS LAKE NEAR AKELEY, MN

LOCATION.--Lat 46°57'24", long 94°40'26", in SE¼NW¼ sec.12, T.140 N., R.32 W., Hubbard County, Hydrologic Unit 07010102, on northwest shore of Williams lake, 4 mi southeast of Akeley.

DRAINAGE AREA--0.88 mi<sup>2</sup>.

## GAGE-HEIGHT RECORDS

PERIOD OF RECORD--October 1988 to September 1989. August 1977 to September 1988, in files of the U.S. Geological Survey's Hydrology of Lakes Section in Denver, Colorado.

GAGE--Water-stage recorder. Elevation of gage is 1,385 ft above National Geodetic Vertical datum of 1929, from topographic map.

EXTREMES FOR CURRENT YEAR--Maximum gage height, 1.33 ft, June 25; minimum, 0.55 ft, August 21.

GAGE HEIGHT, FEET, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.91	.70	.81	.93	.98	.98	1.07	1.23	1.20	1.21	.78	1.03
2	.89	.71	.82	.91	.99	.98	1.08	1.23	1.19	1.21	.77	1.01
3	.88	.70	.82	.92	.99	.98	1.10	1.23	1.17	1.26	.76	1.02
4	.86	.70	.82	.92	.99	1.00	1.14	1.23	1.16	1.24	.81	1.07
5	.85	.68	.82	.92	1.00	1.00	1.16	1.25	1.15	1.23	.78	1.07
6	.84	.67	.82	.92	.99	1.00	1.15	1.23	1.14	1.21	.75	1.06
7	.83	.67	.81	.97	1.00	.99	1.16	1.23	1.13	1.18	.73	1.06
8	.83	.68	.81	.99	.99	.99	1.17	1.24	1.13	1.17	.72	1.05
9	.82	.69	.81	.99	.99	.99	1.17	1.25	1.15	1.15	.71	1.06
10	.81	.70	.80	.99	.99	.99	1.17	1.27	1.14	1.14	.69	1.03
11	.80	.68	.80	.98	.99	.99	1.17	1.27	1.14	1.12	.68	1.03
12	.79	.70	.83	.99	.98	.98	1.17	1.25	1.14	1.11	.66	1.03
13	.78	.73	.86	.99	.99	.98	1.17	1.24	1.14	1.09	.66	1.02
14	.78	.74	.88	1.00	.99	1.00	1.17	1.24	1.14	1.07	.65	1.01
15	.77	.73	.87	.99	.99	1.01	1.17	1.23	1.15	1.06	.63	1.00
16	.77	.77	.87	1.00	.98	1.00	1.18	1.23	1.13	1.04	.63	.99
17	.76	.76	.88	1.00	.98	1.00	1.17	1.22	1.13	1.03	.61	.98
18	.77	.76	.88	1.01	.98	1.00	1.18	1.21	1.12	1.01	.60	.96
19	.76	.78	.88	1.01	.97	.99	1.18	1.22	1.10	1.00	.59	.95
20	.76	.78	.88	1.00	.98	.99	1.17	1.22	1.09	.97	.58	.97
21	.78	.78	.88	1.00	.98	.99	1.17	1.20	1.12	.95	.56	1.10
22	.77	.77	.88	.99	.97	.99	1.17	1.19	1.27	.94	.66	1.14
23	.77	.78	.88	.99	.97	.99	1.16	1.20	1.27	.92	.66	1.12
24	.76	.78	.88	.99	.99	1.00	1.17	1.20	1.27	.91	.65	1.09
25	.74	.78	.87	1.00	.99	1.00	1.19	1.24	1.31	.89	.64	1.08
26	.73	.78	.88	1.00	.97	.99	1.20	1.22	1.32	.87	.67	1.07
27	.73	.82	.93	1.00	.97	1.01	1.20	1.21	1.28	.85	.70	1.05
28	.73	.82	.92	1.00	.98	1.03	1.19	1.20	1.26	.82	.74	1.05
29	.72	.83	.91	.99	---	1.04	1.19	1.21	1.24	.81	.75	1.05
30	.71	.82	.92	1.00	---	1.05	1.22	1.20	1.22	.79	.74	1.04
31	.71	---	.91	.99	---	1.06	---	1.20	---	.78	1.04	---
MEAN	.79	.74	.86	.98	.98	1.00	1.17	1.23	1.18	1.03	.70	1.04
MAX	.91	.83	.93	1.01	1.00	1.06	1.22	1.27	1.32	1.26	1.04	1.14
MIN	.71	.67	.80	.91	.97	.98	1.07	1.19	1.09	.78	.56	.95
WTR YR 1989	MEAN	.97	MAX	1.32	MIN	.56						

## LEECH LAKE RIVER BASIN

05206000 LEECH LAKE AT FEDERAL DAM, MN

LOCATION.--Lat 47°12'23", long 94°18'31", in lot 2, sec.14, T.143 N., R.29 W., Cass County, Hydrologic Unit 07010102, on Leech Lake Indian Reservation, at head of Leech Lake River on Waboose Bay, 5 mi southwest of town of Federal Dam.

DRAINAGE AREA.--1,163 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1884 to current year. Monthend contents only for some periods, published in WSP 1308. Prior to October 1956, published as "Leech Lake Reservoir."

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Dec. 31, 1884, nonrecording gage 0.5 mi north of outlet to Leech Lake River at datum 98.47 ft higher. Dec. 31, 1884, to May 24, 1931, nonrecording gage 0.5 mi north of outlet to Leech Lake River and May 25, 1931, to July 10, 1973, water-stage recorder at same site and at datum 92.70 ft higher.

REMARKS .--Reservoir is formed by Leech Lake and several other natural lakes controlled by concrete and timber dam; storage began in 1884; original timber structure completed in 1884, replaced by present dam in 1902. Capacity between elevation 1,292.70 ft and 1,297.94 ft (maximum allowable range) is 688,985 acre-ft of which 352,637 acre-ft is controlled storage between elevations 1,292.70 ft and 1,295.70 ft (normal operating range). Contents shown herein are contents above elevation 1,290.00 ft. Prior to September 1978, published contents as contents above elevation 1,292.20 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents observed, 734,300 acre-ft, capacity table then in use, June 30, 1916, elevation, 1,297.88 ft; minimum, 51,380 acre-ft, capacity table then in use, Dec. 8, 24, 1976, elevation, 1,292.89 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 603,930 acre-ft, May 25, elevation, 1,294.86 ft; minimum, 461,510 acre-ft, Mar. 27, elevation, 1,293.70 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1988 to SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,294.22	523,030	
Oct. 31 .....	1,293.97	491,630	-31,400
Nov. 30 .....	1,294.08	505,320	+13,690
Dec. 31 .....	1,294.12	510,380	+5,060
CAL YR 1988 .....			+21,140
Jan. 31 .....	1,294.16	515,440	+5,060
Feb. 28 .....	1,293.93	486,850	-28,590
Mar. 31 .....	1,293.77	469,120	-17,730
Apr. 30 .....	1,294.43	549,570	+80,450
May 31 .....	1,294.76	591,290	+41,720
June 30 .....	1,294.85	602,870	+11,380
July 31 .....	1,294.38	543,240	-59,430
Aug. 31 .....	1,294.32	535,670	-7,570
Sept. 30 .....	1,294.40	545,770	+10,100
WTR YR 1989 .....			+22,740

## LEECH LAKE RIVER BASIN

05206500 LEECH LAKE RIVER AT FEDERAL DAM, MN

LOCATION.--Lat 47°14'45", long 94°13'12", in sec.34, T.144 N., R.28 W., Cass County, Hydrologic Unit 07010102, on Leech Lake Indian Reservation, on right bank at dam on Leech Lake River at city of Federal Dam, 2 mi downstream from natural outlet of Leech Lake.

DRAINAGE AREA.--1,163 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1884 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder, headwater gage, and nonrecording tailwater gage. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U. S. Army Corps of Engineers). Prior to June 30, 1973, gages (nonrecording headwater gage prior to July 3, 1948) at same sites with datum at 1,293.23 ft, adjustment of 1912. May 27 to Nov. 30, 1929, nonrecording gage at site 600 ft downstream at different datum.

REMARKS.--Discharge computed on basis of modified weir formula, the head being obtained from readings on tailwater gage and mean gage height from recording headwater gage. Flow completely regulated by Leech Lake (station 05206000).

COOPERATION.--Computations of daily discharge were provided by U.S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--105 years, 372 ft<sup>3</sup>/s, 4.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 2,520 ft<sup>3</sup>/s, June 7, 1957 (result of dam failure); no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 800 ft<sup>3</sup>/s, Mar. 9-27; minimum daily, 92 ft<sup>3</sup>/s, July 28, Aug. 12-14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	270	255	265	275	760	740	495	120	416	396	99	112
2	270	255	265	275	700	760	495	120	416	396	104	112
3	270	260	265	275	700	780	495	120	416	416	99	112
4	312	255	275	275	720	780	423	120	416	396	99	115
5	357	255	265	275	740	780	392	138	416	396	96	115
6	357	260	265	270	740	780	325	126	397	396	96	116
7	400	260	275	275	760	780	260	126	397	396	96	116
8	392	260	265	275	720	780	206	126	384	396	96	118
9	392	255	265	275	740	800	202	108	397	384	96	116
10	392	260	265	275	740	800	202	108	397	384	96	116
11	392	255	265	275	740	800	140	108	397	364	96	116
12	447	260	265	275	760	800	98	231	384	305	92	116
13	447	265	265	324	760	800	98	305	397	256	92	116
14	447	260	265	374	780	800	103	413	397	266	92	214
15	415	255	265	374	760	800	103	320	397	207	106	303
16	415	270	265	374	760	800	103	207	397	198	106	398
17	343	265	265	374	780	800	103	115	397	198	106	390
18	350	260	265	432	780	800	112	115	397	155	106	398
19	350	260	265	492	780	800	112	115	397	108	106	485
20	350	265	275	544	780	800	112	115	397	108	103	475
21	312	265	275	607	780	800	112	118	384	108	103	485
22	265	265	265	608	720	800	112	115	416	244	103	494
23	265	265	275	608	780	800	112	118	416	165	103	494
24	265	265	275	662	780	800	117	207	416	103	103	504
25	265	265	275	724	760	800	115	360	416	103	103	494
26	260	265	265	780	760	800	115	360	416	103	103	485
27	282	275	275	780	760	800	116	448	429	96	103	494
28	265	264	275	780	780	697	116	448	416	92	103	485
29	260	265	275	780	---	697	115	448	396	99	115	485
30	260	265	275	780	---	623	120	396	416	99	106	485
31	260	---	275	780	---	550	---	416	---	99	106	---
TOTAL	10307	7849	8335	14472	21120	23947	5729	6690	12130	7432	3133	9064
MEAN	332	262	269	467	754	772	191	216	404	240	101	302
MAX	447	275	275	780	780	800	495	448	429	416	115	504
MIN	260	255	265	270	700	550	98	108	384	92	92	112
AC-FT	20440	15570	16530	28710	41890	47500	11380	13270	24060	14740	6210	17980
CFSM	.29	.22	.23	.40	.65	.66	.16	.19	.35	.21	.09	.26
IN.	.33	.25	.27	.46	.68	.77	.18	.21	.39	.24	.10	.29
CAL YR 1988	TOTAL 105801	MEAN 289	MAX 792	MIN 102	AC-FT 209900	CFSM .25	IN. 3.38					
WTR YR 1989	TOTAL 130208	MEAN 357	MAX 800	MIN 92	AC-FT 258300	CFSM .31	IN. 4.16					

## MISSISSIPPI RIVER MAIN STEM

05210500 POKEGAMA LAKE NEAR GRAND RAPIDS, MN

LOCATION.--Lat 47°10'00", long 93°33'20", in NW¼ sec.17, T.54 N., R.25 W., Itasca County, Hydrologic Unit 07010101, at narrows on U.S. Highway 169, 4 mi south of Grand Rapids and at mile 1,184 upstream from Ohio River.

DRAINAGE AREA.--3,265 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1884 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Pokegama Reservoir near Grand Rapids, October 1941 to September 1956.

REVISED RECORDS.--WSP 1914: 1897(M).

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to May 30, 1949, nonrecording gage at Pooles Arm of Pokegama Lake 5 mi northwest, and May 31, 1949, to July 12, 1973, water-stage recorder at same site and at datum 64.42 ft higher.

REMARKS.--Reservoir is formed by Pokegama Lake and several other natural lakes controlled by concrete dam; storage began in 1884; original timber dam completed in 1884, replaced by present structure in 1888-89. Capacity between elevation 1,270.42 ft and 1,276.42 ft (maximum allowable range) is 80,126 acre-ft of which 52,483 acre-ft is controlled storage between elevations 1,270.42 ft and 1,274.42 ft (normal operating range). Contents shown herein are contents above elevation 1,267.00 ft. Prior to September 1978, published contents as contents above elevation 1,268.92 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 132,160 acre-ft, May 23, 1986, elevation, 1,275.28 ft; maximum elevation, 1,277.92 ft, May 8, 1897; minimum contents observed, 4,520 acre-ft, below zero of capacity table then in use, Sept. 30, 1934, elevation, 1,268.54 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 110,240 acre-ft, Apr. 26, elevation, 1,274.16 ft; minimum, 64,290 acre-ft, Feb. 8, elevation, 1,271.09 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,273.66	101,860	
Oct. 31 .....	1,272.75	87,840	-14,020
Nov. 30 .....	1,272.15	79,070	-8,770
Dec. 31 .....	1,271.93	75,940	-3,130
CAL YR 1988 .....			+7,120
Jan. 31 .....	1,271.25	66,420	-9,520
Feb. 28 .....	1,271.19	65,620	-800
Mar. 31 .....	1,271.43	68,840	+3,220
Apr. 30 .....	1,273.92	106,220	+37,380
May 31 .....	1,273.37	97,090	-9,130
June 30 .....	1,273.62	101,190	+4,100
July 31 .....	1,273.66	101,860	+670
Aug. 31 .....	1,273.44	98,190	-3,670
Sept. 30 .....	1,273.02	91,880	-6,310
WTR YR 1989 .....			-9,980

## MISSISSIPPI RIVER MAIN STEM

## 05211000 MISSISSIPPI RIVER AT GRAND RAPIDS, MN

LOCATION.--Lat 47°13'56", long 93°31'48", in SW¼ sec.21, T.55 N., R.25 W., Itasca County, Hydrologic Unit 07010103, on left bank, in super-calendar room of Blandin Paper Mill in Grand Rapids, 400 ft downstream from Blandin Dam, 400 ft upstream from bridge on U.S. Highway 169, 2.5 mi upstream from Prairie River, and at mile 1,182 upstream from Ohio River.

DRAINAGE AREA.--3,370 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1883 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "at Pokegama Dam near Grand Rapids" 1942-44.

GAGE.--Water-stage recorder. Datum of gage is 1,242.03 ft above National Geodetic Vertical Datum of 1929. See WSP 1914 for history of changes prior to Jan. 17, 1951.

REMARKS.--Records fair. Flow regulated by Winnibigoshish Lake (station 05201000), Leech Lake (station 05206000), Pokegama Lake (station 05210500) and occasionally at low flow by powerplant at Blandin Dam. Backwater from Prairie River occurs at times in most years.

AVERAGE DISCHARGE.--106 years, 1,194 ft<sup>3</sup>/s; median of yearly mean discharges, 1,080 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,500 ft<sup>3</sup>/s, Sept. 3, 1948, gage height, 15.2 ft, from floodmark, caused by dam failure at gage, from rating curve extended above 4,500 ft<sup>3</sup>/s; maximum daily, 5,250 ft<sup>3</sup>/s, Sept. 5, 8, 1905; no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,610 ft<sup>3</sup>/s, Apr. 6, gage height, 7.39 ft; maximum gage height, 8.81 ft, Apr. 29 (backwater from Prairie River); minimum daily discharge, 470 ft<sup>3</sup>/s, Aug. 11; minimum gage height, 3.27 ft, Nov. 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1310	1160	924	e1200	e1550	e1800	e2100	2320	785	2190	1030	497
2	1270	1150	1100	e1200	e1550	e1800	e2150	2210	824	2210	1060	513
3	1280	1150	1100	e1200	e1550	e1800	e2200	2060	830	2220	991	520
4	1170	1140	1050	e1200	e1550	e1800	2430	1840	830	2230	1110	617
5	1170	1130	1050	e1200	e1600	e1800	2460	1790	1040	2090	1040	720
6	1160	1120	1050	e1300	e1600	e1800	2440	1800	1150	2000	1040	831
7	1090	993	1060	e1300	e1600	e1800	1640	1810	1260	1950	719	773
8	1060	898	1070	e1300	e1600	e1800	1690	1610	1310	2090	500	815
9	1090	888	e1100	e1300	e1600	e1800	1690	1240	1360	2060	505	1030
10	1040	891	e1100	e1300	e1600	e1800	1680	1230	1420	2060	551	964
11	1020	912	e1100	e1300	e1650	e1750	1670	1230	1480	2060	470	1110
12	1000	876	e1100	e1300	e1650	e1750	1670	1250	1590	2070	565	1340
13	1030	893	e1200	e1300	e1650	e1750	1670	1180	1830	2030	516	1590
14	1030	864	e1200	e1300	e1650	e1700	1670	1270	2100	1900	520	1520
15	1060	905	e1200	e1300	e1650	e1700	1710	1240	2240	1910	550	1500
16	1060	917	e1200	e1300	e1700	e1700	1710	1180	1970	1900	511	1520
17	1080	847	e1200	e1300	e1700	e1700	1720	1160	1620	1850	528	1450
18	1100	850	e1200	e1300	e1700	e1700	1930	1140	1640	1880	539	1310
19	1120	861	e1200	e1300	e1700	e1700	2010	1140	1710	1870	528	984
20	1090	860	e1200	e1500	e1700	e1700	2010	1140	1740	1860	538	861
21	1100	865	e1200	e1450	e1750	e1700	2040	1150	1920	1840	512	920
22	1070	848	e1200	e1450	e1750	e1700	2040	1110	2000	1680	546	1070
23	1120	739	e1200	e1450	e1800	e1700	2020	1110	2100	1740	505	1240
24	1050	672	e1200	e1400	e1800	e1700	2020	1100	2020	1670	522	1220
25	1120	644	e1200	e1350	e1800	e1700	2040	1090	2070	1470	522	1220
26	1110	673	e1200	e1350	e1800	e1700	2110	1080	2050	1340	535	1220
27	1160	683	e1200	e1350	e1800	e1750	2350	1110	2070	1270	549	1300
28	1180	752	e1200	e1350	e1800	e1850	2410	1080	2030	1130	528	1470
29	1170	953	e1200	e1350	---	e1900	2470	1100	2010	1090	530	1500
30	1180	894	e1200	e1350	---	e2000	2440	952	2080	1000	520	1410
31	1180	---	e1200	e1500	---	e2000	---	791	---	1090	583	---
TOTAL	34670	27028	35604	41050	46850	54850	60190	41513	49079	55750	19665	33035
MEAN	1118	901	1149	1324	1673	1769	2006	1339	1636	1798	634	1101
MAX	1310	1160	1200	1500	1800	2000	2470	2320	2240	2230	1110	1590
MIN	1000	644	924	1200	1550	1700	1640	791	785	1000	470	497
AC-FT	68770	53610	70620	81420	92930	108600	119400	82340	97350	110600	39010	65520
CFSM	.33	.27	.34	.39	.50	.53	.60	.40	.49	.53	.19	.33
IN.	.38	.30	.39	.45	.52	.61	.66	.46	.54	.62	.22	.36

CAL YR 1988 TOTAL 322974 MEAN 882 MAX 2130 MIN 140 AC-FT 640600 CFSM .26 IN. 3.57  
WTR YR 1989 TOTAL 499284 MEAN 1368 MAX 2470 MIN 470 AC-FT 990300 CFSM .41 IN. 5.51

e Estimated

## SWAN RIVER BASIN

05216860 SWAN RIVER NEAR CALUMET, MN

LOCATION.--Lat 47°17'20", long 93°13'54", in NW¼SW¼ sec.35, T.56 N., R.23 W., Itasca County, Hydrologic Unit 07010103, on left bank 1.0 mi downstream from Snowball Creek, 2.1 mi downstream from bridge on U.S. Highway 65 outlet of Swan Lake and 3.1 mi southeast of Calumet.

DRAINAGE AREA.--114 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder. Steel sheet piling weir since Sept. 1966. On Oct. 9, 1985, the weir was lowered 0.5 ft and the 1.0 ft pipe that allowed minimum flows to pass through the weir was capped. Datum of gage is 1,331.19 ft above National Geodetic Vertical Datum of 1929. Prior to June 5, 1964, reference point at present site and datum.

REMARKS.--Records fair. Natural flow of stream affected by continually changing iron-mining activities that include diversions for iron-ore processing, storage in tailing ponds and Swan Lake, and mine pit dewatering.

AVERAGE DISCHARGE.--25 years, 65.3 ft<sup>3</sup>/s, 7.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 773 ft<sup>3</sup>/s, Apr. 15, 1969, gage height, 5.83 ft; maximum gage height, 5.96 ft, Apr. 23, 1979; no flow July 18 to Aug. 5, 1988; minimum gage height, 3.75 ft, July 31, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 357 ft<sup>3</sup>/s, Apr. 20, gage height, 4.94 ft; minimum, 11 ft<sup>3</sup>/s, Aug. 25, 26, gage height, 4.03 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	106	35	72	51	37	29	71	244	e87	69	27	41
2	102	35	72	50	37	28	79	233	e84	67	25	41
3	94	36	71	50	36	27	90	224	e81	65	24	43
4	91	38	69	50	35	27	105	216	e78	64	31	58
5	86	36	69	48	34	27	118	204	e75	61	30	67
6	80	34	67	47	34	27	140	200	69	70	29	72
7	76	35	66	50	32	27	162	197	68	69	27	74
8	76	34	64	51	31	28	183	e190	67	67	24	73
9	71	35	63	51	30	29	196	e180	64	65	23	72
10	64	35	60	49	30	30	201	e170	61	65	21	71
11	62	35	58	48	30	30	206	e160	59	64	20	72
12	61	38	57	48	30	32	203	e150	61	60	19	69
13	57	40	58	46	31	32	200	e145	70	58	18	66
14	55	40	60	46	32	34	201	e137	74	55	19	62
15	54	45	57	46	31	33	213	e130	73	52	17	59
16	51	49	56	45	30	33	242	e123	73	50	16	56
17	51	53	55	45	30	32	285	e117	69	48	15	54
18	50	57	55	46	30	32	319	e110	65	47	13	51
19	49	59	56	46	29	32	339	e105	64	47	14	51
20	48	61	55	46	29	32	351	e100	62	43	14	56
21	46	59	54	45	28	32	349	e95	63	42	14	76
22	46	59	53	44	27	34	343	e91	67	40	14	90
23	42	61	53	44	27	35	328	e87	64	38	14	97
24	40	61	53	43	28	36	310	e85	62	36	13	99
25	37	62	51	42	29	37	305	e90	63	34	12	97
26	37	67	50	42	29	38	304	e100	63	32	14	98
27	37	77	52	41	29	40	293	e105	59	31	16	92
28	33	74	53	41	29	49	277	e105	59	30	20	85
29	35	73	51	40	---	55	264	e100	54	31	26	83
30	34	74	51	39	---	61	254	e95	66	30	29	77
31	33	---	51	40	---	65	---	e91	---	29	39	---
TOTAL	1804	1497	1812	1420	864	1083	6931	4379	2024	1559	637	2102
MEAN	58.2	49.9	58.5	45.8	30.9	34.9	231	141	67.5	50.3	20.5	70.1
MAX	106	77	72	51	37	65	351	244	87	70	39	99
MIN	33	34	50	39	27	27	71	85	54	29	12	41
AC-FT	3580	2970	3590	2820	1710	2150	13750	8690	4010	3090	1260	4170
CFSM	.51	.44	.51	.40	.27	.31	2.03	1.24	.59	.44	.18	.61
IN.	.59	.49	.59	.46	.28	.35	2.26	1.43	.66	.51	.21	.69
CAL YR 1988	TOTAL 16949.90	MEAN 46.3	MAX 194	MIN .00	AC-FT 33620	CFSM .41	IN. 5.53					
WTR YR 1989	TOTAL 26112	MEAN 71.5	MAX 351	MIN 12	AC-FT 51790	CFSM .63	IN. 8.52					

e Estimated

## SANDY RIVER BASIN

05218500 SANDY LAKE AT LIBBY, MN

LOCATION.--Lat 46°47'20", long 93°19'10", in sec.25, T.50 N., R.24 W., Aitkin County, Hydrologic Unit 07010103, on dam on Sandy River at Libby, 1.2 mi upstream from mouth, and 14 mi north of McGregor.

DRAINAGE AREA.--421 mi<sup>2</sup>.

PERIOD OF RECORD.--July to December 1893, October to December 1894, July 1895 to current year. Monthend contents only for some periods, published in WSP 1308. Published as Sandy Lake Reservoir at Libby, October 1941 to September 1956.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Sept. 23, 1949, nonrecording gage and Sept. 24, 1949, to Nov. 28, 1962, water-stage recorder at site 1 mi upstream at datum 1,207.71 ft, adjustment of 1912. Nov. 29, 1962, to June 30, 1973, water-stage recorder at present site at datum 1,207.71 ft, adjustment of 1912.

REMARKS.--Lake is formed by concrete dam which controls Sandy, Flowage, Snake, and Aitkin Lakes. Storage began in 1893; original timber crib dam completed in 1895, replaced by present structure in 1911. Capacity between elevation 1,214.31 ft and 1,221.31 ft (top of structure) is 73,037 acre-ft, of which 37,539 acre-ft is controlled storage between elevations 1,214.31 ft and 1,218.31 ft (normal operating range). Contents shown herein are contents above elevation 1,207.00 ft. Prior to September 1978, published contents as contents above elevation 1,209.03 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 167,200 acre-ft, capacity table then in use, May 19, 1950, elevation, 1,224.82 ft; minimum observed, 5,950 acre-ft, below zero of capacity table then in use, Jan. 20, 1921, elevation, 1,207.96 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 73,830 acre-ft, Apr. 23, elevation, 1,217.53 ft; minimum, 44,350 acre-ft, Mar. 20, elevation, 1,214.31 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,215.94	58,480	
Oct. 31 .....	1,215.74	56,660	-1,820
Nov. 30 .....	1,216.13	60,240	+3,580
Dec. 31 .....	1,215.87	57,840	-2,400
CAL YR 1988 .....			+1,900
Jan. 31 .....	1,215.40	53,620	-4,220
Feb. 28 .....	1,214.61	46,850	-6,770
Mar. 31 .....	1,214.45	45,520	-1,330
Apr. 30 .....	1,217.40	72,490	+26,970
May 31 .....	1,216.54	64,100	-8,390
June 30 .....	1,216.35	62,290	-1,810
July 31 .....	1,216.13	60,240	-2,050
Aug. 31 .....	1,216.31	61,900	+1,660
Sept. 30 .....	1,216.20	60,880	-1,020
WTR YR 1989 .....			+2,400

## SANDY RIVER BASIN

05219000 SANDY RIVER AT SANDY LAKE DAM, AT LIBBY, MN

LOCATION.--Lat 46°47'20", long 93°19'10", in sec.25, T.50 N., R.24 W., Aitkin County, Hydrologic Unit 07010103, at dam at outlet of Sandy Lake, at Libby, 1.2 mi above mouth, and 14 mi north of McGregor.

DRAINAGE AREA.--421 mi<sup>2</sup>.

PERIOD OF RECORD.--July 1893 to March 1894, July 1894, November 1894 to March 1895, August 1895 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "below Sandy Lake Reservoir" 1893-1916.

GAGE.--Water-stage recorders on headwater and tailwater. Datum of gages is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to June 30, 1973, gages (nonrecording gages prior to June 20, 1949) at same site with datum at 1,207.71 ft, adjustment of 1912.

REMARKS.--Discharge computed on basis of head over dam, using modified weir formula, head being obtained from headwater and tailwater recorder records. Flow completely regulated by Sandy Lake (station 05218500).

COOPERATION.--Computations of daily discharge were provided by U.S. Army Corps of Engineers; discharge measurements made and records reviewed by Geological Survey.

AVERAGE DISCHARGE (unadjusted).--94 years (water years 1896-1989), 222 ft<sup>3</sup>/s, 7.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 3,740 ft<sup>3</sup>/s, July 12, 1897; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,400 ft<sup>3</sup>/s, Apr. 20; minimum daily, 18 ft<sup>3</sup>/s, July 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	24	34	147	128	144	124	230	868	326	225	21	22		
2	25	34	141	126	142	120	220	772	340	222	21	23		
3	26	34	140	126	142	118	210	878	343	219	21	23		
4	42	34	140	126	140	116	210	898	347	213	21	23		
5	45	34	137	126	140	116	195	1010	343	36	21	428		
6	47	34	134	101	140	116	288	1090	202	37	21	408		
7	49	34	134	101	138	112	243	1190	200	18	21	384		
8	50	34	135	101	136	112	198	1240	196	19	21	372		
9	51	34	137	100	136	110	180	912	194	19	22	238		
10	52	34	140	100	136	108	225	1010	97	19	22	238		
11	52	35	141	100	182	108	288	960	97	19	23	238		
12	53	35	140	100	179	110	351	696	96	19	23	171		
13	55	35	137	164	179	112	378	660	95	20	23	169		
14	56	35	134	162	179	75	378	504	94	20	23	166		
15	33	35	131	160	176	77	414	462	273	20	23	162		
16	33	35	128	160	173	77	441	336	378	20	23	117		
17	33	35	126	160	173	77	442	340	365	20	23	118		
18	33	35	126	160	171	77	766	344	360	21	23	118		
19	33	35	126	158	171	77	952	352	374	21	23	118		
20	33	35	126	158	171	77	1400	356	255	21	23	121		
21	33	34	126	158	168	36	1140	360	258	21	23	124		
22	34	32	126	154	122	36	1110	364	1260	21	23	127		
23	34	33	126	152	124	36	1060	364	520	22	23	127		
24	34	55	128	150	124	36	1050	368	276	22	23	125		
25	34	54	126	148	122	36	1030	700	292	23	23	121		
26	34	56	126	148	122	36	928	1040	296	23	23	118		
27	34	59	126	148	122	37	918	924	296	23	23	120		
28	33	61	126	148	124	42	888	729	225	24	23	121		
29	33	156	128	148	---	145	888	312	231	25	23	121		
30	33	155	128	146	---	133	888	326	234	26	23	120		
31	34	---	128	144	---	245	---	326	---	26	23	---		
TOTAL	1195	1385	4094	4261	4176	2837	17909	20691	8863	1484	695	4881		
MEAN	38.5	46.2	132	137	149	91.5	597	667	295	47.9	22.4	163		
MAX	56	156	147	164	182	245	1400	1240	1260	225	23	428		
MIN	24	32	126	100	122	36	180	312	94	18	21	22		
AC-FT	2370	2750	8120	8450	8280	5630	35520	41040	17580	2940	1380	9680		
CFSM	.09	.11	.31	.33	.35	.22	1.42	1.59	.70	.11	.05	.39		
IN.	.11	.12	.36	.38	.37	.25	1.58	1.83	.78	.13	.06	.43		
CAL YR 1988	TOTAL	26673.00	MEAN	72.9	MAX	648	MIN	.00	AC-FT	52910	CFSM	.17	IN.	2.36
WTR YR 1989	TOTAL	72471	MEAN	199	MAX	1400	MIN	18	AC-FT	143700	CFSM	.47	IN.	6.40

## MISSISSIPPI RIVER MAIN STEM

## 05220500 MISSISSIPPI RIVER BELOW SANDY RIVER, NEAR LIBBY, MN

LOCATION.--Lat 46°47'23", long 93°19'43", in SE¼NE¼ sec.25, T.50 N., R.24 W., Aitkin County, Hydrologic Unit 07010103, on right bank 600 ft downstream from Sandy River, 0.8 mi northwest of Libby, and at mile 1,106 upstream from Ohio River.

DRAINAGE AREA.--5,060 mi<sup>2</sup>, approximately.

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

REVISED RECORDS.--WSP 1914: 1958.

GAGE.--Water-stage recorder. Datum of gage is 1,204.06 ft above National Geodetic Vertical Datum of 1929. Prior to July 28, 1931, nonrecording gage at site 600 ft upstream at datum 3.16 ft higher.

REMARKS.--Records good except for those for estimated daily discharges, which are fair. Flow regulated by Winnibigoshish Lake (station 05201000), Leech Lake (station 05206000), Pokegama Lake (station 05210500), and Sandy Lake (station 05218500).

AVERAGE DISCHARGE.--59 years, 2,095 ft<sup>3</sup>/s, 5.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,000 ft<sup>3</sup>/s, May 17, 1950, gage height, 20.02 ft; minimum, 83 ft<sup>3</sup>/s, Nov. 16, 1936, gage height, 1.44 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,360 ft<sup>3</sup>/s, Apr. 26, 27, gage height, 12.79 ft; minimum, 297 ft<sup>3</sup>, Aug. 24, 25, gage height, 2.88 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3810	1670	e1500	e1700	e2000	e2000	e2900	6300	2050	3330	1380	1030
2	3660	1670	e1550	e1700	e2000	e2000	e3000	6280	1950	3360	1340	1070
3	3410	1640	e1600	e1700	e2000	e2000	e3100	6210	1880	3420	1320	1070
4	3090	1630	e1800	e1700	e2000	e2000	e3300	6090	1870	3420	1310	1250
5	2870	1630	e1900	e1700	e2000	e2000	e3400	5960	1830	3370	1310	1520
6	2740	1610	e1900	e1700	e2000	e2000	e3600	5790	1770	3380	1330	1780
7	2610	1600	e1850	e1700	e2000	e2000	e3750	5600	1870	3300	1310	2050
8	2440	1570	e1800	e1700	e2000	e2000	e3900	5330	1930	3170	1280	2020
9	2300	1480	e1800	e1700	e2000	e2000	e4100	5080	1980	3100	1050	1880
10	2240	1410	e1800	e1700	e2000	e2000	e4360	4830	1970	3100	869	1900
11	2190	1380	e1800	e1700	e2000	e2000	e4500	4370	1990	3100	804	1950
12	2130	1380	e1800	e1700	e2000	e2000	e4600	3890	2050	3070	773	1950
13	e2000	1400	e1800	e1700	e2000	e2050	e4700	3540	2180	2980	726	2070
14	1890	1400	e1800	e1700	e2000	e2050	e4800	3220	2370	2920	754	2220
15	1860	1400	e1800	e1700	e2000	e2050	4810	2930	2710	2880	740	2270
16	1810	1460	e1800	e1700	e2000	e2050	4990	2750	2990	2840	732	2190
17	1790	1500	e1800	e1750	e2000	e2050	5290	2650	3060	2800	751	2150
18	1760	1510	e1750	e1750	e2000	e2050	5630	2560	2930	2740	726	2130
19	1760	1500	e1750	e1800	e2000	e2050	5880	2480	2740	2660	728	2100
20	1740	1600	e1750	e1800	e2000	e2050	6110	2440	2650	2600	735	1940
21	1710	e1700	e1750	e1850	e2000	e2050	6190	2400	2700	2540	712	1790
22	1670	e1800	e1750	e1900	e2000	e2050	6240	2350	3720	2460	715	1750
23	1660	e1900	e1750	e1900	e2000	e2050	6270	2340	3680	2330	709	1840
24	1640	e2000	e1750	e1900	e2000	e2100	6290	2370	3430	2260	717	2040
25	1650	e1900	e1750	e1900	e2000	e2200	6310	3010	3340	2260	697	2170
26	1650	e1750	e1750	e1950	e2000	e2300	6350	3130	3320	2160	744	2190
27	1690	1610	e1750	e1950	e2000	e2400	6360	2940	3270	1980	793	2150
28	1700	1470	e1750	e1950	e2000	e2500	6330	2580	3170	1740	838	2120
29	1720	1440	e1750	e1950	---	e2600	6300	2290	3100	1640	825	2150
30	1690	e1450	e1750	e2000	---	e2700	6300	2240	3200	1480	837	2170
31	1650	---	e1750	e2000	---	e2800	---	2200	---	1410	993	---
TOTAL	66530	47460	54600	55550	56000	66150	149660	116150	77700	83800	28548	56910
MEAN	2146	1582	1761	1792	2000	2134	4989	3747	2590	2703	921	1897
MAX	3810	2000	1900	2000	2000	2800	6360	6300	3720	3420	1380	2270
MIN	1640	1380	1500	1700	2000	2000	2900	2200	1770	1410	697	1030
AC-FT	132000	94140	108300	110200	111100	131200	296900	230400	154100	166200	56620	112900
CFSM	.42	.31	.35	.35	.40	.42	.99	.74	.51	.53	.18	.37
IN.	.49	.35	.40	.41	.41	.49	1.10	.85	.57	.62	.21	.42
CAL YR 1988	TOTAL 551633	MEAN 1507	MAX 3880	MIN 268	AC-FT 1094000	CFSM .30	IN. 4.06					
WTR YR 1989	TOTAL 859058	MEAN 2354	MAX 6360	MIN 697	AC-FT 1704000	CFSM .47	IN. 6.32					

e Estimated

## MISSISSIPPI RIVER MAIN STEM

05227500 MISSISSIPPI RIVER AT AITKIN, MN

LOCATION.--Lat 46°32'26", long 93°42'26", in SW¼NW¼ sec.24, T.47 N., R.27 W., Aitkin County, Hydrologic Unit 07010104, on right bank upstream side of highway bridge at north edge of Aitkin, 1 mi downstream from Ripple River and at mile 1,055.9 upstream from Ohio River.

DRAINAGE AREA.--6,140 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1945 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,182.41 ft above National Geodetic Vertical Datum of 1929 (Levels by U.S. Army Corps of Engineers). Mar. 1, 1945, to Mar. 14, 1961, nonrecording gage, and Mar. 15, 1961, to Sept. 30, 1967, water-stage recorder at same site at datum 3.0 ft higher. Diversion channel: Non-recording gage and crest-stage gage. Datum of gage is 1,182.02 ft above National Geodetic Vertical Datum of 1929. Apr. 9, 1955, to Apr. 10, 1956, nonrecording gage at site 4 mi downstream at different datum. Apr. 11, 1956, to Sept. 30, 1967, non-recording gage at same site at datum 3.0 ft higher.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow regulated by Winnibigoshish Lake (sta 05201000), Leech Lake (sta 05206000), Pokegama Lake (sta 05210500), and Sandy Lake (sta 05218500). Water diverted at medium and high stages into Aitkin diversion channel 6.5 mi above station, bypasses station and returns to river 15.5 mi below station. Diversion began Apr. 2, 1955. These records include flow in diversion channel.

AVERAGE DISCHARGE.--44 years, 2,930 ft<sup>3</sup>/s, 6.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,000 ft<sup>3</sup>/s, May 20, 1959, 22.49 ft, present datum; minimum 151 ft<sup>3</sup>/s, Sept. 1, 1961, gage height, 0.60 ft.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 8,810 ft<sup>3</sup>/s, Apr. 23; minimum, 711 ft<sup>3</sup>/s, Aug. 26, gage height, 2.26 ft. River gage: Maximum discharge, 5,110 ft<sup>3</sup>/s, Apr. 22, gage height, 13.30 ft. Diversion channel: Maximum discharge, 3,790 ft<sup>3</sup>/s, Apr. 22, gage height, 13.06 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3960	1750	e1800	e1780	e2000	e2050	e3200	8370	3310	3690	1500	1870
2	3910	1770	e1800	e1770	e2000	e2050	e3500	8340	3120	3800	1450	1950
3	3780	1770	e1840	e1760	e2000	e2050	e3800	8240	2920	3820	1430	1840
4	3540	1750	e1900	e1740	e2000	e2050	e4200	8100	2730	3800	1420	1790
5	3250	1730	e2000	e1730	e2000	e2050	e4600	8020	2600	3740	1390	2030
6	3020	1720	e2050	e1720	e2000	e2050	e5000	7820	2500	3620	1360	2310
7	2850	1700	e2100	e1700	e2000	e2050	e5400	7610	2410	3550	1360	2570
8	2690	1690	e2050	e1680	e2000	e2050	e5700	7430	2360	3470	1350	2800
9	2510	1690	e2000	e1660	e2000	e2050	e6100	7290	2380	3360	1330	2770
10	2380	1630	e1980	e1640	e2000	e2050	e6400	6990	2400	3260	1190	2580
11	2290	1560	e1920	e1620	e2000	e2050	e6800	6590	2370	3180	1000	2480
12	2230	1540	e1890	e1600	e2000	e2050	e7100	6100	2370	3160	892	2440
13	2150	1540	e1870	e1620	e2000	e2070	e7300	5550	2410	3110	832	2390
14	2050	1540	e1850	e1650	e2000	e2100	e7450	5150	2580	3010	780	2410
15	1980	1550	e1850	e1680	e2000	e2100	e7650	4740	2690	2930	766	2470
16	1940	1600	e1850	e1680	e2000	e2100	e8000	4320	3060	2880	760	2490
17	1900	1580	e1850	e1690	e2000	e2100	8320	3980	3250	2830	746	2430
18	1870	e1600	e1850	e1690	e2000	e2100	8320	3780	3280	2780	750	2370
19	1840	e1650	e1850	e1720	e2000	e2100	8440	3660	3150	2730	756	2330
20	1840	e1650	e1850	e1780	e2000	e2100	8580	3540	2970	2660	762	2310
21	1850	e1600	e1850	e1840	e2000	e2100	8720	3410	2830	2590	752	2410
22	1820	e1550	e1850	e1880	e2000	e2100	8800	3320	3280	2520	739	2470
23	1800	e1600	e1850	e1900	e2000	e2100	8810	3290	3530	2440	728	2380
24	1780	e1750	e1850	e1920	e2000	e2100	8790	3300	4540	2330	720	2360
25	1750	e2000	e1850	e1930	e2000	e2150	8720	3900	4220	2260	721	2450
26	1750	e2050	e1840	e1930	e2000	e2200	8670	4430	4100	2240	738	2550
27	1750	e1950	e1830	e1940	e2000	e2300	8590	4520	4000	2170	775	2570
28	1780	e1900	e1830	e1950	e2000	e2400	8500	4320	3840	2030	802	2540
29	1770	e1860	e1830	e1950	---	e2500	8410	3930	3710	1840	864	2470
30	1770	e1810	e1820	e1970	---	e2700	8440	3400	3610	1720	861	2440
31	1760	---	e1800	e2000	---	e2900	---	3460	---	1600	1210	---
TOTAL	71560	51080	58350	55120	56000	66920	212310	166900	92520	89120	30734	71270
MEAN	2308	1703	1882	1778	2000	2159	7077	5384	3084	2875	991	2376
MAX	3960	2050	2100	2000	2000	2900	8810	8370	4540	3820	1500	2800
MIN	1750	1540	1800	1600	2000	2050	3200	3290	2360	1600	720	1790
AC-FT	141900	101300	115700	109300	111100	132700	421100	331000	183500	176800	60960	141400
CFSM	.38	.28	.31	.29	.33	.35	1.15	.88	.50	.47	.16	.39
IN.	.43	.31	.35	.33	.34	.41	1.29	1.01	.56	.54	.19	.43

CAL YR 1988 TOTAL 609055 MEAN 1664 MAX 4980 MIN 290 AC-FT 1208000 CFSM .27 IN. 3.69  
WTR YR 1989 TOTAL 1021884 MEAN 2800 MAX 8810 MIN 720 AC-FT 2027000 CFSM .46 IN. 6.19

e Estimated

## PINE RIVER BASIN

## 05230500 PINE RIVER RESERVOIR AT CROSS LAKE, MN

LOCATION.--Lat 46°40'09", long 94°06'44", in SW¼NW¼ sec.21, T.137 N., R.27 W., Crow Wing County, Hydrologic Unit 07010105, at dam on Pine River, at outlet of Cross Lake at city of Cross Lake.

DRAINAGE AREA.--562 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1886 to current year. Monthend contents only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to May 3, 1949, nonrecording gage at same site and datum.

REMARKS.--Reservoir is formed by Trout, Whitefish, Rush, and Cross Lakes and several other natural lakes controlled by timber crib dams; storage began in 1886; dam completed in 1886. Capacity between elevations 1,226.32 ft and 1,234.82 ft (maximum allowable range) is 118,703 acre-ft of which 53,272 acre-ft is controlled storage between elevations 1,226.32 ft and 1,230.32 ft (normal operating range). Contents shown herein are contents above an elevation 1,216.00 ft. Prior to September 1978, published contents as contents above elevation 1,218.67 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents observed, 173,600 acre-ft, capacity table then in use, July 10, 1916, elevation, 1,234.56 ft; minimum observed, 1,310 acre-ft, below zero of capacity table then in use, Aug. 20, 1918, elevation, 1,217.67 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 105,700 acre-ft, May 25, elevation, 1,229.64 ft; minimum, 74,960 acre-ft, Mar. 24, elevation, 1,227.34 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,229.24	100,250	
Oct. 31 .....	1,229.18	99,430	-820
Nov. 30 .....	1,228.88	95,380	-4,050
Dec. 31 .....	1,228.63	92,020	-3,360
CAL YR 1988 .....			+540
Jan. 31 .....	1,228.25	86,940	-5,080
Feb. 28 .....	1,227.66	79,150	-7,790
Mar. 31 .....	1,227.59	78,240	-910
Apr. 30 .....	1,229.54	104,340	+26,100
May 31 .....	1,229.44	102,980	-1,360
June 30 .....	1,229.41	102,570	-410
July 31 .....	1,229.07	97,950	-4,620
Aug. 31 .....	1,229.15	99,020	+1,070
Sept. 30 .....	1,229.28	100,790	+1,770
WTR YR 1989 .....			+540

## PINE RIVER BASIN

05231000 PINE RIVER AT CROSS LAKE DAM, AT CROSS LAKE, MN

LOCATION.--Lat 46°40'09", long 94°06'44", in SW¼NW¼ sec.21, T.137 N., R.27 W., Crow Wing County, Hydrologic Unit 07010105, at dam at outlet of Cross Lake at city of Cross Lake.

DRAINAGE AREA.--562 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1886 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "below Pine River Reservoir" 1895-1916, 1929, and as "at Pine River Dam, at Cross Lake" 1941-56.

GAGE.--Water-stage recorder, headwater gage, and nonrecording tailwater gage. Datum of gages is 1,216.32 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Mar. 26, 1886, to May 31, 1929, nonrecording gages on headwater and tail water at same sites and datum. June 1 to Nov. 30, 1929, nonrecording gage in tailwater at datum 1.60 ft (0.49 m) lower. Dec. 1, 1929, to May 2, 1949, nonrecording gage on headwater and Dec. 1, 1929, to August 1949, nonrecording gage on tailwater at present sites and datum.

REMARKS.--Discharge computed principally on basis of modified weir formula, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Pine River Reservoir (station 05230500).

COOPERATION.--Computations of daily discharge were provided by U. S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--103 years, 220 ft<sup>3</sup>/s, 5.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 2,250 ft<sup>3</sup>/s, in June 1896 (does not include flow bypassing dam through crevasse); no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 745 ft<sup>3</sup>/s, May 27, 28; minimum daily, 30 ft<sup>3</sup>/s, Oct. 1-3, July 1 to Aug. 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	30	70	400	270	300	300	66	520	510	200	30	120
2	30	70	400	270	300	300	40	520	455	200	30	125
3	30	70	400	270	300	300	40	520	230	200	30	125
4	50	70	400	241	300	300	40	520	230	200	30	125
5	70	70	400	200	300	300	40	576	230	200	30	125
6	70	70	325	200	300	300	40	620	230	124	30	125
7	70	70	200	200	300	300	40	620	230	70	30	125
8	70	70	200	200	300	300	40	620	230	70	30	125
9	70	70	200	200	300	300	40	520	230	70	30	198
10	70	70	200	200	300	300	40	500	230	70	30	250
11	70	175	200	200	300	300	40	500	230	53	30	250
12	70	280	200	200	300	300	40	525	230	30	30	300
13	70	280	200	238	300	300	40	479	190	30	30	350
14	70	280	200	300	300	259	40	445	150	30	30	350
15	70	280	200	300	300	230	40	445	150	30	30	350
16	70	280	200	300	300	230	40	355	150	30	30	350
17	70	280	200	300	300	230	40	280	150	30	30	350
18	70	280	200	300	300	230	171	280	150	30	30	350
19	70	340	200	300	300	230	250	280	150	30	30	312
20	70	400	247	300	300	230	250	280	113	30	30	275
21	70	400	270	300	300	230	250	280	75	30	30	275
22	70	400	270	300	300	230	250	280	75	30	30	323
23	70	400	270	300	300	230	250	280	75	30	30	370
24	70	400	270	300	300	230	250	347	148	30	30	370
25	70	400	270	300	300	230	350	350	200	30	30	370
26	70	400	270	300	300	230	350	666	200	30	30	370
27	70	400	270	300	300	230	350	745	200	30	30	370
28	70	400	270	300	300	160	350	745	200	30	30	370
29	70	400	270	300	---	110	413	687	200	30	30	370
30	70	400	270	300	---	110	466	645	200	30	30	370
31	70	---	270	300	---	110	---	510	---	30	30	---
TOTAL	2030	7575	8142	8289	8400	7639	4656	14940	6041	2057	930	8238
MEAN	65.5	252	263	267	300	246	155	482	201	66.4	30.0	275
MAX	70	400	400	300	300	300	466	745	510	200	30	370
MIN	30	70	200	200	300	110	40	280	75	30	30	120
AC-FT	4030	15030	16150	16440	16660	15150	9240	29630	11980	4080	1840	16340
CFSM	.12	.45	.47	.48	.53	.44	.28	.86	.36	.12	.05	.49
IN.	.13	.50	.54	.55	.56	.51	.31	.99	.40	.14	.06	.55
CAL YR 1988	TOTAL 51819	MEAN 142	MAX 500	MIN 30	AC-FT 102800	CFSM .25	IN. 3.43					
WTR YR 1989	TOTAL 78937	MEAN 216	MAX 745	MIN 30	AC-FT 156600	CFSM .38	IN. 5.23					

## MISSISSIPPI RIVER MAIN STEM

05242300 MISSISSIPPI RIVER AT BRAINERD, MN

LOCATION.--Lat 46°22'40", long 94°10'59", in SE¼SW¼ sec. 18, T.45 N., R.30 W., Crow Wing County, Hydrologic Unit 07010104, on left bank in hydro-plant of Potlatch Corporation, Northwest Paper Division in Brainerd, 12.7 mi upstream from Crow Wing River, and at mile 1003.7 upstream from Ohio River.

DRAINAGE AREA.--7,320 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,146.96 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow regulated by Winnibigoshish Lake (sta. 05201000), Leech Lake (sta. 05206000), Pokegama Lake (sta. 05210500), Sandy Lake (sta. 05218500), and Pine River Reservoir at Cross Lake (sta 05230500).

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 10,800 ft<sup>3</sup>/s, April 23, gage height, 12.40 ft; minimum, 721 ft<sup>3</sup>/s, Aug. 26; minimum gage height, 4.67 ft, Aug. 14, 15, 16, 24, 25, 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3680	1900	e2100	e2100	e2250	e2300	e3700	10400	4500	4830	1700	1490
2	3690	1980	e2150	e2100	e2250	e2350	e4000	10300	4420	4770	1390	2340
3	3700	1970	e2200	e2100	e2250	e2350	4110	10200	4250	4670	1820	2180
4	3760	1970	e2250	e2050	e2250	e2400	4620	9920	3710	4280	1690	2470
5	3900	1970	e2250	e2050	e2250	e2400	4990	9900	3450	4360	1420	2350
6	3550	1870	e2250	e2000	e2250	e2450	5820	9830	3430	4680	1400	2420
7	3360	1750	e2250	e2000	e2250	e2500	6440	9550	3210	4420	1580	2870
8	3180	1760	e2200	e2000	e2250	e2500	7180	9440	3240	4370	1560	3150
9	2980	1830	e2200	e1950	e2250	e2500	7660	9260	3280	4230	1600	3330
10	2820	1900	e2200	e1950	e2250	e2500	7950	8900	2890	3840	1500	3260
11	2500	1800	e2150	e1950	e2250	e2500	8060	8470	2940	3620	1180	3130
12	2690	1790	e2150	e1950	e2250	e2500	8530	7980	3170	3730	1060	3220
13	2620	1890	e2150	e1950	e2250	e2500	9110	7380	3170	3740	1050	3200
14	2300	1970	e2150	e1950	e2250	e2500	10100	6640	3180	3720	977	2930
15	2290	2040	e2150	e1950	e2250	e2500	10400	6210	3040	3530	749	3050
16	2250	1990	e2150	e2000	e2250	e2500	10500	5480	3540	3510	633	3420
17	2200	2010	e2150	e2000	e2250	e2500	10100	5110	3930	3380	951	3270
18	1960	2010	e2150	e2000	e2250	e2500	9950	4900	3900	3010	844	2940
19	2130	2050	e2150	e2050	e2250	e2500	10100	4610	4020	3080	864	2970
20	2270	2090	e2100	e2150	e2250	e2500	10300	4550	3940	2980	959	3100
21	2080	1740	e2100	e2150	e2250	e2500	10300	4650	3930	2910	894	3240
22	2040	1900	e2100	e2200	e2250	e2500	10500	4180	4420	2910	926	3310
23	2050	1850	e2100	e2250	e2250	e2500	10700	4330	5110	2770	880	3250
24	1990	2180	e2100	e2250	e2250	e2500	10600	4320	5270	2700	793	2940
25	1960	2450	e2100	e2250	e2250	e2550	10500	4720	5380	2480	731	2900
26	1850	2770	e2100	e2250	e2250	e2600	10500	5640	4920	2350	882	3230
27	1800	2560	e2100	e2250	e2250	e2750	10400	5980	5100	2350	1030	3350
28	1980	1430	e2100	e2250	e2250	e2900	10300	5880	4910	2350	857	3150
29	2140	1740	e2100	e2250	---	e3000	10200	5590	4790	2360	827	3140
30	1950	1930	e2100	e2250	---	e3200	10400	5370	4790	2060	893	2960
31	1830	---	e2100	e2250	---	e3400	---	4910	---	1830	1800	---
TOTAL	79500	59090	66600	64850	63000	79700	258020	214600	119830	105820	35640	88560
MEAN	2565	1970	2148	2092	2250	2571	8601	6923	3994	3414	1150	2952
MAX	3900	2770	2250	2250	2250	3400	10700	10400	5380	4830	1820	3420
MIN	1800	1430	2100	1950	2250	2300	3700	4180	2890	1830	731	1490
AC-FT	157700	117200	132100	128600	125000	158100	511800	425700	237700	209900	70690	175700
CFSM	.35	.27	.29	.29	.31	.35	1.17	.95	.55	.47	.16	.40
IN.	.40	.30	.34	.33	.32	.41	1.31	1.09	.61	.54	.18	.45

CAL YR 1988 TOTAL 711893 MEAN 1945 MAX 5980 MIN 348 AC-FT 1412000 CFSM .27 IN. 3.62  
WTR YR 1989 TOTAL 1235210 MEAN 3384 MAX 10700 MIN 731 AC-FT 2450000 CFSM .46 IN. 6.28

e Estimated

## CROW WING RIVER BASIN

05243721 STRAIGHT RIVER AT COUNTY HIGHWAY 125 NEAR OSAGE, MN

LOCATION.--Lat 46°54'15", long 95°12'15", in NW¼NW¼ sec.35, T.140 N., R.36 W., Becker County, Hydrologic Unit 07010106, on downstream side of culverts on County Highway 125, 2.7 mi southeast of Osage.

PERIOD OF RECORD.--October to November 1986, March 1987 to current year. Records of hourly water temperature, available in files of the Geological Survey.

GAGE.--Water-stage recorder. Elevation of gage is 1,435 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 69 ft<sup>3</sup>/s, Sept. 4, 1989, gage height, 7.86 ft; minimum, 21 ft<sup>3</sup>/s, July 19, 21, 22, 23, 26, 1988; minimum gage height, 7.20 ft, July 21, 22, 23, 26, 29, 30, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 69 ft<sup>3</sup>/s, Sept. 4, gage height, 7.86 ft; minimum, 23 ft<sup>3</sup>/s, July 24, 25, 26, 27, 28; minimum gage height, 7.26 ft, July 25, 26.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	36	34	43	e38	e38	e35	e41	53	41	37	27	63
2	35	34	40	e38	e38	e35	e42	51	41	36	27	63
3	34	40	e41	e38	38	35	e44	50	41	35	27	61
4	34	41	e41	e38	e38	e35	e46	51	41	34	28	66
5	33	41	e41	e38	e37	e35	47	59	40	33	29	58
6	31	38	e41	e38	e37	e35	e47	53	39	33	28	49
7	30	36	e41	e38	e37	e35	46	50	39	32	27	45
8	30	37	e41	e38	e37	e35	e46	52	40	31	27	42
9	31	38	41	e38	37	e35	e46	51	39	31	27	39
10	31	e38	e41	e38	e37	e35	e45	48	38	31	28	36
11	30	e39	e41	e38	e37	e35	e45	46	38	31	28	37
12	29	e39	e41	e38	e37	e35	e45	45	45	30	30	37
13	30	e40	e40	38	e37	e35	e45	44	49	31	32	35
14	30	40	e40	e38	e37	e35	45	43	49	31	34	34
15	31	e40	e40	e38	e37	e35	e46	42	46	30	33	33
16	31	e40	e40	e37	e36	e35	48	41	44	30	32	32
17	31	e39	e40	e37	35	e35	50	41	42	29	33	32
18	32	e39	e40	e37	e35	e35	50	46	41	29	32	31
19	32	e39	e39	e37	e34	e35	52	46	40	29	34	32
20	32	e39	e39	e37	e34	e35	52	47	38	28	35	34
21	33	e39	e39	e37	e34	e35	53	45	40	28	34	52
22	32	e39	e38	e37	e34	e35	53	44	48	27	36	49
23	33	38	38	e37	e34	e35	52	44	44	27	38	42
24	33	e39	e38	e37	34	34	52	44	42	26	38	38
25	32	e39	e38	e37	e34	e35	54	47	44	25	37	36
26	32	e39	e38	e37	e34	e36	53	45	43	25	39	35
27	32	e39	e38	37	e34	e38	53	42	42	26	39	34
28	33	e39	e38	e37	e34	39	52	42	40	26	43	34
29	32	e39	e38	e37	---	e40	51	43	38	26	43	34
30	32	e39	38	e37	---	e40	53	43	38	26	41	32
31	33	---	e38	e37	---	40	---	42	---	26	61	---
TOTAL	990	1160	1230	1162	1005	1107	1454	1440	1250	919	1047	1245
MEAN	31.9	38.7	39.7	37.5	35.9	35.7	48.5	46.5	41.7	29.6	33.8	41.5
MAX	36	41	43	38	38	40	54	59	49	37	61	66
MIN	29	34	38	37	34	34	41	41	38	25	27	31
AC-FT	1960	2300	2440	2300	1990	2200	2880	2860	2480	1820	2080	2470

WTR YR 1989 TOTAL 14009 MEAN 38.4 MAX 66 MIN 25 AC-FT 27790

e Estimated

## CROW WING RIVER BASIN

05243723 STRAIGHT RIVER AT COUNTY HIGHWAY 115 NEAR PARK RAPIDS, MN

LOCATION.--Lat 46°52'45", Long 95°06'12", in SW¼SW¼ sec.4, T.139 N., R.35 W., Hubbard County, Hydrologic Unit 07010106, downstream from culvert on County Highway 115, 4.17 mi southwest of Park Rapids.

PERIOD OF RECORD.--October to November 1986, March 1987 to current year. Records of hourly water temperature, available in files of the Geological Survey.

GAGE.--Water-stage recorder. Elevation of gage is 1,420 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records fair except those for estimated daily discharges, which are poor.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 88 ft<sup>3</sup>/s, Aug. 31, 1989, gage height, 11.03 ft; minimum, 24 ft<sup>3</sup>/s, Aug. 8, 9, 10, 1989; minimum gage height observed, 9.99 ft, Mar. 12, 13, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 88 ft<sup>3</sup>/s, Aug. 31, gage height, 11.03 ft; minimum, 24 ft<sup>3</sup>/s, Aug. 8, 9, 10; minimum gage height, 10.03 ft, Mar. 31.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	49	40	e39	e45	e41	e41	54	63	51	46	34	66
2	47	40	e40	e46	e41	e41	57	62	49	47	34	68
3	47	41	e40	e46	e41	e41	63	61	48	46	33	68
4	45	42	e41	e46	e41	e41	64	61	47	45	35	70
5	45	43	e41	e45	e41	e41	65	63	47	45	37	68
6	43	43	e41	e44	e41	e41	64	63	45	45	34	67
7	42	42	e41	e43	e41	e41	63	60	45	45	31	64
8	42	41	e41	e42	e41	e41	62	61	45	44	30	59
9	42	41	e41	e41	e41	e41	61	60	45	45	30	57
10	42	e41	e41	e41	e41	e41	60	58	45	45	30	54
11	41	e41	e41	e41	e41	e41	60	57	45	46	32	54
12	41	e41	e41	e41	e41	e41	59	56	48	45	31	53
13	42	e41	e41	e41	e41	e41	60	55	50	45	34	52
14	42	e41	e41	e41	e41	e41	61	54	51	45	38	50
15	41	e40	e41	e41	e41	e41	62	53	51	45	35	49
16	41	e40	e41	e41	e41	e41	64	52	49	45	34	e47
17	42	e40	e41	e41	e41	e41	64	52	48	44	36	e46
18	43	e40	e41	e41	e41	e41	63	56	47	44	33	e46
19	43	e40	e41	e41	e41	e41	64	55	47	43	37	e46
20	43	e40	e41	e41	e41	e41	64	54	46	42	38	e50
21	43	e40	e41	e41	e41	e41	64	53	48	42	34	e59
22	43	e40	e41	e41	e41	e45	65	52	51	41	34	72
23	42	e39	e41	e41	e41	e50	65	52	51	41	36	e66
24	42	e39	e41	e41	e41	e52	64	57	49	42	37	e62
25	42	e39	e41	e41	e41	e55	64	57	50	39	37	e58
26	42	e39	e41	e41	e41	e57	64	54	50	35	40	e54
27	42	e39	e41	e41	e41	57	64	53	48	34	39	e51
28	43	e39	e41	e41	e41	57	63	52	46	35	45	49
29	44	e39	e42	e41	---	56	63	53	45	35	47	e49
30	43	e39	e43	e41	---	53	63	52	45	33	43	e49
31	41	---	e44	e41	---	53	---	52	---	34	77	---
TOTAL	1330	1210	1273	1300	1148	1396	1873	1743	1432	1308	1145	1703
MEAN	42.9	40.3	41.1	41.9	41.0	45.0	62.4	56.2	47.7	42.2	36.9	56.8
MAX	49	43	44	46	41	57	65	63	51	47	77	72
MIN	41	39	39	41	41	41	54	52	45	33	30	46
AC-FT	2640	2400	2520	2580	2280	2770	3720	3460	2840	2590	2270	3380

WTR YR 1989 TOTAL 16861 MEAN 46.2 MAX 77 MIN 30 AC-FT 33440

e Estimated

## CROW WING RIVER BASIN

05243725 STRAIGHT RIVER NEAR PARK RAPIDS, MN

LOCATION.--Lat 46°52'30", long 95°03'56", in NW¼NE¼ sec.11, T.139 N., R.35 W., Hubbard County, Hydrologic Unit 07010106, upstream from culvert on U.S. Highway 71, 3.2 mi south of Park Rapids.

DRAINAGE AREA.--53.2 mi<sup>2</sup>.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1970-71, 1973, 1975-76. October to November 1986, March 1987 to current year. Records of hourly water temperature, available in files of the Geological Survey.

GAGE.--Water-stage recorder. Elevation of gage is 1,400 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 89 ft<sup>3</sup>/s, Aug. 31, 1989, gage height, 2.24 ft; maximum gage height, 2.66 ft, Mar. 11, 1989 (backwater from ice); minimum discharge, 28 ft<sup>3</sup>/s, July 22, 23, 1988; minimum gage height, 0.96 ft, July 22, 1988.

EXTREMES OUTSIDE PERIOD OF RECORD.--A discharge of 35 ft<sup>3</sup>/s was measured Aug. 4, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 89 ft<sup>3</sup>/s, Aug. 31, gage height, 2.24 ft; maximum gage height, 2.66 ft, Mar. 11 (backwater from ice); minimum discharge, 29 ft<sup>3</sup>/s, July 26, 27, 31, Aug. 1, 3, 4, 8; minimum gage height, 1.20 ft, June 19.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	50	46	e46	e46	e46	e46	e69	70	57	51	34	69
2	49	46	e46	e46	e46	e46	e70	69	57	49	35	65
3	49	47	e46	e46	e46	e46	e73	68	56	48	34	67
4	48	51	e46	e46	e46	e46	e74	67	56	48	36	72
5	48	51	e46	e46	e46	e46	75	72	56	46	37	69
6	47	51	e46	e46	e46	e46	e75	72	54	45	37	65
7	46	49	e46	e46	e46	e46	75	68	55	45	36	61
8	45	48	e46	e46	e46	e46	e75	68	56	45	34	57
9	45	49	e46	e46	e46	e46	e74	69	55	45	35	55
10	45	e49	e46	e46	e46	e46	e74	67	54	44	35	53
11	45	e48	e46	e46	e46	e46	e74	65	54	44	37	53
12	45	e48	e46	e46	e46	e46	e74	63	59	43	39	53
13	44	e48	e46	e46	e46	e46	e73	63	62	42	40	52
14	45	e47	e46	e46	e46	e46	73	61	63	42	44	50
15	45	e47	e46	e46	e46	e46	e73	60	61	41	42	49
16	45	e47	e46	e46	e46	e46	e73	59	58	42	40	48
17	47	e47	e46	e46	e46	e46	e73	58	56	42	39	48
18	47	e47	e46	e46	e46	e46	e73	62	54	40	39	47
19	47	e47	e46	e46	e46	e46	73	62	52	40	42	49
20	47	e47	e46	e46	e46	e46	73	63	52	40	41	52
21	48	e47	e46	e46	e46	e46	73	60	54	38	41	67
22	48	e47	e46	e46	e46	e50	74	59	59	37	41	69
23	48	e46	e46	e46	e46	e54	74	60	59	36	42	64
24	49	e46	e46	e46	e46	59	74	65	57	36	43	60
25	48	e46	e46	e46	e46	e61	74	68	59	34	42	57
26	47	e46	e46	e46	e46	e63	73	63	59	33	44	55
27	47	e46	e46	e46	e46	63	72	59	57	34	45	54
28	48	e46	e46	e46	e46	e64	71	58	56	34	50	52
29	47	e46	e46	e46	---	e65	70	59	53	35	50	52
30	52	e46	e46	e46	---	e66	70	59	52	36	49	51
31	46	---	e46	e46	---	67	---	58	---	35	81	---
TOTAL	1457	1422	1426	1426	1288	1578	2191	1974	1692	1270	1284	1715
MEAN	47.0	47.4	46.0	46.0	46.0	50.9	73.0	63.7	56.4	41.0	41.4	57.2
MAX	52	51	46	46	46	67	75	72	63	51	81	72
MIN	44	46	46	46	46	46	69	58	52	33	34	47
AC-FT	2890	2820	2830	2830	2550	3130	4350	3920	3360	2520	2550	3400
CFSM	.88	.89	.86	.86	.86	.96	1.37	1.20	1.06	.77	.78	1.07
IN.	1.02	.99	1.00	1.00	.90	1.10	1.53	1.38	1.18	.89	.90	1.20

WTR YR 1989 TOTAL 18723 MEAN 51.3 MAX 81 MIN 33 AC-FT 37140 CFSM .96 IN. 13.09

e Estimated

## CROW WING RIVER BASIN

05245100 LONG PRAIRIE RIVER AT LONG PRAIRIE, MN

LOCATION.--Lat 45°58'30", long 94°51'56", in NE¼NW¼ sec.20, T.129 N., R.33 W., Todd County, Hydrologic Unit 07010108, on right bank 90 ft upstream from bridge on First Avenue at Long Prairie and 400 ft downstream from Venewitz Creek.

DRAINAGE AREA.--432 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1971 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,281.74 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--18 years, 159 ft<sup>3</sup>/s, 5.00 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,270 ft<sup>3</sup>/s, July 22, 1972, gage height, 9.37 ft; minimum daily, 0.84 ft<sup>3</sup>/s, Jan. 12-18, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 712 ft<sup>3</sup>/s, Apr. 6, gage height, 5.26 ft; minimum, 4.6 ft<sup>3</sup>/s, Aug. 11, 12, gage height, 1.02 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	e29	e23	e11	e12	9.4	158	226	134	45	11	34
2	41	e29	e23	e11	e12	e9.4	210	226	129	41	10	31
3	39	e28	e23	e11	e12	e9.4	280	219	112	39	8.9	44
4	32	e28	e22	e11	e12	9.4	417	210	99	37	8.7	86
5	28	e27	e22	e11	e12	9.4	543	212	89	34	7.9	64
6	28	e26	e22	e11	e12	9.4	644	212	83	32	7.9	54
7	28	e26	e21	e11	e12	9.4	651	206	78	31	6.9	52
8	25	e27	e20	e11	e12	9.4	666	200	74	31	6.9	51
9	24	e27	e19	e11	e12	9.4	598	206	73	30	6.1	45
10	25	e28	e18	e11	e12	9.4	603	206	69	30	4.9	38
11	23	e28	e17	e11	e12	9.4	546	202	64	28	4.9	33
12	22	e27	e16	e11	e12	9.4	472	189	74	27	5.7	33
13	24	e30	e15	e11	e12	e9.4	387	176	75	27	5.7	29
14	26	e35	e14	e12	12	10	334	162	86	26	6.5	27
15	28	e28	e13	e12	11	11	302	149	89	25	6.5	25
16	29	e25	e12	e12	11	11	288	139	85	24	6.5	24
17	28	e20	e12	e12	11	11	274	128	75	22	6.5	21
18	32	e24	e11	e11	11	11	259	125	69	21	6.1	19
19	30	e26	e11	e11	11	11	241	140	63	21	9.4	17
20	36	e26	11	e11	11	12	224	155	56	20	11	20
21	42	e27	11	e11	11	12	211	154	52	19	10	42
22	32	e27	11	e11	10	12	204	137	52	18	9.4	50
23	29	e27	11	e11	10	14	199	128	52	17	9.4	54
24	29	e27	11	e11	10	18	195	123	51	16	9.4	66
25	28	e28	11	e11	9.9	21	190	131	50	15	9.4	66
26	27	e29	11	e11	9.4	25	183	132	53	13	16	55
27	28	e24	e11	e11	9.4	32	176	132	52	13	19	44
28	25	e22	e11	e11	9.4	47	178	124	52	12	18	37
29	21	e23	e11	e11	---	60	199	119	52	11	18	31
30	22	e23	e11	e12	---	70	219	126	50	11	16	27
31	e25	---	e11	e12	---	104	---	130	---	11	28	---
TOTAL	896	801	466	347	313.1	614.2	10051	5124	2192	747	310.6	1219
MEAN	28.9	26.7	15.0	11.2	11.2	19.8	335	165	73.1	24.1	10.0	40.6
MAX	42	35	23	12	12	104	666	226	134	45	28	86
MIN	21	20	11	11	9.4	9.4	158	119	50	11	4.9	17
AC-FT	1780	1590	924	688	621	1220	19940	10160	4350	1480	616	2420
CFSM	.07	.06	.03	.03	.03	.05	.78	.38	.17	.06	.02	.09
IN.	.08	.07	.04	.03	.03	.05	.87	.44	.19	.06	.03	.10

CAL YR 1988 TOTAL 16433.6 MEAN 44.9 MAX 310 MIN 1.4 AC-FT 32600 CFSM .10 IN. 1.42  
WTR YR 1989 TOTAL 23080.9 MEAN 63.2 MAX 666 MIN 4.9 AC-FT 45780 CFSM .15 IN. 1.99

e Estimated

## CROW WING RIVER BASIN

05246500 GULL LAKE NEAR BRAINERD, MN

LOCATION.--Lat 46°24'40", long 94°21'26", in NF sec.20, T.134 N., R.29 W., Cass County, Hydrologic Unit 07010106, in pool of dam on Gull River, 800 ft south of outlet of Gull Lake, 0.2 mi upstream from Gull Lake Dam, and 8 mi northwest of Brainerd.

DRAINAGE AREA.--287 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1911 to current year. Prior to October 1941 monthend contents only, published in WSP 1308. Published as Gull Lake Reservoir October 1941 to September 1956.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Aug. 10, 1949, nonrecording gage 800 ft north of present site at same datum. Aug. 11, 1949, to June 30, 1973, water-stage recorder at present site and at datum 1,188.14 ft, adjustment of 1912.

REMARKS.--Reservoir is formed by Gull Lake and several other natural lakes controlled by concrete dam completed in 1913; storage began in 1912. Capacity between elevation 1,192.75 ft and 1,194.75 ft (maximum allowable range and normal operating range) is 26,008 acre-ft. Contents shown herein are contents above elevation 1,188.00 ft. Prior to September 1978, published contents as contents above elevation 1,188.75 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records were provided by U.S. Army Corps of Engineers.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 74,800 acre-ft, capacity table then in use, June 30, 1914, elevation, 1,195.05 ft; minimum observed, 22,250 acre-ft, capacity table then in use, Mar. 20, 1924, elevation, 1,190.75 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 63,760 acre-ft, May 26, elevation, 1,194.21 ft; minimum, 47,400 acre-ft, Mar. 24, elevation, 1,192.95 ft.

## MONTHEND ELEVATION AND CONTENTS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept. 30 .....	1,194.01	61,150	
Oct. 31 .....	1,193.72	57,370	-3,780
Nov. 30 .....	1,193.77	58,020	+650
Dec. 31 .....	1,193.62	56,060	-1,960
CAL YR 1988 .....			+1,540
Jan. 31 .....	1,193.33	52,320	-3,740
Feb. 28 .....	1,193.05	48,690	-3,630
Mar. 31 .....	1,193.06	48,820	+130
Apr. 30 .....	1,194.09	62,190	+13,370
May 31 .....	1,194.16	63,110	+920
June 30 .....	1,194.01	61,150	-1,960
July 31 .....	1,193.82	58,680	-2,470
Aug. 31 .....	1,193.97	60,620	+1,940
Sept. 30 .....	1,193.70	57,100	-3,520
WTR YR 1989 .....			-4,050

## CROW WING RIVER BASIN

05247000 GULL RIVER AT GULL LAKE DAM, NEAR BRAINERD, MN

LOCATION.--Lat 46°24'40", long 94°21'12", in sec.20, T.134 N., R.29 W., Cass County, Hydrologic Unit 07010106, in headwater and tailwater of dam at outlet of Gull Lake, 8 mi northwest of Brainerd.

DRAINAGE AREA.--287 mi<sup>2</sup>.

PERIOD OF RECORD.--August 1911 to current year. Monthly discharge only for some periods, published in WSP 1308. Published as "Gull Lake Reservoir" 1929.

GAGE.--Water-stage recorder on headwater and nonrecording gage on tailwater. Datum of gages is National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). August 1911 to May 23, 1929, and Dec. 1, 1929, to Aug 1, 1949, both gages were nonrecording gages at same site and datum in use. May 24 to Nov. 30, 1929, non-recording gage 500 ft downstream at different datum. Aug. 2, 1949, to June 30, 1973, at present sites with datum of gage at 1,188.14 ft, adjustment of 1912.

REMARKS.--Discharge computed at dam on basis of modified weir formulas, the head being obtained from twice-daily readings on tailwater gage and from headwater recorder. Flow completely regulated by Gull Lake (station 05246500).

COOPERATION.--Computations of daily discharge were provided by U.S. Army Corps of Engineers.

AVERAGE DISCHARGE (unadjusted).--78 years, 109 ft<sup>3</sup>/s, 5.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 1,120 ft<sup>3</sup>/s, May 15, 1938; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 500 ft<sup>3</sup>/s, Apr. 12-14; minimum daily, 17 ft<sup>3</sup>/s, Aug. 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	140	49	204	122	160	114	83	209	302	20	19	152
2	140	49	204	122	159	113	53	207	211	20	19	150
3	140	49	204	122	159	113	53	208	159	20	19	150
4	138	49	202	121	159	113	53	146	161	20	19	152
5	138	49	201	121	157	114	108	106	160	20	19	190
6	138	49	200	122	159	113	147	103	88	20	19	191
7	96	49	201	122	159	113	150	103	40	20	18	191
8	66	49	201	122	157	113	258	106	47	20	18	191
9	66	50	126	121	157	113	370	106	47	20	18	191
10	66	50	71	121	157	113	470	210	47	20	18	191
11	66	49	73	122	157	113	488	266	47	20	18	189
12	66	50	73	123	157	113	500	304	47	20	19	146
13	66	50	73	142	159	113	500	264	47	20	19	103
14	66	50	73	164	132	114	500	244	48	19	18	103
15	57	66	73	164	116	113	434	242	47	19	18	103
16	49	77	73	164	116	114	390	143	47	19	18	103
17	49	77	73	164	116	114	391	85	33	19	18	103
18	49	76	74	165	116	113	391	47	21	19	18	102
19	49	103	74	165	115	113	389	47	21	19	18	68
20	49	123	74	165	114	113	265	47	21	19	18	45
21	50	123	74	165	115	113	202	47	21	19	18	45
22	50	123	74	162	115	113	202	48	21	19	18	45
23	50	123	105	162	114	113	202	49	208	19	18	81
24	50	123	120	162	114	113	202	83	383	19	18	102
25	49	123	120	162	114	113	108	106	266	19	18	102
26	49	123	120	162	114	112	53	129	199	19	17	101
27	49	130	120	162	114	112	53	186	140	19	18	64
28	49	186	122	160	114	112	54	218	54	19	18	86
29	49	204	122	159	---	112	146	218	20	19	18	101
30	49	202	122	158	---	114	208	292	20	19	18	101
31	49	---	122	159	---	114	---	343	---	19	37	---
TOTAL	2237	2673	3768	4527	3795	3506	7423	4912	2973	602	584	3642
MEAN	72.2	89.1	122	146	136	113	247	158	99.1	19.4	18.8	121
MAX	140	204	204	165	160	114	500	343	383	20	37	191
MIN	49	49	71	121	114	112	53	47	20	19	17	45
AC-FT	4440	5300	7470	8980	7530	6950	14720	9740	5900	1190	1160	7220
CFSM	.25	.31	.42	.51	.47	.39	.86	.55	.35	.07	.07	.42
IN.	.29	.35	.49	.59	.49	.45	.96	.64	.39	.08	.08	.47
CAL YR 1988	TOTAL 23159	MEAN 63.3	MAX 204	MIN 18	AC-FT 45940	CFSM .22	IN. 3.00					
WTR YR 1989	TOTAL 40642	MEAN 111	MAX 500	MIN 17	AC-FT 80610	CFSM .39	IN. 5.27					

## CROW WING RIVER BASIN

05247500 CROW WING RIVER NEAR PILLAGER, MN

LOCATION.--Lat 46°18'18", long 94°22'38", in SW¼NE¼ sec.30, T.133 N., R.29 W., Cass County, Hydrologic Unit 07010106, at Sylvan dam powerplant of Minnesota Power Co., 3.6 mi above mouth and 4.9 mi southeast of Pillager.

PERIOD OF RECORD.--October 1968 to September 1986, 1988-1989. Records for August 1924 to September 1968 available in files of the Minnesota District Office.

REMARKS.--Records poor. Discharge computed on basis of powerplant records. Records for Oct. 1, 1968 to Sept. 30, 1975, were adjusted for storage change in the Sylvan dam reservoir. Flow partly regulated by powerplants and Gull Lake (station 05246500).

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

AVERAGE DISCHARGE.--20 years, 1,330 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16,600 ft<sup>3</sup>/s, Apr. 12, 13, 1969; minimum daily, 60 ft<sup>3</sup>/s, Aug. 10, 11, 13, 14, 1976.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum daily discharge since 1924, 18,300 ft<sup>3</sup>/s, Apr. 14, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 6,370 ft<sup>3</sup>/s, Apr. 8; minimum daily, 92 ft<sup>3</sup>/s, July 27-29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	772	550	652	552	700	561	1720	2540	2100	767	405	468
2	923	537	837	552	683	561	1680	2530	1970	689	393	785
3	741	518	785	510	600	561	2100	2340	1820	689	245	938
4	714	453	646	442	601	591	3220	2200	1720	718	246	1270
5	722	645	716	413	601	568	3190	2240	1320	719	246	901
6	678	510	765	437	602	560	3180	2250	1240	720	246	1020
7	640	374	763	588	582	544	4140	2220	1310	646	93	1220
8	727	646	736	474	603	530	6370	2270	1020	446	93	1100
9	658	752	589	412	602	530	6160	2480	983	408	94	923
10	611	731	400	412	601	584	5910	2580	1030	349	94	880
11	565	629	412	412	601	616	5980	2520	1030	322	107	959
12	604	603	474	412	600	641	5740	2340	978	413	325	1000
13	609	605	366	413	525	583	5000	2270	972	348	367	969
14	640	604	344	484	449	583	4670	2230	955	331	336	912
15	640	756	402	462	450	583	4110	1950	1030	416	323	903
16	621	890	444	411	450	583	3930	1890	965	465	323	903
17	564	515	409	425	605	584	3710	1840	837	363	322	735
18	565	400	471	480	581	585	4020	1640	800	363	335	679
19	565	401	413	495	561	622	3930	1620	740	282	345	792
20	565	402	459	495	594	598	3240	1620	617	247	344	619
21	565	484	448	494	648	571	2070	1620	561	277	311	943
22	640	681	432	547	648	564	2360	1620	651	365	206	1000
23	640	773	448	554	646	603	2760	1620	849	365	183	1000
24	676	825	466	549	645	699	2770	1620	1020	336	183	1220
25	640	1060	425	546	646	601	2830	1770	1350	321	183	1310
26	641	986	493	642	610	571	2590	1970	1450	149	365	1040
27	662	762	476	611	574	792	2310	2070	1190	92	558	1030
28	726	560	552	624	561	906	2360	1800	1000	92	592	998
29	536	492	552	642	---	1400	2490	1730	903	92	548	961
30	399	531	552	642	---	1620	2530	2020	862	191	370	844
31	439	---	552	697	---	1610	---	2100	---	376	811	---
TOTAL	19688	18675	16479	15829	16569	21505	107070	63510	33273	12357	9592	28322
MEAN	635	622	532	511	592	694	3569	2049	1109	399	309	944
MAX	923	1060	837	697	700	1620	6370	2580	2100	767	811	1310
MIN	399	374	344	411	449	530	1680	1620	561	92	93	468
AC-FT	39050	37040	32690	31400	32860	42660	212400	126000	66000	24510	19030	56180
CFSM	.19	.19	.16	.15	.18	.21	1.08	.62	.34	.12	.09	.29
IN.	.22	.21	.19	.18	.19	.24	1.21	.72	.38	.14	.11	.32
CAL YR 1988	TOTAL 257914	MEAN 705	MAX 2980	MIN 70	AC-FT 511600	CFSM .21	IN. 2.91					
WTR YR 1989	TOTAL 362869	MEAN 994	MAX 6370	MIN 92	AC-FT 719800	CFSM .30	IN. 4.09					

## MISSISSIPPI RIVER MAIN STEM

05261000 MISSISSIPPI RIVER NEAR FORT RIPLEY, MN

LOCATION.--Lat 46°10'50", long 94°21'56", in SE¼NW¼ sec.27, T.43 N., R.32 W., Crow Wing County, Hydrologic Unit 07010104, on left bank 600 ft upstream from Nokasippi River, 1.0 mile north of Fort Ripley, and at mile 982.1 upstream from Ohio River.

DRAINAGE AREA.--11,010 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--June 1987 to current year. Operated as high-flow partial-record station October 1971 to June 1987. Prior to Oct. 1971 stage records collected by U.S. Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 1,133.84 ft above National Geodetic Vertical Datum of 1929. Aug. 1904 to June 1987 nonrecording gages at different datums.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see stations 05201000, 05206000, 05210500, 05218500, 05230500, 05246500).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,300 ft<sup>3</sup>/s, Apr. 15, 1989, gage height, 9.54 ft; minimum, 528 ft<sup>3</sup>/s, July 30, 1988, gage height, 2.91 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 15,300 ft<sup>3</sup>/s, Apr. 15, gage height, 9.54 ft; minimum, 1,030 ft<sup>3</sup>/s, Aug. 25, gage height, 3.48 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4970	2610	e2600	e2400	e2700	e2850	e4900	12800	6870	5300	2220	2350
2	5160	2700	e2700	e2400	e2700	e2900	e5500	12700	6520	5150	1930	2580
3	5170	2640	e2750	e2400	e2700	e2950	e6400	12500	6360	5250	1890	3190
4	4960	2630	e2750	e2350	e2700	e3000	e7600	12200	5650	5170	2170	3700
5	4680	2640	e2800	e2350	e2700	e3050	e8500	12000	5220	5060	1840	3510
6	4340	2630	e2750	e2300	e2700	e3100	8860	11900	4770	5060	1610	3400
7	4020	2300	e2700	e2300	e2700	e3150	10200	11800	4770	4880	1740	3870
8	3980	2380	e2650	e2300	e2700	e3150	13200	11800	4470	4570	1750	4320
9	3830	2580	e2600	e2300	e2700	e3190	14400	11800	4320	4630	1750	4380
10	3390	2660	e2600	e2300	e2700	e3200	14200	11800	4050	4320	1760	4260
11	3300	2590	e2550	e2300	e2700	e3200	14400	11400	4070	3970	1590	4160
12	3090	2470	e2550	e2300	e2700	e3200	14700	10800	4290	4140	1370	4090
13	3420	2520	e2500	e2300	e2700	e3200	14400	9930	4240	4080	1380	4270
14	3050	2520	e2500	e2300	e2700	e3200	14800	9290	4230	3830	1390	3880
15	2970	2680	e2500	e2350	e2700	e3200	15000	8480	4100	3800	1230	3800
16	2930	2810	e2500	e2400	e2700	e3200	14700	7690	4180	3720	1130	4060
17	2870	2770	e2500	e2450	e2700	e3200	14200	7320	4700	3700	1260	4120
18	2690	2380	e2500	e2500	e2700	e3200	13900	6740	4510	3510	1300	3790
19	2600	2400	e2500	e2550	e2700	e3200	14300	6530	4430	3460	1240	3710
20	2890	2600	e2500	e2600	e2700	e3200	13900	6200	4480	3390	1330	3770
21	2800	2690	e2500	e2650	e2700	e3250	13200	6270	4200	3260	1340	3990
22	2730	2510	e2450	e2650	e2700	e3250	12600	5970	4620	3280	1270	4190
23	2730	2580	e2450	e2680	e2700	e3250	13000	5810	5270	3240	1230	4260
24	2730	2670	e2400	e2700	e2700	e3300	13100	5970	6210	3100	1160	4140
25	2660	2990	e2400	e2700	e2700	e3350	13000	6160	6560	3020	1070	4210
26	2600	3600	e2400	e2700	e2700	e3400	12900	7210	6420	2770	1150	4140
27	2510	3670	e2400	e2700	e2750	e3500	12600	7980	6170	2690	1520	4330
28	2620	3220	e2400	e2700	e2800	e3600	12500	7830	5800	2640	1530	4220
29	2840	2450	e2400	e2700	---	e3750	12600	7420	5460	2580	1580	4170
30	2690	e2500	e2400	e2700	---	e4000	12700	7510	5170	2480	1360	4060
31	2400	---	e2400	e2700	---	e4400	---	7170	---	2230	1930	---
TOTAL	103620	80390	78600	77030	75750	101590	366260	280980	152110	118280	47020	116920
MEAN	3343	2680	2535	2485	2705	3277	12210	9064	5070	3815	1517	3897
MAX	5170	3670	2800	2700	2800	4400	15000	12800	6870	5300	2220	4380
MIN	2400	2300	2400	2300	2700	2850	4900	5810	4050	2230	1070	2350
AC-FT	205500	159500	155900	152800	150300	201500	726500	557300	301700	234600	93260	231900
CFSM	.30	.24	.23	.23	.25	.30	1.11	.82	.46	.35	.14	.35
IN.	.35	.27	.27	.26	.26	.34	1.24	.95	.51	.40	.16	.40
CAL YR 1988	TOTAL 1003834	MEAN 2743	MAX 8620	MIN 558	AC-FT 1991000	CFSM .25	IN. 3.39					
WTR YR 1989	TOTAL 1598550	MEAN 4380	MAX 15000	MIN 1070	AC-FT 3171000	CFSM .40	IN. 5.40					

e Estimated

## MISSISSIPPI RIVER MAIN STEM

05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN

LOCATION.--Lat 45°51'41", long 94°21'33", in lot 2, sec.20, T.39 N., R.32 W., Morrison County, Hydrologic Unit 07010104, at plant of Minnesota Power Co., 4 mi northwest of Royalton, 4.5 mi downstream from Swan River, and at mile 956 upstream from Ohio River.

DRAINAGE AREA.--11,600 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March 1924 to current year.

REMARKS.--No estimated daily discharges. Records poor. Discharge computed based on powerplant records. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see stations 05201000, 05206000, 05210500, 05218500, 05230500, 05246500).

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

AVERAGE DISCHARGE.--65 years, 4,605 ft<sup>3</sup>/s, 5.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 37,700 ft<sup>3</sup>/s, Apr. 16, 1965; minimum daily, 254 ft<sup>3</sup>/s, Nov. 25, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 16,100 ft<sup>3</sup>/s, Apr. 15; minimum daily, 394 ft<sup>3</sup>/s, Aug. 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	4430	2590	2730	3200	2660	3130	4910	13200	6940	4790	1720	2800		
2	4900	2860	3120	2840	3320	2880	5640	13000	6540	4680	1940	1720		
3	4820	2580	3560	2810	2990	2950	6740	13100	6370	4820	1450	3760		
4	4850	2950	3220	3190	2880	2890	7140	12600	5580	4950	2000	3260		
5	4260	2800	3790	3040	3220	3010	10900	12500	4960	4430	1670	3630		
6	3930	2800	3530	2860	3080	2930	11100	12200	4120	4410	1550	3470		
7	3710	2550	3500	2580	3260	2980	12600	12000	4360	4350	1280	3630		
8	3550	2380	3170	2710	2950	2980	14600	12200	3890	4070	1600	4180		
9	3460	2940	3000	2580	3200	2830	15500	12100	3810	4090	1590	3830		
10	3140	2770	2660	2350	3150	2960	15500	12200	3660	3930	1470	4040		
11	2750	2930	2670	2340	3100	2930	15100	11800	3480	3460	1480	3630		
12	2670	2940	2790	2400	3100	3140	15900	11100	4210	3450	1140	3620		
13	2840	2620	2860	2360	3240	3070	15700	10300	3770	3840	1030	3770		
14	2930	2820	2570	2380	3080	3040	15400	9580	3680	3160	1440	3680		
15	2490	2870	2760	2520	3100	3060	16100	8700	3660	3420	1050	3320		
16	2640	3430	2740	2510	3180	2950	15500	8490	3300	3560	933	3510		
17	2380	2690	2750	2500	3100	2930	15400	7450	4230	3220	933	4030		
18	2500	2620	2920	2550	3170	3020	14900	6840	4190	3560	1110	3420		
19	2070	2760	3140	2660	3050	2890	15200	6180	3590	3100	1220	3570		
20	2440	2390	3020	2560	3150	2930	15100	5480	4160	3110	986	3710		
21	2520	2590	3020	2580	3180	3040	14200	6470	3940	3060	1060	3930		
22	2360	2480	3150	2640	3290	2930	13200	5800	3730	2770	1190	4320		
23	2320	2920	3230	2610	3160	2940	13300	5370	4380	3050	992	3780		
24	2380	3080	3230	2770	3080	3100	13900	6100	5920	2760	999	4080		
25	2420	3470	3240	2840	3050	3260	13700	5720	6130	2640	894	4120		
26	2320	3910	3050	2600	3070	3270	13700	6800	6400	2380	1020	3970		
27	2680	3540	3180	2640	2770	3400	13400	7780	5180	2430	1200	3980		
28	2790	2560	2950	3150	3150	3610	12900	7670	5460	2280	1280	4380		
29	2720	2280	3200	2760	---	3930	13200	7400	4970	2360	1300	3800		
30	2600	2320	3090	2960	---	4340	13700	7260	4640	2280	1280	3800		
31	2700	---	3280	2810	---	4660	---	7080	---	2130	1330	---		
TOTAL	94570	84440	95120	83300	86730	97980	394130	284470	139250	106540	40137	110740		
MEAN	3051	2815	3068	2687	3097	3161	13140	9176	4642	3437	1295	3691		
MAX	4900	3910	3790	3200	3320	4660	16100	13200	6940	4950	2000	4380		
MIN	2070	2280	2570	2340	2660	2830	4910	5370	3300	2130	894	1720		
AC-FT	187600	167500	188700	165200	172000	194300	781800	564200	276200	211300	79610	219700		
CFSM	.26	.24	.26	.23	.27	.27	1.13	.79	.40	.30	.11	.32		
IN.	.30	.27	.31	.27	.28	.31	1.26	.91	.45	.34	.13	.36		
CAL YR 1988	TOTAL	986878	MEAN	2696	MAX	9040	MIN	390	AC-FT	1957000	CFSM	.23	IN.	3.16
WTR YR 1989	TOTAL	1617407	MEAN	4431	MAX	16100	MIN	894	AC-FT	3208000	CFSM	.38	IN.	5.19

## MISSISSIPPI RIVER MAIN STEM

05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1963-66, 1975 to current year.

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

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND (00060)	DIS-CHARGE, INST. CUBIC FEET PER SECOND (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 WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	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)	
DEC 19...	1130	2220	--	311	321	7.1	7.9	0.0	2.1	743	11.6	110	
JAN 25...	1130	--	3150	530	318	7.4	7.7	0.5	2.2	--	--	60	
MAY 24...	1215	2750	--	270	267	8.0	8.2	19.5	4.5	760	7.4	K2	
JUL 20...	1455	567	--	267	257	7.6	7.8	25.0	5.0	730	8.0	K7	
DATE		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)	ALKA-LINITY WAT DIS TOT IT FIELD (MG/L AS CACO3) (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD (MG/L AS CO3) (00452)	BICAR-BONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	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)
DEC 19...	K10	42	14	6.3	1.5	149	155	0	182	18	4.3	0.1	
JAN 25...	K9	43	14	5.8	1.5	--	155	0	--	14	3.8	0.1	
MAY 24...	K21	36	11	4.9	1.6	126	128	0	154	11	3.8	0.1	
JUL 20...	73	34	12	4.9	1.1	95	127	0.0	116	7.0	3.4	0.1	
DATE		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)	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)
DEC 19...	9.8	187	0.02	0.37	0.05	0.05	0.70	0.02	0.02	0.01	2	92	
JAN 25...	9.7	183	<0.01	0.26	0.12	0.10	0.60	0.02	0.01	0.01	2	95	
MAY 24...	5.7	159	<0.01	<0.10	0.03	0.04	1.1	0.05	0.04	0.02	9	95	
JUL 20...	10	169	<0.01	<0.10	0.04	<0.01	0.80	0.06	0.02	0.01	--	--	

## MISSISSIPPI RIVER MAIN STEM

05267000 MISSISSIPPI RIVER NEAR ROYALTON, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

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)
DEC 19...	1130	10	1	50	<0.5	1.0	<1	<3	1	140	<5
JAN 25...	1130	<10	<1	48	<0.5	<1.0	<1	<3	1	150	<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)
DEC 19...	6	28	<0.1	<10	1	<1	<1.0	91	<6	7
JAN 25...	8	51	<0.1	<10	1	<1	<1.0	88	<6	13

## SAUK RIVER BASIN

05270150 ASHLEY CREEK NEAR SAUK CENTRE, MN

LOCATION.--Lat 45°46'46", Long 94°58'52", in NW¼SE¼ sec.29, T.127 N., R.34 W., Todd County, Hydrologic Unit 07010202, at bridge on County Highway 11.3 miles north of Sauk Centre.

DRAINAGE AREA.--113 mi<sup>2</sup>.

## WATER DISCHARGE RECORDS

PERIOD OF RECORD.--October 1988 to September 1989 (discontinued). Miscellaneous low-flow measurements, water years 1968-70, 1974, 1976, and annual maximum, water years 1986-88.

GAGE.--Water-stage recorder and crest-stage gage.

REMARKS.--Records good except those for period of estimated daily discharges, which are fair. Water-stage recorder was located approximately 0.15 mi downstream of crest-stage gage at a water-quality sampling site. Stage record from recorder was used to determine mean daily discharges.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 290 ft<sup>3</sup>/s, Mar. 29, gage height 9.23 (backwater from ice); minimum, 0.24 ft<sup>3</sup>/s, Aug. 25, 26.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e3.6	6.8	e5.8	e4.3	e2.8	e2.5	186	e80	26	12	3.6	19
2	e3.7	7.5	e5.6	e4.2	e2.8	e2.5	185	e85	24	12	3.3	13
3	e3.8	7.8	e5.5	e4.2	e2.8	e2.5	195	e90	23	11	2.5	13
4	e3.9	8.0	e5.4	e4.1	e2.8	e2.5	200	e94	22	8.6	1.5	34
5	e4.0	e8.1	e5.3	e4.1	e2.8	e2.5	196	e98	21	6.5	1.2	36
6	e4.1	e8.2	e5.2	e4.1	e2.8	e2.5	186	e97	21	5.3	2.6	30
7	e4.8	e8.3	e5.1	e4.0	e2.8	e2.5	177	e95	20	4.7	2.3	25
8	e5.4	e8.3	e5.0	e4.0	e2.8	e2.5	164	e89	19	6.5	1.8	20
9	e6.2	e8.4	e4.9	e3.9	e2.9	e2.5	146	e81	18	8.2	.76	17
10	e6.4	e8.5	e4.9	e3.9	e2.9	e2.6	142	e70	17	7.4	e.50	15
11	e6.6	e8.4	e4.9	e3.9	e2.9	e2.6	143	50	16	6.7	e.50	15
12	e6.5	e8.3	e4.9	e3.9	e2.9	e2.6	137	45	21	7.7	.78	15
13	e6.3	e8.2	e4.9	e3.9	e3.0	e2.7	125	42	22	7.3	.74	14
14	e6.2	e8.1	e4.9	e3.8	e3.0	e2.7	113	39	21	5.2	1.5	13
15	e6.2	e8.0	e4.8	e3.8	e3.0	e2.8	103	37	19	2.2	1.7	12
16	e6.1	e7.9	e4.8	e3.8	e2.9	e2.8	94	35	17	.87	1.4	12
17	e6.0	e7.8	e4.8	e3.8	e2.9	e2.8	88	32	16	.93	.93	11
18	e5.9	e7.8	e4.8	e3.8	e2.8	e2.9	80	33	15	1.5	.71	10
19	e5.9	e7.8	e4.8	e3.7	e2.7	e2.9	74	34	14	3.0	1.2	9.7
20	e5.8	e7.8	e4.8	e3.6	e2.7	e3.0	69	31	12	3.3	2.7	11
21	e5.7	e7.7	e4.8	e3.5	e2.6	e3.0	65	28	12	2.0	2.7	13
22	5.5	e7.6	e4.8	e3.5	e2.6	e3.1	64	26	12	4.6	1.6	12
23	5.2	e7.3	e4.8	e3.5	e2.6	e3.0	62	30	12	8.0	.80	9.6
24	5.0	e6.9	e4.7	e3.5	e2.5	e3.0	59	37	11	7.0	.43	8.7
25	4.9	e6.7	e4.7	e3.4	e2.5	e3.0	55	47	12	5.9	.29	8.0
26	4.7	e6.4	e4.7	e3.2	e2.5	e5.0	52	39	15	4.8	12	6.9
27	5.1	e6.3	e4.6	e3.0	e2.5	e30	51	33	15	4.1	43	7.0
28	5.4	e6.2	e4.6	e2.9	e2.5	e120	55	29	13	3.5	42	6.7
29	4.2	e6.1	e4.5	e2.8	---	e270	67	29	11	3.4	25	6.0
30	4.3	e5.9	e4.4	e2.8	---	229	71	31	11	3.5	14	5.8
31	4.7	---	e4.3	e2.8	---	186	---	29	---	3.3	15	---
TOTAL	162.1	227.1	152.0	113.7	77.3	908.0	3404	1615	508	171.00	189.04	428.4
MEAN	5.23	7.57	4.90	3.67	2.76	29.3	113	52.1	16.9	5.52	6.10	14.3
MAX	6.6	8.5	5.8	4.3	3.0	270	200	98	26	12	43	36
MIN	3.6	5.9	4.3	2.8	2.5	2.5	51	26	11	.87	.29	5.8
AC-FT	322	450	301	226	153	1800	6750	3200	1010	339	375	850
CFSM	.05	.07	.04	.03	.02	.26	1.00	.46	.15	.05	.05	.13
IN.	.05	.07	.05	.04	.03	.30	1.12	.53	.17	.06	.06	.14

WTR YR 1989 TOTAL 7955.64 MEAN 21.8 MAX 270 MIN .29 AC-FT 15780 CFSM .19 IN. 2.62

e Estimated

SAUK RIVER BASIN  
05270150 ASHLEY CREEK NEAR SAUK CENTRE, MN--Continued  
WATER QUALITY RECORDS

PERIOD OF RECORD.--September 1988 to August 1989 (discontinued).

REMARKS.--\* Composite sample.

WATER QUALITY DATA, SEPTEMBER 1988 TO SEPTEMBER 1989

DATE	TIME	TEMPER- ATURE WATER (DEG C) (00010)	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	ALKA- LINITY WAT WH TOT IT FIELD MG/L AS CACO3 (39086)	CAR- BONATE WATER WH IT FIELD MG/L AS CO3 (00452)
SEP 1988								
28...	0930	9.5	3.6	723	7.0	7.7	305	0
NOV								
04...	0930	3.5	8.0	655	10.8	8.2	--	--
JAN 1989								
11...	1600	0.0	4.0	673	6.2	7.5	--	--
FEB								
15...	1530	0.0	2.9	668	11.0	7.8	--	--
MAR								
07...	1545	0.0	2.5	663	10.2	7.8	280	0
MAR								
*28-30		--	--	--	--	-	60	0
29...	1000	0.0	268	245	11.7	7.8	--	--
APR								
11...	1315	3.5	143	443	10.2	7.6	157	0
25...	1745	17.0	53	561	13.7	8.5	230	0
MAY								
10...	1610	17.5	54	608	15.9	8.6	220	7
23...	1520	21.0	31	621	8.3	8.1	260	0
JUN								
20...	1605	26.0	12	616	9.2	8.3	252	0
JUL								
18...	1530	23.0	2.0	582	12.0	8.3	282	0
AUG								
15...	1520	22.0	1.6	603	8.5	7.9	--	--

DATE	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3 (00453)	SOLIDS TOTAL AT 105 DEG. C, SUS- PENDE (MG/L) (00530)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHOROUS TOTAL (MG/L AS P) (00665)	PHOS- PHOROUS ORTHO, DIS- SOLVED (MG/L AS P) (00761)
SEP 1988							
28...	372	6	0.01	0.50	0.68	0.06	0.05
MAR 1989							
07...	341	2	0.15	0.70	3.00	0.03	0.01
MAR							
*28-30	73	--	1.4	3.1	3.00	0.49	0.35
APR							
11...	191	<1	0.60	1.6	2.00	0.17	0.08
25...	280	3	0.05	1.1	0.30	0.05	0.02
MAY							
10...	264	1	0.04	2.7	0.32	0.03	<0.01
23...	312	4	0.10	0.80	0.56	0.09	0.05
JUN							
20...	307	<1	--	--	--	--	0.05
JUL							
18...	344	13	0.04	1.2	<0.10	0.15	0.06
AUG							
15...	--	2	0.04	0.60	<0.10	0.12	0.06

## SAUK RIVER BASIN

454433094581100 HOBOKEN CREEK AT SAUK CENTRE, MN

LOCATION.--Lat 45°44'33", long 94°58'11", in NW¼NW¼ sec.4, T.126 N., R.34 W., Stearns County, Hydrologic Unit 07010202, at bridge on County Highway 17 in Sauk Centre.

## WATER DISCHARGE RECORDS

PERIOD OF RECORD.--October 1988 to September 1989 (discontinued).

GAGE.--Water-stage recorder.

REMARKS.--Records good except those for period of estimated discharges, which are poor.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 270 ft<sup>3</sup>/s, Mar. 27, gage height, 10.81 ft (backwater from ice); no flow on many days.DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.00	102	9.9	1.8	.17	.00	2.4
2	.00	.00	.00	.00	.00	.00	69	7.7	1.7	e.00	.00	2.7
3	.00	.00	.00	.00	.00	.00	103	6.2	1.3	e.00	.00	2.9
4	.00	.00	.00	.00	.00	.00	91	5.8	1.1	.13	.00	7.9
5	.00	.00	.00	.00	.00	.00	91	6.2	.90	.11	.00	10
6	.00	.00	.00	.00	.00	.00	53	5.0	.76	e.00	.00	10
7	.00	.00	.00	.00	.00	.00	35	4.3	.72	e.00	.00	8.0
8	.00	.00	.00	.00	.00	.00	29	7.5	.70	e.00	.00	5.3
9	.00	.00	.00	.00	.00	.00	29	9.5	.68	e.00	.00	3.3
10	.00	.00	.00	.00	.00	.00	28	7.8	.55	e.00	.00	2.3
11	.00	.00	.00	.00	.00	.00	e18	6.1	.35	.00	.00	2.2
12	.00	.00	.00	.00	.00	.00	e12	4.8	.56	e.00	.00	1.8
13	.00	.00	.00	.00	.00	.00	e8.5	4.1	.59	e.00	.00	1.6
14	.00	.00	.00	.00	.00	.00	e6.6	3.4	.70	.00	.00	1.3
15	.00	.00	.00	.00	.00	.00	e5.8	2.7	.56	.00	.00	.96
16	.00	.00	.00	.00	.00	.00	e5.1	2.4	.45	.00	.00	.78
17	.00	.00	.00	.00	.00	.00	e4.6	2.0	.36	.00	.00	.65
18	.00	.00	.00	.00	.00	.00	e4.2	2.3	.20	.00	.00	.55
19	.00	.00	.00	.00	.00	.00	e3.9	2.7	.20	.00	e.10	.45
20	.00	.00	.00	.00	.00	.00	3.8	2.1	.11	.00	e.00	.50
21	.00	.00	.00	.00	.00	.00	3.7	1.7	.10	.00	.00	.60
22	.00	.00	.00	.00	.00	e.00	4.2	1.5	.16	.00	.00	.53
23	.00	.00	.00	.00	.00	e1.0	3.7	2.1	.14	.00	.00	.47
24	.00	.00	.00	.00	.00	22	3.2	2.8	.12	.00	.00	.40
25	.00	.00	.00	.00	.00	61	2.8	5.1	.16	.00	.00	.36
26	.00	.00	.00	.00	.00	e120	2.8	4.0	.13	.00	e1.5	.24
27	.00	.00	.00	.00	.00	e180	3.2	2.8	.37	.00	1.1	.20
28	.00	.00	.00	.00	.00	e200	4.8	2.2	.62	.00	1.7	.19
29	.00	.00	.00	.00	---	e195	15	2.2	.30	.00	2.1	.17
30	.00	.00	.00	.00	---	e165	14	2.6	.28	.00	1.1	.17
31	.00	---	.00	.00	---	129	---	2.1	---	.00	1.3	---
TOTAL	0.00	0.00	0.00	0.00	0.00	1073.00	759.9	131.6	16.67	0.41	8.90	68.92
MEAN	.000	.000	.000	.000	.000	34.6	25.3	4.25	.56	.013	.29	2.30
MAX	.00	.00	.00	.00	.00	200	103	9.9	1.8	.17	2.1	10
MIN	.00	.00	.00	.00	.00	.00	2.8	1.5	.10	.00	.00	.17
AC-FT	.00	.00	.00	.00	.00	2130	1510	261	33	.8	18	137

WTR YR 1989 TOTAL 2059.40 MEAN 5.64 MAX 200 MIN .00 AC-FT 4080

e Estimated

SAUK RIVER BASIN  
454433094581100 HOBOKEN CREEK AT SAUK CENTRE, MN--Continued  
WATER QUALITY RECORDS

PERIOD OF RECORD.--September 1988 to August 1989 (discontinued).

REMARKS.--\* Composite sample.

WATER QUALITY DATA, SEPTEMBER 1988 TO SEPTEMBER 1989

DATE	TIME	TEMPER- ATURE WATER (DEG C) (00010)	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	ALKA- LITY WAT WH TOT IT FIELD MG/L AS CACO3 (39086)	CAR- BONATE WATER WH IT FIELD MG/L AS CO3 (00452)
MAR 1989								
*28-30	1600	--	--	--	--	--	--	--
30...	1030	0.0	143	275	12.4	7.9	69	0
APR								
10...	1645	3.5	28	497	10.8	7.7	132	0
25...	1530	16.0	2.7	896	12.6	8.3	265	0
MAY								
10...	1455	16.5	7.7	966	16.7	8.6	228	14
23...	1415	19.5	2.3	924	9.8	8.1	306	0
JUN								
20...	1500	24.5	0.10	868	11.9	8.4	318	0

DATE	BICAR- BONATE WATER WH IT FIELD (MG/L AS HCO3) (00453)	SOLIDS TOTAL AT 105 DEG. C, SUS- PENDED (MG/L) (00530)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHOROUS TOTAL (MG/L AS P) (00665)	PHOS- PHOROUS ORTHO, DIS- SOLVED (MG/L AS P) (00761)
MAR 1989							
*28-30	--	--	1.2	3.5	3.8	0.62	0.50
30...	84	--	--	--	--	--	--
APR							
10...	161	3	1.6	3.5	6.3	0.64	0.45
25...	323	4	0.07	1.1	2.9	0.09	0.02
MAY							
10...	278	6	0.07	1.1	5.6	0.07	0.01
23...	368	<1	0.17	1.1	0.51	0.12	0.05
JUN							
20...	388	5	0.03	0.80	<0.10	0.05	0.03

## SAUK RIVER BASIN

05270170 SAUK RIVER AT SAUK CENTRE, MN

LOCATION.--Lat 45°44'25", long 94°57'02", in SW¼NW¼ sec.10, T.126 N., R.34 W., Stearns County, Hydrologic Unit 07010202, on left bank, 0.1 mi. downstream from dam at outlet from Sauk Lake in Sauk Centre.

## WATER DISCHARGE RECORDS

PERIOD OF RECORD.--October 1988 to September 1989 (discontinued).

GAGE.--Water-stage recorder.

REMARKS.--Records good except those for period of estimated daily discharges, which are fair.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 650 ft<sup>3</sup>/s, Apr. 5, gage height, 8.51 ft; minimum, 0.40 ft<sup>3</sup>/s, Aug. 20.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e1.3	e.66	e8.8	e20	e12	e14	357	111	58	14	2.9	41
2	e1.3	e.67	e9.0	e20	e12	e14	367	111	55	12	2.5	39
3	e1.3	e.68	e9.2	e20	e12	e15	401	106	52	14	2.4	40
4	e1.3	e.71	e9.3	e20	e12	e16	532	112	49	12	1.9	75
5	e1.3	e.73	e9.5	e21	e12	e17	642	132	40	9.2	1.4	77
6	e1.2	e.75	e9.7	e21	e13	e18	619	109	39	11	.99	74
7	e1.2	e.81	e9.9	e21	e13	e19	591	98	36	9.0	.92	76
8	e1.2	e.86	e10	e22	e13	e19	572	115	34	9.9	.96	71
9	e1.2	e.88	e18	e22	e13	e20	517	113	29	10	1.2	64
10	e1.1	e.95	e20	e22	e13	e20	466	113	24	10	1.3	56
11	e1.1	e1.0	e20	e22	e13	e21	293	106	21	9.0	1.2	55
12	e1.0	e1.1	e21	e22	e13	e21	193	106	24	8.0	1.7	51
13	e1.0	e1.2	e21	e21	e13	e20	202	102	22	7.9	.91	45
14	e.96	e1.2	e21	e21	e13	e19	186	96	24	7.4	.92	42
15	e.91	e1.3	e21	e21	e13	e17	175	91	19	7.2	1.3	37
16	e.88	e1.4	e22	e21	e13	e16	174	84	18	6.3	2.0	35
17	e.86	e1.5	e22	e21	e13	e16	127	73	16	5.3	2.6	32
18	e.81	e1.7	e22	e20	e12	e16	68	80	17	6.0	2.8	27
19	e.78	e1.9	e22	e20	e12	e16	76	84	15	5.6	2.3	31
20	e.76	e2.1	e22	e20	e11	e16	83	78	10	5.1	.63	33
21	e.74	e2.4	e22	e19	e11	e16	89	73	13	4.8	.72	36
22	e.77	e2.7	e22	e19	e11	e17	94	67	15	4.4	.72	43
23	e.78	e3.0	e22	e19	e12	17	96	74	14	3.9	1.3	27
24	e.79	e3.4	e22	e19	e12	19	98	80	13	3.8	1.5	19
25	e.76	e3.9	e18	e11	e12	20	101	71	14	3.7	1.9	23
26	e.75	e4.3	e18	e11	e12	22	102	78	18	3.4	10	20
27	e.74	e4.7	e18	e11	e13	25	102	65	18	3.5	17	15
28	e.74	e5.0	e18	e11	e13	41	95	57	18	3.2	19	18
29	e.73	e8.5	e19	e11	---	102	107	70	12	3.2	22	18
30	e.69	e8.6	e19	e11	---	273	109	72	16	3.0	21	15
31	e.66	---	e19	e11	---	345	---	65	---	3.0	32	---
TOTAL	29.61	68.60	544.4	571	347	1247	7634	2792	751	218.6	159.97	1235
MEAN	.96	2.29	17.6	18.4	12.4	40.2	254	90.1	25.0	7.06	5.16	41.2
MAX	1.3	8.6	22	22	13	345	642	132	58	14	32	77
MIN	.66	.66	8.8	11	11	14	68	57	10	3.0	.63	15
AC-FT	59	136	1080	1130	688	2470	15140	5540	1490	434	317	2450

WTR YR 1989 TOTAL 15598.38 MEAN 42.7 MAX 642 MIN .63 AC-FT 30940

e Estimated

## SAUK RIVER BASIN

05270170 SAUK RIVER AT SAUK CENTRE, MN--Continued

## WATER QUALITY RECORDS

PERIOD OF RECORD.--September 1988 to August 1989 (discontinued).

REMARKS.--\* Composite sample.

## WATER QUALITY DATA, SEPTEMBER 1988 TO SEPTEMBER 1989

DATE	TIME	TEMPER- ATURE WATER (DEGREES CELSIUS) (00010)	STREAM- FLOW, INSTAN- TANEOUS (ft <sup>3</sup> /S) (00061)	SPE- CIFIC CON- DUCT- ANCE (uS/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	ALKA- LILITY (MG/L AS CACO <sub>3</sub> ) (39086)	CAR- BONATE (MG/L AS CO <sub>3</sub> ) (00452)
SEP 1988								
27...	1715	12.5	1.4	547	12.4	8.3	261	0
NOV								
04...	0800	8.0	0.70	564	3.7	7.8	--	--
JAN 1989								
11...	1210	2.0	22	520	12.3	7.8	--	--
FEB								
15...	0900	1.0	13	557	9.6	7.7	--	--
MAR								
06...	1745	1.5	18	530	9.2	8.0	242	0
MAR								
*28-30		--	--	--	--	--	92	0
29...	0915	0.5	77	279	12.4	7.9	--	--
30...	1435	0.5	317	272	12.8	7.6	--	--
APR								
11...	1530	3.5	183	420	10.9	8.0	172	0
25...	1300	13.5	99	423	12.2	9.0	181	16
MAY								
10...	1130	13.0	113	494	11.9	8.6	186	12
23...	1145	19.5	69	449	9.8	8.8	166	5
JUN								
20...	1230	21.0	7.4	426	7.6	8.6	178	10
JUL								
18...	1200	23.0	6.8	388	5.1	7.9	178	0
AUG								
15...	1250	20.5	1.1	455	7.2	8.1	--	--

DATE	BICAR- BONATE WATER WH IT FIELD (MG/L AS HCO <sub>3</sub> ) (00453)	SOLIDS TOTAL AT 105 DEG. C, SUS- PENDE (MG/L) (00530)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN,AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO- GEN, NO <sub>2</sub> +NO <sub>3</sub> DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHOROUS TOTAL (MG/L AS P) (00665)	PHOS- PHOROUS ORTHO, DIS- SOLVED (MG/L AS P) (00761)
SEP 1988							
27...	1715	318	24	0.12	1.0	<0.10	0.31
MAR 1989							
06...	1745	295	4	0.22	1.1	0.50	0.03
MAR							
*28-30		112	--	0.98	2.6	2.60	0.45
APR							
11...	1530	210	<1	0.36	1.2	1.20	0.11
25...	1145	189	14	0.04	0.6	<0.10	0.05
MAY							
10...	1130	227	13	0.03	0.7	0.13	0.04
23...	1145	198	<1	0.03	0.7	<0.10	0.04
JUN							
20...	1230	201	<1	--	--	--	<0.01
JUL							
18...	1200	217	<1	0.23	3.4	<0.10	0.10
AUG							
15...	1250	--	13	0.12	0.5	<0.10	0.14

## MISSISSIPPI RIVER MAIN STEM

05270700 MISSISSIPPI RIVER AT ST. CLOUD, MN

LOCATION.--Lat 45°32'50", long 94°08'44", in SE&SW¼ sec.1, T.35 N., R.31 W., Sherburne County, Hydrologic Unit 07010203, on left bank about 250 ft below the left downstream end of the City of St. Cloud hydropower dam and at mile 926.3 upstream from Ohio River.

DRAINAGE AREA.--13,320 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1988 to September 1989.

GAGE.--Water-stage recorder. Datum of gage is 958.49 ft above National Geodatic Vertical Datum of 1929.

REMARKS.--Records fair. Flow partly regulated by powerplants and Winnibigoshish, Leech, Pokegama, Sandy, and Gull Lakes and by Pine River Reservoir (see stations 05201000, 05206000, 05210500, 05218500, 05230500, 05246500).

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 19,300 ft<sup>3</sup>/s, Apr. 12, gage height, 7.66 ft; minimum, 792 ft<sup>3</sup>/s, Aug. 23, gage height, 3.69 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e5470	e2870	e2690	e2770	e2800	e3200	e9500	14500	8490	5370	2180	2980
2	e5680	e2970	e2740	e2770	e2800	e3200	e10300	14400	7990	5540	2010	2370
3	e5690	e2900	e2800	e2770	e2800	e3200	e12000	14500	7760	5480	1930	3060
4	e5460	e2890	e2860	e2770	e2800	e3200	e13300	13900	7340	5500	2020	4690
5	e5150	e2900	e2910	e2770	e2800	e3300	e14300	13500	6460	5160	1870	4850
6	e4770	e2890	e2960	e2780	e2800	e3300	e15300	13000	6170	5320	1580	4200
7	e4420	e2530	e3020	e2780	e2800	e3400	e17200	13100	5640	5270	1720	4120
8	e4380	e2620	e3080	e2780	e2800	e3400	e18100	13200	5740	4750	1490	4880
9	e4210	e2840	e3000	e2780	e2900	e3350	e18600	13200	5300	4610	1630	4930
10	e3730	e2930	e2900	e2780	e2900	e3350	e18900	13500	4930	4710	1680	4930
11	e3630	e2850	e2800	e2780	e2900	e3300	e18500	13500	4650	4150	1660	4780
12	e3400	e2720	e2800	e2780	e2900	e3300	e18200	12600	5030	3900	1610	4230
13	e3760	e2770	e2800	e2780	e2900	e3350	18300	11800	5250	4310	1310	4630
14	e3360	e2770	e2780	e2790	e3000	e3400	18100	11300	4910	3880	1160	4620
15	e3270	e2950	e2780	e2790	e3000	e3400	18600	10200	4750	3720	1460	3910
16	e3220	e3090	e2780	e2790	e3000	e3350	18300	9640	4680	3960	1250	4560
17	e3160	e3050	e2780	e2790	e3000	e3350	17700	8790	4900	3620	e1180	4450
18	e2960	e2620	e2780	e2790	e3000	e3400	16800	9160	5550	3800	1100	4280
19	e2860	e2640	e2780	e2790	e3000	e3450	17100	6500	4660	3740	1310	4220
20	e3180	e2860	e2780	e2790	e3000	e3500	16900	7030	4710	3550	1740	4250
21	e3080	e2960	e2780	e2800	e3000	e3500	15900	7330	5460	3520	1150	4480
22	e3000	e2760	e2780	e2800	e3000	e3500	15000	7250	4840	3020	1490	4670
23	e3000	e2840	e2780	e2800	e3100	e3500	14800	7140	5290	3310	1260	4410
24	e3000	e2940	e2780	e2800	e3100	e3600	15100	7010	6450	3070	1010	4660
25	e2930	e3290	e2780	e2800	e3100	e3750	14800	7730	6470	2530	1050	4580
26	e2860	e3960	e2780	e2800	e3100	e4000	14500	8280	7370	3160	1530	4510
27	e2760	e4040	e2780	e2800	e3100	e4500	14100	9230	6510	2520	1450	4260
28	e2880	e3540	e2780	e2800	e3200	e5200	13900	9620	6490	2620	1680	4770
29	e3120	e2700	e2780	e2800	---	e6000	14500	9550	5760	2390	1670	4530
30	e2960	e2890	e2780	e2800	---	e7000	14300	9080	5680	2720	1630	4150
31	e2640	---	e2780	e2800	---	e8400	---	8780	---	2620	1760	---
TOTAL	113990	88580	87400	86420	82600	119650	472900	328320	175230	121820	47570	129960
MEAN	3677	2953	2819	2788	2950	3860	15760	10590	5841	3930	1535	4332
MAX	5690	4040	3080	2800	3200	8400	18900	14500	8490	5540	2180	4930
MIN	2640	2530	2690	2770	2800	3200	9500	6500	4650	2390	1010	2370
AC-FT	226100	175700	173400	171400	163800	237300	938000	651200	347600	241600	94360	257800
CFSM	.28	.22	.21	.21	.22	.29	1.18	.80	.44	.30	.12	.33
IN.	.32	.25	.24	.24	.23	.33	1.32	.92	.49	.34	.13	.36

WTR YR 1989 TOTAL 1854440 MEAN 5081 MAX 18900 MIN 1010 AC-FT 3678000 CFSM .38 IN. 5.18

e Estimated

## CROW RIVER BASIN

05280000 CROW RIVER AT ROCKFORD, MN

LOCATION.--Lat 45°05'12", long 93°44'02", in sec.29, T.119 N., R.24 W., Hennepin County, Hydrologic Unit 07010204, on right bank at Rockford, 150 ft downstream from bridge on State Highway 55 and 1 mi downstream from confluence of North and South Forks.

DRAINAGE AREA.--2,520 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--April to July 1906 (published as "near Dayton"), June 1909 to September 1917, April to November 1929, March 1930 to September 1931, April to November 1932, March to November 1933, March 1934 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1115: 1932. WSP 1508: 1933. WDR MN-77-2: 1972 (M)(m).

GAGE.--Water-stage recorder. Datum of gage is 893.08 ft above National Geodetic Vertical Datum of 1929. Apr. 13 to July 21, 1906, nonrecording gage at Berning Mill 14 mi downstream at different datum. June 4, 1909, to Sept. 30, 1917, nonrecording gage at site 600 ft downstream at different datum. Apr. 23, 1929, to Aug. 21, 1934, nonrecording gage at site 600 ft downstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--64 years (water years 1910-17, 1931, 1935-89), 723 ft<sup>3</sup>/s, 3.90 in/yr; median of yearly mean discharges, 526 ft<sup>3</sup>/s, 2.83 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,400 ft<sup>3</sup>/s, Apr. 16, 1965, gage height, 19.27 ft, from floodmark; minimum, 1.8 ft<sup>3</sup>/s, Nov. 15, 1936, gage height, 1.05 ft, caused by ice jam upstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,900 ft<sup>3</sup>/s, Mar. 31, gage height, 5.00 ft; minimum discharge, 29 ft<sup>3</sup>/s, Oct. 16, 17, gage height, 1.61 ft; minimum gage height, 1.55 ft, Aug. 12, 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	42	e50	e35	e40	e36	1830	446	269	159	73	135
2	40	45	e50	e35	e39	e36	1760	454	253	215	71	135
3	40	48	e49	e35	e39	e36	1560	476	240	290	60	135
4	41	53	e48	e35	e39	e36	1370	496	227	226	54	164
5	43	57	e48	e35	e38	e36	1210	493	213	173	50	158
6	41	58	e47	e35	e38	e36	1090	480	199	137	44	147
7	41	60	e46	e35	e38	e36	990	465	186	114	42	161
8	39	59	e45	e35	e38	e36	900	478	172	106	40	158
9	36	59	e44	e35	e38	e36	821	504	163	99	38	143
10	36	58	e43	e35	e38	e36	756	486	157	128	36	133
11	33	59	e42	e35	e37	e36	697	438	148	151	33	124
12	32	65	e41	e35	e37	e36	640	391	148	122	32	114
13	34	65	e40	e35	e37	e36	605	360	142	103	33	106
14	31	65	e39	e35	e37	e36	581	335	142	91	40	97
15	30	67	e39	e35	e36	e46	566	317	138	83	43	92
16	31	e65	e38	e36	e36	e84	549	301	131	75	41	84
17	30	60	e37	e36	e36	e109	532	290	127	70	42	78
18	33	e62	e37	e36	e36	e111	511	288	122	83	39	74
19	33	e62	e37	e36	e36	e112	471	302	115	98	36	68
20	35	62	e36	e36	e36	e112	423	316	108	86	36	68
21	37	66	e36	e37	e36	e116	397	299	101	80	39	70
22	37	64	e36	e37	e36	e116	378	292	114	74	86	68
23	38	70	e36	e37	e36	e116	362	309	117	69	135	69
24	36	74	e36	e37	e36	e120	351	345	125	65	258	70
25	44	77	e36	e37	e36	e166	343	395	139	60	262	66
26	41	79	e36	e37	e36	e308	338	368	146	57	224	63
27	45	80	e36	e37	e36	e621	345	349	142	52	190	60
28	43	60	e35	e37	e36	e1070	373	330	139	48	168	56
29	44	e54	e35	e38	---	e1400	413	307	157	68	146	54
30	41	e52	e35	e39	---	e1600	434	294	152	69	127	54
31	41	---	e35	e40	---	1770	---	284	---	67	118	---
TOTAL	1166	1847	1248	1118	1037	8481	21596	11688	4732	3318	2636	3004
MEAN	37.6	61.6	40.3	36.1	37.0	274	720	377	158	107	85.0	100
MAX	45	80	50	40	40	1770	1830	504	269	290	262	164
MIN	30	42	35	35	36	36	338	284	101	48	32	54
AC-FT	2310	3660	2480	2220	2060	16820	42840	23180	9390	6580	5230	5960
CFSM	.01	.02	.02	.01	.01	.11	.29	.15	.06	.04	.03	.04
IN.	.02	.03	.02	.02	.02	.13	.32	.17	.07	.05	.04	.04
CAL YR 1988	TOTAL 57386	MEAN 157	MAX 843	MIN 20	AC-FT 113800	CFSM .06	IN. .85					
WTR YR 1989	TOTAL 61871	MEAN 170	MAX 1830	MIN 30	AC-FT 122700	CFSM .07	IN. .91					

e Estimated

## RUM RIVER BASIN

05284000 MILLE LACS LAKE AT COVE BAY NEAR ONAMIA, MN

LOCATION.--Lat 46°06'36", long 93°37'08", in NE¼NE¼ sec.21, T.42 N., R.26 W., Mille Lacs County, Hydrologic Unit 07010207, in Minnesota Department of Natural Resources boathouse at Cove Bay boatlanding, 3.6 mi northeast of Onamia.

PERIOD OF RECORD.--June 1931 to current year. Monthend records for the period October 1939 to September 1953 published in WSP 1278 (fragmentary 1940-41). Published as "at Wealthwood" prior to October 1939, and as "at Garrison" October 1939 to September 1987 (gage heights collected at Wealthwood October 1939 to September 1941, but converted to gage datum at Garrison for publication).

GAGE.--Water-stage recorder. Datum of gage is 1,240.40 ft above National Geodetic Vertical Datum of 1929 (levels by Minnesota Department of Natural Resources). Gage readings have been reduced to elevations NGVD. Prior to Oct. 1, 1941, nonrecording gage at Wealthwood, 17 mi north of present site, at various datums; gage readings have been reduced to elevations, adjustment of 1912. Oct. 1, 1941, to Sept. 30, 1958, water-stage recorder at Garrison, 16 mi northwest of present site at datum 1,240.50 ft, adjustment of 1912. To convert these readings to National Geodetic Vertical Datum of 1929, subtract 0.10 ft. Oct. 1, 1958, to Sept. 30, 1987, water stage recorder at Garrison at present datum.

REMARKS.--Water level affected by fixed-crest spillway constructed in 1953 at outlet of Ogechie Lake, 2.7 mi downstream from outlet of Mille Lacs Lake, with crest at elevation 1,250.50 ft. Water level subject to fluctuation caused by change in direction and velocity of wind and by seiches.

EXTREMES FOR PERIOD OF RECORD.--Maximum elevation, 1,253.87 ft, Aug. 14, 1972, affected by wind action and seiche action; maximum daily, 1,253.43 ft, Aug. 22, 1972; minimum observed, 1,245.74 ft, Oct. 16-19, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum elevation, 1,252.06 ft, May 29, affected by wind action and seiche action; maximum daily, 1,250.98 ft, June 22; minimum, 1,249.44 ft, Nov. 11, affected by wind action and seiche action; minimum daily, 1,249.52 ft, Nov. 11.

## MONTHEND ELEVATION, IN FEET NGVD, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

Oct. 31	1,249.66	Feb. 21	1,249.92	June 30	1,250.97
Nov. 30	1,249.78	Mar. 31	---	July 31	1,250.55
Dec. 30	1,249.81	Apr. 30	1,250.51	Aug. 31	1,250.33
Jan. 31	1,249.88	May 31	1,250.90	Sept. 30	1,250.08

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

## RUM RIVER BASIN

05286000 RUM RIVER NEAR ST. FRANCIS, MN

LOCATION.--Lat 45°19'40", long 93°22'20", in SE¼ sec.19, T.33 N., R.24 W., Anoka County, Hydrologic Unit 07010207, on left bank at upstream side of highway bridge, 4 mi south of St. Francis and 15.8 mi upstream from mouth.

DRAINAGE AREA.--1,360 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--May to November 1929, March 1930 to September 1931, April to November 1932, March 1933 to current year.

REVISED RECORDS.--WSP 1308: 1930(M), 1932(M).

GAGE.--Water-stage recorder. Datum of gage is 860.74 ft above National Geodetic Vertical Datum of 1929 (levels by Anoka County Highway Department). Prior to Nov. 9, 1933, nonrecording gage at site 50 ft downstream at same datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Occasional regulation by Ogechie (also controls Mille Lacs Lake) and Onamia Lakes.

AVERAGE DISCHARGE.--57 years (water years 1931, 1934-89), 625 ft<sup>3</sup>/s, 6.24 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,100 ft<sup>3</sup>/s, Apr. 20, 1965, Apr. 13, 1969; maximum gage height, 11.63 ft, Apr. 13, 1969; minimum discharge, 29 ft<sup>3</sup>/s, Aug. 18, 1934, gage height, 1.91 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,750 ft<sup>3</sup>/s, Apr. 11, gage height, 4.96 ft; minimum, 72 ft<sup>3</sup>/s, Aug. 13, gage height, 1.85 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	132	132	e171	e108	e107	e106	e948	590	682	255	100	196
2	140	133	e171	e108	e107	e106	e1130	631	665	244	96	173
3	132	132	e171	e108	e107	e106	1440	717	671	235	94	170
4	128	137	e171	e108	e107	e106	1670	777	632	219	94	174
5	125	146	181	e108	e107	e106	1610	771	574	211	89	173
6	122	146	174	e108	e107	e106	1460	724	519	202	85	171
7	123	145	189	e108	e107	e106	1400	670	471	188	81	174
8	125	146	e160	e108	e107	e106	1440	651	433	185	79	174
9	135	144	e155	e108	e107	e106	1550	646	390	180	79	174
10	122	142	e150	e108	e107	e107	1670	635	366	171	77	169
11	117	140	e145	e108	e107	e107	1740	632	340	163	74	162
12	115	145	e142	e108	e107	e107	1700	684	324	155	74	156
13	111	146	e140	e108	e107	e107	1540	728	306	149	75	152
14	110	149	e138	e108	e107	e108	1350	715	297	140	84	145
15	111	152	e138	e108	e107	e108	1170	668	280	136	89	140
16	110	175	e137	e108	e107	e108	1040	615	267	135	81	134
17	112	184	e136	e108	e107	e108	936	559	255	128	83	128
18	112	182	e135	e109	e107	e109	859	534	250	142	79	123
19	114	171	e134	e110	e107	e109	799	516	241	163	76	120
20	120	181	e132	e111	e106	e109	742	517	227	153	80	123
21	122	166	e132	e115	e106	e109	686	538	215	144	83	122
22	121	e167	e131	e117	e106	e110	638	538	220	140	123	121
23	118	172	e130	e118	e106	e120	590	538	217	130	169	115
24	121	e170	e129	e119	e106	e130	550	532	213	122	157	109
25	124	e171	e127	e120	e106	e148	520	518	231	115	148	105
26	125	e171	e125	e120	e106	e170	500	510	298	110	158	104
27	129	e171	e117	e119	e106	e250	486	507	310	106	164	101
28	129	176	e112	e118	e106	e380	478	607	292	101	152	100
29	129	e171	e111	e117	---	e505	498	751	271	113	143	99
30	127	e171	e108	e115	---	e658	543	783	263	108	141	94
31	125	---	e108	e111	---	e832	---	741	---	103	149	---
TOTAL	3786	4734	4400	3455	2987	5553	31683	19543	10720	4846	3256	4201
MEAN	122	158	142	111	107	179	1056	630	357	156	105	140
MAX	140	184	189	120	107	832	1740	783	682	255	169	196
MIN	110	132	108	108	106	106	478	507	213	101	74	94
AC-FT	7510	9390	8730	6850	5920	11010	62840	38760	21260	9610	6460	8330
CFSM	.09	.12	.10	.08	.08	.13	.78	.46	.26	.11	.08	.10
IN.	.10	.13	.12	.09	.08	.15	.87	.53	.29	.13	.09	.11

CAL YR 1988 TOTAL 71573 MEAN 196 MAX 864 MIN 60 AC-FT 142000 CFSM .14 IN. 1.96  
WTR YR 1989 TOTAL 99164 MEAN 272 MAX 1740 MIN 74 AC-FT 196700 CFSM .20 IN. 2.71

e Estimated

## ELM CREEK BASIN

05287890 ELM CREEK NEAR CHAMPLIN, MN

LOCATION.--Lat 45°09'48", long 93°26'11", in NE¼NW¼ sec.35, T.120 N., R.22 W., Hennepin County, Hydrologic Unit 07010206, on left bank, 33 ft downstream from bridge on Elm Creek Road, 2.5 mi southwest of Champlin.

DRAINAGE AREA.--84.9 mi<sup>2</sup>.

## WATER DISCHARGE RECORDS

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

GAGE.--Water-stage recorder. Datum of gage is 850.71 ft above National Geodetic Vertical Datum of 1929. Prior to March 15, 1979, nonrecording gage at present site and datum.

REMARKS.--Records good Apr. 1 to May 7 and fair to poor for the remainder of the year due to beaver activity.

AVERAGE DISCHARGE.--11 years, 30.6 ft<sup>3</sup>/s, 4.89 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 597 ft<sup>3</sup>/s, Mar. 27, 1986, gage height, 9.93 ft; minimum, 0.29 ft<sup>3</sup>/s, July 9, 1989; minimum gage height, 2.86 ft, Feb. 24, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 159 ft<sup>3</sup>/s, Mar. 31, gage height, 7.25 ft; minimum discharge, 0.29 ft<sup>3</sup>/s, July 9, gage height, 3.57 ft; minimum gage height, 3.56 ft, July 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.3	e1.5	e1.4	e1.0	e.94	1.0	158	17	17	1.5	1.1	3.9
2	1.1	e1.5	e1.3	e1.0	e.94	1.0	151	16	15	1.2	1.1	7.3
3	1.1	1.6	1.2	e1.1	e.95	.94	136	15	13	1.7	1.1	6.1
4	1.1	1.6	e1.2	e1.1	e.96	e1.0	124	15	12	1.7	1.4	4.3
5	1.0	1.5	1.2	e1.1	e.96	e1.0	109	17	9.9	1.2	1.3	3.8
6	e1.0	1.5	1.1	e1.2	e.96	e1.1	94	16	8.5	.83	1.2	3.7
7	e1.0	1.5	e1.1	e1.2	e.97	e1.2	82	15	7.3	.69	1.0	3.2
8	e1.0	1.5	e1.1	e1.2	e.97	e1.2	70	16	6.0	.66	1.1	2.4
9	e1.0	1.4	e1.1	1.2	e.98	e1.3	59	29	4.9	.45	1.2	1.9
10	e1.0	1.4	e1.1	1.2	e.99	e1.3	51	33	4.3	.41	1.1	1.1
11	e1.0	1.4	e1.1	1.2	e1.0	1.4	45	29	4.0	.54	1.2	.96
12	e1.0	1.3	1.1	1.2	e1.0	1.4	39	28	4.2	.72	1.5	.75
13	e1.0	1.3	1.2	1.3	e1.0	1.4	32	26	3.8	.69	1.6	.87
14	e1.0	1.2	1.4	1.4	e1.0	1.7	27	25	3.8	.85	1.9	1.1
15	e1.0	1.2	1.3	1.5	e1.0	1.4	23	23	4.0	1.1	1.8	1.1
16	e1.2	e1.6	1.2	1.4	e1.0	1.3	20	21	3.1	1.1	1.7	1.5
17	e1.1	e1.6	1.1	1.4	e1.0	1.4	17	18	2.3	1.1	1.7	1.4
18	e1.1	e1.6	1.1	1.3	e1.0	1.6	15	18	2.3	1.3	1.9	.95
19	e1.1	e1.6	1.1	1.3	e1.0	2.0	13	19	2.1	1.1	1.6	1.0
20	e1.1	e1.6	1.3	1.4	e1.0	2.3	11	17	2.1	.98	1.1	1.1
21	e1.2	1.6	1.2	1.5	e1.0	2.6	9.8	16	1.9	.56	1.2	1.1
22	e1.3	1.4	1.6	1.4	e1.0	2.7	9.1	13	2.6	.48	1.7	1.1
23	e1.3	1.4	1.4	1.4	e1.0	2.6	9.3	15	2.6	.40	1.7	1.3
24	e1.3	1.5	1.2	1.3	e1.0	4.8	8.4	16	2.1	.46	1.2	1.3
25	e1.3	1.5	1.2	1.3	e1.0	e8.0	7.4	21	2.1	.51	1.1	1.2
26	e1.4	1.4	1.1	1.2	e1.0	e20	7.5	21	2.7	.51	1.4	1.1
27	e1.4	e1.5	.97	1.2	.97	e35	7.4	19	2.5	.48	1.6	1.1
28	e1.4	e1.6	e1.0	1.1	e1.0	e60	10	19	2.3	.66	1.8	.98
29	e1.4	e1.6	e1.0	.91	---	102	16	19	2.3	.99	1.5	1.1
30	e1.5	e1.5	e1.0	.91	---	124	17	19	2.5	.96	1.7	1.1
31	e1.5	---	e1.0	e.92	---	148	---	18	---	.94	2.1	---
TOTAL	36.2	44.4	36.37	37.84	27.59	536.64	1379.9	609	153.2	26.77	44.6	59.81
MEAN	1.17	1.48	1.17	1.22	.99	17.3	46.0	19.6	5.11	.86	1.44	1.99
MAX	1.5	1.6	1.6	1.5	1.0	148	158	33	17	1.7	2.1	7.3
MIN	1.0	1.2	.97	.91	.94	.94	7.4	13	1.9	.40	1.0	.75
AC-FT	72	88	72	75	55	1060	2740	1210	304	53	88	119
CFSM	.01	.02	.01	.01	.01	.20	.54	.23	.06	.01	.02	.02
IN.	.02	.02	.02	.02	.01	.24	.60	.27	.07	.01	.02	.03
CAL YR 1988	TOTAL 1546.59	MEAN 4.23	MAX 34	MIN .31	AC-FT 3070	CFSM .05	IN. .68					
WTR YR 1989	TOTAL 2992.32	MEAN 8.20	MAX 158	MIN .40	AC-FT 5940	CFSM .10	IN. 1.31					

e Estimated

ELM CREEK BASIN  
05287890 ELM CREEK NEAR CHAMPLIN, MN--Continued  
WATER QUALITY RECORDS

PERIOD OF RECORD.--February 1988 to current year.

INSTRUMENTATION.--Stage-activated automatic pumping sampler since July 1988.

REMARKS.--No automatic samples taken.

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
OCT								
03...	1400	1.2	--	695	8.2	11.0	769	10.1
03...	1430	1.2	--	--	--	--	--	--
JAN								
17...	1400	1.4	--	670	7.9	0.0	--	--
MAR								
02...	1400	1.0	--	766	8.2	0.0	--	--
APR								
14...	1300	71	--	--	--	--	--	--
21...	1207	9.4	--	--	--	--	--	--
21...	1213	9.4	--	--	--	--	--	--
21...	1300	9.4	--	480	7.8	13.0	775	11.8
MAY								
08...	1900	22	--	--	--	--	--	--
09...	1139	29	--	--	--	--	--	--
10...	0418	32	--	--	--	--	--	--
10...	2057	29	--	--	--	--	--	--
11...	1336	28	--	--	--	--	--	--
13...	1533	25	--	--	--	--	--	--
15...	0051	23	--	--	--	--	--	--
24...	0118	14	--	--	--	--	--	--
24...	1757	17	--	--	--	--	--	--
25...	1036	19	--	--	--	--	--	--
27...	1233	18	--	--	--	--	--	--
JUN								
07...	1325	7.2	--	504	8.1	20.5	--	--
19...	1130	2.1	--	574	7.5	19.5	772	6.0
JUL								
19...	1130	1.2	--	720	--	17.0	775	--
AUG								
18...	1410	1.7	--	705	8.0	19.0	--	--
24...	1410	--	1.2	705	8.0	19.0	--	--
SEP								
02...	0200	--	7.3	--	--	--	--	--
02...	1839	--	7.3	--	--	--	--	--
03...	1118	--	6.1	--	--	--	--	--
04...	2036	--	4.3	--	--	--	--	--
07...	1030	--	3.2	554	7.6	17.5	770	4.3
07...	1512	--	3.2	--	--	--	--	--
15...	2300	--	1.1	--	--	--	--	--
16...	1539	--	1.5	--	--	--	--	--
17...	0818	--	1.4	--	--	--	--	--
21...	1100	--	1.1	658	7.9	23.0	773	6.0

## ELM CREEK BASIN

05287890 ELM CREEK NEAR CHAMPLIN, MN--Continued

DATE	OXYGEN DEMAND, CHEM- ICAL (HIGH LEVEL) (MG/L) (00340)	SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) (00500)	SOLIDS, VOLA- TILE ON IGNI- TION, TOTAL (MG/L) (00505)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	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)
OCT								
03...	18	437	87	<0.10	<0.01	0.20	0.07	0.07
03...	--	344	--	--	--	--	0.10	--
JAN								
17...	20	446	81	0.20	0.21	0.50	0.05	0.04
MAR								
02...	<10	451	113	0.10	0.13	0.90	0.05	0.02
APR								
14...	39	248	97	1.10	0.28	2.2	0.29	0.25
21...	--	316	--	--	--	--	0.19	--
21...	--	322	--	--	--	--	0.18	--
21...	54	313	88	0.20	0.02	0.90	0.19	0.11
MAY								
08...	--	408	--	--	--	--	0.09	--
09...	--	392	--	--	--	--	0.09	--
10...	--	404	--	--	--	--	0.10	--
10...	--	440	--	--	--	--	0.11	--
11...	--	432	--	--	--	--	0.09	--
13...	--	420	--	--	--	--	0.13	--
15...	--	396	--	--	--	--	0.15	--
24...	--	392	--	--	--	--	0.41	--
24...	--	105	--	--	--	--	0.27	--
25...	--	428	--	--	--	--	0.34	--
27...	--	404	--	--	--	--	0.53	--
JUN								
07...	55	413	212	<0.10	0.04	1.1	0.28	0.21
19...	38	376	204	<0.10	0.05	0.90	0.12	0.12
JUL								
19...	27	--	238	<0.10	0.04	0.60	0.16	0.10
AUG								
18...	23	400	154	<0.10	0.03	0.30	0.09	0.08
24...	--	--	--	--	--	--	--	--
SEP								
02...	--	320	--	--	--	--	0.15	--
02...	--	346	--	--	--	--	0.14	--
03...	--	320	--	--	--	--	0.14	--
04...	--	317	--	--	--	--	0.12	--
07...	38	326	192	0.10	0.05	0.60	0.10	0.08
07...	--	341	--	--	--	--	0.12	--
15...	--	366	--	--	--	--	0.08	--
16...	--	355	--	--	--	--	0.08	--
17...	--	353	--	--	--	--	0.08	--
21...	20	396	190	0.10	0.02	0.60	0.14	0.09

## MISSISSIPPI RIVER MAIN STEM

05288500 MISSISSIPPI RIVER NEAR ANOKA, MN

LOCATION.--Lat 45°07'36", long 93°17'48", in SW¼ sec.12, T.119 N., R.21 W., Hennepin County, Hydrologic Unit 07010206, on right bank 0.4 mi downstream from Coon Creek, 1.3 mi downstream from Coon Rapids dam at Coon Rapids, 6.5 mi downstream from Anoka, and at mile 864.8 upstream from Ohio River.

DRAINAGE AREA.--19,100 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1931 to current year. Prior to October 1931 published as "at Coon Rapids, near Anoka."

GAGE.--Water-stage recorder. Datum of gage is 804.53 ft above National Geodetic Vertical Datum of 1929. Prior to June 14, 1932, at site 1.2 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Discharge during period of backwater from ice, Dec. 8 to Mar. 12, computed from discharge furnished by Ford Plant Dam downstream from station adjusted for time of travel, leakage through dam, and diversions to St. Paul and Minneapolis water works. Flow slightly regulated by six reservoirs on headwaters; total usable capacity, 1,640,600 acre-ft. Diurnal regulation caused by dam above station.

AVERAGE DISCHARGE.--58 years, 7,918 ft<sup>3</sup>/s, 5.63 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 91,000 ft<sup>3</sup>/s, Apr. 17, 1965, gage height, 19.53 ft; minimum, 529 ft<sup>3</sup>/s, Aug. 29, 1976, gage height, 0.04 ft, result of regulation; minimum daily, 602 ft<sup>3</sup>/s, Sept. 10, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 23,000 ft<sup>3</sup>/s, Apr. 10, gage height, 7.78 ft; minimum, 927 ft<sup>3</sup>/s, Aug. 19, gage height, 0.58 ft, result of regulation; minimum daily, 1,310 ft<sup>3</sup>/s, Dec. 15.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5440	3190	2690	3130	2160	3560	11300	15900	10000	6620	3290	2880
2	5350	3270	2990	3010	1960	3610	12100	16100	9790	6180	2780	3780
3	5200	3040	3540	2980	3110	2610	13700	16000	9160	6450	2730	2940
4	5580	3360	3890	3280	3450	3580	14700	16200	8850	6470	2580	4250
5	5610	3310	4030	3700	3690	4140	15600	15900	8430	6290	2620	5290
6	4860	3320	4080	3650	4160	4100	18100	15300	7500	5940	2330	5490
7	5040	3160	4040	3310	4050	4290	19300	15100	7070	5930	2070	4910
8	4440	3010	3070	2420	3590	4340	20600	15000	6620	6040	2220	4730
9	4430	2850	2730	2700	3520	4100	21600	15700	6570	5340	1930	5710
10	4250	2970	2740	2620	4020	3680	22300	15400	6030	5330	2130	5440
11	4130	3330	2090	2600	4170	4310	22200	15500	5620	5310	2120	5450
12	3310	3150	2860	2760	4130	3830	21900	15000	5570	4920	2090	5480
13	3590	3440	4080	3070	4020	3780	21800	14200	5860	4620	2100	4960
14	3500	3120	3400	2580	4000	3990	21200	13200	5940	5100	2050	5220
15	4120	3350	1310	3510	3920	3830	20500	12600	5470	4500	1760	5030
16	3210	3620	2060	3170	3910	3630	20700	11500	5470	4310	1820	4410
17	3260	3880	2710	3290	3860	3880	20000	10900	5300	4590	1730	4950
18	3630	3470	3420	3350	3740	3900	19300	10300	5620	4440	1580	4930
19	3130	3310	4030	3500	3350	3840	18300	10200	6010	4730	1380	4610
20	3080	3210	3880	3560	3980	3850	18500	8290	5090	4410	1790	4730
21	2880	2890	3320	3770	3820	3650	18100	8240	5440	4200	2170	4640
22	3770	2880	3790	3500	3580	3770	17100	8780	6110	4290	1970	4830
23	3060	3200	3530	3860	4040	3940	16100	8660	5560	3540	2000	4990
24	4040	3420	2780	3200	4330	4110	16000	8470	5810	3990	1790	4800
25	3680	3740	2710	3260	4150	4240	16400	8830	7330	3590	1960	4870
26	3310	3880	3030	3500	3620	5030	16100	8870	7630	3250	1770	4960
27	3530	4710	2600	3590	3850	6270	16100	9720	8220	3730	2200	4900
28	3020	4110	2420	3610	3350	6860	15800	10500	7200	2950	2060	4690
29	3080	3370	3040	3600	---	7830	15800	10800	7350	3540	2170	5080
30	3000	3120	3510	3960	---	9350	16400	10800	6680	3080	2190	5030
31	3280	---	3100	3600	---	10200	---	10500	---	3390	2330	---
TOTAL	121810	100680	97470	101640	103530	142100	537600	382460	203300	147070	65710	143980
MEAN	3929	3356	3144	3279	3697	4584	17920	12340	6777	4744	2120	4799
MAX	5610	4710	4080	3960	4330	10200	22300	16200	10000	6620	3290	5710
MIN	2880	2850	1310	2420	1960	2610	11300	8240	5090	2950	1380	2880
AC-FT	241600	199700	193300	201600	205400	281900	1066000	758600	403200	291700	130300	285600
CFSM	.21	.18	.16	.17	.19	.24	.94	.65	.35	.25	.11	.25
IN.	.24	.20	.19	.20	.20	.28	1.05	.74	.40	.29	.13	.28
CAL YR 1988	TOTAL 1367355	MEAN 3736	MAX 11400	MIN 842	AC-FT 2712000	CFSM .20	IN. 2.66					
WTR YR 1989	TOTAL 2147350	MEAN 5883	MAX 22300	MIN 1310	AC-FT 4259000	CFSM .31	IN. 4.18					



## MISSISSIPPI RIVER MAIN STEM

05288500 MISSISSIPPI RIVER NEAR ANOKA, MN--Continued

SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)		MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)		MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)		MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)	
	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH					
1	13	191	13	112	8	58	8	68	7	41	5	48				
2	13	188	12	106	8	65	8	65	5	26	5	49				
3	15	211	11	90	8	76	8	64	5	42	5	35				
4	14	211	14	127	8	84	8	71	5	47	5	48				
5	13	197	14	125	8	87	8	80	5	50	5	56				
6	13	171	9	81	8	88	8	79	5	56	5	55				
7	13	177	8	68	8	87	8	71	5	55	5	58				
8	13	156	8	65	8	66	8	52	5	48	5	59				
9	12	144	8	62	8	59	8	58	5	48	5	55				
10	13	149	8	64	8	59	8	57	5	54	5	50				
11	10	112	9	81	8	45	8	56	5	56	5	58				
12	8	71	6	51	8	62	8	60	5	56	5	52				
13	9	87	4	37	8	88	8	66	5	54	5	51				
14	10	94	4	34	8	73	8	56	5	54	5	54				
15	11	122	4	36	8	28	8	76	5	53	5	52				
16	9	78	6	59	8	44	8	68	5	53	5	49				
17	10	88	7	73	8	59	8	71	5	52	5	52				
18	11	108	7	66	8	74	9	81	5	50	5	53				
19	8	68	8	71	8	87	9	85	5	45	5	52				
20	7	58	8	69	8	84	9	87	5	54	5	52				
21	8	62	8	62	8	72	9	92	5	52	5	49				
22	10	102	8	62	8	82	9	85	5	48	5	51				
23	9	74	8	69	8	76	9	94	5	55	6	64				
24	9	98	8	74	8	60	10	86	5	58	7	78				
25	12	119	8	81	8	59	10	88	5	56	10	114				
26	21	188	8	84	8	65	10	94	5	49	16	217				
27	22	210	8	102	8	56	10	97	5	52	24	406				
28	17	139	8	89	8	52	10	97	5	45	34	630				
29	14	116	8	73	8	66	10	97	---	---	46	972				
30	13	105	8	67	8	76	10	107	---	---	66	1670				
31	12	106	---	---	8	67	10	97	---	---	84	2310				
TOTAL	---	4000	---	2240	---	2104	---	2405	---	1409	---	7599				
	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER					
1	92	2810	32	1370	18	486	12	214	10	89	16	124				
2	96	3140	31	1350	17	449	12	200	10	75	17	174				
3	97	3590	30	1300	16	396	11	192	9	66	19	151				
4	97	3850	28	1220	15	358	10	175	9	63	25	287				
5	95	4000	24	1030	14	319	10	170	8	57	20	286				
6	93	4540	22	909	13	263	11	176	8	50	16	237				
7	90	4690	24	978	11	210	10	160	8	45	15	199				
8	88	4890	28	1130	12	214	13	212	8	48	18	230				
9	86	5020	27	1140	12	213	14	202	7	36	19	293				
10	83	5000	23	956	11	179	13	187	6	35	16	235				
11	74	4440	20	837	9	137	13	186	6	34	13	191				
12	65	3840	18	729	10	150	13	173	9	51	13	192				
13	60	3530	18	690	13	206	13	162	10	57	12	161				
14	53	3030	20	713	13	208	12	165	10	55	9	127				
15	49	2710	19	646	11	162	11	134	10	48	10	136				
16	46	2570	17	528	14	207	11	128	10	49	13	155				
17	43	2320	16	471	11	157	11	136	8	37	12	160				
18	42	2190	16	445	10	152	14	168	8	34	10	133				
19	43	2120	17	468	10	162	10	128	8	30	10	124				
20	42	2100	17	381	10	137	10	119	10	48	11	140				
21	37	1810	17	378	11	162	10	113	10	59	11	138				
22	28	1290	16	379	11	181	10	116	10	53	11	143				
23	26	1130	21	491	11	165	10	96	8	43	11	148				
24	28	1210	22	503	11	173	10	108	7	34	10	130				
25	31	1370	21	501	14	277	9	87	7	37	9	118				
26	32	1390	21	503	19	391	9	79	7	33	9	121				
27	32	1390	20	525	20	444	10	101	8	48	9	119				
28	32	1370	20	567	18	350	11	88	11	61	10	127				
29	32	1370	20	583	16	318	12	115	19	111	7	96				
30	32	1420	19	554	14	253	12	100	18	106	6	81				
31	---	---	18	510	---	---	10	92	15	94	---	---				
TOTAL YEAR	---	84130 145275	---	22785	---	7479	---	4482	---	1686	---	4956				

## MINNESOTA RIVER BASIN

05291000 WHETSTONE RIVER NEAR BIG STONE CITY, SD

LOCATION.--Lat 45°17'32", long 96°29'14", in SE&NW¼ sec.18, T.121 N., R.46 W., Grant County, Hydrologic Unit 07020001, on right bank 20 ft downstream from former highway bridge site, 1.5 mi west of Big Stone City, and 4.5 mi upstream from Big Stone Lake.

DRAINAGE AREA.--389 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1910 to November 1912 (no winter records), and March 1931 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 895: Drainage area. WSP 1308: 1932(M), 1935(M).

GAGE.--Water-stage recorder. Datum of gage is 996.96 ft adjustment of 1912. Mar. 8, 1910, to Nov. 30, 1912, nonrecording gage 2 mi downstream at different datum. Mar. 18, 1931, to May 3, 1939, nonrecording gage, at site 20 ft upstream at present datum. May 4, 1939, to Nov. 8, 1952, water-stage recorder at site 80 ft downstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--58 years (water years 1932-89), 49.8 ft<sup>3</sup>/s, 1.74 in/yr, 36,080 acre-ft/yr; median of yearly mean discharges, 35 ft<sup>3</sup>/s, 1.22 in/yr, 25,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,870 ft<sup>3</sup>/s, Apr. 8, 1969, gage height, 14.32 ft from flood-mark; no flow at times in most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage known, about 26 ft in June 1919, present site and datum, from information by local resident, discharge 29,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 14	1815	370	a5.84	Mar. 27	1815	*3,490	10.76
Mar. 25	1000	2,290	a9.97	Apr. 29	2200	423	4.72
Mar. 26	1230	Ice jam	*a10.88				

a Backwater from ice.

Minimum discharge, 0.41 ft<sup>3</sup>/s, Aug. 11, gage height, 0.78 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.7	2.4	e2.6	e2.8	e3.4	e3.7	324	263	10	3.0	3.6	3.0
2	2.5	2.4	e2.7	e2.8	e3.4	e3.7	258	169	9.5	2.4	2.5	2.5
3	2.0	2.4	e2.9	e2.8	e3.3	e3.7	323	116	8.8	2.4	2.4	2.4
4	1.7	2.8	e3.0	e2.8	e3.2	e3.7	290	91	7.9	1.8	2.3	2.9
5	1.7	3.3	e3.3	e2.8	e3.2	e3.7	254	77	6.9	1.4	2.2	2.9
6	1.7	3.3	e3.4	e2.8	e3.2	e3.7	198	68	6.2	.89	2.0	3.5
7	1.6	3.3	e3.4	e2.8	e3.2	e3.8	145	61	5.1	.73	1.7	3.3
8	1.4	3.3	e3.3	e2.7	e3.2	e4.0	122	56	4.2	.87	1.6	2.6
9	1.1	3.3	e3.0	e2.7	e3.2	e4.6	94	51	4.1	1.2	1.2	2.5
10	.88	3.3	e2.8	e2.6	e3.3	e69	78	45	3.6	1.9	.67	2.4
11	.88	e3.2	e2.6	e2.6	e3.3	e208	70	39	3.0	1.3	.47	2.7
12	.93	e3.1	e2.7	e2.6	e3.4	e311	63	34	5.3	1.6	.48	2.9
13	.93	e3.1	e2.7	e2.6	e3.4	e339	57	29	4.2	1.6	.63	2.5
14	.93	e3.2	e2.7	e2.6	e3.4	e343	52	26	4.6	1.6	4.3	2.4
15	.93	e3.2	e2.7	e2.6	e3.4	e233	48	22	4.4	1.3	4.3	2.4
16	.93	e3.1	e2.7	e2.7	e3.4	e210	46	20	4.1	1.7	2.8	2.4
17	1.2	e3.0	e2.7	e2.7	e3.3	e192	46	19	3.6	1.5	2.4	2.4
18	1.3	e3.0	e2.8	e2.7	e3.3	e210	47	19	4.2	4.3	2.2	2.4
19	1.3	e3.0	e2.8	e2.8	e3.3	e190	47	18	3.7	5.3	4.3	2.3
20	1.6	e3.0	e2.8	e2.8	e3.2	e147	43	17	2.7	6.0	5.4	2.3
21	1.4	e2.9	e2.8	e2.9	e3.2	e109	35	16	3.6	3.9	5.6	2.4
22	1.7	e2.8	e2.9	e3.0	e3.2	e94	31	15	3.7	2.5	4.7	2.4
23	1.6	e2.8	e3.0	e3.1	e3.2	e185	29	15	3.1	2.4	5.2	2.3
24	1.6	e3.0	e3.0	e3.1	e3.6	e995	41	15	2.7	2.4	4.9	2.1
25	1.7	e3.0	e2.9	e3.1	e3.7	e1760	41	14	3.1	2.3	3.8	1.6
26	1.7	e2.9	e2.9	e3.1	e3.7	e1740	41	12	5.0	2.2	5.5	2.0
27	1.7	e2.9	e2.8	e3.3	e3.7	2950	68	10	3.9	1.1	5.0	3.1
28	1.9	e2.9	e2.8	e3.3	e3.7	1710	122	10	3.7	.79	3.3	3.3
29	2.0	e2.9	e2.8	e3.2	---	761	318	10	3.3	4.8	3.4	3.0
30	2.1	e2.8	e2.8	e3.5	---	688	373	9.7	3.5	7.6	3.2	2.5
31	2.3	---	e2.8	e3.5	---	618	---	10	---	5.8	3.4	---
TOTAL	47.91	89.6	89.1	89.4	94.0	14096.6	3704	1376.7	141.7	78.58	95.45	77.4
MEAN	1.55	2.99	2.87	2.88	3.36	455	123	44.4	4.72	2.53	3.08	2.58
MAX	2.7	3.3	3.4	3.5	3.7	2950	373	263	10	7.6	5.6	3.5
MIN	.88	2.4	2.6	2.6	3.2	3.7	29	9.7	2.7	.73	.47	1.6
AC-FT	95	178	177	177	186	27960	7350	2730	281	156	189	154
CFSM	.00	.01	.01	.01	.01	1.17	.32	.11	.01	.01	.01	.01
IN.	.00	.01	.01	.01	.01	1.35	.35	.13	.01	.01	.01	.01

CAL YR 1988	TOTAL	3213.69	MEAN	8.78	MAX	153	MIN	.13	AC-FT	6370	CFSM	.02	IN.	.31
WTR YR 1989	TOTAL	19980.44	MEAN	54.7	MAX	2950	MIN	.47	AC-FT	39630	CFSM	.14	IN.	1.91

e Estimated

## MINNESOTA RIVER BASIN

05291500 BIG STONE LAKE NEAR BIG STONE CITY, SD  
(formerly published as Big Stone Lake at Ortonville)

LOCATION (REVISED).--Lat 45°18'32", long 96°28'04", in NE&NW¼ sec.8, T.121 N., R.46 W., Grant County, Hydrologic Unit 07020001, at new powerplant intake, 1.2 mi north of Big Stone City, SD, 1.2 mi northwest of concrete dam at outlet, and 1.0 mi west of Ortonville. Prior to January 1989, at old powerplant site at west edge of Ortonville.

PERIOD OF RECORD.--March 1937 to current year.

GAGE.--Nonrecording gage read once a day. Datum of gage is 957.69 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 17, 1947, nonrecording gage at site 1.2 mi southeast at same datum. Sept. 18, 1947, to June 30, 1963, water-stage recorder at site 1.2 mi southeast at same datum. Sept. 21, 1959, to June 30, 1963, supplementary nonrecording gage read once daily, at site 0.9 mi southeast at same datum. July 1, 1963 to Jan. 1989 nonrecording gage at site 0.9 mi southeast at same datum.

REMARKS.--Natural lake with concrete dam at outlet. Dam was rebuilt and completed in Nov. 1985, with the following changes: Eight 7 ft high by 10 ft wide electrically operated slide gates, one 48 in. by 48 in. gate; and one 18 in. sluice gate; sills of all gates are at 3.0 ft. Silt barrier dam 700 ft upstream in outlet channel of lake completed July 7, 1958; rebuilt and completed Dec. 1986 with the new crest at 7.0 ft (previous crest was at 5.9 ft). Supplementary nonrecording gage readings used for stages below crest of silt barrier to June 30, 1963. Water level subject to fluctuation caused by wind action.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 12.73 ft, Apr. 17, 1952; minimum observed, 3.53 ft, Mar. 2, 1957 (strong upstream wind in channel). Minimum observations of 3.10 ft, Mar. 2, 1940, and 2.20 ft, Nov. 20, 1940, at spillway site are the result of blockage of channel to spillway by ice and snow and do not represent lake elevations.

EXTREMES FOR CURRENT YEAR.--Maximum gage height observed, 8.90 ft, Apr. 6-8; minimum observed, 4.95 ft, Nov. 2, 3.

## GAGE HEIGHT, IN FEET, OCTOBER 1988 TO SEPTEMBER 1989

Oct. 31	5.05	Feb. 28	5.45	June 30	7.87
Nov. 30	5.20	Mar. 31	8.25	July 31	7.60
Dec. 31	5.25	Apr. 30	8.55	Aug. 31	7.20
Jan. 31	5.38	May 31	8.10	Sept. 30	7.30

NOTE.--Gage-height record other than that shown above is available in the District office.

## MINNESOTA RIVER BASIN

05292000 MINNESOTA RIVER AT ORTONVILLE, MN

LOCATION.--Lat 45°17'44", long 96°26'38", in NE¼NW¼ sec.16, T.121 N., R.46 W., Big Stone County, Hydrologic Unit 07020001, on left bank 400 ft downstream from bridge on U.S. Highway 12 and 1,300 ft downstream from dam at outlet of Big Stone Lake, at Ortonville.

DRAINAGE AREA.--1,160 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--February 1938 to current year.

REVISED RECORDS.--WSP 895: 1939. WSP 1508: 1942 (yearly mean).

GAGE.--Water-stage recorder. Datum of gage is 956.38 ft above National Geodetic Vertical Datum of 1929. Prior to Mar. 31, 1939, nonrecording gage on downstream side of dam 1,300 ft upstream at datum 1.31 ft higher.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Some regulation by Big Stone Lake (station 05291500).

AVERAGE DISCHARGE.--51 years, 108 ft<sup>3</sup>/s, 78,250 acre-ft/yr; median of yearly mean discharges, 80 ft<sup>3</sup>/s, 58,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,060 ft<sup>3</sup>/s, Apr. 13, 1952, gage height, 12.92 ft; no flow Dec. 13, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,780 ft<sup>3</sup>/s, Mar. 27, gage height, 10.76 ft; minimum, 0.25 ft<sup>3</sup>/s, Nov. 2, gage height, 1.17 ft; minimum gage height, 1.13 ft, Oct. 6, due to regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	.56	.66	1.5	e2.0	e2.2	e2.0	659	720	12	5.3	6.4	2.4		
2	.58	.28	1.5	e2.0	e2.2	e2.0	516	757	7.8	5.3	6.0	2.4		
3	.56	.28	1.4	e2.1	e2.1	e2.0	450	694	8.1	5.3	6.2	2.4		
4	.45	.85	1.8	e2.1	e2.0	e2.0	407	559	7.9	5.3	6.2	3.2		
5	.47	1.5	1.8	e2.1	e1.9	e1.9	286	378	8.4	5.3	6.1	1.2		
6	.41	1.5	2.0	e1.8	e1.9	e1.9	292	177	8.4	5.7	5.3	1.1		
7	.51	1.5	2.1	e2.1	e1.9	e2.0	618	93	8.4	5.7	5.3	4.7		
8	.75	1.1	2.1	e2.1	e1.9	e2.5	939	93	8.4	5.9	5.3	7.0		
9	.93	1.1	e2.1	e2.1	e1.8	e2.7	1180	90	7.3	6.2	5.3	5.4		
10	.92	1.0	e2.0	e2.1	e1.8	e1.0	882	88	5.7	6.2	5.1	4.3		
11	.77	1.0	e1.7	e2.1	e1.8	e135	365	86	5.0	6.2	4.9	3.8		
12	.76	1.5	1.7	e2.1	e1.9	e205	212	86	4.4	6.6	4.9	2.0		
13	.73	1.3	1.5	e2.1	e1.9	e290	188	77	4.1	6.7	5.0	1.7		
14	.65	1.5	e1.5	e2.1	e2.0	e300	170	64	4.1	6.7	5.0	1.6		
15	.77	1.6	e1.4	e2.0	e2.0	e250	168	64	4.1	6.7	4.9	1.8		
16	1.1	1.4	e1.3	e2.1	e1.9	e210	166	61	4.1	6.7	4.3	1.8		
17	.92	1.3	1.3	e2.1	e1.9	e200	162	40	4.1	7.0	3.8	2.1		
18	.81	1.2	1.3	e2.2	e1.9	e190	92	23	4.1	9.8	3.2	2.1		
19	.83	1.3	1.5	e2.2	e1.9	e175	58	22	4.0	7.5	4.0	2.1		
20	1.1	1.2	1.5	e2.2	e1.9	e167	50	22	3.8	7.0	3.8	2.1		
21	.96	1.0	1.6	e2.4	e1.9	e160	49	22	6.1	7.0	3.5	2.1		
22	1.0	.99	1.7	e2.4	e1.9	e160	48	23	5.4	7.0	3.8	32		
23	1.1	1.0	1.9	e2.4	e1.9	e195	48	23	5.3	7.1	3.4	52		
24	1.0	1.1	2.1	e2.4	e2.0	e460	46	23	5.3	6.9	3.3	49		
25	1.0	1.2	2.1	e2.3	e2.0	e1040	122	22	5.3	6.7	3.1	41		
26	1.1	1.2	2.1	e2.3	e2.0	e1840	199	22	5.9	6.7	3.8	39		
27	1.1	1.2	2.1	e2.4	e2.0	e2460	381	20	5.3	6.7	3.5	35		
28	1.0	1.4	2.1	e2.3	e2.0	e1790	584	19	5.3	6.7	3.1	35		
29	1.0	1.3	e2.1	e2.3	---	e1120	660	19	5.3	10	3.1	35		
30	1.0	1.5	e2.1	e2.3	---	805	646	19	5.3	7.2	2.9	36		
31	.97	---	e2.0	e2.3	---	734	---	19	---	6.7	2.8	---		
TOTAL	25.81	34.96	54.9	67.5	54.5	12915.0	10643	4425	178.7	205.8	137.3	411.3		
MEAN	.83	1.17	1.77	2.18	1.95	417	355	143	5.96	6.64	4.43	13.7		
MAX	1.1	1.6	2.1	2.4	2.2	2460	1180	757	12	10	6.4	52		
MIN	.41	.28	1.3	1.8	1.8	1.9	46	19	3.8	5.3	2.8	1.1		
AC-FT	51	69	109	134	108	25620	21110	8780	354	408	272	816		
CFSM	.00	.00	.00	.00	.00	.36	.31	.12	.01	.01	.00	.01		
IN.	.00	.00	.00	.00	.00	.41	.34	.14	.01	.01	.00	.01		
CAL YR 1988	TOTAL	2311.90	MEAN	6.32	MAX	126	MIN	.05	AC-FT	4590	CFSM	.01	IN.	.07
WTR YR 1989	TOTAL	29153.77	MEAN	79.9	MAX	2460	MIN	.28	AC-FT	57830	CFSM	.07	IN.	.93

e Estimated

## MINNESOTA RIVER BASIN

05293000 YELLOW BANK RIVER NEAR ODESSA, MN

LOCATION.--Lat 45°13'35", long 96°21'12", in SE½SE¼ sec.1, T.120 N., R.46 W., Lac qui Parle County, Hydrologic Unit 07020001, on left bank 150 ft downstream from highway bridge, 2.5 mi southwest of Odessa, and 4.5 mi upstream from mouth.

DRAINAGE AREA.--398 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1939 to current year.

REVISED RECORDS.--WSP 1388: 1947(M), 1950.

GAGE.--Water-stage recorder. Datum of gage is 953.34 ft above National Geodetic Vertical Datum of 1929 (U.S. Army Corps of Engineers bench mark). Prior to Aug. 28, 1940, nonrecording gage at site 150 ft upstream at same datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--50 years, 59.0 ft<sup>3</sup>/s, 2.01 in/yr, 42,750 acre-ft/yr; median of yearly mean discharges, 47 ft<sup>3</sup>/s, 1.60 in/yr, 34,100 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,970 ft<sup>3</sup>/s, Apr. 9, 1969, gage height, 19.07 ft, from floodmark; no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge base of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 28	0300	*2,080	*a12.25	No other peak greater than base discharge.			

a Backwater from ice.

Minimum discharge, 0.17 ft<sup>3</sup>/s, Sept. 30, gage height, 1.68 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.50	1.6	e2.0	e1.9	e2.3	e2.1	430	178	11	2.4	1.2	.58
2	.33	1.8	e2.1	e1.9	e2.2	e2.1	376	136	10	2.3	.91	.57
3	.32	1.8	e2.1	e2.0	e2.0	e2.1	349	107	9.5	2.0	.75	.42
4	.33	2.2	e2.2	e2.0	e1.9	e2.1	297	88	8.9	1.7	.67	.58
5	.25	1.8	e2.3	e2.0	e1.8	e2.2	246	77	8.2	1.5	.67	.49
6	.25	e1.8	e2.4	e2.0	e1.8	e2.3	198	67	7.6	1.2	.59	.42
7	.24	1.8	e2.3	e2.0	e1.8	e2.4	164	63	6.9	1.2	.50	.42
8	.25	1.8	e2.3	e1.9	e1.8	e2.5	141	59	6.5	1.2	.58	.42
9	.33	e1.8	e2.2	e1.9	e1.8	e2.8	118	53	6.3	1.1	.58	.33
10	.25	e1.8	e2.1	e1.8	e1.8	e7.9	101	48	5.9	1.0	.50	.43
11	.25	1.8	e2.0	e1.8	e1.8	e14	97	43	5.5	1.0	.50	.92
12	.25	e1.8	e2.0	e1.8	e1.8	e25	92	39	5.7	1.0	.42	.83
13	.32	e1.9	e2.0	e1.8	e1.9	e44	82	36	5.2	1.0	.51	.92
14	.33	e2.0	e2.0	e1.9	e1.9	e55	73	33	5.4	.93	.75	.68
15	.34	e2.0	e1.9	e1.9	e1.9	e84	65	29	5.1	.82	.75	.50
16	.50	e2.0	e1.9	e2.0	e1.9	e38	60	27	4.4	.81	.67	.43
17	.50	e2.0	e1.9	e2.0	e1.9	e33	56	25	4.1	.95	.50	.42
18	.43	e1.9	e1.9	e2.0	e1.8	e30	53	25	3.8	3.0	.42	.33
19	.50	e1.9	e2.0	e2.0	e1.8	e28	50	26	3.4	2.0	1.2	.33
20	.51	e1.9	e2.0	e2.0	e1.7	e27	48	22	3.1	1.2	1.1	.42
21	.67	e1.9	e2.0	e2.1	e1.7	e25	45	21	3.3	.93	.75	.49
22	.58	e1.9	e2.0	e2.2	e1.7	e23	44	20	3.1	.81	.83	.49
23	.58	e1.9	e2.0	e2.2	e1.8	e33	41	19	2.9	.68	.83	.59
24	.59	e2.0	e1.9	e2.2	e2.1	e220	43	18	2.9	.67	.75	.50
25	.75	e2.2	e1.9	e2.2	e2.1	e770	45	17	2.9	.58	.67	.42
26	.82	e2.1	e1.9	e2.2	e2.1	e1680	51	15	3.5	.59	.83	.42
27	1.0	e2.1	e1.9	e2.3	e2.1	e1970	54	14	3.5	.51	.92	.33
28	1.1	e2.0	e1.9	e2.3	e2.1	e1730	70	13	3.0	.50	.75	.25
29	.93	e2.0	e1.9	e2.3	---	890	102	12	2.8	3.9	.62	.33
30	1.0	e2.0	e1.9	e2.4	---	702	157	11	2.7	2.1	.50	.25
31	1.2	---	e1.9	e2.4	---	635	---	11	---	1.6	.58	---
TOTAL	16.20	57.5	62.8	63.4	53.3	9084.5	3748	1352	157.1	41.18	21.80	14.51
MEAN	.52	1.92	2.03	2.05	1.90	293	125	43.6	5.24	1.33	.70	.48
MAX	1.2	2.2	2.4	2.4	2.3	1970	430	178	11	3.9	1.2	.92
MIN	.24	1.6	1.9	1.8	1.7	2.1	41	11	2.7	.50	.42	.25
AC-FT	32	114	125	126	106	18020	7430	2680	312	82	43	29
CFSM	.00	.00	.01	.01	.00	.74	.31	.11	.01	.00	.00	.00
IN.	.00	.01	.01	.01	.00	.85	.35	.13	.01	.00	.00	.00

CAL YR 1988 TOTAL 4605.92 MEAN 12.6 MAX 176 MIN .05 AC-FT 9140 CFSM .03 IN. .43  
WTR YR 1989 TOTAL 14672.29 MEAN 40.2 MAX 1970 MIN .24 AC-FT 29100 CFSM .10 IN. 1.37

e Estimated

MINNESOTA RIVER BASIN

05294000 POMME DE TERRE RIVER AT APPLETON, MN

LOCATION.--Lat 45°12'10", long 96°01'20", in SW¼ sec.14, T.120 N., R.43 W., Swift County, Hydrologic Unit 07020002, on left bank 60 ft upstream from bridge on U.S. Highway 59 and State Highway 119 at Appleton and 8 mi upstream from mouth.

DRAINAGE AREA.--905 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1931 to September 1935 (no winter records), October 1935 to current year. Prior to October 1953, published as "near Appleton."

REVISED RECORDS.--WSP 1308: 1931(M), 1937(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 978.00 ft above National Geodetic Vertical Datum of 1929. Prior to Dec. 22, 1952, nonrecording gage at site 4 mi upstream at datum 25.17 ft higher.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow affected by lakes above station. Occasional regulation at low flow by old milldam 500 ft upstream.

AVERAGE DISCHARGE.--54 years (water years 1936-89), 112 ft<sup>3</sup>/s, 1.68 in/yr, 81,140 acre-ft/yr; median of yearly mean discharge, 93 ft<sup>3</sup>/s, 1.40 in/yr, 67,400 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,520 ft<sup>3</sup>/s, Apr. 11, 1969, gage height, 13.78 ft; maximum gage height, 14.58 ft, Apr. 9, 1969 (backwater from ice); no flow for several periods.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 28	2045	*849	*6.75	Apr. 30	0645	238	5.47

No flow on many days.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.78	.50	1.2	.03	580	218	132	77	25	23
2	.00	.00	.81	.51	1.3	.00	583	208	128	82	22	24
3	.00	.00	.81	.50	1.1	e.00	564	201	124	73	19	33
4	.00	.00	.88	.51	1.0	.00	525	197	126	71	17	35
5	.00	.00	1.2	.45	.77	.00	513	196	124	65	14	33
6	.00	.00	2.2	.45	.60	.00	509	195	115	61	12	38
7	.00	.00	3.3	.45	.52	.00	488	183	106	55	10	35
8	.00	1.3	3.4	.45	.49	.08	472	170	103	51	9.5	32
9	.00	4.2	3.1	.46	.42	.11	447	165	101	55	9.1	28
10	.00	4.7	2.5	.41	.38	.33	388	163	101	76	8.2	27
11	.00	6.3	1.8	.40	.26	.05	369	157	94	66	7.7	30
12	.00	9.3	1.5	.35	.17	e5.5	389	150	97	59	7.9	27
13	.00	11	1.4	.32	e.14	e8.5	386	144	114	55	7.7	28
14	.00	7.0	1.5	.26	.12	e9.0	354	140	113	50	5.9	28
15	.00	6.7	1.4	e.25	e.12	e25	337	136	106	46	5.4	26
16	.00	5.5	1.1	e.25	.12	e30	314	130	97	43	5.7	22
17	.00	4.9	.89	e.25	e.12	e30	301	126	91	50	6.2	20
18	.00	e4.6	.84	.25	e.11	e26	266	128	e86	68	6.3	17
19	.00	4.4	.98	.26	e.10	e24	218	126	80	61	6.6	15
20	.00	3.7	1.0	e.27	e.09	e20	201	123	75	63	8.5	15
21	.00	e3.7	1.0	.28	.09	18	195	117	72	55	10	16
22	.00	e3.7	1.2	.30	e.09	17	190	116	68	48	19	16
23	.00	3.7	1.3	e.31	e.09	24	187	119	67	43	49	21
24	.00	3.9	1.4	.32	e.09	72	186	159	69	39	32	28
25	.00	4.6	1.3	.36	.09	89	184	143	68	35	21	33
26	.00	e4.8	e1.2	.39	e.09	e260	189	141	73	31	16	29
27	.00	4.3	e1.1	.44	e.08	620	192	138	70	27	13	25
28	.00	1.4	1.0	.47	.06	729	207	134	68	24	12	23
29	.00	.99	.80	.71	---	787	223	132	63	35	14	26
30	.00	.84	.70	1.2	---	684	232	131	61	30	21	24
31	.00	---	.58	1.2	---	567	---	135	---	28	22	---
TOTAL	0.00	105.53	42.97	13.53	9.81	4045.60	10189	4721	2792	1622	442.7	777
MEAN	.00	3.52	1.39	.44	.35	131	340	152	93.1	52.3	14.3	25.9
MAX	.00	11	3.4	1.2	1.3	787	583	218	132	82	49	38
MIN	.00	.00	.58	.25	.06	.00	184	116	61	24	5.4	15
AC-FT	.0	209	85	27	19	8020	20210	9360	5540	3220	878	1540
CFSM	.00	.00	.00	.00	.00	.14	.38	.17	.10	.06	.02	.03
IN.	.00	.00	.00	.00	.00	.17	.42	.19	.11	.07	.02	.03

CAL YR 1988	TOTAL	8165.92	MEAN	22.3	MAX	139	MIN	.00	AC-FT	16200	CFSM	.02	IN.	.34
WTR YR 1989	TOTAL	24761.14	MEAN	67.8	MAX	787	MIN	.00	AC-FT	49110	CFSM	.07	IN.	1.02

e Estimated

MINNESOTA RIVER BASIN

05300000 LAC QUI PARLE RIVER NEAR LAC QUI PARLE, MN

LOCATION.--Lat 44°59'42, long 95°55'09" in SW¼SW¼ sec.27, T.118 N., R.42 W., Lac qui Parle County, Hydrologic Unit 07020003, on right bank 40 ft downstream from highway bridge and 0.5 mi southwest of city of Lac qui Parle.

DRAINAGE AREA.--983 mi<sup>2</sup>.

PERIOD OF RECORD.--April 1910 to November 1914; March 1931 to current year (winter records incomplete prior to 1934). Published as "at Lac qui Parle," 1910-14.

REVISED RECORDS.--WSP 1308: 1912(M), 1935(M).

GAGE.--Water-stage recorder. Datum of gage is 951.98 ft above National Geodetic Vertical Datum of 1929 (Minnesota Department of Transportation benchmark). Apr. 27, 1910, to Nov. 15, 1914, nonrecording gage at site 2 mi downstream at different datum. Mar. 17, 1931, to Mar. 9, 1937, non recording gage at site 40 ft upstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--58 years (water years 1913, 1932, 1934-89), 131 ft<sup>3</sup>/s, 1.81 in/yr, 94,910 acre-ft/yr; median of yearly mean discharges, 101 ft<sup>3</sup>/s, 1.40 in/yr, 73,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,100 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 18.94 ft, from floodmark; maximum gage height, 19.37 ft, Apr. 9, 1965, from floodmark (backwater from ice); no flow at times in several years.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,720 ft<sup>3</sup>/s, Mar. 29, gage height, 10.00 ft (backwater from ice); no flow for several days.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e10	2.4	e1.8	e2.1	e2.9	e1.6	e1120	133	21	5.2	59	6.8
2	e7.5	2.4	e1.9	e2.1	e2.8	e1.6	e929	126	20	6.1	33	2.5
3	4.3	2.4	e1.9	e2.1	e2.7	e1.6	e754	112	18	4.3	18	1.6
4	3.9	2.7	e1.9	e2.1	e2.5	e1.6	607	103	15	3.8	11	1.2
5	e2.7	2.6	e1.9	e1.9	e2.2	e1.6	e545	97	13	1.8	7.4	.83
6	2.0	2.4	e1.9	e1.8	e2.1	e1.6	e475	87	11	.57	4.3	.85
7	1.6	2.4	e1.9	e1.8	e2.0	e1.6	e400	80	11	.37	2.5	1.7
8	e1.2	2.3	e1.9	e1.6	e1.9	e4.0	e350	74	10	.00	3.6	2.5
9	e.85	2.2	e1.8	e1.5	e1.9	e10	e300	68	9.0	.00	7.5	3.6
10	e.70	e2.2	e1.7	e1.4	e1.9	e35	e252	60	6.8	.00	8.1	5.6
11	.57	e2.2	e1.6	e1.4	e1.9	e90	e215	53	4.6	.00	12	6.9
12	.57	e2.1	e1.7	e1.4	e1.9	e140	e178	47	24	.00	15	4.5
13	.71	e2.1	e1.7	e1.5	e1.9	e240	152	40	17	.00	15	4.4
14	1.3	e2.1	e1.8	e1.5	e1.9	e350	146	38	12	.00	15	5.2
15	1.6	e2.0	e1.7	e1.6	e1.9	e300	137	34	11	.00	14	5.8
16	1.7	e2.0	e1.7	e1.6	e1.8	e250	128	32	7.5	.00	14	7.5
17	1.7	e2.0	e1.8	e1.8	e1.8	e180	121	30	5.7	.06	12	6.2
18	1.7	e2.0	e1.9	e1.8	e1.8	e135	115	35	4.8	3.9	6.3	4.4
19	1.8	e2.0	e2.0	e2.0	e1.7	e96	109	36	2.8	5.8	6.8	3.7
20	1.8	e2.0	e2.1	e1.9	e1.7	e90	104	32	1.3	8.4	20	1.9
21	1.8	e2.0	e2.1	e2.0	e1.7	e85	101	30	1.9	10	21	2.6
22	1.8	e2.0	e2.1	e2.2	e1.6	e76	99	29	2.0	5.0	36	2.0
23	1.9	e2.0	e2.1	e2.2	e1.6	e130	91	31	3.3	2.4	37	2.3
24	1.9	e2.0	e2.1	e2.5	e1.6	e570	85	30	4.2	1.4	26	1.9
25	1.9	e2.0	e2.1	e2.6	e1.6	e800	82	27	6.3	.66	10	1.2
26	1.9	e1.9	e2.1	e2.6	e1.6	e1010	81	22	7.7	.15	7.4	.43
27	2.0	e1.8	e2.1	e2.9	e1.6	e1940	76	20	7.3	.02	8.7	.89
28	2.2	e1.8	e2.1	e3.0	e1.6	e2180	83	19	4.7	.00	5.9	1.9
29	2.2	e1.8	e2.1	e3.0	---	e2530	93	19	3.9	19	5.4	.87
30	2.3	e1.8	e2.1	e3.0	---	e1970	104	21	4.0	91	6.4	.16
31	2.4	---	e2.1	e3.0	---	e1430	---	20	---	84	6.8	---
TOTAL	70.50	63.6	59.7	63.9	54.1	14652.2	8032	1585	270.8	253.93	455.1	91.93
MEAN	2.27	2.12	1.93	2.06	1.93	473	268	51.1	9.03	8.19	14.7	3.06
MAX	10	2.7	2.1	3.0	2.9	2530	1120	133	24	91	59	7.5
MIN	.57	1.8	1.6	1.4	1.6	1.6	76	19	1.3	.00	2.5	.16
AC-FT	140	126	118	127	107	29060	15930	3140	537	504	903	182
CFSM	.00	.00	.00	.00	.00	.48	.27	.05	.01	.01	.01	.00
IN.	.00	.00	.00	.00	.00	.55	.30	.06	.01	.01	.02	.00

CAL YR 1988 TOTAL 13389.70 MEAN 36.6 MAX 386 MIN .00 AC-FT 26560 CFMSM .04 IN. .51  
WTR YR 1989 TOTAL 25652.76 MEAN 70.3 MAX 2530 MIN .00 AC-FT 50880 CFMSM .07 IN. .97

e Estimated

## MINNESOTA RIVER BASIN

05301000 MINNESOTA RIVER NEAR LAC QUI PARLE, MN

LOCATION.--Lat 45°01'17", long 95°52'05", in NW¼NE¼ sec.24, T.118 N., R.42 W., Chippewa County, Hydrologic Unit 07020004, on left bank 200 ft downstream from dam at Lac qui Parle Outlet, 2.4 mi northwest of city of Lac qui Parle, and 3.5 mi west of Watson.

DRAINAGE AREA.--4,050 mi<sup>2</sup>, approximately.

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

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Nov. 10, 1944, at datum 0.20 ft lower.

REMARKS.--Records good. Part of flow from 2,050 mi<sup>2</sup>, of Chippewa River basin at times diverted into Minnesota River above station. Some regulation by Big Stone Lake since Apr. 17, 1937, Lac qui Parle since January 1938, Marsh Lake since Nov. 1, 1939, and Odessa Dam since May 1974.

AVERAGE DISCHARGE.--47 years, 682 ft<sup>3</sup>/s, 494,100 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 29,400 ft<sup>3</sup>/s, Apr. 12, 1969, gage height, 39.75 ft; no flow Nov. 17, 1942, Sept. 29, 1947, Oct. 19 to Nov. 18, 1951, Nov. 24, 1952, Dec. 9-11, 1976, Feb. 28 to Mar. 5, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,720 ft<sup>3</sup>/s, Apr. 4, 5, gage height, 31.52 ft; minimum discharge, 4.2 ft<sup>3</sup>/s, Sept. 2, 3, gage height, 20.20 ft, due to regulation; minimum gage height, 20.20 ft, Aug. 27, 31, Sept. 1-3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	14	13	e14	12	e14	3300	1390	462	158	42	4.6
2	23	15	13	e14	e12	e14	3480	1390	384	160	42	4.2
3	22	15	13	e13	e12	e14	3580	1380	350	158	42	5.0
4	20	14	13	e13	e12	e14	3700	1380	345	158	42	6.1
5	14	12	13	e13	e12	e14	3700	1390	232	93	42	6.3
6	13	12	13	e13	13	e14	3610	1350	108	40	42	6.2
7	12	13	13	e13	13	e14	3480	1330	67	55	42	6.5
8	12	14	13	e13	13	e14	3340	1310	41	56	42	6.1
9	13	13	13	e13	e13	e50	3190	1250	39	56	42	6.2
10	13	13	13	e13	14	e259	3050	1230	41	56	39	6.0
11	14	14	13	e13	14	e421	2950	1200	42	56	36	5.9
12	14	14	13	e13	14	e352	2650	1130	43	55	37	5.1
13	14	14	13	e13	14	e271	2060	1110	42	54	37	5.0
14	14	14	13	e14	14	e407	1900	1090	54	50	38	4.9
15	14	14	13	14	e13	e744	1780	1030	65	41	40	4.5
16	15	14	e18	14	e13	e678	1770	775	106	41	41	5.0
17	15	15	e26	14	e13	e675	1790	645	106	42	41	6.5
18	15	15	e26	14	e13	e662	1700	583	105	42	25	6.6
19	16	14	e26	14	e13	e634	1560	574	106	103	15	5.6
20	16	14	e25	13	e13	e589	1350	546	107	135	14	5.8
21	15	14	23	13	e13	e559	1120	547	130	134	15	5.8
22	16	14	15	13	e13	e515	893	556	146	134	14	5.5
23	14	14	15	13	e13	e467	898	555	146	134	12	5.5
24	15	14	14	13	e14	e555	997	557	145	134	10	5.7
25	15	14	e14	13	e14	e784	1090	534	146	111	24	5.5
26	14	14	e14	13	e14	843	1090	500	145	92	48	6.0
27	14	13	e14	13	e14	1120	1090	495	161	61	27	6.5
28	14	14	e14	13	e14	1520	1180	495	159	37	13	5.9
29	14	14	e14	13	---	2180	1330	497	159	41	13	7.2
30	14	13	e14	13	---	2730	1390	496	159	40	8.5	7.2
31	14	---	e14	12	---	2940	---	496	---	40	4.8	---
TOTAL	470	415	481	410	369	20067	65018	27813	4361	2567	930.3	172.9
MEAN	15.2	13.8	15.5	13.2	13.2	647	2167	897	145	82.8	30.0	5.76
MAX	23	15	26	14	14	2940	3700	1390	462	160	48	7.2
MIN	12	12	13	12	12	14	893	495	39	37	4.8	4.2
AC-FT	932	823	954	813	732	39800	129000	55170	8650	5090	1850	343
CFSM	.00	.00	.00	.00	.00	.16	.54	.22	.04	.02	.01	.00
IN.	.00	.00	.00	.00	.00	.16	.60	.26	.04	.02	.01	.00

CAL YR 1988 TOTAL 46232 MEAN 126 MAX 1040 MIN 11 AC-FT 91700 CFSM .03 IN. .42  
WTR YR 1989 TOTAL 123074.2 MEAN 337 MAX 3700 MIN 4.2 AC-FT 244100 CFSM .08 IN. 1.13

e Estimated

MINNESOTA RIVER BASIN

05304500 CHIPPEWA RIVER NEAR MILAN, MN

LOCATION.--Lat 45°06'39", long 95°47'57", in SE&SE& sec.16, T.119 N., R.41 W., Chippewa County, Hydrologic Unit 07020005, on right bank 800 ft upstream from bridge on State Highway 40, 2.0 mi upstream from small tributary, and 5.5 mi east of Milan.

DRAINAGE AREA.--1,870 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--March 1937 to current year.

REVISED RECORDS.--WSP 1145: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 959.69 ft above National Geodetic Vertical Datum of 1929. Prior to June 15, 1942, nonrecording gage on bridge 800 ft downstream at same datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow regulated by several small lakes upstream from gage.

AVERAGE DISCHARGE.--52 years, 313 ft<sup>3</sup>/s, 2.27 in/yr, 226,800 acre-ft/yr; median of yearly mean discharges, 229 ft<sup>3</sup>/s, 1.66 in/yr, 166,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,400 ft<sup>3</sup>/s, Apr. 9, 1969, gage height, 15.45 ft; no flow at times during 1940.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s, and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 27	0645	*2,550	*a7.75	Apr. 30	1915	466	2.84

a Backwater from ice.

Minimum discharge, 9.6 ft<sup>3</sup>/s, Aug. 19, gage height, 0.79 ft; minimum gage height, 0.79 ft, Aug. 11, 19.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	26	e22	e22	e20	e16	e1170	463	210	60	25	23
2	32	34	e24	e22	e19	e16	e1210	455	202	56	25	23
3	31	28	e23	e22	e18	e16	e1220	447	194	55	21	23
4	27	29	e23	e22	e18	e16	e1220	444	181	66	21	32
5	22	36	e25	e21	e18	e17	945	438	167	58	20	88
6	21	32	e25	e21	e18	e18	866	432	158	52	16	69
7	24	29	e25	e21	e18	e19	798	417	146	48	14	98
8	23	34	e24	e20	e18	e22	725	407	138	42	12	100
9	21	37	e24	e19	e17	e25	641	406	131	45	12	84
10	18	31	e24	e19	e17	e31	621	401	122	56	12	72
11	19	31	e24	e19	e17	e42	595	379	116	81	11	74
12	20	32	e24	e19	e17	e65	542	366	121	68	14	80
13	17	34	e24	e19	e17	e140	508	346	112	58	12	81
14	14	42	e24	e19	e17	e245	487	324	118	58	12	76
15	14	42	e24	e19	e17	e255	469	307	117	45	12	68
16	17	e40	e24	e19	e17	e265	446	289	119	39	13	60
17	14	e34	e24	e19	e17	e270	420	272	110	38	12	55
18	12	e22	e25	e19	e17	e280	390	272	105	79	12	49
19	15	e28	e26	e19	e16	e296	372	283	96	67	11	42
20	18	e30	e25	e19	e16	e300	358	280	83	54	14	46
21	19	e31	e25	e19	e16	e310	346	266	82	54	30	43
22	24	e31	e25	e19	e16	e330	344	250	79	50	68	42
23	19	e32	e24	e19	e16	e443	353	247	70	46	38	38
24	16	e33	e24	e19	e16	e710	362	256	66	39	29	35
25	19	e34	e24	e19	e16	e2180	358	257	62	35	22	31
26	18	e34	e24	e19	e16	e2410	357	255	69	31	21	29
27	21	e34	e24	e20	e16	e2010	363	241	74	28	22	30
28	19	e30	e23	e21	e16	e1670	401	227	73	25	20	29
29	e20	e26	e23	e21	---	e1390	432	223	69	40	17	29
30	20	e24	e23	e22	---	e1140	459	216	62	34	15	30
31	22	---	e22	e23	---	e1080	---	213	---	31	21	---
TOTAL	621	960	744	620	477	16027	17778	10079	3452	1538	604	1579
MEAN	20.0	32.0	24.0	20.0	17.0	517	593	325	115	49.6	19.5	52.6
MAX	32	42	26	23	20	2410	1220	463	210	81	68	100
MIN	12	22	22	19	16	16	344	213	62	25	11	23
AC-FT	1230	1900	1480	1230	946	31790	35260	19990	6850	3050	1200	3130
CFSM	.01	.02	.01	.01	.01	.28	.32	.17	.06	.03	.01	.03
IN.	.01	.02	.01	.01	.01	.32	.35	.20	.07	.03	.01	.03

CAL YR 1988	TOTAL	28622.8	MEAN	78.2	MAX	372	MIN	5.6	AC-FT	56770	CFSM	.04	IN.	.57
WTR YR 1989	TOTAL	54479	MEAN	149	MAX	2410	MIN	11	AC-FT	108100	CFSM	.08	IN.	1.08

e Estimated

## MINNESOTA RIVER BASIN

05311000 MINNESOTA RIVER AT MONTEVIDEO, MN

LOCATION.--Lat 44°56'00", long 95°44'00", in NW¼ sec.19, T.117 N., R.40 W., Yellow Medicine County, Hydrologic Unit 07020004, on right bank 100 ft upstream from bridge on U.S. Highway 212, at Montevideo, and 400 ft downstream from Chippewa River.

DRAINAGE AREA.--6,180 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1909 to September 1917, October 1917 to September 1929 (no winter records), October 1929 to current year. Prior to October 1939, published as "near Montevideo." Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1035: 1919(M). WSP 1085: 1935-36. WSP 1508: 1912, 1925(M), 1929(M).

GAGE.--Water-stage recorder. Datum of gage is 909.12 ft above National Geodetic Vertical Datum of 1929. July 22, 1909, to Feb. 4, 1932, nonrecording gage at bridge 600 ft downstream at present datum. Feb. 5, 1932, to Nov. 26, 1934, nonrecording gage at bridge 100 ft downstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Flow regulated by Big Stone Lake since Apr. 17, 1937, Lac qui Parle since Jan. 1938, and Marsh Lake since Nov. 1, 1939.

AVERAGE DISCHARGE.--68 years (water years 1910-17, 1930-89), 743 ft<sup>3</sup>/s, 538,300 acre-ft/yr; median of yearly mean discharges, 574 ft<sup>3</sup>/s, 415,900 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 35,100 ft<sup>3</sup>/s, Apr. 12, 1969, gage height, 21.68 ft, from high-water mark; no flow for several days in 1933-34, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,650 ft<sup>3</sup>/s, Apr. 6, gage height, 11.78 ft; minimum, 15 ft<sup>3</sup>/s, Sept. 29, gage height, 0.88 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	20	e18	e34	e32	e28	3100	1550	577	184	71	27
2	31	21	e18	e34	e31	e28	3210	1540	491	182	70	24
3	30	20	e18	e34	e30	e28	3390	1520	424	179	68	23
4	29	22	e18	e34	e29	e29	3510	1520	407	179	68	42
5	28	24	e18	e34	e29	e31	3600	1520	385	178	62	29
6	25	18	e18	e34	e28	e33	3640	1490	184	100	53	24
7	24	19	e18	e33	e28	e34	3630	1480	121	69	52	25
8	24	17	e18	e33	e28	e40	3570	1480	86	74	52	26
9	22	17	e17	e32	e28	e50	3450	1370	76	76	51	24
10	20	17	e17	e32	e28	e60	3360	1350	e74	77	50	22
11	20	17	e17	e32	e28	e250	3290	1330	e73	76	47	25
12	20	e18	e16	e32	e28	e450	3180	1270	72	75	45	22
13	21	e19	e16	e32	e28	e480	2800	1250	73	75	47	22
14	22	e20	e17	e32	e28	e500	2480	1250	74	75	48	23
15	20	20	e21	e32	e28	e510	2130	1240	77	74	46	22
16	20	21	e25	e32	e28	e570	2030	1030	102	69	46	22
17	19	20	e28	e32	e28	e590	2020	876	114	69	47	22
18	18	e20	e30	e32	e28	e600	1900	746	115	121	47	23
19	18	e20	e36	e32	e28	e600	1800	668	115	85	41	22
20	19	e20	e42	e32	e28	e605	1570	631	115	123	33	23
21	19	e20	e42	e32	e28	e610	1380	622	118	140	33	24
22	20	e20	e39	e32	e28	e636	1050	624	147	140	42	19
23	17	e20	e34	e32	e28	e675	999	627	154	141	33	17
24	17	e21	e32	e32	e28	e1040	1050	627	156	141	29	18
25	17	e22	e30	e32	e28	e1820	1180	623	160	138	28	18
26	17	e22	e32	e32	e28	e1830	1190	591	167	107	41	17
27	18	e21	e34	e32	e28	e1800	1190	582	168	97	55	18
28	17	e20	e34	e32	e28	e2130	1230	578	185	75	41	18
29	e18	e19	e34	e32	---	2680	e1420	577	184	96	32	16
30	e19	e18	e34	e32	---	2960	e1530	579	184	77	32	17
31	20	---	e34	e32	---	3000	---	580	---	73	30	---
TOTAL	658	593	805	1006	795	24697	69879	31721	5378	3365	1440	674
MEAN	21.2	19.8	26.0	32.5	28.4	797	2329	1023	179	109	46.5	22.5
MAX	31	24	42	34	32	3000	3640	1550	577	184	71	42
MIN	17	17	16	32	28	28	999	577	72	69	28	16
AC-FT	1310	1180	1600	2000	1580	48990	138600	62920	10670	6670	2860	1340
CFSM	.00	.00	.00	.01	.00	.13	.38	.17	.03	.02	.01	.00
IN.	.00	.00	.00	.01	.00	.15	.42	.19	.03	.02	.01	.00

CAL YR 1988 TOTAL 62616 MEAN 171 MAX 1430 MIN 16 AC-FT 124200 CFSM .03 IN. .38  
WTR YR 1989 TOTAL 141011 MEAN 386 MAX 3640 MIN 16 AC-FT 279700 CFSM .06 IN. .85

e Estimated

## 05313500 YELLOW MEDICINE RIVER NEAR GRANITE FALLS, MN

LOCATION.--Lat 44°43'18", long 95°31'07", in SW¼ sec.35, T.115 N., R.39 W., Yellow Medicine County, Hydrologic Unit 07020004, on right bank 50 ft downstream from highway bridge, 6 mi upstream from mouth, and 8 mi south of town of Granite Falls.

DRAINAGE AREA.--653 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1931 to September 1935 (no winter records), October 1935 to September 1938, October 1939 to current year. Monthly discharge only for some periods, published in WSP 1308.

REVISED RECORDS.--WSP 1508: 1931, 1934(M), 1937(M), 1946(M), 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 960.64 ft above National Geodetic Vertical Datum of 1929.

Mar. 16, 1931, to June 13, 1938, nonrecording gage, on bridge 50 ft upstream at present datum. Oct. 12, 1939, to Nov. 30, 1952, nonrecording gage 500 ft downstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--53 years (water years 1936-38, 1940-89), 122 ft<sup>3</sup>/s, 2.54 in/yr, 88,390 acre-ft/yr; median of yearly mean discharges, 79 ft<sup>3</sup>/s, 1.64 in/yr, 57,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,200 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 14.90 ft; no flow at times in 1931, 1933, 1948, 1959.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in June 1919 reached a stage of 17.5 ft, from information by local residents, discharge, 25,200 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 13	1130	647	a4.53	Mar. 29	0745	*2,520	*a7.48

a Backwater from ice.

Minimum discharge, 0.66 ft<sup>3</sup>/s, Sept. 18, 19, gage height, 2.08 ft; minimum gage height, 2.04 ft, July 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	e21	e5.6	e5.6	e5.8	e5.8	687	72	18	17	9.3	1.2
2	19	e21	e5.6	e5.6	e5.8	e5.8	585	73	16	12	7.8	1.2
3	17	e20	e5.6	e5.6	e5.8	e5.8	466	68	15	11	5.7	1.0
4	16	e21	e5.6	e5.6	e5.8	e5.8	383	64	14	8.0	4.9	3.6
5	13	e23	e5.6	e5.6	e5.8	e5.8	328	63	13	6.7	4.2	2.4
6	14	e20	e6.0	e5.6	e5.8	e5.8	290	60	12	4.8	3.1	1.9
7	14	e18	e6.2	e5.6	e5.8	e5.8	263	57	11	3.9	2.9	2.5
8	13	e18	e6.0	e5.6	e5.8	e5.8	220	54	11	3.4	2.7	2.9
9	13	e20	e6.0	e5.6	e5.8	e6.4	187	51	10	2.6	2.8	2.5
10	13	e21	e5.8	e5.6	e5.8	e15	171	48	9.3	1.9	2.8	2.0
11	13	e21	e5.8	e5.6	e5.8	e63	156	45	6.9	1.8	2.6	2.1
12	13	e20	e5.8	e5.6	e5.8	e225	139	42	6.8	2.2	2.3	1.7
13	13	e19	e5.9	e5.6	e5.8	e580	127	40	8.0	1.6	2.1	1.5
14	13	e18	e6.0	e5.6	e5.8	e525	117	36	7.3	1.4	1.8	1.3
15	10	e17	e5.8	e5.6	e5.8	e325	108	33	7.4	1.2	1.4	1.3
16	14	e16	e5.7	e5.6	e5.8	e250	100	31	7.0	1.0	1.9	1.1
17	16	e15	e5.6	e5.6	e5.8	e170	92	29	6.3	1.5	1.7	1.1
18	15	e13	e5.6	e5.6	e5.8	e110	85	31	6.4	6.5	1.5	.76
19	15	e12	e5.6	e5.6	e5.8	e105	77	32	4.8	7.1	1.7	.96
20	16	e12	e5.6	e5.6	e5.8	e95	73	30	4.3	5.6	2.1	1.6
21	15	e12	e5.6	e5.6	e5.8	e85	70	28	4.7	4.7	2.1	1.7
22	15	e11	e5.6	e5.8	e5.8	e70	70	27	5.0	4.1	2.6	1.4
23	15	e10	e5.6	e5.8	e5.8	e68	67	26	5.2	3.7	2.1	1.3
24	15	e10	e5.6	e5.8	e5.8	e200	63	25	4.3	3.2	1.7	1.2
25	e24	e9.8	e5.6	e5.8	e5.8	e420	59	24	4.1	5.0	1.6	.97
26	e25	e8.7	e5.6	e5.8	e5.8	e825	59	22	8.3	4.6	1.7	1.1
27	e24	e7.6	e5.6	e5.8	e5.8	e1450	59	20	9.9	3.5	1.7	1.0
28	e22	e6.5	e5.6	e5.9	e5.8	e1710	68	19	8.8	3.1	1.5	1.1
29	e21	e5.8	e5.6	e5.9	---	e2220	66	18	8.0	16	1.3	1.2
30	e21	e5.7	e5.6	e5.9	---	1380	68	18	17	17	1.1	1.1
31	e21	---	e5.6	e5.9	---	869	---	18	---	12	1.1	---
TOTAL	508	453.1	177.0	176.0	162.4	11812.8	5303	1204	269.8	178.1	83.8	46.69
MEAN	16.4	15.1	5.71	5.68	5.80	381	177	38.8	8.99	5.75	2.70	1.56
MAX	25	23	6.2	5.9	5.8	2220	687	73	18	17	9.3	3.6
MIN	10	5.7	5.6	5.6	5.8	5.8	59	18	4.1	1.0	1.1	.76
AC-FT	1010	899	351	349	322	23430	10520	2390	535	353	166	93
CFSM	.03	.02	.01	.01	.01	.58	.27	.06	.01	.01	.00	.00
IN.	.03	.03	.01	.01	.01	.67	.30	.07	.02	.01	.00	.00

CAL YR 1988 TOTAL 15104.47 MEAN 41.3 MAX 493 MIN .34 AC-FT 29960 CFSM .06 IN. .86  
WTR YR 1989 TOTAL 20374.69 MEAN 55.8 MAX 2220 MIN .76 AC-FT 40410 CFSM .09 IN. 1.16

e Estimated

## MINNESOTA RIVER BASIN

05315000 REDWOOD RIVER NEAR MARSHALL, MN

LOCATION.--Lat 44°25'49", long 95°50'43", in SE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.12, T.111 N., R.42 W., Lyon County, Hydrologic Unit 07020006, on right bank 2.0 mi upstream from Redwood River diversion structure on southwest edge of town of Marshall, MN. Prior to Apr. 10, 1960, at site 5 mi downstream.

DRAINAGE AREA.--259 mi<sup>2</sup>, revised.

PERIOD OF RECORD.--March 1940 to current year. Monthly discharge only for some periods, published in WSP 1308.

GAGE.--Water-stage recorder. Datum of gage is 1,188.23 ft above National Geodetic Vertical Datum of 1929. March 1940 to April 9, 1980, nonrecording gage 5.0 mi downstream from present site at datum 43.35 ft lower (crest-stage gage added June 12, 1968). Since March 1964, nonrecording gage and crest-stage gage on diversion channel 1.5 mi downstream at datum 1,100.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records fair. Water diverted at medium and high stages into diversion channel 2.0 mi below station. Diversion began Mar. 18, 1964. Unknown amount of natural diversion into Cottonwood River basin occurs at extremely high stages 0.8 mi below station.

AVERAGE DISCHARGE.--49 years, 56.0 ft<sup>3</sup>/s, 2.94 in/yr, 40,570 acre-ft/yr; median of yearly mean discharges, 41 ft<sup>3</sup>/s, 2.15 in/yr, 29,700 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--River only, maximum discharge, 5,370 ft<sup>3</sup>/s, June 17, 1957, gage height, 10.14 ft; maximum gage height, 11.05 ft, Apr. 6, 1951, from floodmark; no flow at times.

Diversion only, maximum discharge, 4,440 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 78.45 ft; no flow on many days.

Combined flow, maximum discharge, 5,590 ft<sup>3</sup>/s, Apr. 10, 1969; no flow at times.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 608 ft<sup>3</sup>/s, Mar. 25, gage height, 11.13 ft (from floodmark); minimum discharge, 0.77 ft<sup>3</sup>/s, Aug. 31, gage height, 7.41 ft (backwater from beaver activity); minimum gage height, 6.11 ft, Oct. 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.2	e4.8	e6.6	e6.2	e8.2	e7.2	173	e29	e8.8	14	5.7	2.6
2	4.7	e4.8	e6.6	e6.2	e8.1	e7.2	162	e29	e8.6	11	4.6	2.6
3	4.6	6.0	e6.6	e6.2	e7.6	e7.1	151	e27	e8.3	9.8	3.9	2.6
4	4.5	8.9	e6.5	e6.2	e7.5	e7.1	139	e26	e7.5	7.2	3.5	12
5	4.2	9.4	e6.5	e6.2	e7.3	e7.1	e122	e25	e7.0	5.6	3.4	10
6	4.2	8.3	e6.4	e6.1	e7.3	e7.1	e108	e23	e6.2	4.4	3.4	9.0
7	4.2	7.6	e6.4	e6.0	e7.3	e15	e89	e22	5.1	3.1	3.4	7.5
8	4.3	7.7	e6.4	e5.9	e7.3	e22	e78	e21	5.1	2.9	3.3	7.8
9	4.4	7.5	e6.3	e5.8	e7.2	e30	e62	e20	5.1	3.2	3.3	6.8
10	4.2	e7.3	e6.3	e5.7	e7.2	e50	e55	e20	5.0	2.6	3.1	6.4
11	3.7	e7.3	e6.2	e5.6	e7.2	e56	e47	e19	5.0	4.5	3.0	6.2
12	4.1	e7.3	e6.1	e5.7	e7.2	e64	41	e18	4.9	4.3	2.7	5.9
13	4.5	e7.3	e6.0	e5.7	e7.4	e70	39	e17	4.9	3.6	2.5	5.6
14	4.3	e7.2	e5.9	e5.7	e7.4	e72	36	e16	5.1	2.3	2.9	4.9
15	4.5	e7.2	e5.8	e5.8	e7.4	e73	e35	e16	5.1	3.4	2.3	4.6
16	4.3	e7.0	e5.8	e5.8	e7.4	e74	e33	e15	5.0	4.1	2.4	4.4
17	4.5	e7.0	e5.8	e5.8	e7.4	74	e32	e16	4.9	5.1	2.4	4.3
18	4.6	e7.0	e5.8	e5.9	e7.4	e74	e32	e16	4.9	14	2.4	4.2
19	4.6	e6.9	e5.8	e6.0	e7.4	e75	e31	e16	4.9	10	2.5	4.1
20	6.0	e6.9	e5.8	e6.1	e7.4	e78	e30	e15	5.0	7.9	2.8	8.0
21	4.5	e6.9	e5.9	e6.2	e7.4	e94	e29	e14	5.0	6.5	2.4	13
22	3.9	e6.9	e6.0	e6.3	e7.4	e210	e28	e14	4.9	6.3	2.4	11
23	4.8	e6.9	e6.0	e6.4	e7.4	e360	e28	e13	4.8	6.0	2.4	8.7
24	4.9	e6.9	e6.1	e6.6	e7.3	e500	e28	e12	4.8	5.7	2.4	7.3
25	4.8	e6.9	e6.2	e6.8	e7.3	e614	e29	e11	4.8	5.4	2.4	6.4
26	4.8	e6.9	e6.2	e6.8	e7.3	e470	e30	e11	32	5.1	2.4	6.1
27	e4.8	e6.9	e6.2	e6.8	e7.3	e235	e30	e10	21	4.8	2.4	5.1
28	e4.8	e6.8	e6.2	e7.0	e7.2	217	e31	e9.7	14	5.0	2.3	4.9
29	e4.8	e6.8	e6.2	e7.4	---	e215	e30	e9.4	13	9.2	2.3	4.6
30	e4.8	e6.7	e6.2	e7.6	---	212	e30	e9.2	13	8.6	2.3	4.4
31	e4.8	---	e6.2	e8.0	---	187	---	e9.1	---	6.8	2.4	---
TOTAL	141.3	212.0	191.0	194.5	207.2	4183.8	1788	528.4	233.7	192.4	89.6	191.0
MEAN	4.56	7.07	6.16	6.27	7.40	135	59.6	17.0	7.79	6.21	2.89	6.37
MAX	6.0	9.4	6.6	8.0	8.2	614	173	29	32	14	5.7	13
MIN	3.7	4.8	5.8	5.6	7.2	7.1	28	9.1	4.8	2.3	2.3	2.6
AC-FT	280	421	379	386	411	8300	3550	1050	464	382	178	379
CFSM	.02	.03	.02	.02	.03	.52	.23	.07	.03	.02	.01	.02
IN.	.02	.03	.03	.03	.03	.60	.26	.08	.03	.03	.01	.03

CAL YR 1988 TOTAL 6261.5 MEAN 17.1 MAX 178 MIN 1.3 AC-FT 12420 CFSM .07 IN. .90  
WTR YR 1989 TOTAL 8152.9 MEAN 22.3 MAX 614 MIN 2.3 AC-FT 16170 CFSM .09 IN. 1.17

e Estimated

## MINNESOTA RIVER BASIN

05316500 REDWOOD RIVER NEAR REDWOOD FALLS, MN

LOCATION.--Lat 44°31'25", long 95°10'20", in SE¼NE¼ sec.9, T.112 N., R.36 W., Redwood County, Hydrologic Unit 07020006, on right bank 4 ft upstream from highway bridge, 3 mi west of town of Redwood Falls, and 8.5 mi upstream from mouth.

DRAINAGE AREA.--629 mi<sup>2</sup>, revised.

PERIOD OF RECORD.--July 1909 to September 1914 (no winter records except 1911-12). August 1930 to September 1935 (no winter records), October 1935 to current year.

GAGE.--Water-stage recorder. Datum of gage is 972.33 ft above National Geodetic Vertical Datum of 1929. July 1909 to September 1914, nonrecording gage at bridge 20 ft downstream at datum 0.22 ft lower. August 1930 to Oct. 25, 1949, nonrecording gage, at bridge 20 ft downstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are poor. Natural discharge affected by unknown amount of interbasin flow between Yellow Medicine, Redwood, and Cottonwood River basins during extreme floods.

AVERAGE DISCHARGE.--55 years (water years 1912, 1936-89), 124 ft<sup>3</sup>/s, 2.68 in/yr, 89,840 acre-ft/yr; median of yearly mean discharges, 80 ft<sup>3</sup>/s, 1.73 in/yr, 58,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,700 ft<sup>3</sup>/s, June 18, 1957, gage height, 15.92 ft, from floodmark; no flow for several days in January 1940 and for part of each day Aug. 19, 20, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 28	0615	*3,740	*11.58, from highwater mark in well.	No other peak greater than base discharge.			

a Backwater from ice.

Minimum discharge, 0.77 ft<sup>3</sup>/s, Aug. 27, gage height, 1.19 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	13	e8.4	e6.9	e12	e8.1	364	68	18	39	21	2.4
2	20	13	e8.1	e6.9	e10	e8.0	327	65	17	30	18	2.1
3	16	13	e7.9	e7.0	e9.2	e7.9	311	61	18	25	12	4.3
4	14	15	e7.7	e7.0	e8.9	e7.8	274	58	16	21	11	12
5	11	17	e7.6	e7.0	e8.5	e7.8	230	55	14	17	9.0	22
6	8.5	17	e7.4	e7.0	e8.4	e7.7	206	53	13	13	6.2	38
7	8.2	22	e7.4	e7.0	e8.4	e7.8	183	49	11	11	5.6	33
8	8.5	18	e7.2	e6.8	e8.4	e7.9	162	46	10	8.5	4.4	27
9	9.3	17	e7.0	e6.4	e8.3	e8.4	148	45	10	7.1	3.2	22
10	9.3	16	e6.8	e6.2	e8.2	e13	134	43	9.6	6.1	2.7	27
11	11	e14	e6.6	e6.2	e8.1	e20	128	41	8.7	5.7	2.4	22
12	9.2	e14	e6.5	e6.2	e8.1	e30	120	39	8.3	5.0	1.9	17
13	7.7	e14	e6.4	e6.3	e8.1	e38	115	38	9.7	4.9	1.7	12
14	7.1	e14	e6.3	e6.3	e8.1	e48	108	35	9.3	4.6	1.4	10
15	8.1	e14	e6.3	e6.4	e8.1	e66	100	35	9.0	4.4	1.7	9.6
16	8.4	e14	e6.0	e6.6	e8.1	e70	92	34	9.8	4.5	2.0	8.0
17	8.9	e13	e6.0	e6.7	e8.1	e72	85	34	10	5.6	1.8	6.7
18	9.5	e13	e6.3	e6.8	e8.1	e72	79	36	9.4	15	1.8	5.1
19	8.8	e12	e6.4	e6.9	e8.1	e70	75	38	9.4	18	3.4	4.0
20	13	e12	e6.6	e7.2	e8.1	e68	73	38	7.8	41	3.4	5.1
21	11	e12	e6.6	e7.4	e8.1	e68	70	36	8.3	34	2.7	7.0
22	9.4	e11	e6.6	e7.7	e8.1	e68	70	35	8.3	25	2.2	15
23	11	e10	e6.6	e7.8	e8.1	e77	69	33	8.3	20	1.8	23
24	12	e10	e6.7	e8.0	e8.1	e274	65	30	7.8	16	1.5	19
25	12	e10	e6.7	e8.3	e8.1	e1640	60	26	7.2	12	1.3	14
26	11	e9.8	e6.8	e8.5	e8.1	e1470	63	23	113	9.8	1.3	10
27	11	e9.6	e6.8	e8.7	e8.1	e1380	64	22	113	7.3	1.0	7.4
28	12	e9.4	e6.8	e9.0	e8.1	e2800	66	20	96	5.6	1.1	7.3
29	12	e9.3	e6.8	e9.3	---	1160	68	19	73	8.6	1.4	7.4
30	12	e8.8	e6.9	e9.7	---	882	70	17	51	10	1.8	5.7
31	12	---	e6.9	e11	---	454	---	18	---	17	1.8	---
TOTAL	347.9	394.9	213.1	229.2	236.1	10911.4	3979	1190	713.9	451.7	132.3	405.1
MEAN	11.2	13.2	6.87	7.39	8.43	352	133	38.4	23.8	14.6	4.27	13.5
MAX	26	22	8.4	11	12	2800	364	68	113	41	21	38
MIN	7.1	8.8	6.0	6.2	8.1	7.7	60	17	7.2	4.4	1.0	2.1
AC-FT	690	783	423	455	468	21640	7890	2360	1420	896	262	804
CFSM	.02	.02	.01	.01	.01	.56	.21	.06	.04	.02	.01	.02
IN.	.02	.02	.01	.01	.01	.65	.24	.07	.04	.03	.01	.02

CAL YR 1988 TOTAL 15224.8 MEAN 41.6 MAX 468 MIN 1.1 AC-FT 30200 CFSM .07 IN. .90  
WTR YR 1989 TOTAL 19204.6 MEAN 52.6 MAX 2800 MIN 1.0 AC-FT 38090 CFSM .08 IN. 1.14

e Estimated

MINNESOTA RIVER BASIN

05317000 COTTONWOOD RIVER NEAR NEW ULM, MN

LOCATION.--Lat 44°17'29", long 94°26'24", in SW¼NE¼ sec.33, T.110 N., R.30 W., Brown County, Hydrologic Unit 07020008, on left bank 600 ft upstream from highway bridge, 1.8 mi south of New Ulm, and 3.2 mi upstream from mouth.

DRAINAGE AREA.--1,280 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1909 to December 1913, March 1931 to March 1938, August 1938 to current year (winter records incomplete prior to 1936).

REVISED RECORDS.--WSP 355: 1912.

GAGE.--Water-stage recorder. Datum of gage is 796.83 ft above National Geodetic Vertical Datum of 1929. July 1, 1909, to Dec. 13, 1913, nonrecording gage at site 2.7 mi upstream at different datum. Mar. 15, 1931, to Mar. 31, 1938, nonrecording gage 2.2 mi upstream at datum 11.41 ft higher. Aug. 23, 1938, to June 25, 1948, nonrecording gage at present site and datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--55 years (water years 1912-13, 1936-37, 1939-89), 317 ft<sup>3</sup>/s, 3.36 in/yr, 230,000 acre-ft/yr; median of yearly mean discharges, 226 ft<sup>3</sup>/s, 2.40 in/yr, 164,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 28,700 ft<sup>3</sup>/s, Apr. 10, 1969, gage height, 19.15 ft; maximum gage height, 20.86 ft, Apr. 8, 1965, from floodmark (backwater from ice); minimum discharge observed, 0.5 ft<sup>3</sup>/s, Nov. 27, 1952; minimum gage height, 0.72 ft, Nov. 20, 1964.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 26	2000	4,190	10.58	No other peak greater than base discharge.			
Minimum discharge, 7.6 ft <sup>3</sup> /s, Aug. 13, gage height, 0.88 ft.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	24	e33	e9.5	e12	e16	728	212	50	87	25	18
2	20	24	e31	e9.4	e12	e15	598	200	48	72	23	18
3	19	25	e29	e9.3	e12	e15	526	185	47	59	21	19
4	18	32	e27	e9.1	e12	e15	467	178	45	50	19	26
5	16	33	e26	e9.0	e12	e15	408	163	43	43	18	22
6	16	32	e24	e9.0	e12	e15	352	144	42	36	15	20
7	15	32	e23	e9.0	e12	e15	310	137	51	32	13	24
8	18	31	e22	e8.9	e12	e30	285	131	132	32	12	22
9	18	32	e21	e8.9	e12	e60	253	123	78	28	11	20
10	16	34	e20	e8.9	e12	99	225	114	59	24	9.3	19
11	15	32	e19	e8.9	e12	210	213	106	50	24	11	18
12	14	35	e18	e8.9	e12	e550	204	97	44	20	8.2	17
13	14	33	e17	e8.9	e12	e700	188	90	41	20	12	17
14	13	33	e16	e8.9	e12	e675	178	85	44	19	15	16
15	14	35	e16	e9.0	e12	e250	165	80	37	20	12	14
16	16	35	e15	e9.1	e12	e100	155	77	35	17	11	13
17	17	e36	e14	e9.2	e12	e480	145	75	34	22	10	13
18	18	e37	e14	e9.3	e12	e350	140	81	34	51	14	12
19	18	e38	e13	e9.5	e12	e415	132	87	32	56	17	14
20	20	39	e13	e9.6	e12	e320	124	81	28	49	16	14
21	19	e41	e12	e9.7	e12	e126	115	74	31	66	15	18
22	19	43	e12	e9.8	e12	e110	113	72	34	66	15	18
23	19	43	e12	e9.9	e12	e100	118	71	27	60	13	16
24	20	48	e11	e10	e13	e190	121	68	25	52	11	15
25	21	45	e11	e10	e14	e2000	121	74	25	46	10	13
26	20	48	e11	e10	e15	3870	136	75	80	39	15	12
27	22	44	e10	e11	e16	3690	142	66	75	34	12	13
28	23	35	e10	e11	e16	2720	168	59	172	29	15	17
29	24	e37	e9.9	e11	---	1970	166	55	127	39	13	15
30	24	e36	e9.8	e12	---	1420	219	53	92	32	13	11
31	24	---	e9.6	e12	---	989	---	51	---	27	16	---
TOTAL	571	1072	529.3	298.7	350	21530	7215	3164	1662	1251	440.5	504
MEAN	18.4	35.7	17.1	9.64	12.5	695	240	102	55.4	40.4	14.2	16.8
MAX	24	48	33	12	16	3870	728	212	172	87	25	26
MIN	13	24	9.6	8.9	12	15	113	51	25	17	8.2	11
AC-FT	1130	2130	1050	592	694	42700	14310	6280	3300	2480	874	1000
CFSM	.01	.03	.01	.01	.01	.54	.19	.08	.04	.03	.01	.01
IN.	.02	.03	.02	.01	.01	.63	.21	.09	.05	.04	.01	.01

CAL YR 1988 TOTAL 43794.9 MEAN 120 MAX 992 MIN 8.4 AC-FT 86870 CFSM .09 IN. 1.27  
WTR YR 1989 TOTAL 38587.5 MEAN 106 MAX 3870 MIN 8.2 AC-FT 76540 CFSM .08 IN. 1.12

e Estimated

## MINNESOTA RIVER BASIN

05317200 LITTLE COTTONWOOD RIVER NEAR COURTLAND, MN

LOCATION.--Lat 44°14'47", long 94°20'19", in SW¼ sec.17, T.109 N., R.29 W., Blue Earth County, Hydrologic Unit 07020007, on right bank 30 ft downstream from bridge on State Highway 68, 0.7 mi above mouth, 1.5 mi south of Courtland.

DRAINAGE AREA.--230 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1973 to current year. September 1969 to September 1973, operated as a low-flow station only.

GAGE.--Water-stage recorder. Datum of gage is 788.25 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--16 years, 54.5 ft<sup>3</sup>/s, 3.22 in/yr, 39,480 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 951 ft<sup>3</sup>/s, July 7, 1983, gage height, 7.80 ft; maximum gage height, 8.29 ft, Mar. 26, 1979, (backwater from ice); minimum discharge, 0.01 ft<sup>3</sup>/s, Sept. 17, 1977.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 180 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 24	1800	*275	*6.32	Mar. 28	0730	252	5.36

Minimum discharge, 0.34 ft<sup>3</sup>/s, Aug. 7, gage height, 2.37 ft; minimum gage height, 2.34 ft, July 17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e1.0	e.72	1.4	.73	.87	.78	e66	e28	6.2	15	1.4	e1.3
2	e1.0	e.72	1.5	.70	.86	.81	e54	e28	6.1	14	1.1	e1.3
3	e.95	e.75	1.6	.70	.86	.86	e47	e26	5.0	11	.95	e1.4
4	e.90	e.86	1.4	.73	.86	.86	e42	e25	4.3	9.5	.77	e1.9
5	e.80	e.99	1.4	.78	.86	.86	e37	e23	3.4	6.9	.55	e1.6
6	e.80	e.80	1.4	.78	.86	.83	e35	e20	3.3	5.1	.44	e1.5
7	e.75	e.80	1.5	.69	.90	.86	e31	e19	3.4	4.2	.41	e1.8
8	e.90	e.78	1.6	.63	.88	.86	e28	e18	11	4.0	.65	e1.6
9	e.90	e.80	1.5	.63	.86	.89	e25	e17	6.4	3.4	.66	e1.5
10	e.80	e.85	1.4	.63	.89	6.7	e22	e17	5.3	2.4	.90	e1.4
11	e.75	e.80	1.4	.63	.78	26	e21	e16	4.9	e1.7	1.3	e1.3
12	e.70	e.88	1.4	.70	.78	25	e20	e15	4.2	e1.4	1.0	e1.2
13	e.70	e.82	1.5	.70	.78	27	e21	e14	e3.3	e1.4	.86	e1.2
14	e.65	.84	1.3	.63	.78	28	e20	e13	e3.5	e1.3	.92	e1.2
15	e.70	1.2	1.2	.59	.78	25	e18	e12	e3.0	e1.4	.82	e1.2
16	e.80	1.2	1.2	.57	.81	26	e17	e12	e2.8	e1.2	.75	e1.1
17	e.68	.95	1.2	.57	.86	19	e16	e12	e2.7	e1.5	.76	e1.1
18	e.72	.91	1.1	.59	.86	15	e15	e13	e2.7	10	.61	e1.0
19	e.72	.94	e1.0	.66	.80	19	e16	e14	e2.6	14	.65	e1.2
20	e.80	.91	1.0	.68	.82	16	e15	e13	e2.2	8.2	.59	e1.2
21	e.76	.90	.95	.73	.86	12	e14	e12	e2.5	5.5	.65	e1.5
22	e.76	.86	.91	.81	.86	8.6	e14	e12	e2.7	4.5	.72	e1.5
23	e.76	.91	.88	.86	.80	8.4	e14	11	e2.2	6.1	.84	e1.4
24	e.80	1.1	.86	.86	.84	89	e15	10	e2.0	10	.71	e1.3
25	e.84	1.1	.86	.86	.87	148	e16	9.1	e2.0	7.7	.89	e1.1
26	e.80	1.1	.86	.86	.78	136	e18	7.7	51	6.0	1.0	e1.0
27	e.88	1.1	.85	.86	.78	193	e18	7.3	74	4.2	1.0	e1.1
28	e.92	1.3	.72	.72	.78	e242	e22	7.4	45	2.8	.81	e1.4
29	e.84	1.3	.70	.90	---	e173	e22	7.1	29	3.4	.87	e1.3
30	e.84	1.5	.74	1.0	---	e125	e28	6.0	20	2.5	.90	e.94
31	e.84	---	.78	.96	---	e87	---	5.8	---	2.5	1.1	---
TOTAL	25.06	28.79	36.11	22.74	23.32	1462.31	747	450.4	316.7	172.8	25.58	39.54
MEAN	.81	.96	1.16	.73	.83	47.2	24.9	14.5	10.6	5.57	.83	1.32
MAX	1.0	1.5	1.6	1.0	.90	242	66	28	74	15	1.4	1.9
MIN	.65	.72	.70	.57	.78	.78	14	5.8	2.0	1.2	.41	.94
AC-FT	50	57	72	45	46	2900	1480	893	628	343	51	78
CFSM	.00	.00	.01	.00	.00	.21	.11	.06	.05	.02	.00	.01
IN.	.00	.00	.01	.00	.00	.24	.12	.07	.05	.03	.00	.01

CAL YR 1988 TOTAL 4853.52 MEAN 13.3 MAX 101 MIN .50 AC-FT 9630 CFSM .06 IN. .79  
WTR YR 1989 TOTAL 3350.35 MEAN 9.18 MAX 242 MIN .41 AC-FT 6650 CFSM .04 IN. .54

e Estimated

MINNESOTA RIVER BASIN

05319500 WATONWAN RIVER NEAR GARDEN CITY, MN

LOCATION.--Lat 44°02'47", Long 94°11'43", in SW¼NE¼ sec.28, T.107 N., R.28 W., Blue Earth County, Hydrologic Unit 07020010, on left bank 25 ft downstream from bridge on County Highway 13, 1.5 miles west of Garden City, 7.3 mi upstream from mouth, and 9.2 mi downstream from Perch Creek.

DRAINAGE AREA.-- 812 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1940 to September 1945, September 1976 to current year. 1953, 1960, 1961, and 1969 (one or more discharge measurements each year).

REVISED RECORDS.--WDR MN-78-2: 1977.

GAGE.--Water-stage recorder. Datum of gage is 905.05 ft above National Geodetic Vertical Datum of 1929. Prior to September 30, 1945, nonrecording gage at site 200 ft upstream and at datum 0.17 ft higher.

REMARKS.--Records good except those for the periods of estimated daily discharge, which are fair.

AVERAGE DISCHARGE.--18 years (water years 1941-45, 1977-89), 315 ft<sup>3</sup>/s, 5.27 in/yr, 228,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,620 ft<sup>3</sup>/s, May 21, 1944, gage height 9.84 ft, datum then in use; minimum daily, 1.9 ft<sup>3</sup>/s, Jan. 20 to Feb. 8, 1977; minimum gage height, 0.27 ft, July 23, 1940, datum then in use.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1965, reached a stage of 18.89 ft at datum 0.17 ft higher, from floodmarks, discharge, 19,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 27	Unknown	*2,560	*6.90, from floodmarks	No other peak greater than base discharge.			
Minimum discharge, 2.2 ft <sup>3</sup> /s, Feb. 19, gage height, 1.09 ft; minimum gage height, 0.40 ft, Aug. 12, 13.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.1	10	e15	e8.0	4.9	4.6	242	135	23	14	13	10
2	6.7	12	e15	7.7	3.6	4.4	221	126	22	12	12	11
3	6.3	13	e15	8.0	3.4	4.0	203	112	23	10	10	8.8
4	6.0	15	e15	8.1	3.6	3.2	200	104	21	9.1	9.2	11
5	5.7	15	e15	8.1	3.9	2.9	203	102	19	7.9	8.3	13
6	5.2	14	e15	7.5	6.0	2.9	197	126	18	7.1	7.0	8.7
7	4.9	14	e15	8.3	5.2	3.3	192	116	19	6.1	5.6	11
8	4.9	15	14	8.3	5.7	3.3	187	92	22	5.9	5.1	12
9	4.9	13	14	6.7	10	3.9	177	83	20	6.3	4.5	8.6
10	5.2	12	14	5.4	5.5	19	182	76	20	6.5	4.3	6.2
11	4.9	11	12	5.2	3.0	e44	170	68	18	8.0	4.1	5.4
12	4.9	12	12	4.1	2.8	e38	162	63	20	11	3.9	5.1
13	5.2	13	13	3.6	2.9	e36	152	60	16	10	5.9	4.5
14	4.9	13	e13	4.1	3.2	e32	150	56	18	12	7.7	5.1
15	4.9	14	13	4.1	3.1	e30	141	51	18	11	6.1	5.4
16	5.2	16	11	4.4	2.9	e28	128	48	17	9.8	6.7	4.3
17	6.0	11	8.8	4.9	2.7	e26	126	44	14	9.5	6.0	3.5
18	7.7	13	11	4.9	2.4	e25	124	44	13	16	5.4	3.2
19	5.6	12	e11	4.9	2.4	e25	120	42	11	20	6.3	3.1
20	5.2	8.6	e11	4.9	2.4	e25	106	42	10	32	7.7	3.6
21	7.4	11	e11	4.9	2.4	e26	59	44	9.7	85	7.4	3.5
22	8.5	11	e11	4.9	2.5	32	56	42	16	67	6.4	3.2
23	9.3	12	e11	4.4	3.1	90	57	36	14	51	5.8	2.6
24	10	13	e11	4.1	3.0	429	57	32	11	38	6.1	3.1
25	11	13	e11	3.9	3.2	840	63	31	11	29	5.4	3.1
26	11	23	10	3.9	4.3	1110	73	32	18	23	5.6	2.8
27	12	18	e9.5	4.1	6.2	e1900	81	30	20	20	5.7	3.1
28	11	11	e9.2	4.1	4.9	e960	98	32	20	18	5.8	2.9
29	9.9	e14	e8.9	3.9	---	579	141	25	21	16	5.5	2.9
30	10	e15	8.7	3.9	---	407	150	24	17	15	5.3	2.8
31	11	---	8.2	4.4	---	292	---	23	---	13	5.6	---
TOTAL	222.5	397.6	372.3	167.7	109.2	7025.5	4218	1941	519.7	599.2	203.4	173.5
MEAN	7.18	13.3	12.0	5.41	3.90	227	141	62.6	17.3	19.3	6.56	5.78
MAX	12	23	15	8.3	10	1900	242	135	23	85	13	13
MIN	4.9	8.6	8.2	3.6	2.4	2.9	56	23	9.7	5.9	3.9	2.6
AC-FT	441	789	738	333	217	13940	8370	3850	1030	1190	403	344
CFSM	.01	.02	.01	.01	.00	.28	.17	.08	.02	.02	.01	.01
IN.	.01	.02	.02	.01	.01	.32	.19	.09	.02	.03	.01	.01

CAL YR 1988 TOTAL 26628.9 MEAN 72.8 MAX 522 MIN 4.9 AC-FT 52820 CFSM .09 IN. 1.22  
WTR YR 1989 TOTAL 15949.6 MEAN 43.7 MAX 1900 MIN 2.4 AC-FT 31640 CFSM .05 IN. .73

e Estimated

## MINNESOTA RIVER BASIN

## 05320000 BLUE EARTH RIVER NEAR RAPIDAN, MN

LOCATION.--Lat 44°05'44", long 94°06'33", in SE½SE¼ sec.6, T.107 N., R.27 W., Blue Earth County, Hydrologic Unit 07020009, on left bank 0.2 mi downstream from powerplant (reactivated in 1984) operated by Rapidan Redevelopment Limited Partnership, 2 mi west of Rapidan, 3.5 mi downstream from Watonwan River, and 7.8 mi upstream from Le Sueur River.

DRAINAGE AREA.--2,430 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--July 1909 to November 1910 (published as "at Rapidan Mills," no winter records), October 1939 to September 1945, July 1949 to current year.

REVISED RECORDS.--WSP 895: Drainage area. WSP 1508: 1910.

GAGE.--Water-stage recorder. Datum of gage is 807.83 ft above National Geodetic Vertical Datum of 1929. July 20, 1909, to Apr. 28, 1910, nonrecording gage at site 0.2 mi upstream at different datum. Apr. 29 to Nov. 12, 1910, nonrecording gage at site 800 ft upstream at different datum. Oct. 4 to Nov. 14, 1939, nonrecording gage at present site and datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--46 years (water years 1940-45, 1950-89), 903 ft<sup>3</sup>/s, 5.05 in/yr, 654,200 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 43,100 ft<sup>3</sup>/s, Apr. 9, 1965, gage height, 21.36 ft, from floodmark; minimum, 6.9 ft<sup>3</sup>/s, Oct. 12, 1955, gage height, 1.04 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,890 ft<sup>3</sup>/s, Mar. 27, gage height, 7.36 ft, due to regulation; minimum, 13 ft<sup>3</sup>/s, Nov. 20, gage height, 1.12 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	39	41	e72	33	41	28	803	1220	335	97	104	83
2	36	44	e71	33	36	28	560	878	319	96	104	83
3	34	41	e70	33	e35	29	567	1040	300	96	330	80
4	35	49	e69	30	e34	26	561	1020	269	97	82	93
5	38	53	66	29	e33	25	441	767	247	302	70	92
6	35	52	69	29	e31	26	405	613	213	324	63	79
7	35	53	69	29	e30	27	441	756	208	88	61	88
8	35	52	61	28	e29	25	436	855	197	59	56	77
9	34	50	54	e27	30	26	378	531	182	58	53	66
10	32	48	e53	e27	27	30	268	479	168	56	48	61
11	31	48	50	e26	27	49	280	503	167	54	43	59
12	32	48	46	e25	26	72	319	521	166	54	40	52
13	32	51	46	24	27	87	251	427	143	55	43	53
14	30	51	48	26	28	254	255	357	127	85	48	50
15	31	53	48	26	29	253	237	463	126	112	59	45
16	32	69	43	26	29	240	230	384	129	113	51	44
17	31	51	41	26	28	241	204	321	125	112	43	43
18	32	59	41	26	28	244	197	346	127	123	40	42
19	35	70	41	26	28	246	201	326	127	129	41	33
20	34	31	43	26	28	263	221	287	118	157	52	38
21	34	49	45	27	27	257	206	297	110	232	44	39
22	33	57	45	27	24	258	186	281	107	236	40	37
23	33	60	46	29	31	276	178	281	105	234	39	34
24	33	61	46	30	28	586	176	288	100	229	36	30
25	33	61	46	32	27	1890	251	270	86	228	46	28
26	33	77	43	32	27	2440	747	311	96	396	40	25
27	35	87	43	32	29	3220	1430	490	103	186	38	27
28	35	50	38	33	28	1920	1490	509	104	166	54	28
29	36	71	35	33	---	1620	1410	322	102	155	52	25
30	35	72	35	33	---	1360	1430	287	97	121	42	23
31	42	---	35	38	---	894	---	279	---	109	41	---
TOTAL	1055	1659	1558	901	825	16940	14759	15709	4803	4559	1903	1557
MEAN	34.0	55.3	50.3	29.1	29.5	546	492	507	160	147	61.4	51.9
MAX	42	87	72	38	41	3220	1490	1220	335	396	330	93
MIN	30	31	35	24	24	25	176	270	86	54	36	23
AC-FT	2090	3290	3090	1790	1640	33600	29270	31160	9530	9040	3770	3090
CFSM	.01	.02	.02	.01	.01	.22	.20	.21	.07	.06	.03	.02
IN.	.02	.03	.02	.01	.01	.26	.23	.24	.07	.07	.03	.02

CAL YR 1988 TOTAL 126858 MEAN 347 MAX 2500 MIN 18 AC-FT 251600 CFSM .14 IN. 1.94  
WTR YR 1989 TOTAL 66228 MEAN 181 MAX 3220 MIN 23 AC-FT 131400 CFSM .07 IN. 1.01

e Estimated

MINNESOTA RIVER BASIN

05320500 LE SUEUR RIVER NEAR RAPIDAN, MN

LOCATION.--Lat 44°06'40", long 94°02'28", in SW¼ sec.35, T.108 N., R.27 W., Blue Earth County, Hydrologic Unit 07020011, on right bank 600 ft downstream from highway bridge, 1.8 mi northeast of Rapidan, and 2.3 mi upstream from mouth.

DRAINAGE AREA.--1,100 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--October 1939 to September 1945, July 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 775.76 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 15, 1939, nonrecording gage at same site and datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--46 years (water years 1940-45, 1950-89), 457 ft<sup>3</sup>/s, 5.64 in/yr, 331,100 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 24,700 ft<sup>3</sup>/s, Apr. 8, 1965, gage height, 22.10 ft, from floodmark; maximum gage height, 22.72 ft, May 22, 1960, from floodmark; minimum daily discharge, 1.6 ft<sup>3</sup>/s, Feb. 9-25, 1959; minimum gage height, 0.64 ft, Sept. 27, 1989.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 26	1830	*3,770	*6.61	No other peak greater than base discharge.			

Minimum discharge, 5.5 ft<sup>3</sup>/s, Sept. 27, 29, 30; minimum gage height, 0.64 ft, Sept. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	14	e55	e13	e16	e18	773	813	71	49	11	15
2	14	15	50	e13	e16	e18	599	670	70	43	10	11
3	14	16	e47	e12	e17	e18	469	547	91	36	9.8	10
4	14	20	e45	e12	e17	e18	387	461	90	30	9.5	14
5	12	22	e43	e12	e17	e18	353	402	80	25	9.1	14
6	12	22	42	e12	e17	e18	341	357	73	21	8.4	14
7	12	21	e41	e12	e16	e18	302	332	71	19	7.9	17
8	13	24	e40	e11	e16	e18	268	305	74	19	7.5	23
9	14	21	e39	e11	e16	e18	232	279	62	17	7.3	21
10	13	20	e37	e11	e16	e22	206	256	56	16	7.0	18
11	12	19	e34	e11	e16	e42	189	238	49	20	6.6	16
12	12	24	e33	e11	e16	e64	174	219	63	19	6.6	13
13	12	26	e32	e11	e16	e95	161	202	68	18	7.8	13
14	12	26	e32	e11	e16	e240	149	190	66	18	9.6	12
15	12	23	e32	e11	e16	e235	136	177	77	18	8.4	10
16	12	27	e31	e11	e17	e230	126	162	67	17	7.5	9.7
17	26	e31	e30	e11	e17	e230	116	151	57	15	7.4	8.7
18	21	e32	e30	e11	e17	e230	109	148	50	32	6.9	8.4
19	15	32	e29	e11	e17	e240	105	148	46	34	7.7	8.5
20	13	e32	e28	e11	e17	e245	99	157	39	33	8.1	9.3
21	13	e31	e27	e11	e17	e245	97	142	34	28	7.6	8.5
22	12	30	e25	e11	e16	e240	98	134	34	39	7.4	7.7
23	10	30	e24	e11	e17	e435	99	131	32	32	7.1	7.1
24	11	36	e22	e12	e18	e930	101	116	29	27	6.7	6.9
25	12	40	e19	e12	e17	e2010	106	106	31	24	6.6	6.8
26	12	45	e18	e12	e17	e2730	144	98	47	20	6.9	6.3
27	13	52	e17	e13	e17	2970	493	92	48	18	7.1	6.3
28	13	e62	e16	e14	e17	2320	799	86	41	15	10	6.5
29	13	e63	e15	e14	---	1720	904	81	39	14	9.7	6.0
30	14	61	e14	e15	---	1310	978	78	46	13	11	5.9
31	14	---	e14	e15	---	985	---	74	---	12	9.9	---
TOTAL	415	917	961	369	465	17930	9113	7352	1701	741	254.1	333.6
MEAN	13.4	30.6	31.0	11.9	16.6	578	304	237	56.7	23.9	8.20	11.1
MAX	26	63	55	15	18	2970	978	813	91	49	11	23
MIN	10	14	14	11	16	18	97	74	29	12	6.6	5.9
AC-FT	823	1820	1910	732	922	35560	18080	14580	3370	1470	504	662
CFSM	.01	.03	.03	.01	.02	.53	.28	.22	.05	.02	.01	.01
IN.	.01	.03	.03	.01	.02	.61	.31	.25	.06	.03	.01	.01

CAL YR 1988 TOTAL 73690.5 MEAN 201 MAX 1670 MIN 9.6 AC-FT 146200 CFSM .18 IN. 2.49  
WTR YR 1989 TOTAL 40551.7 MEAN 111 MAX 2970 MIN 5.9 AC-FT 80430 CFSM .10 IN. 1.37

e Estimated

MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN

LOCATION.--Lat 44°09'58", long 94°00'57", in NW¼NE¼ sec.13, T.108 N., R.27 W., Nicollet County, Hydrologic Unit 07020007, on left bank 12 ft downstream from bridge on U.S. Highway 169 in North Mankato, 1.1 mi downstream from Blue Earth River and at mile 107.1 upstream from Mississippi River.

DRAINAGE AREA.--14,900 mi<sup>2</sup>, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1903 to current year (no winter records 1904, 1906-10, 1918-29). Monthly discharge only for some periods, published in WSP 1308. Published as "near Mankato": 1903-21.

REVISED RECORDS.--WSP 875: 1917. WSP 955: Drainage area. WSP 1085: 1929. WSP 1238: 1903, 1908, 1919. WSP 1508: 1916(M), 1918(M), 1926(M), 1928, 1930, 1932(M), 1938(M). WDR-MN-76-1: 1881(M).

GAGE.--Water-stage recorder. Datum of gage is 747.92 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 19, 1921, nonrecording gage, at site 1.1 mi upstream at datum 6.4 ft higher. Mar. 15, 1922, to Nov. 30, 1924, nonrecording gage, and Dec. 1, 1924 to May 24, 1971, recorder at site 0.5 mi downstream at present datum. May 25, 1971 to Aug. 14, 1977, recorder at site 0.2 mi downstream at present datum. Aug. 14, 1977 to July 27, 1978, nonrecording gage at present site and datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--68 years (water years 1905, 1911-17, 1930-89), 2,972 ft<sup>3</sup>/s, 2.71 in/yr, 2,153,000 acre-ft/yr; median of yearly mean discharges, 2,550 ft<sup>3</sup>/s, 2.32 in/yr, 1,850,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 94,100 ft<sup>3</sup>/s, Apr. 10, 1965, gage height, 29.09 ft; minimum observed, 26 ft<sup>3</sup>/s, Aug. 4, 1934.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage since Apr. 26, 1881, 29.9 ft, present site and datum, from floodmark, discharge, 110,000 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 15,800 ft<sup>3</sup>/s, Mar. 27, gage height, 14.40 ft, minimum daily discharge, 139 ft<sup>3</sup>/s, Jan. 4-10; minimum gage height, 1.78 ft, Oct. 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	184	154	e257	e142	e185	e170	9200	4430	e1270	852	347	260
2	176	167	254	e141	e185	e168	9110	3940	e1270	738	336	240
3	172	170	246	e140	e182	e168	8760	3820	1260	640	363	218
4	175	197	251	e139	e180	e168	8270	3870	1240	571	549	239
5	180	203	239	e139	e178	e167	7640	3520	1200	569	319	242
6	182	200	236	e139	e176	e166	7140	3200	1130	706	287	233
7	180	201	243	e139	e173	e165	6800	3210	1110	647	261	237
8	178	208	252	e139	e172	e164	6530	3270	1080	427	243	259
9	179	200	e250	e139	e171	e162	6230	3000	1090	400	225	268
10	178	200	e240	e139	e170	e170	5820	2740	1020	375	210	259
11	177	201	e250	e140	e172	277	5590	2690	886	390	202	260
12	160	222	e260	e140	e177	e500	5440	2620	812	347	197	253
13	152	230	e270	e141	e180	e700	5180	2500	707	316	210	239
14	153	231	e260	e142	e184	e1000	4970	2340	656	301	202	227
15	152	244	e255	e142	e186	e960	4760	2370	632	318	212	216
16	154	264	e250	e143	e188	e980	4530	2260	596	316	214	205
17	158	236	e240	e144	e188	e1020	4190	2130	545	305	192	195
18	174	231	230	e145	e185	e1080	3790	2150	528	400	182	187
19	154	261	204	e146	e183	e1080	3480	2120	497	432	182	179
20	157	222	181	e147	e181	e1130	3300	1950	428	422	191	179
21	152	201	179	e148	e180	e1190	3150	1810	390	472	200	181
22	150	244	176	150	e179	e1370	2970	1690	449	536	189	171
23	150	261	166	149	e177	e1770	2790	1600	437	563	179	165
24	151	253	e163	155	e176	3150	2610	1530	411	547	177	162
25	150	232	e160	152	e175	6050	2460	1470	407	529	169	154
26	150	260	e158	e157	e175	8550	2650	1450	525	504	184	156
27	151	e275	e152	e158	e173	13700	3660	1520	729	639	192	159
28	150	e272	e150	158	e172	11500	4410	1600	817	426	201	147
29	151	e270	e148	159	---	10600	4400	1390	1070	416	206	152
30	150	259	e145	161	---	9720	4680	1340	970	417	204	156
31	150	---	e143	170	---	9330	---	1280	---	378	194	---
TOTAL	5030	6769	6608	4543	5003	87325	154510	74810	24162	14899	7219	6198
MEAN	162	226	213	147	179	2817	5150	2413	805	481	233	207
MAX	184	275	270	170	188	13700	9200	4430	1270	852	549	268
MIN	150	154	143	139	170	162	2460	1280	390	301	169	147
AC-FT	9980	13430	13110	9010	9920	173200	306500	148400	47930	29550	14320	12290
CFSM	.01	.02	.01	.01	.01	.19	.35	.16	.05	.03	.02	.01
IN.	.01	.02	.02	.01	.01	.22	.39	.19	.06	.04	.02	.02

CAL YR 1988 TOTAL 395166 MEAN 1080 MAX 5460 MIN 129 AC-FT 783800 CFSM .07 IN. .99  
WTR YR 1989 TOTAL 397076 MEAN 1088 MAX 13700 MIN 139 AC-FT 787600 CFSM .07 IN. .99

e Estimated

## MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN--Continued

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1963-66, 1968 to current year.

PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1967 to September 30, 1981, October 1982 to current year (fragmentary records).

SUSPENDED-SEDIMENT DISCHARGE: October 1967 to current year.

REMARKS.--During the winter period, daily suspended-sediment samples were collected monthly and daily sediment load was estimated on the basis of water records and these sediment samples. Occasional water temperature readings were obtained by hydrographers, which are considered good.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum daily, 31.0°C, July 4-9, 1989; minimum daily, 0.0°C on many days each year.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 2,850 mg/L, Aug. 7, 1968; minimum daily mean, 13 mg/L, Nov. 24, 1974, Feb. 18, 19, 1979.

SEDIMENT LOADS: Maximum daily, 247,000 tons, Apr. 9, 1969; minimum daily, 5.2 tons, Nov. 6, 1976.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURES: Maximum daily observed, 31.0°C, July 4-9; minimum daily, 0.0°C on many days during winter period.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 780 mg/L, Mar. 22; minimum daily mean, 24 mg/L, July 31.

SEDIMENT LOADS: Maximum daily, 19,200 tons, Mar. 27; minimum daily, 12 tons, Jan. 3-12, Sept. 28.

WATER TEMPERATURE, DEGREES CELSIUS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
ONCE-DAILY

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	7.0	---	---	---	---	---	12.0	20.0	29.0	29.0	21.0
2	---	7.5	---	---	---	---	---	12.0	20.0	28.5	29.0	23.5
3	---	8.5	---	---	---	---	---	13.5	19.5	30.0	29.5	24.0
4	---	7.0	---	.0	---	---	11.0	13.0	20.0	31.0	29.5	24.0
5	---	6.5	---	---	---	---	11.0	12.5	20.5	31.0	25.0	23.5
6	---	6.0	---	---	---	---	11.0	13.0	24.0	31.0	23.0	23.5
7	---	6.5	---	---	.0	---	11.0	14.0	23.5	31.0	24.0	23.5
8	15.0	7.0	---	---	---	---	9.0	12.5	17.0	31.0	23.0	23.0
9	15.0	7.0	---	---	---	1.0	9.0	12.5	19.0	31.0	26.0	21.0
10	15.0	---	---	---	---	---	9.0	16.5	21.5	30.5	24.0	21.0
11	---	---	---	---	---	---	7.0	17.5	22.0	28.5	24.0	19.0
12	14.0	---	---	---	---	---	6.0	17.0	21.0	29.0	24.0	18.5
13	15.0	---	---	---	---	---	5.5	18.0	20.0	28.5	23.5	18.0
14	14.0	---	---	---	---	---	7.0	19.5	19.5	27.0	24.0	18.5
15	13.5	6.5	---	---	---	---	8.5	21.0	20.0	27.0	24.0	19.0
16	15.5	---	---	---	---	---	10.0	19.5	22.5	26.0	24.0	20.0
17	13.5	---	---	---	---	---	9.5	---	23.5	26.0	24.5	22.5
18	13.0	---	---	---	---	---	10.0	19.5	25.0	24.0	25.0	22.0
19	12.0	---	---	---	---	---	10.5	19.5	27.5	25.0	24.0	19.5
20	---	---	---	---	---	---	10.5	20.0	26.0	26.0	25.5	20.0
21	12.5	---	---	---	---	---	10.5	18.5	24.0	26.5	26.0	18.5
22	12.0	---	---	---	---	---	12.0	22.0	23.5	27.0	25.5	18.0
23	9.5	---	---	---	---	---	13.0	21.5	24.0	28.0	26.0	18.0
24	8.0	---	---	---	---	---	13.5	21.5	24.0	28.0	26.0	16.5
25	7.0	---	---	---	---	---	13.5	20.5	27.0	29.0	25.0	15.0
26	7.0	---	---	---	---	---	14.0	20.0	25.0	29.5	25.0	15.0
27	4.0	---	---	---	---	---	15.0	21.0	27.0	30.0	25.0	15.5
28	3.0	---	---	---	---	---	12.5	20.0	28.0	29.5	25.0	17.0
29	4.0	---	---	---	---	2.5	12.0	19.0	28.0	29.0	25.0	17.0
30	5.0	---	---	---	---	---	12.0	20.0	27.5	27.0	25.0	18.0
31	7.0	---	---	---	---	---	---	19.5	---	29.0	22.0	---
MEAN	---	---	---	---	---	---	---	---	23.0	28.5	25.2	19.8
MAX	---	---	---	---	---	---	---	---	28.0	31.0	29.5	24.0
MIN	---	---	---	---	---	---	---	---	17.0	24.0	22.0	15.0

## MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN--Continued

SUSPENDED-SEDIMENT, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)		MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)		MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)		MEAN CONCENTRATION (MG/L)		LOAD (TONS/DAY)	
	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER				
1	145	72	39	16	40	28	33	13	40	20	36	17				
2	124	59	41	18	40	27	33	13	39	19	36	16				
3	104	48	48	22	39	26	33	12	39	19	36	16				
4	84	40	62	33	39	26	33	12	39	19	36	16				
5	68	33	55	30	38	25	33	12	38	18	36	16				
6	52	26	43	23	38	24	33	12	38	18	36	16				
7	38	18	40	22	37	24	33	12	38	18	36	16				
8	41	20	45	25	37	25	33	12	38	18	36	16				
9	49	24	54	29	37	25	33	12	38	18	36	16				
10	55	26	52	28	36	23	33	12	38	17	40	18				
11	65	31	52	28	36	24	33	12	38	18	60	45				
12	70	30	60	36	36	25	33	12	38	18	110	148				
13	71	29	61	38	36	26	33	13	37	18	300	567				
14	71	29	58	36	35	25	33	13	37	18	450	1210				
15	54	22	54	36	35	24	34	13	37	19	430	1110				
16	43	18	52	37	35	24	34	13	37	19	420	1110				
17	40	17	51	32	34	22	34	13	37	19	410	1130				
18	38	18	50	31	34	21	34	13	37	18	410	1200				
19	51	21	49	35	34	19	33	13	37	18	500	1460				
20	65	28	48	29	34	17	35	14	37	18	560	1710				
21	77	32	47	26	34	16	35	14	37	18	750	2410				
22	85	34	46	30	34	16	36	15	37	18	780	2890				
23	79	32	45	32	33	15	36	14	37	18	700	3350				
24	69	28	45	31	33	15	36	15	36	17	640	5440				
25	60	24	44	28	33	14	37	15	36	17	580	9470				
26	50	20	43	30	33	14	38	16	36	17	540	12500				
27	56	23	42	31	33	14	38	16	36	17	520	19200				
28	71	29	42	31	33	13	38	16	36	17	490	15200				
29	59	24	41	30	33	13	38	16	---	---	477	13700				
30	35	14	41	29	33	13	39	17	---	---	458	12000				
31	34	14	---	---	33	13	39	18	---	---	430	10800				
TOTAL	---	883	---	882	---	636	---	423	---	506	---	116813				
	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER										
1	400	9940	116	1390	70	240	63	145	26	24	89	62				
2	372	9150	110	1170	68	233	45	90	30	27	65	42				
3	344	8140	98	1010	74	252	45	78	31	30	60	35				
4	317	7080	85	888	91	305	45	69	32	47	75	48				
5	296	6110	71	675	100	324	43	66	32	28	66	43				
6	260	5010	58	501	76	232	42	80	32	25	64	40				
7	218	4000	42	364	64	192	40	70	38	27	61	39				
8	205	3610	36	318	75	219	35	40	46	30	56	39				
9	208	3500	35	283	88	259	31	33	55	33	51	37				
10	190	2990	34	252	92	253	34	34	56	32	50	35				
11	176	2660	36	261	91	218	36	38	58	32	50	35				
12	157	2310	59	417	90	197	35	33	51	27	48	33				
13	145	2030	67	452	72	137	40	34	64	36	45	29				
14	138	1850	62	392	58	103	45	37	65	35	47	29				
15	134	1720	59	378	53	90	46	39	74	42	50	29				
16	131	1600	64	391	49	79	36	31	68	39	50	28				
17	128	1450	69	397	49	72	35	29	56	29	48	25				
18	125	1280	74	430	54	77	58	63	54	27	46	23				
19	118	1110	78	446	63	85	61	71	51	25	44	21				
20	112	998	73	384	70	81	70	80	50	26	43	21				
21	101	859	58	283	64	67	68	87	48	26	42	21				
22	92	738	64	292	59	72	63	91	51	26	40	18				
23	92	693	75	324	59	70	57	87	62	30	40	18				
24	93	655	81	335	60	67	46	68	76	36	62	27				
25	93	618	95	377	82	90	36	51	95	43	73	30				
26	99	708	90	352	82	116	38	52	103	51	53	22				
27	110	1090	85	349	52	102	38	66	106	55	32	14				
28	120	1430	84	363	87	192	39	45	100	54	30	12				
29	121	1440	83	311	140	404	49	55	84	47	70	29				
30	121	1530	81	293	89	233	32	36	67	37	56	24				
31	---	---	79	273	---	---	24	24	67	35	---	---				
TOTAL YEAR	---	86299 229645	---	14351	---	5061	---	1822	---	1061	---	908				

## MINNESOTA RIVER BASIN

05325000 MINNESOTA RIVER AT MANKATO, MN--Continued

PARTICLE-SIZE DISTRIBUTION OF SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	SEDI- MENT, SUS- PENDED (MG/L) (80154)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM (70337)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM (70338)	SED. SUSP. FALL DIAM. % FINER THAN .016 MM (70340)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM (70342)	SED. SUSP. FALL DIAM. % FINER THAN .125 MM (70343)	SED. SUSP. FALL DIAM. % FINER THAN .250 MM (70344)	SED. SUSP. FALL DIAM. % FINER THAN .500 MM (70345)
MAR 29...	10600	460	31	39	58	84	88	99	100

## MINNESOTA RIVER BASIN

05327000 HIGH ISLAND CREEK NEAR HENDERSON, MN

LOCATION.--Lat 44°34'19", long 93°55'18", in NE¼NW¼ sec.26, T.113 N., R.26 W., Sibley County, Hydrologic Unit 07020012, on left bank 20 ft downstream from bridge on County Road 6, 1.6 mi upstream from mouth, and 3.1 mi north of Henderson.

DRAINAGE AREA.--237 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1973 to current year. May 1970 to September 1973, operated as a low-flow station only.

GAGE.--Water-stage recorder. Datum of gage is 728.56 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--16 years, 84.3 ft<sup>3</sup>/s, 4.83 in/yr, 61,080 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,760 ft<sup>3</sup>/s, Aug. 25, 1981, gage height, 9.09 ft; minimum discharge, 0.20 ft<sup>3</sup>/s, Jan. 4, 1981, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 24	1915	*434	*3.93	Mar. 26	1700	381	3.58

Minimum discharge, 0.95 ft<sup>3</sup>/s, Nov. 2; minimum gage height, 0.60 ft, Feb. 24, 27, 28, Mar. 6, June 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.2	2.0	2.0	1.4	1.2	1.1	113	23	3.2	8.0	4.1	6.6
2	2.1	1.2	1.9	1.4	1.3	1.2	96	22	3.0	14	2.9	4.1
3	1.9	1.8	1.9	1.4	1.5	1.2	84	22	2.6	17	2.7	3.6
4	1.7	2.1	1.6	1.4	1.4	1.4	71	22	2.1	12	2.5	4.4
5	1.7	2.7	1.6	1.6	1.4	1.2	65	22	1.8	8.2	2.2	4.2
6	1.5	2.9	1.7	1.6	1.4	1.2	63	21	1.9	6.0	2.1	4.0
7	1.6	2.8	1.7	1.6	1.4	1.2	58	19	1.9	5.3	1.7	3.6
8	1.5	2.5	1.7	1.6	1.4	1.2	54	21	1.6	7.1	1.5	3.5
9	1.6	2.4	1.6	1.4	1.3	1.2	49	21	2.0	7.3	1.3	3.3
10	1.6	2.1	1.5	1.4	1.3	1.8	45	17	1.6	6.6	1.3	3.4
11	1.4	1.9	1.3	1.4	1.3	60	41	16	1.5	7.3	1.5	3.1
12	1.7	2.2	1.3	1.4	1.3	30	35	14	1.3	6.4	1.4	2.8
13	1.8	2.3	1.4	1.4	1.4	34	31	13	1.4	5.9	1.4	2.8
14	1.8	2.3	1.4	1.7	1.3	31	30	12	1.8	4.2	1.7	2.8
15	1.7	2.5	1.4	1.5	1.3	15	28	11	1.8	3.3	1.7	2.8
16	1.6	e3.0	1.3	1.5	1.1	13	24	9.8	1.5	3.3	1.5	2.3
17	1.8	e2.9	1.3	1.6	1.2	15	22	8.9	1.5	3.1	1.4	2.2
18	2.0	e2.6	1.3	1.5	1.3	4.5	19	11	1.3	4.0	1.5	2.5
19	1.7	e2.5	1.4	1.6	1.3	4.4	18	13	1.4	6.7	3.5	2.5
20	2.1	2.2	1.4	1.6	1.3	5.2	17	12	1.5	4.6	3.8	2.2
21	2.1	2.0	1.4	1.7	1.4	4.8	16	11	1.3	3.7	7.1	2.4
22	2.1	1.7	1.6	1.6	1.2	4.2	16	10	2.6	2.9	17	2.6
23	2.3	1.7	1.6	1.5	1.2	5.2	16	10	2.6	2.6	11	2.0
24	2.0	2.0	1.6	1.4	1.2	138	13	9.7	3.4	2.3	5.5	1.9
25	1.6	1.9	1.4	1.6	1.1	237	13	9.8	2.9	2.5	6.3	2.0
26	1.8	2.4	1.5	1.6	1.1	240	16	6.9	19	1.9	6.1	1.7
27	2.4	e2.5	1.6	1.6	1.1	279	20	6.1	24	1.8	5.0	1.4
28	1.6	2.5	1.3	1.4	1.2	172	27	4.5	19	1.8	4.6	1.4
29	1.6	2.5	1.3	1.3	---	128	30	4.2	13	4.7	3.6	1.7
30	1.5	2.4	1.4	1.3	---	132	28	3.9	9.0	6.0	4.3	1.6
31	1.4	---	1.4	1.3	---	122	---	3.6	---	5.7	5.9	---
TOTAL	55.4	68.5	46.8	46.3	35.9	1687.0	1158	410.4	133.5	176.2	118.1	85.4
MEAN	1.79	2.28	1.51	1.49	1.28	54.4	38.6	13.2	4.45	5.68	3.81	2.85
MAX	2.4	3.0	2.0	1.7	1.5	279	113	23	24	17	17	6.6
MIN	1.4	1.2	1.3	1.3	1.1	1.1	13	3.6	1.3	1.8	1.3	1.4
AC-FT	110	136	93	92	71	3350	2300	814	265	349	234	169
CFSM	.01	.01	.01	.01	.01	.23	.16	.06	.02	.02	.02	.01
IN.	.01	.01	.01	.01	.01	.26	.18	.06	.02	.03	.02	.01

CAL YR 1988 TOTAL 3427.56 MEAN 9.36 MAX 68 MIN .77 AC-FT 6800 CFSM .04 IN. .54  
WTR YR 1989 TOTAL 4021.5 MEAN 11.0 MAX 279 MIN 1.1 AC-FT 7980 CFSM .05 IN. .63

e Estimated

## 05330000 MINNESOTA RIVER NEAR JORDAN, MN

LOCATION.--Lat 44°41'35", long 93°38'30", in NW¼SW¼ sec.7, T.114 N., R.23 W., Carver County, Hydrologic Unit 07020012, on pier at center downstream side of bridge, 1.5 mi northwest of Jordan, and at mile 39.4 upstream from Mississippi River.

DRAINAGE AREA.--16,200 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1934 to current year. Prior to Oct. 1, 1966, published as "near Carver, Minn".

REVISED RECORDS.--WSP 955: Drainage area. WSP 1508: 1935. WDR MN-87-2: 1976 (cal. yr. summary).

GAGE.--Water-stage recorder. Datum of gage is 690.00 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1966, water-stage recorder 2.8 mi downstream with auxiliary nonrecording gage at present site and present datum.

REMARKS.--Records good.

AVERAGE DISCHARGE.--55 years, 3,731 ft<sup>3</sup>/s, 3.13 in/yr, 2,703,000 acre-ft/yr; median of yearly mean discharges, 3,230 ft<sup>3</sup>/s, 2.71 in/yr, 2,340,000 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 117,000 ft<sup>3</sup>/s, Apr. 11, 1965; maximum gage height, 35.07 ft, Apr. 12, 1965 (backwater from Mississippi River); minimum discharge, 79 ft<sup>3</sup>/s, Nov. 17, 1955; minimum gage height, 2.66 ft, Nov. 22, 1935.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 14,800 ft<sup>3</sup>/s, Mar. 27, gage height, 18.49 ft; minimum discharge, 192 ft<sup>3</sup>/s, Jan. 11; minimum gage height, 3.39 ft, Jan. 11, Feb. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	280	242	301	e215	e305	e275	10300	4990	1520	1210	571	353
2	270	240	366	e210	e300	e275	9880	4880	1460	1180	538	354
3	259	245	421	e210	e305	e265	9730	4480	1470	1110	512	384
4	252	263	432	e205	290	e260	9420	4150	1460	978	505	374
5	244	287	436	e205	e285	e255	8940	4240	1430	866	554	350
6	244	294	424	e205	e280	e250	8340	4000	1380	783	589	353
7	248	298	400	e205	e275	e240	7750	3710	1330	780	480	355
8	250	303	341	e205	e270	e255	7350	3530	1280	866	439	350
9	253	302	292	e205	e270	e275	7030	3590	1260	808	415	348
10	259	303	265	e205	e270	e295	6740	3430	1230	673	391	350
11	257	299	e275	e205	e270	e340	6370	3130	1210	628	372	355
12	254	318	e280	e205	e280	e395	6060	3010	1150	611	358	345
13	252	329	e280	e210	e285	e450	5840	2930	1060	599	351	346
14	251	335	e275	e210	e290	e560	5580	2840	995	560	361	343
15	248	353	e270	e210	e300	e670	5320	2670	895	526	369	329
16	247	392	e265	e215	e300	e900	5100	2590	837	506	346	319
17	242	376	e260	e220	e300	e920	4860	2550	807	511	338	312
18	240	389	e260	e225	e295	e950	4590	2460	766	532	338	300
19	236	382	e260	e235	e295	e980	4210	2420	727	558	321	295
20	246	349	e260	e240	e290	e1000	3870	2440	696	609	337	292
21	263	309	e260	e245	e290	e1500	3620	2350	667	602	328	286
22	252	342	e260	e250	e285	e1900	3450	2170	662	593	442	289
23	259	371	e260	e255	e285	e1940	3300	2040	641	610	366	266
24	250	394	e260	e260	e285	e2140	3130	1940	653	650	325	258
25	245	395	e255	e265	e280	e3240	2970	1840	654	673	303	261
26	241	389	e245	e275	e280	e6280	2830	1760	697	670	304	255
27	253	398	e235	e285	e280	e10000	2800	1670	818	657	301	246
28	253	373	e225	e295	e280	14000	3490	1660	1080	663	307	247
29	245	350	e225	e300	---	13700	4560	1770	1120	714	309	250
30	245	340	e225	e305	---	12500	4810	1720	1110	650	318	243
31	247	---	e220	e310	---	11100	---	1580	---	600	332	---
TOTAL	7785	9960	9033	7290	8020	88110	172240	88540	31065	21976	12120	9408
MEAN	251	332	291	235	286	2842	5741	2856	1035	709	391	314
MAX	280	398	436	310	305	14000	10300	4990	1520	1210	589	384
MIN	236	240	220	205	270	240	2800	1580	641	506	301	243
AC-FT	15440	19760	17920	14460	15910	174800	341600	175600	61620	43590	24040	18660
CFSM	.02	.02	.02	.01	.02	.18	.35	.18	.06	.04	.02	.02
IN.	.02	.02	.02	.02	.02	.20	.40	.20	.07	.05	.03	.02

CAL YR 1988 TOTAL 445061 MEAN 1216 MAX 5530 MIN 220 AC-FT 882800 CFSM .08 IN. 1.02  
WTR YR 1989 TOTAL 465547 MEAN 1275 MAX 14000 MIN 205 AC-FT 923400 CFSM .08 IN. 1.07

e Estimated

## MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1952, 1963-69, 1972 to current year.

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

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (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 WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
JAN 31...	1015	382	1050	1160	7.8	7.8	0.5	4.4	743	10.3	K21	K5
MAR 06...	1225	374	1220	1230	7.8	7.6	0.0	2.5	790	7.9	K5	K5
MAR 22...	1330	242	590	--	8.2	--	1.0	--	--	--	--	--
APR 24...	1310	3120	670	670	8.4	8.7	14.0	28	772	13.2	K24	170
JUL 19...	1330	582	868	--	8.1	--	24.0	--	780	--	--	--
JUL 27...	1515	631	708	733	8.2	7.9	29.5	8.8	781	8.8	--	--

DATE	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)	ALKA-LINITY WAT DIS TOT IT FIELD (MG/L AS CACO3) (39086)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	CAR-BONATE WATER DIS IT FIELD (MG/L AS CO3) (00452)	BICAR-BONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	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)
JAN 31...	120	50	69	5.5	370	356	0	451	200	72	0.3	17
MAR 06...	140	54	74	6.1	356	389	0	434	210	75	0.4	20
MAR 22...	--	--	--	--	--	--	--	--	--	--	--	--
APR 24...	77	34	22	5.7	171	169	18	165	170	19	0.2	8.1
JUL 19...	--	--	--	--	--	--	--	--	--	--	--	--
JUL 27...	59	35	44	6.3	175	174	--	214	140	46	0.3	6.6

DATE	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	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 + 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)
JAN 31...	733	0.01	1.4	0.82	0.81	1.3	0.17	0.10	0.08	75	18
MAR 06...	816	0.01	1.4	0.97	0.95	1.3	0.24	0.13	0.12	66	16
MAR 22...	--	--	2.8	--	--	--	--	--	--	--	--
APR 24...	456	0.02	0.31	0.03	0.02	0.80	0.11	0.03	0.01	132	96
JUL 19...	--	--	<0.10	--	--	--	--	--	--	--	--
JUL 27...	455	<0.01	<0.10	0.03	0.02	1.8	0.16	0.02	0.02	42	100

MINNESOTA RIVER BASIN

05330000 MINNESOTA RIVER NEAR JORDAN, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

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)
JAN 31...	1015	<10	1	90	<0.5	<1.0	1	<3	2	9	<5
MAR 06...	1225	10	2	94	<0.5	<1.0	10	<3	<1	19	<5
APR 24...	1310	10	3	66	<0.5	<1.0	2	<3	3	9	<5
JUL 27...	1515	<10	3	79	<0.5	<1.0	<1	<3	1	6	<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)
JAN 31...	41	370	<0.1	<10	5	<1	<1.0	520	<6	22
MAR 06...	45	350	<0.1	<10	<1	<1	1.0	570	<6	26
APR 24...	30	2	<0.1	<10	5	1	<1.0	290	<6	9
JUL 27...	29	18	<0.1	<10	2	1	<1.0	310	<6	6

RADIOCHEMICAL, ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

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)	URANIUM NATURAL DIS- SOLVED (UG/L AS U) (22703)
APR 24...	1310	7.7	<0.4	12	<0.4	8.4	<0.4	0.07	4.9
JUL 27...	1515	2.2	1.2	13	1.2	10	0.9	0.13	4.4

MISSISSIPPI RIVER MAIN STEM

05331000 MISSISSIPPI RIVER AT ST. PAUL, MN

LOCATION.--Lat 44°56'40", Long 93°05'20", in SE¼NE¼ sec.6, T.28 N., R.22 W., Ramsey County, Hydrologic Unit 07010206, on left bank in St. Paul, 300 ft upstream from Robert Street Bridge, 6 mi downstream from Minnesota River, and at mile 839.3 upstream from Ohio River.

DRAINAGE AREA.--36,800 mi<sup>2</sup>, approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--Water year 1867-69, 1872-92 (annual maximums), March 1892 to current year (prior to 1901, fragmentary during some winters). Records prior to March 1892, published in the 19th Annual Report, Part 4, have been found to be unreliable and should not be used. Monthly discharge only for some periods, published in WSP 1308. Gage-height records (winter records incomplete) collected at same site since 1866 are contained in reports of U.S. Weather Bureau, War Department and Mississippi River Commission.

REVISED RECORDS.--WSP 285: 1892-96. WSP 715: Drainage area. WSP 875: 1938. WSP 895: 1939. WSP 1308: 1867(M). WSP 1508: 1897, 1898(M), 1903(M), 1917-18(M), 1928(M), 1929. WRD MN-74: 1973.

GAGE.--Water-stage recorder. Datum of gage is 683.62 ft above National Geodetic Vertical Datum of 1929. Prior to Mar. 18, 1925, nonrecording gage at several sites within 300 ft of present site at present datum. Mar. 18, 1925, to Mar. 10, 1933, water-stage recorder and Mar. 11, 1933, to Sept. 14, 1939, nonrecording gage, at present site and datum. Since September 1938, auxiliary water-stage recorder 5.6 mi downstream.

REMARKS.--Records good. Slight regulation except during extreme floods by reservoirs on headwaters and by power plants. Beginning July 20, 1938, sewage from Minneapolis and St. Paul, which formerly entered above station, was diverted to a sewage-disposal plant, thence to river below station. Figures of daily discharge do not include this diversion.

COOPERATION.--Records of Mississippi River at Twin City Lock and dam computed and furnished by Ford Motor Co. Diversion through sewage disposal plant furnished by Metropolitan Waste Control Commission.

AVERAGE DISCHARGE (ADJUSTED FOR DIVERSION).--91 years (water years 1895, 1897, 1901-89), 11,150 ft<sup>3</sup>/s, 4.11 in/yr; median of yearly mean discharges, 9,960 ft<sup>3</sup>/s, 3.68 in/yr.

EXTREMES FOR PERIOD OF RECORD (1867-70, 1872-1989).--Maximum discharge, 171,000 ft<sup>3</sup>/s, Apr. 16, 1965, gage height, 26.01 ft, from floodmark. Maximum flood known since at least 1851, that of 1965. Flood of Apr. 11, 1870 reached a stage of 19.4 ft, discharge, 100,000 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD (1897,1917-89).--Minimum daily discharge, 632 ft<sup>3</sup>/s, Aug. 26, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 29,200 ft<sup>3</sup>/s, Apr. 11; minimum daily, 1,640 ft<sup>3</sup>/s, Aug. 20.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5240	3420	3370	3510	3730	3590	21700	21200	12200	7200	3890	2550
2	5540	3330	2850	3530	2530	3780	21900	20900	11600	7170	3770	3160
3	5420	3410	3260	3430	2340	3800	22300	21000	11200	7020	3240	4060
4	5270	3210	4850	3390	3510	3040	23700	20500	10600	7360	3180	3200
5	5670	3520	4210	3440	3630	3800	24400	20400	10200	7470	3090	4460
6	5680	3490	4340	3890	3880	4350	24800	20200	9740	7220	3080	5480
7	4930	3480	4400	3840	4350	4300	26600	18500	8790	6810	2750	5660
8	5140	3300	4330	3480	4240	4480	27200	19100	8380	6810	2420	5100
9	4530	3160	3570	2820	3800	4540	28100	18700	7900	6860	2550	4940
10	4530	3010	3220	3180	3750	4290	28800	19100	7790	5970	2250	5920
11	4360	3130	3230	3000	4260	3890	29200	19000	7200	5970	2410	5680
12	4270	3500	2550	2960	4410	4490	28700	18900	6770	5880	2440	5720
13	3450	3300	3370	3140	4360	4020	28100	18100	6710	5520	2490	5730
14	3710	3600	4420	3420	4250	3960	27700	17200	6980	5230	2510	5190
15	3620	3280	3750	2960	4240	4180	26900	16100	7040	5720	2390	5450
16	4230	3500	1880	3670	4140	4010	25900	15300	6480	4960	2060	5280
17	3330	3790	2610	3280	4130	3800	25900	14100	6410	4730	2080	4630
18	3370	4060	3200	3440	4080	4060	24900	13400	6180	5040	1990	5160
19	3760	3680	3690	3450	3950	4060	23900	12800	6420	4910	1840	5150
20	3230	3530	4260	3660	3560	4000	22500	12600	6730	5180	1640	4850
21	3180	3420	4090	3640	4180	3990	22500	10600	5760	4810	2000	4970
22	3000	3100	3550	3920	4020	4040	22000	10600	6110	4550	2370	4870
23	3900	3080	3990	3640	3780	4640	20700	11000	6770	4840	2200	5070
24	3180	3420	3710	3980	4240	5020	19500	10700	6170	3840	2200	5240
25	4170	3680	3230	3360	4540	5960	19300	10500	6420	4280	2000	5010
26	3800	4040	3150	3360	4360	8120	19500	10800	7920	3880	2200	5100
27	3430	4190	3460	3620	3840	8960	19100	10700	8180	3600	1990	5160
28	3650	5010	3020	3710	4080	16600	18900	11400	8730	4120	2390	5080
29	3160	4400	2840	3750	---	21400	18500	12200	7700	3410	2250	4850
30	3200	3640	3460	3480	---	22000	19800	12400	7840	4020	2350	5260
31	3120	---	3690	4100	---	22200	---	12300	---	3570	2400	---
TOTAL	127070	106680	109550	108050	110180	201370	713000	480300	236920	167750	76420	147980
MEAN	4099	3556	3534	3485	3935	6496	23770	15490	7897	5411	2465	4933
MAX	5680	5010	4850	4100	4540	22200	29200	21200	12200	7470	3890	5920
MIN	3000	3010	1880	2820	2340	3040	18500	10500	5760	3410	1640	2550
AC-FT	252000	211600	217300	214300	218500	399400	1414000	952700	469900	332700	151600	293500
CFSM	.11	.10	.10	.09	.11	.18	.65	.42	.21	.15	.07	.13
IN.	.13	.11	.11	.11	.11	.20	.72	.49	.24	.17	.08	.15
†	329	329	312	313	310	366	343	374	367	364	374	343
MEAN‡	4428	3885	3846	3798	4245	6862	24113	15864	8264	5775	2839	5276
CFSM‡	.12	.11	.10	.10	.12	.19	.66	.43	.22	.16	.08	.14
IN‡	.14	.12	.12	.12	.12	.22	.73	.50	.25	.18	.09	.16

CAL YR 1988 TOTAL 1,789,560 MEAN 4890 MAX 16400 MIN 1060 MEAN‡ 5223 CFSM‡ .14 IN‡ 1.93

WTR YR 1989 TOTAL 2,585,270 MEAN 7083 MAX 29200 MIN 1640 MEAN‡ 7427 CFSM‡ .20 IN‡ 2.74

† Diversion equivalent in cubic feet per second through sewage disposal plant.

‡ Adjusted for diversion.

MISSISSIPPI RIVER BASIN  
05331000 MISSISSIPPI RIVER AT ST. PAUL, MN--Continued

WATER-QUALITY RECORDS

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

PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: October 1956 to current year.

INSTRUMENTATION.--Temperature recorder since October 1956.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum, 31.0°C, July 24-28, 1964, July 31, 1975, July 19, 21, 1977, Aug. 17, 1988; minimum, 0.0°C many days during winter periods.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURES: Maximum 29.0°C, July 5, 11, 12, 27, Aug. 4, 5; minimum, 0.0°C, Feb. 12, 13.

WATER TEMPERATURE, DEGREES CENTIGRADE, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989												
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	17.0	17.0	16.5	4.5	4.5	4.5	1.0	1.0	.5	.5	.5	.5
2	17.5	17.5	16.5	5.0	5.0	4.0	1.0	1.0	.5	1.0	.5	.5
3	17.5	17.5	16.5	5.5	5.5	5.0	2.0	2.0	1.0	1.0	.5	.5
4	16.5	16.5	15.0	5.5	5.5	5.5	2.5	2.5	1.0	1.0	.5	.5
5	15.5	15.5	14.0	5.5	5.5	5.0	2.5	2.5	1.5	1.0	.5	.5
6	14.5	14.5	13.5	5.5	5.5	5.0	3.0	3.0	2.0	.5	.5	.5
7	14.0	14.0	13.0	5.0	5.0	4.5	3.0	3.0	2.0	1.0	.5	.5
8	14.0	14.0	13.5	5.0	5.0	4.0	2.5	2.5	1.5	1.0	.5	1.0
9	14.5	14.5	13.5	5.5	5.5	4.5	1.5	1.0	1.5	1.0	1.0	1.0
10	15.0	15.0	14.5	5.5	5.5	4.5	1.0	.5	1.0	1.0	1.0	1.0
11	15.0	15.0	14.0	6.0	6.0	5.0	1.0	.5	1.0	1.0	.5	.5
12	14.5	14.5	13.5	6.0	6.0	4.5	1.0	.5	1.0	1.0	.5	.5
13	14.0	14.0	13.0	4.5	4.5	4.0	1.0	.5	1.0	.5	.5	.5
14	14.0	14.0	13.0	4.5	4.5	4.0	2.0	1.0	1.5	.5	.5	.5
15	13.5	13.5	12.5	4.5	4.5	4.0	1.5	.5	1.0	.5	.5	.5
16	14.0	14.0	13.0	4.5	4.5	3.5	1.0	.5	1.0	.5	.5	.5
17	14.5	14.5	13.5	4.0	4.0	3.0	1.5	1.0	1.0	1.0	.5	.5
18	14.5	14.5	13.5	3.5	3.5	2.5	1.5	.5	.5	1.0	.5	.5
19	13.5	13.5	13.0	3.0	3.0	2.5	1.5	.5	1.0	1.5	.5	1.0
20	13.0	13.0	12.0	2.5	2.5	1.5	2.5	1.5	1.5	1.0	.5	.5
21	12.5	12.5	11.0	1.5	1.5	1.0	1.5	1.0	1.0	1.0	.5	.5
22	11.5	11.5	10.5	2.0	2.0	1.0	1.5	1.0	1.5	.5	.5	.5
23	10.5	10.5	9.5	2.0	2.0	1.5	2.0	1.0	1.5	1.0	.5	1.0
24	9.5	9.5	9.0	2.5	2.5	2.0	1.5	.5	1.0	1.5	.5	1.0
25	9.5	9.5	8.5	3.5	3.5	2.0	1.0	.5	.5	1.0	.5	.5
26	8.5	8.5	8.0	4.0	4.0	3.5	.5	.5	.5	1.0	.5	.5
27	8.0	8.0	7.0	4.0	4.0	3.5	1.0	.5	.5	1.0	.5	1.0
28	7.0	7.0	6.0	4.0	4.0	2.0	1.0	.5	1.0	1.0	.5	1.0
29	6.0	6.0	5.5	2.0	2.0	1.5	1.0	.5	1.0	1.0	.5	.5
30	5.5	5.5	4.5	1.5	1.5	.5	1.0	.5	.5	1.5	.5	1.0
31	5.0	5.0	4.0	---	---	---	.5	.5	.5	2.0	1.0	1.5
MONTH	17.5	5.0	11.6	6.0	1.5	3.3	3.0	.5	1.0	2.0	.5	.7



## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°51'37", long 93°00'24", in NE¼NE¼ sec.2, T.27 N., R.22 W., Washington County, Hydrologic Unit O7010206, on left bank at the end of Fifth Street, and at mile 830.6 upstream from Ohio River.

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

## PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: December 1978 to current year.

pH: December 1978 to current year.

WATER TEMPERATURES: December 1978 to current year.

DISSOLVED OXYGEN: December 1978 to current year.

INSTRUMENTATION.--Water-quality monitor since December 1978.

REMARKS.--Water is pumped to a monitor that is inside a heated shelter. Extremes are published for those years with 80 percent or more daily record.

COOPERATION.--Water-quality monitor is operated by the Metropolitan Waste Control Commission, St. Paul, Minn.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water year 1981, 1983-89): Maximum, 855 microsiemens July 24, 1988; minimum, 201 microsiemens Mar. 22, 1985.

pH (water year 1981, 1983-89): Maximum, 8.8 units July 16, 1989, minimum, 7.1 units, July 5, 1989.

WATER TEMPERATURES (water year 1981, 1983-89): Maximum, 30.5 °C Aug. 3, 1987; minimum, 0.0 °C on many days during winter period.

DISSOLVED OXYGEN (water year 1981, 1983-85, 88-89): Maximum, 15.7 mg/L Mar. 25, 1981; minimum, 2.6 mg/L June 6, 1988.

## EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 774 microsiemens Feb. 3; minimum, 259 microsiemens Sept. 18.

pH: Maximum, 8.8 units July 16; minimum, 7.1, July 5.

WATER TEMPERATURES: Maximum, 29.0 °C July 6; minimum, 0.5 °C several days during winter.

DISSOLVED OXYGEN; Maximum, 14.8 mg/L Dec. 25; minimum, 4.3 mg/L Aug. 1.

## TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	18.0	18.0	18.5	6.5	6.5	6.5	2.0	2.0	2.0	0.5	0.5	1.0
2	17.5	17.5	18.0	6.5	6.0	6.5	2.0	2.0	2.0	0.5	0.5	0.5
3	17.5	17.0	17.5	6.5	6.0	6.5	2.0	2.0	2.0	0.5	0.5	0.5
4	17.0	16.5	17.5	6.5	6.5	7.0	2.0	2.0	2.0	0.5	0.5	1.0
5	16.0	15.5	17.0	6.5	6.0	7.0	2.0	2.0	2.5	1.0	0.5	1.0
6	15.5	15.0	17.5	6.0	6.0	6.5	2.5	2.0	2.5	1.0	1.0	1.0
7	15.0	15.0	15.0	6.5	6.0	6.5	2.0	1.5	2.5	1.0	0.5	1.0
8	15.0	15.0	15.0	---	---	---	1.5	1.5	2.0	0.5	0.5	0.5
9	15.0	15.0	15.5	---	---	---	1.5	1.0	1.5	0.5	0.5	0.5
10	14.5	14.0	15.0	---	---	---	1.0	1.0	1.0	0.5	0.5	1.0
11	14.0	13.5	15.0	---	---	---	1.0	0.5	1.0	0.5	0.5	1.0
12	14.0	13.5	14.0	---	---	---	1.0	1.0	1.0	0.5	0.5	1.0
13	14.0	13.5	14.0	---	---	---	1.0	1.0	1.0	0.5	0.5	1.0
14	14.0	13.5	14.5	---	---	---	1.0	0.5	1.0	1.0	0.5	1.0
15	14.5	14.0	14.0	5.0	5.0	5.0	0.5	0.5	1.0	1.0	0.5	1.0
16	---	---	---	5.0	4.0	5.0	1.0	0.5	1.0	1.0	0.5	1.0
17	13.5	13.5	13.5	4.0	4.0	4.0	0.5	0.5	1.0	1.0	0.5	1.0
18	13.5	13.5	14.0	4.0	4.0	4.0	1.0	1.0	1.0	1.0	0.5	1.0
19	13.5	13.5	14.0	4.0	4.0	4.0	1.0	1.0	1.0	1.0	0.5	1.0
20	13.5	13.0	13.5	4.0	3.0	4.0	1.0	1.0	1.0	0.5	0.5	1.0
21	13.0	13.0	13.5	3.0	3.0	3.5	1.0	1.0	1.0	1.0	0.5	1.0
22	13.0	12.5	13.0	3.0	3.0	3.5	1.0	1.0	1.0	1.0	1.0	1.0
23	12.0	11.5	12.5	3.5	3.0	3.5	1.0	1.0	1.5	1.0	1.0	1.0
24	10.5	9.5	11.5	4.0	3.5	4.0	1.0	0.5	1.0	1.0	1.0	1.0
25	9.5	9.5	10.0	3.5	3.5	4.0	0.5	0.5	1.0	1.0	1.0	1.5
26	9.5	9.0	9.5	3.5	3.5	4.0	1.0	0.5	1.0	1.0	1.0	1.0
27	9.5	9.0	9.5	4.0	3.5	4.0	1.0	0.5	1.0	1.0	1.0	1.5
28	8.0	7.0	9.0	3.5	3.5	3.5	0.5	0.5	1.0	1.0	1.0	1.5
29	7.0	6.5	7.0	3.5	3.5	3.5	0.5	0.5	1.0	1.0	1.0	1.5
30	6.5	6.5	7.0	2.5	2.0	3.5	1.0	0.5	1.0	1.5	1.0	1.5
31	6.5	6.5	7.0	---	---	---	1.0	0.5	1.0	1.5	1.0	1.5
MONTH	13.0	6.5	18.5	---	---	---	1.0	0.5	2.5	1.0	0.5	1.5



## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued

SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	445	349	506	476	455	496	508	487	524	538	516	561
2	315	300	348	468	408	490	514	485	548	510	501	518
3	407	324	485	422	402	445	514	505	531	526	509	534
4	416	386	441	448	431	534	510	495	531	639	527	720
5	399	375	438	474	442	504	498	486	515	718	694	728
6	404	328	430	432	424	442	509	488	528	684	664	722
7	385	361	403	497	426	649	504	486	519	656	627	676
8	362	344	397	---	---	---	479	452	507	643	622	663
9	351	327	373	508	499	515	501	445	549	675	656	689
10	394	362	425	528	509	549	509	494	531	688	680	702
11	413	376	458	541	515	557	547	517	577	633	566	729
12	417	387	442	529	497	547	536	509	554	562	544	573
13	387	361	404	516	486	535	523	499	542	544	535	552
14	404	365	431	527	490	543	470	457	500	536	518	546
15	403	388	420	511	475	540	451	438	463	539	517	548
16	---	---	---	460	417	502	479	437	510	567	547	590
17	399	350	438	444	418	472	492	483	501	573	551	587
18	489	422	534	470	459	489	539	490	603	535	523	558
19	479	384	547	485	464	498	566	535	611	533	522	557
20	390	353	420	457	445	470	520	500	549	533	519	555
21	431	392	470	471	454	504	521	504	549	567	531	586
22	394	364	415	477	460	494	549	530	554	560	544	577
23	402	362	451	476	463	483	532	517	555	565	551	579
24	389	363	424	496	483	516	565	539	585	580	569	588
25	371	358	408	471	460	482	543	525	553	563	551	584
26	380	361	407	487	475	493	542	527	555	545	539	551
27	384	364	443	491	472	509	520	503	538	551	540	561
28	410	384	463	516	485	543	522	503	534	563	541	596
29	438	413	460	518	492	544	534	494	544	569	560	579
30	427	403	475	498	488	535	556	533	571	559	532	578
31	460	446	479	---	---	---	579	562	593	546	521	560
MONTH	405	300	547	486	402	649	520	437	611	581	501	729
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
	FEBRUARY			MARCH			APRIL			MAY		
1	534	520	547	488	471	519	---	---	---	374	357	388
2	543	527	584	528	511	615	372	362	383	386	372	399
3	641	571	774	531	517	552	382	373	392	383	365	413
4	664	632	772	510	498	528	389	379	400	379	364	395
5	687	632	731	496	486	519	375	341	391	372	362	381
6	591	562	637	534	500	574	371	364	381	360	352	368
7	569	556	613	476	440	511	377	367	382	359	348	366
8	556	545	585	475	424	530	368	361	402	357	342	385
9	556	534	597	521	495	571	363	355	380	345	329	366
10	567	549	626	552	500	590	343	334	359	318	281	363
11	543	532	557	602	581	626	335	327	370	297	288	312
12	---	---	---	613	582	626	343	330	352	304	296	321
13	539	526	554	563	507	609	348	337	392	320	307	340
14	565	535	599	501	481	520	364	355	377	332	321	346
15	588	577	601	489	474	504	374	364	386	390	345	423
16	594	559	616	510	477	543	383	372	395	414	404	431
17	553	522	589	556	535	581	389	382	397	424	409	441
18	581	558	597	543	516	568	383	361	397	456	434	478
19	596	582	609	497	453	525	380	368	391	439	386	493
20	595	575	607	524	441	589	378	319	395	436	403	514
21	549	488	615	556	523	578	374	365	391	457	424	482
22	443	427	487	536	527	559	371	363	382	445	430	473
23	434	416	454	536	521	601	382	372	391	468	427	512
24	476	442	493	513	487	549	393	387	403	439	416	467
25	485	470	513	515	493	579	400	395	419	434	417	466
26	495	468	524	471	450	498	403	379	419	436	425	450
27	525	508	548	435	412	457	357	332	389	421	421	477
28	533	488	580	381	339	439	341	323	369	393	367	431
29	---	---	---	346	341	352	350	335	386	391	379	407
30	---	---	---	363	348	378	358	335	393	381	368	409
31	---	---	---	366	358	379	---	---	---	392	379	422
MONTH	556	416	774	501	339	626	371	319	419	391	281	514

MISSISSIPPI RIVER MAIN STEM  
 05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued  
 SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	384	377	395	436	402	486	600	562	627	---	---	---
2	399	375	420	484	423	539	558	508	593	---	---	---
3	420	399	445	489	456	511	518	483	570	---	---	---
4	420	409	431	462	433	486	552	464	615	---	---	---
5	405	342	446	456	419	490	571	545	587	---	---	---
6	428	379	449	479	452	498	546	538	552	---	---	---
7	433	416	466	475	467	498	539	517	573	---	---	---
8	448	425	470	468	455	482	538	506	571	---	---	---
9	435	388	482	471	444	507	578	571	590	463	446	477
10	415	397	473	447	405	467	593	571	610	444	413	459
11	411	400	425	468	431	495	590	564	617	425	406	441
12	447	407	484	434	401	440	580	565	623	418	389	434
13	458	430	487	458	410	484	607	575	624	331	289	411
14	482	438	510	490	445	526	570	534	612	326	283	368
15	460	422	499	471	445	483	543	514	587	331	291	404
16	452	442	483	429	414	454	516	479	538	300	282	323
17	463	420	487	461	434	475	575	511	605	308	263	398
18	447	433	478	477	434	521	589	557	612	351	259	420
19	488	463	514	408	364	441	594	558	611	363	336	431
20	449	411	469	478	414	513	575	560	622	359	343	401
21	495	457	527	498	462	515	538	502	623	416	372	452
22	509	489	538	465	432	500	548	506	607	437	390	482
23	454	422	490	529	494	561	443	420	506	434	400	492
24	465	448	481	465	421	525	461	421	541	431	413	460
25	438	429	448	498	420	531	528	490	570	405	375	454
26	409	369	434	493	431	547	523	470	572	419	387	448
27	340	313	387	531	495	569	467	454	493	395	368	448
28	390	350	438	572	527	600	473	404	530	386	370	397
29	436	423	468	540	515	562	546	530	561	393	371	415
30	438	421	464	518	483	556	---	---	---	386	362	406
31	---	---	---	525	482	564	---	---	---	---	---	---
MONTH	437	313	538	480	364	600	547	404	627	---	---	---
YEAR	505	259	774									

OXYGEN, DISSOLVED (MG/L), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	7.7	7.5	8.0	10.0	9.8	10.2	12.3	12.1	12.5	13.9	13.6	14.0
2	8.3	8.1	8.5	9.8	---	10.2	12.2	12.0	12.4	14.0	13.9	14.1
3	8.1	7.9	8.4	10.0	9.8	10.2	12.1	11.9	12.3	13.9	13.5	14.0
4	8.3	8.1	8.5	9.8	9.6	9.9	12.1	11.9	12.3	13.5	13.1	14.1
5	8.2	8.0	8.6	9.8	9.7	10.1	12.4	12.0	12.9	13.2	12.7	13.4
6	8.1	8.0	8.4	10.1	10.0	10.2	12.6	12.3	12.8	13.0	12.8	13.2
7	8.3	8.2	8.5	10.0	9.8	10.1	12.4	12.1	12.9	13.1	13.0	13.4
8	8.4	8.1	8.6	---	---	---	12.5	12.3	12.9	13.5	13.4	13.5
9	8.2	8.0	8.3	11.0	11.0	11.0	12.7	12.5	12.9	13.5	13.4	13.6
10	8.1	7.7	8.3	11.0	11.0	11.0	13.2	12.8	13.5	13.4	13.2	13.6
11	8.3	8.1	8.5	11.0	11.0	11.0	13.2	12.8	13.5	12.6	12.0	13.5
12	8.4	8.2	8.6	11.0	11.0	11.0	13.0	12.7	13.3	12.1	12.0	12.2
13	8.5	8.3	8.6	11.0	11.0	11.0	12.9	12.8	13.1	12.0	11.8	12.1
14	8.6	8.3	8.7	11.0	10.0	11.0	13.0	12.6	13.4	12.0	11.8	12.1
15	8.5	8.4	8.6	11.0	11.0	11.0	13.4	13.3	13.6	12.0	11.9	12.1
16	---	---	---	12.0	11.0	12.0	13.3	13.2	13.5	12.0	11.8	12.1
17	8.4	8.1	8.7	12.0	12.0	12.0	13.4	13.3	13.5	12.0	11.9	12.1
18	8.2	8.1	8.5	12.0	12.0	12.0	13.1	12.6	13.5	11.8	11.4	12.1
19	8.1	7.6	8.3	12.0	12.0	12.0	13.7	12.8	14.3	11.6	11.5	11.8
20	8.0	7.9	8.2	12.0	12.0	13.0	14.1	13.9	14.3	11.8	11.7	12.0
21	8.2	8.0	8.4	12.4	11.0	13.0	14.2	14.1	14.3	11.7	11.5	11.9
22	8.5	8.4	8.8	12.1	11.9	12.4	14.0	13.4	14.1	11.5	11.4	11.7
23	9.1	8.8	9.5	11.7	11.4	12.1	13.9	13.7	14.1	11.6	11.5	11.8
24	9.0	8.3	9.7	11.4	11.1	11.6	14.1	13.8	14.6	11.6	11.3	11.8
25	8.8	8.7	9.0	11.2	11.1	11.4	14.5	14.4	14.8	11.7	11.4	12.0
26	8.9	8.4	9.0	11.3	11.1	11.4	14.5	14.3	14.6	12.1	12.0	12.2
27	8.9	8.7	9.1	11.1	10.9	11.3	14.1	13.6	14.7	11.9	11.6	12.1
28	9.3	9.0	9.6	11.5	11.3	11.7	14.0	13.8	14.1	11.8	11.7	11.9
29	9.7	9.6	9.8	11.5	11.4	11.8	13.8	13.2	14.0	11.8	11.7	11.9
30	9.9	9.7	10.1	12.0	11.8	12.3	13.8	13.7	13.8	11.7	11.6	11.7
31	9.9	9.6	10.1	---	---	---	13.9	13.7	14.0	11.7	11.4	12.0
MONTH	8.6	7.5	10.1	11.1	9.6	13.0	13.3	11.9	14.8	12.4	11.3	14.1



## MISSISSIPPI RIVER MAIN STEM

05331545 MISSISSIPPI RIVER AT FIFTH STREET AT NEWPORT, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	8.0	7.9	8.1	8.0	7.9	8.1	7.9	7.8	7.9	7.5	7.5	7.6
2	8.1	8.0	8.1	7.9	---	8.1	7.8	7.7	7.9	7.5	7.5	7.6
3	8.1	8.1	8.2	8.1	8.1	8.1	7.8	7.7	8.0	7.5	7.5	7.6
4	8.2	8.1	8.3	8.1	8.0	8.1	7.9	7.8	8.0	7.5	7.4	7.6
5	8.3	8.2	8.4	8.1	8.1	8.1	7.9	7.8	8.1	7.5	7.4	7.6
6	8.3	8.0	8.4	8.1	8.1	8.2	8.0	7.9	8.1	7.5	7.4	7.5
7	8.3	8.2	8.4	8.1	8.1	8.2	8.0	7.9	8.1	7.5	7.4	7.5
8	8.1	8.1	8.3	---	---	---	7.9	7.8	8.0	7.4	7.4	7.5
9	8.1	8.0	8.2	8.0	8.0	8.0	7.9	7.8	8.0	7.5	7.4	7.5
10	8.1	8.0	8.1	8.0	8.0	8.0	7.8	7.7	8.0	7.5	7.4	7.5
11	8.1	8.0	8.3	8.0	8.0	8.0	8.0	7.9	8.0	7.5	7.5	7.6
12	8.1	8.0	8.1	8.0	8.0	8.0	8.0	7.9	8.1	7.5	7.4	7.6
13	8.0	8.0	8.1	8.0	8.0	8.0	7.9	7.8	8.0	7.6	7.4	7.8
14	8.1	8.0	8.1	8.0	---	8.0	7.8	7.7	7.9	7.7	7.6	7.7
15	8.0	8.0	8.0	8.0	8.0	8.0	7.8	7.7	7.9	7.6	7.6	7.7
16	---	---	---	8.0	8.0	8.0	7.8	7.7	7.9	7.6	7.6	7.7
17	8.0	8.0	8.1	8.0	8.0	8.0	7.7	7.6	7.8	7.7	7.6	7.7
18	8.0	7.9	8.1	8.0	8.0	8.0	7.7	7.6	7.8	7.6	7.6	7.8
19	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.7	7.8	7.7	7.6	7.8
20	8.0	8.0	8.1	8.0	8.0	8.0	7.8	7.7	7.8	7.6	7.6	7.7
21	8.0	7.9	8.0	8.0	---	8.1	7.7	7.7	7.8	7.6	7.5	7.6
22	8.0	8.0	8.1	8.0	7.9	8.1	7.7	7.6	7.8	7.6	7.5	7.8
23	8.1	8.0	8.1	8.0	7.9	8.1	7.7	7.6	7.8	7.7	7.6	7.7
24	8.0	7.9	8.1	8.0	7.9	8.1	7.7	7.6	7.8	7.7	7.6	7.8
25	8.0	8.0	8.0	8.1	8.0	8.2	7.7	7.6	7.8	7.7	7.6	7.8
26	8.0	8.0	8.1	8.1	8.0	8.1	7.7	7.6	7.7	7.7	7.6	7.7
27	8.0	8.0	8.1	8.0	7.9	8.0	7.6	7.6	7.7	7.7	7.6	7.8
28	8.1	8.1	8.1	8.1	8.0	8.2	7.6	7.6	7.7	7.7	7.6	7.8
29	8.1	8.1	8.1	8.0	7.9	8.1	7.6	7.4	7.7	7.7	7.6	7.8
30	8.1	8.1	8.1	7.9	7.8	8.0	7.6	7.5	7.6	7.7	7.6	7.8
31	8.1	8.1	8.2	---	---	---	7.6	7.5	7.6	7.7	7.7	7.8
MONTH	8.1	7.9	8.4	8.0	7.8	8.2	7.8	7.4	8.1	7.6	7.4	7.8
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	7.8	7.7	7.9	7.7	7.6	7.8	8.0	8.0	8.1	7.8	7.7	7.9
2	7.8	7.7	7.8	7.7	7.6	7.8	7.5	7.4	7.5	7.7	7.6	7.8
3	7.7	7.6	7.8	7.7	7.6	7.7	7.5	7.4	7.6	7.8	7.7	7.9
4	7.6	7.5	7.7	7.7	7.6	7.7	7.5	7.4	7.6	7.8	7.7	7.9
5	7.6	7.6	7.7	7.6	7.6	7.7	---	---	---	7.8	7.7	7.9
6	7.6	7.5	7.7	7.6	7.6	7.7	7.5	7.4	7.6	7.9	7.8	8.0
7	7.6	7.5	7.7	7.7	7.6	7.7	7.5	7.4	7.6	7.9	7.8	8.1
8	7.6	7.5	7.7	7.6	7.5	7.7	7.5	7.5	7.6	7.9	7.7	8.0
9	7.5	7.4	7.6	7.6	7.5	7.7	7.5	7.5	7.6	7.9	7.7	8.0
10	7.5	7.5	7.6	7.7	7.6	7.8	---	---	---	8.0	7.8	8.2
11	7.5	7.5	7.6	7.7	7.7	7.8	7.6	7.5	7.7	8.1	8.0	8.3
12	---	---	---	7.7	7.6	7.7	7.6	7.5	7.6	8.2	8.0	8.4
13	7.6	7.5	7.6	7.7	7.6	7.7	---	---	---	8.3	8.1	8.4
14	7.6	7.4	7.7	7.6	7.5	7.7	7.6	7.5	7.6	8.3	8.2	8.4
15	7.6	7.5	7.7	7.7	7.6	7.8	7.6	7.5	7.7	8.3	8.1	8.4
16	7.6	7.4	7.7	7.7	7.6	7.8	7.6	7.6	7.7	8.0	7.8	8.2
17	7.6	7.4	7.7	7.7	7.7	7.8	7.7	7.6	7.8	8.0	7.7	8.2
18	7.6	7.6	7.7	7.8	7.7	7.8	7.7	7.6	7.8	8.0	7.9	8.1
19	7.6	7.6	7.7	7.8	7.7	7.8	7.7	7.6	7.9	7.8	7.8	7.9
20	7.6	7.6	7.7	7.8	7.7	7.9	---	---	---	7.8	7.8	7.9
21	7.7	7.6	7.8	7.8	7.7	7.9	7.7	7.6	7.9	7.9	7.8	7.9
22	7.7	7.6	7.8	7.8	7.6	7.8	7.8	7.7	7.9	7.9	7.8	8.0
23	7.7	7.6	7.8	7.7	7.6	7.8	7.8	7.7	8.0	8.0	7.9	8.1
24	7.7	7.6	7.7	7.7	7.6	7.7	7.9	7.7	8.0	8.0	7.9	8.1
25	7.7	7.6	7.7	7.7	7.6	7.8	7.9	7.8	8.0	8.0	7.9	8.0
26	7.7	7.6	7.8	7.6	7.5	7.7	7.8	7.6	7.9	8.0	7.9	8.1
27	7.7	7.7	7.8	7.6	7.5	7.6	7.7	7.6	7.8	8.1	8.0	8.2
28	7.7	7.7	7.8	7.5	7.4	7.5	7.7	7.6	7.8	8.1	8.0	8.3
29	---	---	---	7.4	7.3	7.5	7.6	7.4	7.7	8.1	8.1	8.2
30	---	---	---	7.4	7.3	7.5	7.7	7.6	7.8	8.0	7.9	8.1
31	---	---	---	7.4	7.3	7.5	---	---	---	7.9	7.8	8.0
MONTH	7.6	7.4	7.9	7.7	7.3	7.9	7.7	7.4	8.1	8.0	7.6	8.4



## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°48'13", long 93°00'43", in NW¼NE¼ sec.26, T.27 N., R.22 W., Washington County, Hydrologic Unit 07010206, on left bank at the J. L. Shiely Co. loading dock, and at mile 826.2 upstream from Ohio River.

PERIOD OF RECORD.--February 1977 to current year.

## PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: September 1977 to current year.

pH: September 1977 to current year.

WATER TEMPERATURES: September 1977 to current year.

DISSOLVED OXYGEN: September 1977 to current year.

INSTRUMENTATION.--Water-quality monitor since September 1977.

REMARKS.--Extremes are published for years with 80 percent or more daily record.

COOPERATION.--Samples collected and water-quality monitor operated by the Metropolitan Waste Control Commission, St. Paul, MN.

## EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water year 1981-89): Maximum, 773 microsiemens Feb. 23, 1985; minimum, 243 microsiemens Mar. 19, 1985.

pH (water year 1981, 1984-89): Maximum, 9.0 units Sept. 16, 1989; minimum, 7.0 units Oct. 10, 1983, Aug. 15, 1985.

WATER TEMPERATURES (water year 1981-89): Maximum, 29.0 °C Aug. 7, 1982 and July 10, 12, and 28, 1989; minimum, 0.0 °C several days during winter period.

DISSOLVED OXYGEN (water year 1981-82, 1984-87): Maximum, 16.0 mg/L Jan. 18, 1985; minimum, 1.1 mg/L June 30, 1986.

## EXTREMES FOR CURRENT YEAR.--

SPECIFIC CONDUCTANCE: Maximum, 669 microsiemens Mar. 13; minimum, 294 microsiemens May 22.

pH: Maximum, 9.0 units Sept. 16; minimum, 7.1 units Oct. 11, Jan. 4, and July 10.

WATER TEMPERATURES: Maximum, 29.0 °C July 10, 12, and 28; minimum, 0.0 °C several days during winter period.

## TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	17.5	17.0	17.5	6.5	6.0	6.5	1.5	1.0	2.0	1.0	0.5	1.0
2	16.5	15.5	17.0	6.0	6.0	6.0	1.5	1.5	1.5	0.5	0.5	1.0
3	15.5	15.0	16.0	6.0	6.0	6.0	1.5	1.5	2.0	0.5	0.5	1.0
4	15.0	14.5	15.5	6.0	6.0	6.5	1.5	1.5	1.5	0.5	0.5	1.0
5	14.5	14.0	15.0	6.5	6.0	6.5	2.0	1.5	2.0	0.5	0.5	1.0
6	14.0	14.0	14.5	5.5	5.5	6.0	2.0	2.0	2.0	0.5	0.5	0.5
7	13.5	13.0	14.0	5.5	5.5	6.0	1.5	1.0	2.0	0.5	0.5	1.0
8	13.0	12.5	13.5	6.5	6.0	6.5	1.0	1.0	1.5	0.0	0.0	0.5
9	13.5	12.5	14.0	---	---	---	0.5	0.5	1.0	0.5	0.0	0.5
10	14.0	13.0	14.5	---	---	---	0.0	0.0	0.5	0.5	0.5	0.5
11	13.5	13.5	14.0	---	---	---	0.0	0.0	0.0	0.5	0.5	0.5
12	13.5	13.5	14.0	---	---	---	0.0	0.0	0.5	0.5	0.5	1.0
13	13.5	13.5	14.0	---	---	---	0.0	0.0	0.5	1.0	0.5	1.0
14	14.0	13.5	14.5	6.0	5.0	6.0	0.5	0.5	1.0	1.0	0.5	1.0
15	14.5	14.0	14.5	5.0	5.0	6.0	0.0	0.0	0.5	1.0	1.0	1.0
16	---	---	---	4.0	4.0	6.0	0.5	0.0	0.5	1.0	0.5	1.0
17	13.5	13.0	14.5	4.0	4.0	4.0	0.5	0.5	0.5	1.0	0.5	1.0
18	13.0	13.0	13.5	4.0	3.0	4.0	0.5	0.5	1.0	1.0	0.5	1.0
19	13.0	12.5	13.5	4.0	4.0	4.0	1.0	0.5	1.0	1.0	0.5	1.0
20	13.0	12.5	13.5	3.0	3.0	4.0	1.0	1.0	1.0	0.5	0.5	1.0
21	12.5	12.0	12.5	3.0	2.0	3.0	1.0	1.0	1.0	0.5	0.0	1.0
22	12.0	11.5	12.0	2.0	2.0	2.5	---	---	---	1.0	1.0	1.5
23	11.0	10.5	11.5	2.5	2.5	3.0	1.5	1.0	1.5	1.5	1.0	1.5
24	9.5	9.0	10.0	3.5	3.0	3.5	1.0	1.0	1.5	1.5	1.0	1.5
25	8.5	8.0	9.0	3.5	3.5	3.5	0.5	0.5	1.0	1.5	1.0	1.5
26	8.0	8.0	8.5	3.5	3.0	3.5	0.5	0.5	0.5	1.0	1.0	1.0
27	8.5	8.0	8.5	3.5	3.0	4.0	0.5	0.5	0.5	1.0	1.0	1.5
28	7.5	7.0	8.0	2.5	2.5	3.5	0.5	0.5	0.5	1.5	1.0	1.5
29	6.5	6.0	7.0	2.5	2.5	2.5	0.5	0.5	1.0	1.5	1.5	1.5
30	5.5	5.5	6.0	2.5	2.0	2.5	1.0	0.5	1.0	1.5	1.0	1.5
31	6.0	5.5	6.5	---	---	---	1.0	1.0	1.0	1.0	1.0	1.5
MONTH	12.0	5.5	17.5	4.5	2.0	6.5	1.0	0.0	2.0	1.0	0.0	1.5



## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN.--Continued

SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 SEPTEMBER 1989

DAY	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	515	475	560	484	456	497	490	476	503	565	543	588
2	421	389	485	485	470	511	492	484	499	542	525	561
3	397	384	414	463	430	487	482	476	489	527	519	542
4	413	406	425	450	440	458	475	470	482	538	532	543
5	409	399	417	456	438	477	500	467	521	599	513	651
6	410	400	426	452	435	475	516	508	522	637	628	649
7	395	378	405	461	425	491	516	508	523	640	632	657
8	396	386	403	471	465	500	506	493	536	626	621	635
9	405	393	426	---	---	---	510	488	525	636	626	645
10	417	403	433	---	---	---	498	488	504	646	634	650
11	412	306	428	---	---	---	503	491	520	595	559	653
12	392	384	412	---	---	---	533	506	551	571	550	579
13	390	377	405	---	---	---	549	525	558	543	526	565
14	390	379	404	495	484	503	553	546	563	528	521	533
15	400	391	411	487	468	497	555	537	568	519	513	526
16	---	---	---	483	472	502	539	530	558	528	523	535
17	369	353	384	483	471	502	536	523	543	535	524	539
18	393	333	411	489	466	496	527	515	537	530	518	541
19	417	410	434	500	481	508	554	521	575	529	511	541
20	424	394	444	494	484	506	547	531	565	543	537	550
21	411	396	423	487	481	493	527	525	531	539	533	551
22	418	399	435	470	448	487	---	---	---	539	531	551
23	393	380	419	470	463	484	527	526	533	536	532	539
24	407	389	438	468	458	479	525	520	537	532	529	535
25	402	389	435	475	468	485	536	524	543	534	528	536
26	420	388	458	457	444	471	528	522	541	528	519	531
27	432	426	447	469	457	476	515	505	524	526	523	533
28	439	419	460	487	454	525	515	511	519	522	518	525
29	461	446	473	511	497	525	520	507	551	535	524	539
30	445	419	469	488	481	498	540	536	551	550	536	559
31	462	446	478	---	---	---	555	540	567	550	526	560
MONTH	415	306	560	477	425	525	522	467	575	557	511	657
DAY	FEBRUARY			MARCH			APRIL			MAY		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	533	523	548	493	478	505	---	---	---	361	336	377
2	532	527	535	487	475	496	338	337	340	377	362	383
3	540	534	555	503	495	510	345	337	354	384	381	388
4	554	550	559	502	495	507	345	337	354	388	376	390
5	568	556	580	495	490	501	345	339	356	388	384	391
6	568	494	586	502	489	528	356	350	364	382	380	384
7	537	525	546	519	507	528	363	343	367	383	380	386
8	536	530	541	499	482	515	356	348	368	353	332	386
9	531	527	534	493	474	502	347	343	352	330	318	341
10	540	532	545	524	495	548	338	332	344	351	332	365
11	548	541	551	579	534	606	330	322	337	367	344	371
12	---	---	---	623	594	653	333	308	342	372	370	376
13	545	536	556	641	614	669	337	330	345	377	373	380
14	549	536	552	622	605	650	341	329	351	384	377	389
15	554	546	573	614	607	628	348	337	358	392	389	396
16	551	541	558	616	607	624	361	349	370	392	368	396
17	543	531	553	624	616	633	366	359	372	396	392	404
18	532	528	534	630	620	640	362	343	370	406	400	413
19	538	533	541	603	596	625	359	350	369	404	393	414
20	545	540	549	546	513	596	365	354	386	401	396	405
21	502	477	546	530	493	542	374	368	382	413	402	422
22	482	475	489	530	516	545	363	342	380	413	294	424
23	480	476	486	517	512	529	344	331	367	416	389	422
24	481	478	484	499	478	511	331	327	336	415	412	419
25	477	471	482	499	491	505	331	317	339	414	398	422
26	477	471	484	481	466	493	322	301	333	413	406	420
27	496	484	503	443	414	469	329	310	342	409	405	413
28	506	500	508	390	365	418	335	326	341	402	392	409
29	---	---	---	344	328	369	334	330	340	395	392	399
30	---	---	---	332	318	335	337	333	341	---	---	---
31	---	---	---	335	332	339	---	---	---	---	---	---
MONTH	528	471	586	517	318	669	346	301	386	389	294	424

MISSISSIPPI RIVER MAIN STEM  
05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN.--Continued  
SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 SEPTEMBER 1989

DAY	JUNE			JULY			AUGUST			SEPTEMBER		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	---	---	---	---	---	---	543	505	561	484	478	489
2	398	397	400	---	---	---	568	557	581	449	431	477
3	402	398	407	---	---	---	570	558	575	427	422	434
4	403	399	409	---	---	---	572	502	578	443	435	448
5	398	393	404	438	411	443	581	571	587	452	423	476
6	407	379	414	438	405	450	575	568	581	463	454	472
7	418	404	428	---	---	---	525	498	568	457	433	462
8	425	416	429	---	---	---	504	495	518	459	456	461
9	427	397	434	441	439	443	510	501	516	460	457	462
10	427	423	430	435	400	441	521	516	526	454	451	459
11	427	423	431	441	400	451	529	519	538	429	417	453
12	431	420	440	434	428	443	532	521	539	413	387	420
13	437	405	440	423	366	437	523	510	525	409	400	414
14	450	428	461	441	434	455	520	500	546	412	393	415
15	449	420	462	446	440	460	518	501	533	415	412	418
16	435	426	445	435	422	443	517	509	527	411	406	414
17	434	430	441	430	420	445	509	503	515	409	404	414
18	435	430	440	445	414	453	522	479	534	406	400	416
19	490	437	524	431	410	446	535	533	538	407	386	418
20	512	489	523	417	360	438	541	531	552	418	391	434
21	512	503	520	439	432	442	531	513	550	438	401	450
22	523	518	528	443	440	446	514	489	525	441	433	452
23	520	512	531	455	443	466	522	496	536	428	423	435
24	517	510	524	468	461	474	482	454	494	427	417	437
25	512	507	520	469	463	476	452	436	479	394	374	417
26	---	---	---	504	476	524	437	434	445	384	370	393
27	---	---	---	518	511	525	443	438	450	392	382	403
28	---	---	---	527	516	538	465	449	480	392	374	395
29	---	---	---	531	521	543	467	443	478	394	389	398
30	---	---	---	523	517	530	493	477	505	398	394	402
31	---	---	---	527	501	539	484	471	494	---	---	---
MONTH	---	---	---	---	---	---	516	434	487	426	370	489
YEAR	467	294	669									

OXYGEN, DISSOLVED (MG/L), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	6.5	5.6	6.8	10.2	9.9	10.7	12.3	12.3	12.4	13.6	13.3	13.7
2	6.3	5.8	6.5	10.0	9.7	10.2	12.4	12.3	12.5	13.6	13.5	13.7
3	6.9	5.5	7.8	9.7	9.6	9.9	12.4	12.4	12.5	13.6	13.4	13.7
4	6.9	6.0	7.2	9.4	9.1	9.8	12.4	12.3	12.4	13.6	13.4	13.8
5	7.5	6.4	8.2	8.7	8.4	9.1	12.7	12.3	13.0	13.5	12.9	13.8
6	7.6	7.0	7.9	8.1	7.7	8.5	12.9	12.9	13.0	13.8	13.6	14.0
7	8.0	7.0	8.8	9.1	7.4	10.7	12.9	12.9	13.0	14.2	14.0	14.5
8	7.8	6.8	8.3	9.3	8.7	9.6	13.0	12.9	13.1	14.6	14.5	14.7
9	7.1	6.7	7.5	---	---	---	12.9	12.9	13.0	13.8	13.0	14.8
10	8.0	6.4	9.0	---	---	---	12.8	12.8	12.9	12.9	12.8	13.0
11	10.3	8.1	12.3	---	---	---	12.8	12.8	12.9	12.6	12.5	12.8
12	9.6	7.7	12.2	---	---	---	13.0	12.9	13.0	12.9	12.4	13.6
13	7.3	6.5	7.7	---	---	---	13.1	13.0	13.1	13.2	12.4	13.9
14	6.6	6.3	7.0	11.0	10.0	14.0	12.9	12.8	13.0	12.3	12.0	12.8
15	6.0	5.6	6.4	9.0	8.0	11.0	12.8	12.8	12.9	11.9	11.8	12.0
16	---	---	---	10.0	8.0	11.0	12.6	12.3	13.1	11.8	11.7	12.0
17	6.8	4.4	8.1	10.0	9.0	10.0	12.2	12.0	12.3	11.7	11.6	11.7
18	7.1	6.6	7.6	10.0	9.0	11.0	11.9	11.8	12.0	11.6	11.5	11.7
19	6.3	5.9	6.7	10.0	10.0	10.0	13.1	11.8	13.8	11.7	11.5	11.8
20	6.7	5.6	7.9	9.0	9.0	10.0	13.7	13.6	13.8	11.9	11.8	11.9
21	6.6	6.2	7.0	10.8	9.2	11.8	13.8	13.6	14.1	11.8	11.7	11.9
22	---	---	---	11.7	11.5	12.0	---	---	---	11.9	11.8	12.1
23	---	---	---	12.1	12.0	12.2	13.9	13.9	14.0	11.8	11.8	11.9
24	7.0	4.6	8.4	12.3	12.1	12.4	13.9	13.8	14.0	11.8	11.7	11.9
25	8.5	8.2	8.8	12.4	12.3	12.4	13.8	13.8	13.9	11.8	11.7	11.9
26	8.4	8.2	8.6	12.4	12.3	12.5	13.8	13.7	13.8	11.8	11.7	11.9
27	8.0	7.7	8.4	12.6	12.4	12.7	13.7	13.6	13.8	11.8	11.7	11.9
28	8.7	7.8	9.3	12.3	12.1	12.7	13.8	13.7	13.9	11.7	11.7	11.8
29	9.7	8.9	10.1	12.2	12.1	12.3	13.9	13.8	14.0	11.7	11.7	11.7
30	9.5	9.2	9.8	12.2	12.2	12.3	13.6	13.6	13.7	11.9	11.9	12.0
31	9.8	9.0	10.4	---	---	---	13.6	13.4	13.7	11.9	11.8	11.9
MONTH	7.7	4.4	12.3	10.6	7.4	14.0	13.1	11.8	14.1	12.5	11.5	14.8



## MISSISSIPPI RIVER MAIN STEM

05331560 MISSISSIPPI RIVER AT GREY CLOUD ISLAND NEAR COTTAGE GROVE, MN.--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	8.1	8.0	8.1	8.2	8.1	8.2	8.0	8.0	8.1	7.3	7.3	7.4
2	8.1	8.1	8.2	8.1	8.0	8.2	8.0	8.0	8.0	7.3	7.2	7.4
3	8.2	7.9	8.3	8.1	8.1	8.1	8.0	7.9	8.0	7.3	7.2	7.4
4	8.3	8.2	8.4	8.1	8.1	8.1	8.0	8.0	8.1	7.3	7.1	7.5
5	8.2	8.1	8.3	8.1	8.1	8.1	8.1	8.0	8.1	7.6	7.2	7.9
6	8.2	8.1	8.3	8.2	8.1	8.2	8.1	8.0	8.1	7.8	7.8	7.9
7	8.2	8.2	8.3	8.2	8.1	8.2	8.1	8.1	8.2	7.8	7.8	7.8
8	8.1	8.0	8.2	8.1	8.1	8.1	8.2	8.1	8.2	7.8	7.8	7.9
9	8.0	7.9	8.1	---	---	---	8.2	8.1	8.2	7.6	7.4	7.9
10	8.0	7.9	8.1	---	---	---	8.2	8.1	8.2	7.5	7.4	7.6
11	8.0	7.1	8.0	---	---	---	8.2	8.2	8.2	7.6	7.6	7.8
12	8.0	7.9	8.0	---	---	---	8.2	8.1	8.2	7.9	7.6	8.1
13	8.0	7.9	8.1	---	---	---	8.2	8.1	8.2	8.0	7.8	8.1
14	8.0	7.9	8.1	8.0	8.0	8.0	8.1	8.0	8.1	7.8	7.7	8.0
15	8.0	7.9	8.0	8.0	8.0	8.0	8.1	7.8	8.1	7.9	7.7	8.0
16	---	---	---	8.0	8.0	8.0	8.0	7.8	8.1	7.8	7.7	8.0
17	7.9	7.8	7.9	8.0	8.0	8.0	7.8	7.8	7.9	7.7	7.6	7.9
18	7.9	7.8	8.0	8.0	8.0	8.0	7.8	7.7	7.9	7.7	7.6	7.8
19	7.9	7.8	8.0	8.0	8.0	8.0	7.9	7.7	8.0	7.7	7.5	7.8
20	7.9	7.9	7.9	8.0	8.0	8.0	7.9	7.8	8.0	7.6	7.4	7.9
21	7.9	7.8	7.9	8.0	8.0	8.0	7.8	7.8	7.9	7.6	7.5	7.8
22	7.8	7.8	7.9	8.3	8.2	8.3	---	---	---	7.7	7.4	7.9
23	7.9	7.9	8.0	8.2	8.2	8.3	7.8	7.7	7.9	7.6	7.4	7.8
24	8.0	8.0	8.1	8.2	8.2	8.3	7.8	7.7	7.9	7.8	7.6	7.9
25	8.0	7.9	8.1	8.3	8.2	8.3	7.7	7.7	7.8	7.7	7.6	7.8
26	8.1	8.0	8.1	8.4	8.3	8.4	7.7	7.6	7.8	7.8	7.7	8.1
27	8.0	8.0	8.1	8.3	8.3	8.4	7.6	7.5	7.7	7.7	7.5	7.8
28	8.1	8.0	8.2	8.2	8.1	8.4	7.7	7.5	7.8	7.6	7.4	7.7
29	8.1	8.0	8.2	8.1	8.1	8.1	7.7	7.6	7.8	7.4	7.3	7.7
30	8.1	8.1	8.2	8.1	8.0	8.1	7.5	7.3	7.7	7.4	7.3	7.6
31	8.1	8.1	8.2	---	---	---	7.3	7.2	7.4	7.4	7.3	7.6
MONTH	8.0	7.1	8.4	8.1	8.0	8.4	7.9	7.2	8.2	7.6	7.1	8.1
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
FEBRUARY				MARCH				APRIL				MAY
1	7.9	7.5	8.1	7.8	7.7	7.9	---	---	---	8.0	7.7	8.3
2	7.9	7.8	8.1	7.8	7.6	7.8	8.0	8.0	8.1	8.0	7.8	8.1
3	8.0	7.9	8.3	7.6	7.6	7.8	8.1	8.0	8.1	8.1	7.7	8.2
4	8.0	7.9	8.2	7.7	7.7	7.8	8.0	8.0	8.1	8.1	7.9	8.1
5	7.9	7.8	8.0	7.8	7.7	7.9	8.0	7.9	8.1	8.1	7.6	8.2
6	7.6	7.2	7.9	7.8	7.7	7.8	8.0	8.0	8.1	8.2	8.2	8.3
7	7.4	7.2	7.5	7.7	7.5	7.8	8.0	7.9	8.1	8.3	8.2	8.4
8	7.6	7.4	7.7	7.8	7.7	7.9	8.0	8.0	8.1	8.2	8.0	8.3
9	7.6	7.4	7.8	7.9	7.2	8.0	8.1	8.0	8.1	8.2	8.0	8.4
10	7.6	7.4	7.7	7.9	7.8	8.0	8.1	8.1	8.2	8.3	8.2	8.4
11	7.7	7.5	7.8	7.8	7.6	7.9	8.1	8.1	8.1	8.4	8.2	8.5
12	---	---	---	7.7	7.5	8.0	8.1	8.0	8.1	8.5	8.4	8.6
13	7.7	7.5	7.9	7.6	7.4	7.7	8.1	8.1	8.1	8.5	8.4	8.6
14	7.8	7.6	7.9	7.7	7.4	7.9	8.1	8.1	8.1	8.5	8.4	8.6
15	7.9	7.6	8.1	8.0	7.9	8.0	8.1	8.1	8.2	8.3	8.2	8.5
16	8.0	7.9	8.2	7.9	7.9	8.0	8.1	8.1	8.2	8.1	7.9	8.2
17	7.9	7.8	8.0	8.0	7.9	8.0	8.1	8.1	8.2	8.1	7.9	8.3
18	8.1	8.0	8.2	8.0	8.0	8.0	8.2	7.9	8.2	8.0	7.9	8.2
19	8.1	8.0	8.2	8.0	8.0	8.0	8.2	8.0	8.3	8.0	7.8	8.2
20	8.1	8.0	8.2	8.1	8.0	8.2	8.3	8.1	8.4	8.2	8.1	8.3
21	7.8	7.5	8.2	8.2	8.2	8.3	8.3	8.1	8.4	8.2	8.1	8.3
22	7.8	7.7	7.9	8.2	8.1	8.3	8.3	8.2	8.4	8.3	8.2	8.4
23	7.9	7.8	7.9	8.1	8.1	8.2	8.3	8.2	8.5	8.3	8.2	8.4
24	7.7	7.5	7.9	8.1	7.8	8.1	8.4	8.3	8.5	8.2	8.1	8.3
25	7.6	7.5	7.7	8.0	8.0	8.1	8.3	8.1	8.4	8.0	7.9	8.1
26	7.7	7.5	7.8	8.0	8.0	8.1	8.1	7.8	8.2	8.1	8.0	8.2
27	7.8	7.6	7.9	8.0	7.9	8.0	8.1	8.0	8.2	8.2	8.1	8.3
28	7.8	7.7	7.9	8.0	7.9	8.0	8.1	8.0	8.2	8.3	8.2	8.4
29	---	---	---	7.9	7.9	8.0	8.1	7.7	8.1	8.2	8.2	8.3
30	---	---	---	8.0	7.8	8.0	8.1	8.1	8.2	---	---	---
31	---	---	---	8.0	8.0	8.0	---	---	---	---	---	---
MONTH	7.8	7.2	8.3	7.9	7.2	8.3	8.1	7.7	8.5	8.2	7.6	8.6



## MISSISSIPPI RIVER MAIN STEM

05331570 MISSISSIPPI RIVER AT NININGER, MN  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

LOCATION.--Lat 44°46'22", long 92°54'07", NE¼NE¼ sec.18, T.115 N., R.17 W., Dakota County, Hydrologic Unit 07010206, on right bank at the end of Jason Avenue, and at mile 817.8 upstream from Ohio River.

DRAINAGE AREA.--37,000 mi<sup>2</sup> (95,000 km<sup>2</sup>), approximately.

PERIOD OF RECORD.--January 1977 to current year.

REMARKS.--Water-discharge computed on the basis of discharge for Mississippi River at St. Paul (station 05331000) adjusted for inflow and travel time. Letter K indicates non-ideal colony count.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND (00060)	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-AIR (DEG C) (00020)	TEMPER-WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)
NOV 22...	1215	3330	530	534	8.3	8.0	1.0	1.0	3.9	771	13.8	1100
FEB 22...	1200	4350	508	524	7.8	8.0	--	0.5	2.5	794	12.5	290
APR 13...	1430	29100	337	357	8.0	8.1	--	5.5	25	767	12.2	K27
AUG 31...	1300	2930	541	578	8.2	8.0	--	22.0	9.1	541	7.1	K19
DATE	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)	ALKA-LINITY WAT DIS TOT IT FIELD (MG/L AS CAC03) (39086)	ALKA-LINITY LAB (MG/L AS CAC03) (90410)	CAR-BONATE WATER DIS IT FIELD (MG/L AS CO3) (00452)	BICAR-BONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	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 22...	47	53	20	35	3.3	220	177	0	260	39	39	0.3
FEB 22...	K20	54	19	27	3.4	190	189	0	232	32	29	0.2
APR 13...	K33	42	14	9.7	4.2	117	115	0	143	43	11	0.1
AUG 31...	K4	53	21	36	4.4	198	175	0	242	46	39	0.3
DATE	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)	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. 75 MICRONS (MG/L) (70331)
NOV 22...	7.1	310	0.06	1.3	0.41	0.41	1.6	0.34	0.28	0.25	8	98
FEB 22...	12	307	0.07	1.6	0.61	0.58	1.2	0.29	0.26	0.20	3	--
APR 13...	11	230	0.03	1.4	0.37	0.37	1.3	0.29	0.13	0.10	69	99
AUG 31...	11	339	0.12	1.4	0.21	0.27	1.9	0.43	0.30	0.29	31	100

## MISSISSIPPI RIVER MAIN STEM

05331570 MISSISSIPPI RIVER AT NININGER, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

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 22...	1215	<10	1	48	<0.5	<1.0	<1	<3	3	18	<5
FEB 22...	1200	<10	1	55	<0.5	<1.0	1	<3	3	23	<5
APR 13...	1430	40	1	55	<0.5	<1.0	1	<3	2	140	<5
AUG 31...	1300	<10	1	61	<0.5	<1.0	2	<3	3	6	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 22...	10	3	<0.1	<10	6	<1	<1.0	140	<6	13
FEB 22...	12	66	<0.1	<10	3	<1	<1.0	130	<6	11
APR 13...	8	31	<0.1	<10	3	<1	<1.0	110	<6	10
AUG 31...	13	5	0.1	10	3	<1	<1.0	150	<6	11

## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN

LOCATION.--Lat 44°45'37", Long 92°52'02", in SE¼SW¼ sec.16, T.115 N., R.17 W., Dakota County, Hydrologic unit 07010206, in old lock house at lock and dam and at mile 815.2 upstream from Ohio River.

PERIOD OF RECORD.--Water years 1975 to current year.

PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE: October 1974 to current year.

pH: October 1974 to current year.

WATER TEMPERATURES: October 1974 to current year.

DISSOLVED OXYGEN: October 1974 to current year.

INSTRUMENTATION.--Water-quality monitor since October 1974.

REMARKS.--Extremes are published for those years with 80 percent or more daily record.

COOPERATION.--Water-quality monitor operated by the Metropolitan Waste Control Commission, St. Paul, MN.

EXTREMES FOR PERIOD OF DAILY RECORD.--

SPECIFIC CONDUCTANCE (water years 1980, 1982, 1987-88): Maximum, 799 microsiemens June 27, July 6, 20, 1980; minimum, (more than 20 percent missing record), 268 microsiemens Sep. 20, 1986.

pH (water years 1980, 1982, 1987-88): Maximum, 9.5 units June 13, 1988; minimum, 6.7 units Jan. 23, 27, 1982, June 22, 1988.

WATER TEMPERATURES (water years 1980, 1983-84, 1987-89): Maximum, 32.5 °C July 10, 1980; minimum, 0.0 °C several days during winter period.

DISSOLVED OXYGEN (water years 1980, 1982, 1987-88): Maximum, 19.2 mg/L Oct. 16, 1979; minimum, 1.7 mg/L June 4, 1980.

EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURES: Maximum, 29 °C, July 6, 7, 10, 11, 16; minimum, 0 °C several days during winter.

## TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	18.0	17.5	18.0	5.0	4.5	5.5	0.5	0.5	0.5	---	---	---
2	17.5	17.5	17.5	5.0	5.0	5.0	1.0	0.5	1.0	---	---	---
3	17.0	16.5	17.5	5.0	5.0	5.0	1.0	1.0	1.0	---	---	---
4	14.5	13.5	16.5	5.0	5.0	5.5	1.0	1.0	1.0	---	---	---
5	13.5	13.0	18.0	5.0	4.5	5.5	1.0	1.0	1.0	---	---	---
6	13.5	13.0	14.0	4.5	4.5	4.5	1.0	0.5	1.0	---	---	---
7	13.5	13.5	13.5	4.5	4.5	4.5	0.5	0.5	1.0	---	---	---
8	13.5	13.5	14.5	4.5	4.5	5.0	0.5	0.5	0.5	---	---	---
9	14.0	13.5	14.0	5.0	4.5	5.0	0.5	0.0	0.5	---	---	---
10	13.5	13.5	14.0	5.0	4.5	5.0	0.5	0.0	0.5	---	---	---
11	13.0	12.5	13.5	4.5	4.5	5.0	0.5	0.5	0.5	---	---	---
12	12.5	12.5	13.0	4.5	4.5	4.5	0.5	0.5	0.5	---	---	---
13	12.0	12.0	12.5	4.5	4.5	4.5	0.5	0.5	0.5	---	---	---
14	12.5	12.0	13.0	4.5	4.0	4.5	0.5	0.5	0.5	---	---	---
15	12.5	12.5	13.0	4.0	4.0	4.5	0.5	0.5	0.5	---	---	---
16	---	---	---	---	---	---	0.5	0.5	0.5	---	---	---
17	13.0	12.5	13.5	---	---	---	0.5	0.0	0.5	---	---	---
18	12.5	12.5	13.5	---	---	---	0.5	0.5	0.5	---	---	---
19	12.0	12.0	12.5	---	---	---	0.5	0.0	0.5	---	---	---
20	12.0	11.5	12.0	---	---	---	0.5	0.0	0.5	---	---	---
21	11.5	11.5	12.0	---	---	---	0.0	0.0	0.5	---	---	---
22	11.5	11.5	11.5	1.5	0.5	3.0	0.5	0.0	0.5	---	---	---
23	11.5	11.0	11.5	1.0	0.5	2.5	0.0	0.0	0.5	---	---	---
24	10.5	10.5	11.0	1.0	1.0	1.0	0.5	0.0	0.5	---	---	---
25	7.0	5.5	11.5	1.5	1.0	1.5	0.5	0.5	0.5	---	---	---
26	5.5	5.0	6.0	1.5	1.0	1.5	0.5	0.5	0.5	---	---	---
27	5.5	5.5	6.0	1.0	1.0	1.5	0.5	0.0	0.5	---	---	---
28	5.0	5.0	5.5	0.5	0.5	1.0	0.5	0.0	0.5	---	---	---
29	4.5	4.5	5.0	0.5	0.5	0.5	0.0	0.0	0.0	---	---	---
30	4.5	4.5	5.0	0.5	0.5	0.5	0.0	0.0	0.0	---	---	---
31	5.0	4.5	5.5	---	---	---	0.0	0.0	0.0	---	---	---
MONTH	11.5	4.5	18.0	---	---	---	0.5	0.0	1.0	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN.--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	FEBRUARY			MARCH			APRIL			MAY		
				MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	---	---	---	1.0	1.0	1.0	---	---	---	12.0	12.0	12.0			
2	---	---	---	1.0	1.0	1.0	3.5	3.5	3.5	11.0	10.0	12.0			
3	---	---	---	1.0	1.0	1.0	3.5	3.5	4.0	11.0	10.5	11.0			
4	---	---	---	1.0	1.0	1.0	4.0	4.0	4.0	11.0	10.5	11.0			
5	---	---	---	1.0	1.0	1.0	4.0	4.0	4.0	10.5	10.0	10.5			
6	---	---	---	1.0	1.0	1.0	4.0	4.0	4.5	10.0	9.5	10.0			
7	---	---	---	1.0	1.0	1.0	4.5	4.5	4.5	10.5	9.5	11.0			
8	---	---	---	1.0	1.0	1.0	4.5	4.5	4.5	10.5	10.5	11.0			
9	---	---	---	1.0	1.0	1.0	4.0	4.0	4.5	10.5	10.0	11.5			
10	---	---	---	1.0	1.0	1.0	3.5	3.5	4.0	11.5	11.0	12.0			
11	---	---	---	1.0	1.0	1.0	3.5	3.5	4.0	11.5	11.5	12.0			
12	---	---	---	1.0	1.0	1.0	4.0	3.5	4.5	12.5	12.0	13.0			
13	---	---	---	1.0	1.0	1.0	4.5	4.0	4.5	12.5	12.5	13.0			
14	---	---	---	1.0	1.0	1.0	4.5	4.5	5.0	13.0	13.0	13.5			
15	---	---	---	1.0	1.0	1.0	5.0	5.0	5.5	13.5	13.0	14.0			
16	---	---	---	0.5	0.0	1.5	5.5	5.0	5.5	17.0	13.5	19.0			
17	---	---	---	---	---	---	6.0	5.5	6.0	18.5	18.5	19.0			
18	---	---	---	---	---	---	6.0	5.5	6.0	---	---	---			
19	---	---	---	---	---	---	6.5	5.5	7.0	---	---	---			
20	---	---	---	---	---	---	7.0	7.0	7.5	---	---	---			
21	---	---	---	---	---	---	7.5	7.0	8.0	---	---	---			
22	---	---	---	---	---	---	8.0	7.5	8.0	---	---	---			
23	---	---	---	---	---	---	8.0	8.0	8.5	---	---	---			
24	---	---	---	1.5	1.5	1.5	8.0	8.0	8.5	19.0	19.0	19.5			
25	---	---	---	1.5	1.5	1.5	---	---	---	19.0	18.5	19.0			
26	---	---	---	1.5	1.5	2.0	---	---	---	18.0	17.5	18.5			
27	---	---	---	2.0	1.5	2.0	13.5	13.0	13.5	18.0	17.5	19.0			
28	---	---	---	3.0	1.5	3.5	13.5	13.0	13.5	18.0	18.0	18.5			
29	---	---	---	3.0	3.0	3.5	13.0	12.5	13.5	18.0	17.5	18.5			
30	---	---	---	3.0	3.0	3.5	12.0	12.0	12.5	17.5	14.5	17.5			
31	---	---	---	3.5	3.0	3.5	---	---	---	17.0	17.0	17.5			
MONTH	---	---	---	---	---	---	6.5	3.5	13.5	---	---	---			
DAY	MEAN	MIN	MAX	JUNE			JULY			AUGUST			SEPTEMBER		
1	17.5	17.5	18.0	23.0	23.0	24.0	27.0	26.5	27.5	22.5	22.5	22.5			
2	18.0	17.5	18.0	24.0	23.5	24.5	27.0	26.5	27.5	22.5	22.5	23.0			
3	18.0	18.0	18.5	24.5	24.0	25.0	27.0	27.0	27.5	22.5	22.5	23.0			
4	18.5	18.0	19.0	24.5	24.0	25.5	27.5	27.0	27.5	22.5	22.5	22.5			
5	18.5	18.5	19.0	24.5	24.0	25.5	27.0	26.5	27.5	22.5	22.5	23.0			
6	20.0	18.5	22.5	27.0	24.5	29.0	26.0	25.5	26.5	22.5	22.0	23.0			
7	21.0	20.5	21.5	28.5	28.0	29.0	25.5	25.0	25.5	22.5	22.0	22.5			
8	20.5	20.0	21.0	28.0	28.0	28.5	24.0	23.0	25.5	22.0	22.0	22.5			
9	19.5	19.5	20.0	28.0	28.0	28.5	23.5	23.0	24.0	22.0	21.5	22.0			
10	20.0	19.5	21.0	28.5	28.5	29.0	24.0	23.5	24.0	21.5	21.0	21.5			
11	20.5	20.0	20.5	28.5	28.0	29.0	24.0	24.0	24.5	21.0	21.0	21.5			
12	20.5	20.5	20.5	28.0	27.5	28.5	24.0	24.0	24.0	19.0	17.5	21.0			
13	20.0	20.0	20.5	28.0	27.0	28.5	24.0	23.5	24.0	17.5	17.5	18.5			
14	19.5	19.5	20.0	28.0	27.5	28.5	24.0	23.5	24.0	18.0	17.5	18.0			
15	19.5	19.0	20.0	28.0	27.5	28.5	23.5	22.5	24.0	18.0	17.5	18.0			
16	20.0	19.5	21.0	28.5	28.0	29.0	23.5	23.5	23.5	18.0	17.5	18.0			
17	20.5	20.5	21.5	28.0	28.0	28.5	23.5	23.5	24.0	18.0	18.0	18.5			
18	21.0	20.5	21.5	27.0	26.5	28.0	23.5	23.5	24.0	18.0	18.0	18.5			
19	21.0	21.0	22.0	26.0	26.0	26.5	23.5	23.0	23.5	19.0	18.5	19.5			
20	22.0	21.0	22.5	26.0	25.5	26.5	23.0	23.0	23.5	19.5	19.5	19.5			
21	22.0	22.0	22.5	26.0	26.0	26.5	23.0	23.0	23.5	19.5	19.5	19.5			
22	22.0	22.0	22.5	26.5	26.5	27.0	23.5	23.0	24.5	19.5	18.5	19.5			
23	22.5	22.0	23.0	26.5	26.5	27.0	23.5	23.5	24.0	18.5	18.0	18.5			
24	23.0	22.5	23.0	27.0	26.5	27.0	23.5	23.5	23.5	17.5	17.5	18.0			
25	23.0	22.5	23.0	27.0	27.0	27.5	23.5	23.0	23.5	17.5	17.5	18.0			
26	22.5	22.5	23.0	27.0	27.0	27.5	23.5	23.0	23.5	17.0	16.5	17.5			
27	22.5	20.0	23.5	27.5	27.0	27.5	23.5	23.5	24.0	16.5	16.5	17.0			
28	23.0	23.0	23.5	27.0	26.5	27.0	23.5	23.0	23.5	16.5	16.5	17.0			
29	23.0	23.0	23.5	26.5	26.0	27.0	23.5	23.0	23.5	17.0	16.5	17.5			
30	---	---	---	26.0	26.0	26.0	23.0	23.0	23.0	17.0	17.0	17.0			
31	---	---	---	26.0	26.0	26.5	22.5	22.5	23.0	---	---	---			
MONTH	20.5	17.5	23.5	27.0	23.0	29.0	24.0	22.5	27.5	19.5	16.5	23.0			

## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN.--Continued

SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	413	392	439	440	420	456	510	504	521	---	---	---
2	388	375	404	453	450	459	526	492	535	---	---	---
3	240	236	362	455	450	459	534	529	539	---	---	---
4	351	238	426	457	435	465	538	535	543	---	---	---
5	359	305	424	468	464	474	547	542	553	---	---	---
6	362	335	398	469	466	473	543	540	547	---	---	---
7	398	394	402	465	459	469	534	523	560	---	---	---
8	395	392	399	459	457	466	522	520	526	---	---	---
9	391	344	395	465	459	474	526	521	531	---	---	---
10	363	339	389	---	---	---	522	518	531	---	---	---
11	372	340	398	463	459	467	529	521	534	---	---	---
12	389	386	393	466	457	472	521	516	526	---	---	---
13	390	386	397	470	462	478	505	496	522	---	---	---
14	397	390	404	478	460	486	497	492	519	---	---	---
15	396	390	402	496	483	515	500	491	518	---	---	---
16	---	---	---	---	---	---	524	517	530	---	---	---
17	401	396	405	---	---	---	528	525	532	---	---	---
18	396	376	416	---	---	---	532	522	538	---	---	---
19	388	385	391	---	---	---	534	491	538	---	---	---
20	381	379	390	---	---	---	519	511	528	---	---	---
21	411	380	441	503	492	582	508	507	515	---	---	---
22	443	427	454	510	506	517	513	508	519	---	---	---
23	456	451	463	517	491	544	505	500	510	---	---	---
24	462	451	473	525	521	531	498	496	501	---	---	---
25	445	433	467	524	520	529	502	499	506	---	---	---
26	435	428	442	514	507	523	506	504	509	---	---	---
27	436	428	444	500	494	512	507	505	515	---	---	---
28	428	425	433	490	486	495	524	514	555	---	---	---
29	429	427	438	500	496	504	525	523	526	---	---	---
30	434	430	442	500	497	505	523	519	526	---	---	---
31	428	421	439	---	---	---	516	514	520	---	---	---
MONTH	399	236	473	483	420	582	520	491	560	---	---	---
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
	FEBRUARY			MARCH			APRIL			MAY		
1	---	---	---	486	467	496	361	353	375	316	312	321
2	---	---	---	499	493	504	300	295	305	352	321	372
3	---	---	---	513	505	519	311	305	318	373	368	380
4	---	---	---	504	499	513	319	317	322	377	374	380
5	---	---	---	507	501	511	367	321	393	372	352	378
6	---	---	---	508	503	516	383	379	388	373	368	377
7	---	---	---	493	477	512	376	372	380	376	372	380
8	---	---	---	477	472	486	372	366	376	376	370	380
9	---	---	---	501	487	506	364	361	369	429	369	473
10	---	---	---	497	491	504	357	354	361	451	447	457
11	---	---	---	481	473	492	354	350	356	451	448	454
12	---	---	---	487	477	502	343	324	354	454	450	456
13	---	---	---	527	502	550	342	338	347	454	452	458
14	---	---	---	553	547	559	336	334	338	458	455	461
15	---	---	---	561	554	566	337	335	340	468	460	477
16	---	---	---	562	550	565	339	335	343	420	387	479
17	---	---	---	---	---	---	346	342	348	388	385	390
18	---	---	---	---	---	---	342	339	347	---	---	---
19	---	---	---	---	---	---	360	320	381	---	---	---
20	---	---	---	---	---	---	382	380	385	---	---	---
21	---	---	---	---	---	---	389	381	397	---	---	---
22	---	---	---	---	---	---	382	377	390	---	---	---
23	---	---	---	---	---	---	376	373	379	---	---	---
24	---	---	---	462	442	470	377	375	380	437	430	442
25	---	---	---	441	427	454	380	378	382	432	427	436
26	---	---	---	423	414	428	330	297	384	427	424	432
27	---	---	---	400	383	418	292	277	297	404	385	428
28	---	---	---	373	355	397	276	274	281	396	394	399
29	---	---	---	327	294	355	273	270	276	396	392	399
30	---	---	---	282	277	293	278	276	289	415	340	434
31	---	---	---	288	277	295	---	---	---	423	418	428
MONTH	---	---	---	---	---	---	345	270	397	---	---	---

## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN.--Continued

SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	JUNE			JULY			AUGUST			SEPTEMBER		
				MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	426	422	428	400	389	409	520	509	529	540	536	549			
2	426	423	429	385	363	415	522	514	526	541	537	545			
3	423	413	427	399	372	416	519	512	522	538	536	540			
4	415	411	417	413	405	425	515	509	521	532	521	538			
5	414	406	418	421	411	426	525	515	547	502	486	521			
6	418	412	428	421	413	426	546	539	548	483	474	494			
7	426	418	433	417	410	425	535	511	549	480	466	488			
8	422	410	438	418	413	421	497	475	536	473	466	477			
9	425	411	444	420	414	425	485	473	489	457	450	463			
10	447	441	452	418	405	425	485	474	490	450	447	455			
11	456	448	463	438	408	457	484	478	490	450	447	455			
12	452	449	457	448	437	452	489	484	493	448	447	450			
13	423	344	454	449	441	461	494	491	496	443	433	449			
14	372	364	381	450	434	458	494	489	500	437	433	441			
15	383	379	387	439	429	443	507	482	515	435	432	437			
16	423	387	457	434	426	448	516	512	520	433	431	436			
17	448	441	454	454	445	464	515	509	521	437	433	441			
18	442	439	445	455	437	462	522	514	532	438	436	439			
19	443	438	447	448	442	455	524	522	525	429	420	436			
20	481	439	506	455	447	463	518	512	528	424	422	428			
21	504	502	509	456	439	462	519	511	525	425	423	427			
22	498	491	504	441	432	447	509	500	518	414	404	425			
23	494	487	500	445	441	449	526	508	534	406	402	409			
24	501	497	503	450	441	462	534	530	536	408	401	414			
25	495	489	501	459	436	463	537	532	543	412	409	415			
26	489	484	494	473	461	486	540	526	545	415	410	421			
27	446	413	486	489	475	497	534	524	538	408	403	413			
28	409	387	426	502	487	511	527	519	536	396	391	404			
29	395	393	400	511	502	526	526	489	542	394	389	398			
30	---	---	---	508	502	523	539	526	551	396	394	401			
31	---	---	---	516	505	527	547	542	551	---	---	---			
MONTH	441	344	509	446	363	527	518	473	551	448	389	549			

OXYGEN, DISSOLVED (MG/L), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
				MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	8.7	8.0	9.7	11.8	11.1	12.6	13.4	13.0	14.2	---	---	---			
2	8.1	7.1	9.6	11.8	11.4	12.2	13.6	12.2	14.8	---	---	---			
3	9.1	8.0	10.4	12.0	11.5	13.1	14.1	13.6	14.8	---	---	---			
4	10.0	8.8	11.6	12.5	11.6	13.5	14.1	13.6	14.9	---	---	---			
5	10.9	8.8	12.6	11.6	11.4	11.8	14.5	13.9	15.0	---	---	---			
6	11.5	9.9	14.2	11.7	11.3	12.2	14.0	13.2	14.8	---	---	---			
7	11.4	10.9	12.1	12.2	11.6	12.9	13.5	13.1	14.0	---	---	---			
8	11.2	10.1	13.2	12.7	12.3	13.1	13.4	13.1	13.8	---	---	---			
9	11.4	10.6	13.0	12.3	11.9	12.9	13.7	13.2	14.0	---	---	---			
10	9.9	9.2	11.3	11.7	9.7	12.7	14.4	13.6	15.1	---	---	---			
11	9.4	8.4	11.9	11.6	11.4	11.9	15.2	14.5	15.7	---	---	---			
12	9.8	8.6	12.5	11.6	11.4	12.6	15.1	14.9	15.6	---	---	---			
13	9.7	9.1	10.6	12.0	11.6	12.7	14.0	13.0	15.2	---	---	---			
14	9.6	8.9	10.8	12.2	11.6	12.8	13.5	13.2	14.2	---	---	---			
15	9.8	9.4	10.4	12.0	11.5	12.4	14.3	13.5	15.3	---	---	---			
16	---	---	---	---	---	---	14.8	14.3	15.2	---	---	---			
17	7.5	7.0	8.2	---	---	---	14.8	14.2	15.1	---	---	---			
18	8.7	6.6	10.6	---	---	---	14.4	13.9	15.1	---	---	---			
19	10.1	9.5	11.4	---	---	---	15.2	13.8	15.6	---	---	---			
20	9.9	9.5	11.0	---	---	---	14.8	14.0	15.4	---	---	---			
21	9.2	8.3	9.8	---	---	---	14.3	13.7	14.8	---	---	---			
22	8.8	8.4	9.2	12.8	12.4	13.4	14.1	13.8	14.6	---	---	---			
23	9.2	9.0	9.7	12.9	11.9	13.3	13.5	13.0	14.0	---	---	---			
24	10.0	9.6	10.7	12.9	12.6	13.0	13.4	13.2	13.8	---	---	---			
25	10.7	9.6	11.6	13.1	12.8	13.7	13.4	13.1	13.7	---	---	---			
26	11.0	10.5	11.6	13.2	12.8	13.7	13.3	12.9	13.9	---	---	---			
27	11.1	10.8	11.7	12.4	12.1	12.9	12.8	12.5	13.1	---	---	---			
28	11.4	10.9	11.9	12.5	12.2	13.3	13.4	12.5	14.2	---	---	---			
29	11.8	11.4	12.5	13.3	13.0	13.6	13.1	12.9	13.5	---	---	---			
30	11.7	11.6	12.0	13.3	12.9	13.8	12.9	12.8	13.1	---	---	---			
31	11.6	11.4	12.6	---	---	---	13.0	12.8	13.2	---	---	---			
MONTH	10.1	6.6	14.2	---	---	---	13.9	12.2	15.7	---	---	---			

## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN.--Continued

OXYGEN, DISSOLVED (MG/L), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	
													FEBRUARY	MARCH	APRIL	MAY
1	---	---	---	11.6	12.3	12.6	11.2	11.0	11.3	11.9	10.4	13.0	
2	---	---	---	12.1	12.0	12.5	10.9	10.6	11.3	11.8	10.6	12.4	
3	---	---	---	12.0	11.9	12.1	11.3	11.2	11.4	10.9	10.4	11.6	
4	---	---	---	12.0	11.9	12.1	11.5	11.2	12.0	10.2	9.9	10.7	
5	---	---	---	11.9	11.8	12.0	11.4	10.9	11.9	9.7	9.1	9.9	
6	---	---	---	11.7	11.5	11.8	11.3	11.2	11.4	10.0	9.4	10.8	
7	---	---	---	11.5	11.3	11.8	11.2	11.1	11.4	11.2	10.2	12.6	
8	---	---	---	11.4	11.3	11.5	10.8	10.8	11.2	10.8	10.0	11.9	
9	---	---	---	11.1	10.9	11.4	11.0	10.8	11.2	11.2	9.6	12.9	
10	---	---	---	10.9	10.7	11.2	11.2	10.9	11.4	12.2	11.3	13.2	
11	---	---	---	11.4	11.2	11.5	11.4	11.1	11.6	12.7	11.3	14.4	
12	---	---	---	11.5	11.3	11.6	11.9	11.5	12.3	13.5	11.7	15.3	
13	---	---	---	11.4	11.1	11.6	12.1	11.4	12.8	13.0	11.8	14.3	
14	---	---	---	11.1	10.8	11.2	12.5	12.3	12.6	11.8	10.2	12.9	
15	---	---	---	10.6	10.6	10.8	12.1	11.9	12.2	10.7	9.3	12.0	
16	---	---	---	10.4	10.6	11.4	12.0	11.7	12.4	10.3	8.5	11.6	
17	---	---	---	---	---	---	12.2	11.9	12.5	8.9	8.0	10.0	
18	---	---	---	---	---	---	12.1	11.7	12.6	---	---	---	
19	---	---	---	---	---	---	12.3	11.9	12.8	---	---	---	
20	---	---	---	---	---	---	12.9	12.1	13.9	---	---	---	
21	---	---	---	---	---	---	13.3	12.2	14.3	---	---	---	
22	---	---	---	---	---	---	13.4	12.4	14.6	---	---	---	
23	---	---	---	---	---	---	12.4	11.7	13.6	---	---	---	
24	---	---	---	11.9	11.8	12.0	11.6	10.5	13.1	---	---	---	
25	---	---	---	11.6	11.4	12.1	12.2	11.2	13.8	7.4	6.6	8.7	
26	---	---	---	11.2	10.8	11.4	12.3	11.2	13.3	7.0	6.6	7.4	
27	---	---	---	10.5	10.1	10.8	11.5	10.4	12.4	7.4	6.3	9.6	
28	---	---	---	9.7	9.3	10.0	10.2	9.6	11.0	7.0	6.5	7.5	
29	---	---	---	8.9	8.7	9.3	9.3	9.0	9.8	6.3	6.0	6.7	
30	---	---	---	9.6	8.8	10.4	9.4	9.0	9.9	7.8	5.6	9.0	
31	---	---	---	10.8	10.4	11.0	---	---	---	8.2	7.7	8.7	
MONTH	---	---	---	11.1	8.7	12.6	11.6	9.0	14.6	---	---	---	
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	
		JUNE			JULY			AUGUST			SEPTEMBER		
1	8.1	7.6	8.6	5.1	4.3	6.1	9.4	6.2	13.5	6.9	5.6	8.5	
2	7.8	7.3	8.3	4.7	4.0	6.0	6.1	4.8	10.3	6.7	5.8	7.9	
3	7.7	7.0	8.6	6.9	4.4	9.5	3.9	3.0	5.3	6.2	5.7	7.1	
4	7.7	7.2	8.3	8.9	6.1	14.7	3.5	2.3	5.5	5.3	4.7	7.1	
5	8.3	6.7	9.7	10.0	7.8	15.3	---	---	---	5.6	4.5	7.2	
6	9.0	7.6	11.6	9.6	7.5	13.5	---	---	---	7.2	4.0	9.2	
7	7.6	6.5	10.4	7.2	6.1	9.7	---	---	---	8.6	7.4	10.3	
8	5.4	5.0	6.5	5.0	4.1	7.2	8.6	5.6	12.4	8.3	7.2	9.6	
9	5.7	4.6	7.0	4.8	4.2	5.4	8.5	7.0	13.6	7.0	6.2	8.2	
10	6.3	5.4	7.6	6.2	4.1	11.1	10.3	8.6	13.2	6.8	5.9	8.0	
11	6.0	5.4	7.0	9.7	5.7	14.0	9.8	7.5	13.3	7.3	5.8	8.5	
12	5.8	5.5	6.3	---	---	---	6.8	4.9	9.3	8.5	6.9	11.0	
13	7.1	5.7	8.7	8.7	7.4	12.8	4.8	4.1	6.1	9.5	8.2	12.6	
14	6.6	6.1	7.3	9.5	7.0	15.4	6.4	4.5	8.2	9.7	8.0	12.6	
15	6.5	5.8	8.1	10.3	7.3	16.0	7.3	5.3	11.6	8.5	7.7	9.5	
16	6.7	5.0	9.2	12.4	8.6	17.6	6.3	5.2	8.6	8.1	7.4	8.9	
17	8.5	7.3	11.1	9.1	6.4	12.1	7.3	6.1	9.7	8.0	7.4	9.3	
18	8.3	7.4	9.7	8.5	7.0	11.9	6.3	5.3	8.6	7.8	7.3	8.3	
19	7.9	6.7	10.8	7.1	5.8	9.0	---	---	---	8.1	6.9	9.1	
20	7.9	7.1	8.5	6.7	4.9	10.7	---	---	---	8.0	7.5	8.8	
21	7.1	6.7	7.8	6.0	4.5	9.6	5.5	3.9	7.2	7.4	7.0	7.9	
22	5.9	5.3	6.8	8.5	6.4	11.8	---	---	---	6.7	6.2	7.3	
23	6.1	5.2	7.7	8.2	6.9	9.7	8.1	6.4	13.5	6.2	5.7	6.9	
24	6.4	5.5	8.1	9.1	6.3	12.5	6.8	6.0	7.9	6.1	5.6	6.4	
25	5.8	5.2	7.0	9.3	7.8	10.8	6.1	5.3	7.5	6.9	5.6	8.4	
26	5.0	4.1	6.1	7.1	5.3	9.3	5.2	4.5	10.3	9.5	7.1	14.2	
27	6.4	4.1	8.0	5.5	4.6	6.9	5.6	3.8	8.3	10.5	9.3	12.9	
28	8.0	6.8	9.9	5.4	4.0	7.5	4.3	3.6	5.7	9.7	9.0	11.1	
29	7.8	7.1	8.9	---	---	---	7.4	4.4	10.2	10.0	8.7	13.0	
30	---	---	---	---	---	---	7.3	6.6	8.6	8.4	7.8	9.7	
31	---	---	---	---	---	---	6.6	6.1	7.1	---	---	---	
MONTH	7.0	4.1	11.6	7.8	4.0	17.6	6.7	2.3	13.6	7.8	4.0	14.2	



## MISSISSIPPI RIVER MAIN STEM

05331578 MISSISSIPPI RIVER AT LOCK AND DAM 2 AT HASTINGS, MN.--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	JUNE			JULY			AUGUST			SEPTEMBER		
		MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	
1	7.4	7.2	7.6	7.5	7.2	7.8	8.5	7.9	9.1	8.1	8.0	8.3	
2	7.4	7.2	7.5	7.5	7.3	7.9	8.2	8.0	8.8	8.0	7.7	8.2	
3	7.5	7.2	7.8	7.7	7.1	8.3	8.0	7.7	8.5	8.0	7.9	8.1	
4	7.6	7.4	7.8	8.0	7.2	9.4	8.0	7.5	8.6	7.9	7.7	8.2	
5	7.7	7.5	8.0	8.5	7.6	9.3	7.8	7.5	8.1	8.1	7.7	8.5	
6	7.9	7.5	8.7	8.1	7.5	8.5	7.7	7.5	7.9	8.2	7.9	8.5	
7	7.8	7.6	8.5	8.0	7.2	8.8	7.9	7.4	8.6	8.4	8.1	8.8	
8	7.5	7.4	7.6	7.8	7.5	8.5	8.2	7.4	8.8	8.4	8.1	8.7	
9	7.4	7.3	7.6	7.8	7.6	8.2	8.1	7.8	9.0	8.2	8.0	8.6	
10	7.5	7.3	7.8	8.1	7.7	9.2	8.5	8.3	9.0	8.3	8.0	8.7	
11	7.4	7.3	7.7	7.9	7.1	8.9	8.6	8.2	9.1	8.3	8.0	8.6	
12	7.4	7.3	7.5	---	---	---	8.4	8.1	8.7	8.4	8.1	8.8	
13	8.1	7.4	8.7	---	---	---	8.1	7.9	8.4	8.5	8.3	9.0	
14	8.2	8.1	8.3	7.8	7.0	8.9	8.2	8.0	8.3	8.6	8.2	9.1	
15	8.3	8.1	8.7	8.3	7.6	9.1	8.0	7.5	8.7	8.4	8.2	8.6	
16	8.3	8.0	8.8	8.6	8.1	9.4	7.8	7.6	8.3	8.4	8.2	8.6	
17	8.6	8.2	9.2	7.9	7.2	8.5	8.2	8.0	8.7	8.5	8.4	8.6	
18	8.7	8.4	9.1	7.7	7.0	8.3	8.3	8.1	8.6	8.5	8.4	8.6	
19	8.6	8.3	9.2	7.3	6.6	7.9	8.2	8.0	8.4	8.5	8.5	8.7	
20	8.4	8.1	8.9	7.3	6.7	8.1	8.2	7.9	8.5	8.4	8.2	8.6	
21	8.2	8.1	8.3	7.4	6.7	8.5	8.0	7.8	8.3	8.1	8.0	8.3	
22	8.0	7.9	8.2	8.1	7.7	8.5	8.4	7.9	9.6	8.0	7.9	8.1	
23	8.0	7.8	8.4	8.1	7.9	8.4	8.4	8.1	9.3	8.1	8.0	8.4	
24	8.1	7.8	8.6	8.0	7.5	8.4	8.4	8.2	8.6	8.2	8.0	8.3	
25	8.0	7.8	8.4	8.0	7.6	8.4	8.5	8.3	8.7	8.2	8.0	8.3	
26	7.9	7.5	8.2	7.9	7.4	8.3	8.4	8.1	8.5	8.4	8.0	9.1	
27	7.9	7.6	8.3	8.1	7.3	8.7	8.4	8.1	9.0	8.5	8.2	8.9	
28	8.3	7.9	8.8	8.1	7.8	8.5	8.3	8.1	8.7	8.5	8.3	8.8	
29	8.4	8.2	8.6	8.0	7.8	8.4	8.5	8.3	8.6	8.6	8.3	9.2	
30	---	---	---	7.7	7.5	8.1	8.3	8.1	8.4	8.3	8.1	8.5	
31	---	---	---	7.9	7.7	8.3	8.2	8.1	8.3	---	---	---	
MONTH	7.9	7.2	9.2	7.9	6.6	9.4	8.2	7.4	9.6	8.3	7.7	9.2	

ST. CROIX RIVER BASIN

05336700 KETTLE RIVER BELOW SANDSTONE, MN

LOCATION.--Lat 46°06'20", long 92°51'50", in NW¼SW¼ sec.22, T.42 N., R.20 W., Pine County, Hydrologic Unit 07030003, on Sandstone Federal Correctional Institution property, on left bank about 900 ft downstream from abandoned powerplant dam, 1.8 mi south of Sandstone.

DRAINAGE AREA.--863 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1967 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 931.50 ft above National Geodetic Vertical Datum of 1929. (Minnesota Department of Transportation bench mark).

REMARKS.--Records good except those for estimated daily discharge, which are fair.

AVERAGE DISCHARGE.--22 years, 714 ft<sup>3</sup>/s, 11.24 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,200 ft<sup>3</sup>/s, July 23, 1972, gage height, 15.38 ft; minimum, 25 ft<sup>3</sup>/s, Nov. 11, 12, 1977, gage height, 3.37 ft, result of freezeup.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in April 1965 reached a stage of 12.96 ft, from flood marks, discharge, 13,400 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,600 ft<sup>3</sup>/s and maximum (\*)

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Apr. 8	0500	*4,840	*8.40	No other peak greater than base discharge.			
Minimum discharge, 86 ft <sup>3</sup> /s, Aug. 8, 9, 10, 12, 15, 18, 19, gage height, 3.82 ft.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	271	172	332	e152	e144	e136	e809	1390	1210	239	108	714
2	261	169	327	e152	e144	e136	987	1450	1020	228	99	671
3	242	168	321	e152	e144	e136	1270	1360	904	230	101	556
4	224	169	288	e152	e143	e135	1940	1250	756	220	101	515
5	208	169	284	e152	e143	e135	2800	1210	635	204	97	543
6	193	163	272	e151	e143	e135	3780	1180	556	193	93	520
7	185	163	253	e151	e142	e134	4570	1100	497	177	91	462
8	177	165	226	e151	e142	e134	4710	1110	437	162	89	413
9	172	167	e220	e151	e142	e134	4080	1530	373	149	86	362
10	166	168	e210	e151	e141	e134	3550	1590	360	143	88	315
11	157	168	e190	e151	e141	e134	3190	1430	326	135	89	282
12	152	177	175	e150	e141	e133	2760	1270	321	126	88	254
13	148	183	172	e150	e141	e133	2580	1100	363	125	90	231
14	145	185	e168	e150	e141	e133	2680	964	466	119	88	206
15	142	196	e167	e150	e140	e133	3020	847	493	116	86	182
16	144	260	e166	e149	e140	e133	3250	739	473	114	91	168
17	148	e300	e165	e148	e140	e133	3350	645	429	111	91	160
18	152	e310	e164	e148	e140	e133	3230	598	387	108	87	157
19	157	e310	e162	e147	e140	e133	2960	620	358	106	90	158
20	168	e300	e162	e146	e140	e133	2670	872	325	104	94	157
21	174	292	e161	e145	e139	e132	2360	1150	287	103	91	148
22	178	e300	e161	e144	e139	e132	2040	1070	283	105	96	146
23	188	e305	159	e143	e138	e138	1770	942	306	107	91	146
24	184	e310	158	e143	e138	e142	1550	882	344	101	93	142
25	186	312	e158	142	e138	e149	1380	1640	358	93	92	140
26	187	329	157	143	e138	e168	1230	1930	346	94	109	160
27	185	365	154	142	e138	e207	1130	1570	325	92	101	159
28	182	335	e153	140	e137	e332	1050	1280	297	89	98	179
29	175	327	e152	143	---	e677	1030	1090	271	101	99	191
30	168	e332	e152	145	---	e800	1180	1270	259	107	96	180
31	170	---	e152	144	---	e826	---	1380	---	111	201	---
TOTAL	5589	7269	6141	4578	3937	6383	72906	36459	13765	4212	3014	8617
MEAN	180	242	198	148	141	206	2430	1176	459	136	97.2	287
MAX	271	365	332	152	144	826	4710	1930	1210	239	201	714
MIN	142	163	152	140	137	132	809	598	259	89	86	140
AC-FT	11090	14420	12180	9080	7810	12660	144600	72320	27300	8350	5980	17090
CFSM	.21	.28	.23	.17	.16	.24	2.82	1.36	.53	.16	.11	.33
IN.	.24	.31	.26	.20	.17	.28	3.14	1.57	.59	.18	.13	.37

CAL YR 1988 TOTAL 120067 MEAN 328 MAX 2790 MIN 88 AC-FT 238200 CFSM .38 IN. 5.18  
WTR YR 1989 TOTAL 172870 MEAN 474 MAX 4710 MIN 86 AC-FT 342900 CFSM .55 IN. 7.45

e Estimated

ST. CROIX RIVER BASIN

05337400 KNIFE RIVER NEAR MORA, MN

LOCATION.--Lat 45°55'12", long 93°18'26", in SW¼SW¼S sec.26, T.40 N., R.24 W., Kanabec County, Hydrologic Unit 07030004, on left bank 400 ft upstream from bridge on County Highway 77, 1.1 mi upstream from mouth and 2.5 mi north of Mora.

DRAINAGE AREA.--102 mi<sup>2</sup>.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1969-74; July 1974 to current year.

GAGE.--Water-stage recorder. Datum of gage is 991.20 ft above National Geodetic Vertical Datum of 1929. (Kanabec County bench mark).

REMARKS.--Records good except those for periods of estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--15 years, 62.7 ft<sup>3</sup>/s, 8.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,840 ft<sup>3</sup>/s, May 10, 1979, gage height, 6.31 ft; maximum gage height, 6.69 ft, Nov. 24, 1977, from floodmark (backwater from ice); minimum discharge, 0.74 ft<sup>3</sup>/s, July 6, 7, 28, 29, 1988, gage height, 1.28.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of July 26, 1972, reached a stage of 14.0 ft, from information by local resident (discharge not determined). Result of dam failure and backwater from collapsed bridge.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Apr. 7	2400	*546	*4.37	No other peak greater than base discharge.			
Minimum discharge, 0.88 ft <sup>3</sup> /s, Aug. 6, gage height, 1.28 ft.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	13	5.3	e25	e9.3	e6.0	e5.8	164	131	252	35	1.2	67		
2	11	5.3	24	e9.0	e6.0	e5.8	173	142	210	30	1.1	66		
3	10	5.6	23	e8.7	e6.0	e5.8	199	134	171	29	1.2	66		
4	9.3	7.5	22	e8.4	e6.0	e5.9	251	126	136	24	1.1	68		
5	5.9	13	20	e8.2	e6.0	e7.0	328	125	107	19	1.0	65		
6	5.0	11	20	e8.0	e6.0	e10	437	109	89	18	.95	64		
7	4.0	6.2	19	e7.8	e6.0	e9.7	514	96	74	15	1.0	62		
8	4.0	5.6	e18	e7.8	e6.0	e9.2	515	108	65	10	1.0	62		
9	4.6	5.9	e17	e7.5	e5.9	e8.8	427	145	51	9.6	18	63		
10	4.7	7.5	e16	e7.4	e5.8	e8.5	350	189	39	9.7	70	62		
11	5.2	5.9	e15	e7.2	e5.8	e8.4	292	189	31	8.8	70	62		
12	3.6	7.7	e14	e7.1	e5.8	8.2	251	169	29	6.9	71	61		
13	3.1	10	e14	e7.0	e5.8	8.4	222	146	32	5.3	69	60		
14	2.7	9.8	e13	e6.8	e5.8	e9.0	205	123	33	4.0	70	58		
15	2.9	13	e13	e6.7	e5.8	e9.3	188	107	22	3.3	69	55		
16	2.9	e20	e13	e6.6	e5.8	e9.4	179	91	16	2.6	67	59		
17	3.4	21	e12	e6.5	e5.8	e9.4	165	75	14	2.3	67	58		
18	4.0	e21	e12	e6.4	e5.8	e9.3	149	76	17	9.1	66	58		
19	3.4	26	e12	e6.4	e5.8	e9.0	138	81	17	10	67	58		
20	3.6	e25	e12	e6.3	e5.8	e8.9	129	90	14	4.1	66	58		
21	5.9	e25	e11	e6.2	e5.8	e8.7	118	83	14	2.9	70	57		
22	5.6	25	e11	e6.2	e5.8	e8.6	109	75	37	2.3	68	56		
23	5.5	24	e11	e6.1	e5.8	8.4	100	70	46	1.8	67	56		
24	6.3	23	11	e6.1	e5.8	9.0	91	96	50	1.6	67	55		
25	4.8	22	12	e6.0	e5.8	10	89	184	53	1.3	66	54		
26	4.2	24	e12	e6.0	e5.8	16	86	270	58	1.3	67	53		
27	4.3	e27	e11	e6.0	e5.8	27	86	234	55	1.2	65	52		
28	4.2	e27	e11	e6.0	e5.8	52	81	191	49	1.2	65	51		
29	3.9	e27	e10	e6.0	---	98	96	180	37	1.2	64	47		
30	4.0	27	e10	e6.0	---	147	108	232	37	1.3	64	41		
31	4.5	---	e9.6	e6.0	---	159	---	276	---	1.3	68	---		
TOTAL	159.5	483.3	453.6	215.7	164.1	709.5	6240	4343	1855	273.1	1509.55	1754		
MEAN	5.15	16.1	14.6	6.96	5.86	22.9	208	140	61.8	8.81	48.7	58.5		
MAX	13	27	25	9.3	6.0	159	515	276	252	35	71	68		
MIN	2.7	5.3	9.6	6.0	5.8	5.8	81	70	14	1.2	.95	41		
AC-FT	316	959	900	428	325	1410	12380	8610	3680	542	2990	3480		
CFSM	.05	.16	.14	.07	.06	.22	2.04	1.37	.61	.09	.48	.57		
IN.	.06	.18	.17	.08	.06	.26	2.28	1.58	.68	.10	.55	.64		
CAL YR 1988	TOTAL	6277.48	MEAN	17.2	MAX	123	MIN	.76	AC-FT	12450	CFSM	.17	IN.	2.29
WTR YR 1989	TOTAL	18160.35	MEAN	49.8	MAX	515	MIN	.95	AC-FT	36020	CFSM	.49	IN.	6.62

e Estimated

## ST. CROIX RIVER BASIN

05340500 ST. CROIX RIVER AT ST. CROIX FALLS, WI

LOCATION.--Lat 45 24'25", long 92 38'49", in SW 1/4 NW 1/4 sec.30, T.34 N., R.18 W., Polk County, Hydrologic Unit 07030005, St. Croix National Scenic Riverway, on left bank, 1,500 ft downstream from powerplant of Northern States Power Co., in St. Croix Falls, and at mile 52.2.

DRAINAGE AREA.--6,240 mi .

PERIOD OF RECORD.--January 1902 to current year. Prior to January 1910, monthly discharge only, published in WSP 1308. Prior to October 1939, published as "near St. Croix Falls."

REVISED RECORDS.--WSP 1115: 1929. WDR WI-82-1: Drainage area.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 689.94 ft above National Geodetic Vertical Datum of 1929. Prior to July 1905, gage heights and discharge measurements were used by Loweth and Wolff, consulting engineers of St. Paul, Minn., to determine the flow. July 1905 to February 1940, records were computed from power generation at the St. Croix Falls Powerplant. February 1940 to Sept. 30, 1979, water-stage recorder at site 300 ft downstream at same datum.

REMARKS.--No estimated daily discharges. Records good. Diurnal fluctuation caused by St. Croix Falls Powerplant 1,500 ft upstream. Data-collection platform at station.

AVERAGE DISCHARGE.--87 years, 4,309 ft /s, 9.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 54,900 ft /s, May 8, 1950, gage height, 25.19 ft; minimum daily, 75 ft /s, July 17, 1910.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 18,100 ft /s, Apr. 9, May 27, gage height, 8.97 ft; minimum daily, 1,200 ft /s, Aug. 9-12.

## RATING TABLE (gage height, in feet, and discharge, in cubic feet per second).

2.3	1,100	4.0	4,950
2.5	1,400	6.0	10,700
3.0	2,350	8.0	15,700
		9.0	18,200

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3090	2250	2550	2260	2340	1810	7020	6490	10100	2420	1590	3100
2	2530	1880	2700	1990	1860	1770	7280	6580	9270	2690	1570	3500
3	2770	2150	2650	2080	2040	1950	8110	6940	8410	2390	1400	4110
4	2590	2550	3120	2010	2080	1760	9170	6730	7630	2460	1430	4290
5	2430	2660	2820	2000	1740	1870	11900	6760	6990	2430	1430	4020
6	2380	1990	3070	2120	2000	1890	14000	6560	6120	2360	1420	4090
7	2010	2690	2780	1900	1870	2070	15200	6350	5290	2000	1320	4120
8	1900	2300	2690	2020	2250	1780	16900	6300	4210	1680	1220	3820
9	1900	2460	2420	2090	1830	1740	17900	6510	4400	1680	1200	3590
10	2130	2600	1640	1970	1980	1930	17600	7150	3730	1850	1200	3090
11	1960	2440	1550	2050	1700	1650	16000	7700	3420	1690	1200	3160
12	1950	2440	1660	2030	1990	1860	14600	7430	3520	1680	1200	2800
13	1920	2400	1660	2210	1910	2180	12900	6960	3200	1670	1340	2300
14	2070	2910	2070	2080	2090	1950	11600	6200	3540	1530	1500	2340
15	1920	2680	2060	1900	1940	2120	11300	5800	3590	1580	1650	2430
16	1910	3380	2250	1920	1950	2220	11300	5380	3700	1580	2150	2180
17	2180	3300	1950	1910	1940	2130	11500	4670	3660	1520	1740	2000
18	1950	4200	2000	1820	1990	2110	11800	4260	3330	1580	1460	1940
19	1890	4120	2100	1780	1830	2200	11900	4790	3120	1700	1590	1950
20	2020	4370	2330	1990	1920	1980	11200	4770	2790	1600	1640	2100
21	2110	3790	2340	2370	1850	2010	10100	5500	2750	1540	1570	2030
22	2290	3200	2050	1950	1880	2080	9130	6660	2770	1530	1950	2230
23	2250	3330	2220	1980	2110	2200	8410	6600	2660	1410	1760	1980
24	2160	3740	2420	2100	2010	2260	7570	5600	2700	1430	2050	1930
25	2170	4120	2110	2100	1740	2580	7180	10200	2500	1350	1780	1950
26	2290	3720	2160	2010	1790	2970	6240	16400	2740	1340	1790	2130
27	2070	3430	1980	2280	1780	4800	5950	17900	2940	1320	2200	1760
28	2220	3270	1930	1900	1850	6000	5780	16100	2930	1320	2060	1820
29	2400	3110	2070	2140	---	6490	5760	13400	2710	1270	2070	1860
30	2460	3000	2180	1920	---	6400	6010	11700	2670	1350	1910	1670
31	2470	---	1790	2020	---	6680	---	10100	---	1560	1980	---
TOTAL	68390	90480	69320	62900	54260	83440	321310	244490	127390	53510	50370	80290
MEAN	2206	3016	2236	2029	1938	2692	10710	7887	4246	1726	1625	2676
MAX	3090	4370	3120	2370	2340	6680	17900	17900	10100	2690	2200	4290
MIN	1890	1880	1550	1780	1700	1650	5760	4260	2500	1270	1200	1670
CFSM	.35	.48	.36	.33	.31	.43	1.72	1.26	.68	.28	.26	.43
IN.	.41	.54	.41	.37	.32	.50	1.92	1.46	.76	.32	.30	.48
CAL YR 1988	TOTAL 1012540	MEAN 2767	MAX 10900	MIN 1100	CFSM .44	IN. 6.04						
WTR YR 1989	TOTAL 1306150	MEAN 3578	MAX 17900	MIN 1200	CFSM .57	IN. 7.79						

## MISSISSIPPI RIVER MAIN STEM

05344500 MISSISSIPPI RIVER AT PRESCOTT, WI

LOCATION.--Lat 44°44'45", long 92°48'00", in sec.9, T.26 N., R.20 W., Pierce County, Hydrologic Unit 07040001, on left bank at Prescott, 200 ft downstream from St. Croix River, 300 ft south of Chicago, Burlington & Quincy Railroad bridge, 800 ft south of bridge on U.S. Highway 10, and at mile 811.4 upstream from Ohio River.

DRAINAGE AREA.--44,800 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--June 1928 to current year.

REVISED RECORDS.--WSP 1508: 1941. WRD MN-74: 1973.

GAGE.--Water-stage recorder. Datum of gage is 649.50 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 2, 1932, nonrecording gage at railroad bridge 300 ft upstream at following datums: June 3, 1928, to Sept. 30, 1929, 19.27 ft higher; Oct. 1, 1929, to Sept. 30, 1930, 17.68 ft higher; Oct. 1, 1930, to Aug. 1, 1932, 19.28 ft higher. Aug. 2, 1932, to Oct. 30, 1938, water-stage recorder at present site at datum 19.28 ft higher; Nov. 1, 1938, to Sept. 7, 1971, water-stage recorder at present site at datum 50.00 ft lower.

REMARKS.--Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

AVERAGE DISCHARGE.--61 years, 17,150 ft<sup>3</sup>/s, 5.20 in/yr; median of yearly mean discharges, 16,000 ft<sup>3</sup>/s, 4.85 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 228,000 ft<sup>3</sup>/s, Apr. 18, 1965, gage height, 43.11 ft; minimum daily, 1,380 ft<sup>3</sup>/s, July 13, 1940; minimum gage height, 15.08 ft, Aug. 29, 1934, present datum.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 49,000 ft<sup>3</sup>/s, Apr. 11; maximum gage height, 30.33 ft, Apr. 11; minimum daily discharge, 3,920 ft<sup>3</sup>/s, Aug. 21; minimum gage height, 24.79 ft, July 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8010	6340	7560	6160	6920	6670	31100	27400	23900	11500	5840	5350
2	9270	6620	6770	6470	6750	6130	31000	29300	24000	10500	6270	6470
3	8990	5940	6340	6250	5190	6210	31300	29100	22500	10700	6070	7400
4	9130	6310	6690	6220	4990	6430	32700	29600	21100	10200	5360	9050
5	8750	6590	8900	6200	6230	5470	35200	29000	19600	10700	5320	8430
6	8950	6940	7870	6180	6080	6350	38700	28800	18500	10800	5160	9530
7	8900	6180	8250	6760	6630	7000	41200	28400	17100	10400	5120	10600
8	7730	6920	8040	6470	6980	7160	44200	26400	15300	9630	4730	10800
9	7880	6320	7860	6220	7260	7050	46700	27100	13700	9370	4280	9900
10	7290	6380	6750	5630	6360	7120	48800	26800	13300	9330	4400	9550
11	7380	6400	5540	5840	6470	7030	49000	28000	12500	8610	4090	10000
12	6980	6280	5450	5740	6680	6300	47900	28300	11600	8440	4250	9820
13	6970	6720	4920	5670	7130	7130	45700	27900	11300	8350	4280	9470
14	6040	6500	5750	6050	7020	7090	43300	26500	10900	7990	4530	8970
15	6470	7340	7320	6230	7090	6750	41400	24800	11500	7620	4660	8470
16	6210	6800	6590	5550	6930	7070	40300	23400	11700	8040	4700	8800
17	6810	7690	4830	6350	6850	7010	39200	22100	11200	7290	4900	8310
18	6190	6860	5220	5890	6800	6690	39400	20100	11000	7040	4500	7440
19	5980	9090	5820	5990	6800	6990	38700	19000	10500	7610	4080	7950
20	6330	8620	6480	5970	6490	7030	37600	18800	10600	7400	4050	8040
21	6010	8820	7280	6420	6210	6780	35600	18600	10500	7580	3920	7790
22	6000	8140	7080	6800	6730	6820	34400	17200	9450	7110	4250	7890
23	5950	7200	6340	6620	6640	6860	32800	18500	9830	6820	5040	8030
24	6940	7210	6930	6390	6620	7770	30600	18700	10400	6760	4690	7860
25	6120	7920	6820	6850	6920	8340	28600	17700	9750	5980	5000	7910
26	7110	8580	5970	6210	7000	9500	28000	22100	9940	6360	4500	7750
27	6840	8800	5960	6100	6850	10300	27400	28800	11700	5920	4580	8030
28	6290	8530	6120	6760	6300	15000	26600	30300	12100	5690	4960	7690
29	6620	9270	5670	6320	---	24100	26200	29200	12700	6160	5180	7690
30	6350	8480	5650	6640	---	30200	25800	27300	11400	5480	5090	7480
31	6430	---	6330	6180	---	30500	---	25700	---	6090	5060	---
TOTAL	220920	219790	203100	193130	184920	290850	1099400	774900	409570	251470	148860	252470
MEAN	7126	7326	6552	6230	6604	9382	36650	25000	13650	8112	4802	8416
MAX	9270	9270	8900	6850	7260	30500	49000	30300	24000	11500	6270	10800
MIN	5950	5940	4830	5550	4990	5470	25800	17200	9450	5480	3920	5350
AC-FT	438200	436000	402800	383100	366800	576900	2181000	1537000	812400	498800	295300	500800
CFSM	.16	.16	.15	.14	.15	.21	.82	.56	.30	.18	.11	.19
IN.	.18	.18	.17	.16	.15	.24	.91	.64	.34	.21	.12	.21

CAL YR 1988 TOTAL 3102600 MEAN 8477 MAX 28200 MIN 2700 AC-FT 6154000 CFSM .19 IN. 2.58  
WTR YR 1989 TOTAL 4249380 MEAN 11640 MAX 49000 MIN 3920 AC-FT 8429000 CFSM .26 IN. 3.53

VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN

LOCATION.--Lat 44°40'00", long 93°03'17", in SW¼NW¼ sec.24, T.114 N., R.19 W., Dakota County, Hydrologic Unit 07040001, on right bank and just downstream from County Road 79, 2 mi west of Empire and 4 mi northeast of Farmington.

DRAINAGE AREA.--110 mi<sup>2</sup>.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1942 to June 1945 (no record during July, August, and September 1944), September 1969 to September 1973 (discharge measurements only), October 1973 to current year. Prior to October 1975 published as "near Empire City".

GAGE.--Water-stage recorder. Datum of gage is 851.99 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). April 12, 1942, to June 30, 1944, and October 1, 1944, to July 7, 1945, nonrecording gage at same site and present datum.

REMARKS.--Records good. Some regulation at low flow by sewage plant upstream.

AVERAGE DISCHARGE.--17 years (water years 1943, 1974-89), 54.5 ft<sup>3</sup>/s, 6.73 in/yr, 39,490 acre-ft/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,030 ft<sup>3</sup>/s, Sept. 18, 1942; maximum gage height, 8.30 ft, Sept. 22, 1986; minimum daily discharge, 8.4 ft<sup>3</sup>/s, Jan. 15, 1975; minimum gage height, 1.63 ft, Oct. 14, 1976.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in April 1965, reached a stage of 7.5 ft, from information by local resident, discharge 6,200 ft<sup>3</sup>/s, from rating extended above 2,100 ft<sup>3</sup>/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 27	0700	*1,650	*7.55	No other peak greater than base discharge.			
Minimum discharge, 15 ft <sup>3</sup> /s, Oct. 2, 4, 5, 8, 9, 10, 11, 16, 17, 29, 30, Sept. 30; minimum gage height, 1.88 ft, Oct. 4.							

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18	19	23	e20	e22	e21	168	105	42	46	24	38
2	17	19	23	e20	e21	e21	142	89	40	37	23	34
3	17	19	22	e20	e20	e21	133	80	39	34	22	31
4	17	20	22	e20	e20	e21	125	77	37	31	22	32
5	17	22	23	20	e20	e21	115	79	37	29	22	32
6	17	21	23	20	e19	e22	107	70	36	28	22	29
7	17	21	23	e20	e19	23	102	66	35	26	24	28
8	17	20	22	e20	e19	23	98	70	35	28	23	26
9	17	20	22	e20	e19	23	92	87	35	29	23	26
10	17	20	21	e20	e19	26	89	79	34	27	19	26
11	17	20	21	e20	e20	40	87	71	32	27	19	26
12	17	21	22	e20	e20	45	83	65	34	26	21	25
13	17	22	21	e20	e20	46	81	60	33	25	23	24
14	17	23	22	20	e20	75	80	57	62	24	26	24
15	17	23	22	20	e20	e48	78	55	58	23	25	23
16	17	32	e21	21	e20	e43	77	53	47	23	24	23
17	18	26	21	21	e20	e42	76	51	42	23	22	22
18	18	24	22	21	e20	e42	73	51	38	26	22	22
19	18	23	22	21	e20	e42	72	57	36	34	23	22
20	18	23	22	21	e20	40	70	86	34	27	24	22
21	19	22	21	20	e20	41	67	65	33	26	24	22
22	19	22	22	21	e20	42	67	57	32	24	48	22
23	19	22	22	21	e20	44	65	54	31	23	43	20
24	19	22	22	20	e20	55	66	56	30	24	30	19
25	19	22	20	20	e20	141	66	68	31	23	26	20
26	18	24	20	20	e20	349	68	59	47	22	25	18
27	19	26	e20	20	e20	1300	75	51	51	21	26	18
28	18	26	e20	20	e20	889	87	46	39	21	26	19
29	18	25	e20	21	---	474	114	45	35	27	26	18
30	18	24	e20	21	---	347	125	46	34	28	26	18
31	19	---	20	22	---	230	---	44	---	26	29	---
TOTAL	550	673	667	631	558	4597	2748	1999	1149	838	782	729
MEAN	17.7	22.4	21.5	20.4	19.9	148	91.6	64.5	38.3	27.0	25.2	24.3
MAX	19	32	23	22	22	1300	168	105	62	46	48	38
MIN	17	19	20	20	19	21	65	44	30	21	19	18
AC-FT	1090	1330	1320	1250	1110	9120	5450	3970	2280	1660	1550	1450

CAL YR 1988 TOTAL 10293 MEAN 28.1 MAX 201 MIN 14 AC-FT 20420  
WTR YR 1989 TOTAL 15921 MEAN 43.6 MAX 1300 MIN 17 AC-FT 31580

e Estimated





## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

SPECIFIC CONDUCTANCE, MICROSIEMENS PER CENTIMETER AT 25, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1	949	857	1050	1040	957	1110	---	---	---	848	688	959
2	954	834	1060	1020	924	1100	---	---	---	820	734	900
3	907	821	1060	1070	973	1200	---	---	---	866	729	954
4	843	748	923	1070	923	1140	---	---	---	839	728	940
5	843	600	1050	914	778	998	---	---	---	851	776	930
6	869	804	1010	923	822	991	---	---	---	858	775	933
7	873	770	1020	1010	908	1080	---	---	---	808	695	865
8	893	732	1100	1020	910	1110	---	---	---	860	771	983
9	926	815	1050	---	---	---	---	---	---	848	745	930
10	940	819	1020	---	---	---	---	---	---	804	715	857
11	935	840	1080	---	---	---	842	744	940	797	656	874
12	928	840	1040	---	---	---	871	740	956	---	---	---
13	943	851	1050	---	---	---	863	743	911	---	---	---
14	1010	926	1090	---	---	---	837	710	907	---	---	---
15	981	917	1070	---	---	---	835	767	921	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	1010	793	1100	---	---	---	823	669	886	---	---	---
18	1020	903	1160	---	---	---	862	765	937	---	---	---
19	1060	960	1160	---	---	---	---	---	---	---	---	---
20	1040	893	1120	---	---	---	---	---	---	---	---	---
21	1040	872	1110	---	---	---	---	---	---	---	---	---
22	1020	914	1160	---	---	---	---	---	---	---	---	---
23	1000	791	1140	---	---	---	---	---	---	1090	955	1170
24	992	878	1060	---	---	---	791	675	843	---	---	---
25	1020	904	1110	---	---	---	821	659	961	1030	1010	1050
26	1010	883	1170	---	---	---	737	655	818	1030	988	1060
27	1020	907	1120	---	---	---	786	725	823	1040	1020	1070
28	977	878	1060	---	---	---	813	720	867	1040	1010	1070
29	977	878	1090	---	---	---	835	734	910	1040	1010	1060
30	1010	864	1100	835	760	900	827	743	875	1050	1010	1090
31	1040	965	1110	---	---	---	862	758	941	---	---	---
MONTH	967	600	1170	---	---	---	---	---	---	---	---	---
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
FEBRUARY			MARCH			APRIL			MAY			
1	---	---	---	1040	1010	1090	672	664	686	749	737	765
2	964	943	1010	1030	1010	1060	---	---	---	783	750	830
3	966	946	986	1030	1020	1060	---	---	---	819	796	861
4	969	932	987	1040	998	1070	---	---	---	813	789	838
5	975	940	990	1030	974	1060	---	---	---	798	781	821
6	969	956	983	1040	1010	1080	721	702	753	789	760	819
7	959	933	977	1100	1020	1180	736	718	770	815	794	848
8	972	936	994	1140	1100	1190	735	716	755	813	768	847
9	927	868	993	1160	1130	1190	733	704	747	787	769	808
10	---	---	---	1150	1080	1200	723	709	744	803	783	834
11	---	---	---	1080	1000	1170	---	---	---	815	791	851
12	---	---	---	1040	1010	1110	814	732	891	823	802	860
13	1060	1030	1090	1050	1020	1100	866	836	905	823	801	859
14	1050	1010	1100	712	494	1020	881	858	910	834	768	896
15	1040	1010	1070	553	514	593	893	878	917	852	825	889
16	1040	1010	1080	568	548	587	891	875	926	788	708	869
17	1040	1010	1060	577	549	630	903	886	924	738	694	778
18	1030	990	1050	594	557	620	905	890	920	725	690	756
19	1030	1010	1080	627	602	653	---	---	---	704	648	744
20	1040	1010	1070	655	621	685	918	899	956	651	605	721
21	1050	1010	1080	860	636	997	930	908	963	697	669	723
22	1030	1000	1080	984	945	1020	937	910	974	725	708	755
23	1040	1010	1080	1000	967	1020	933	877	955	734	710	768
24	1040	1010	1080	999	939	1030	938	910	965	722	675	745
25	1050	1010	1090	828	771	972	947	925	967	688	619	725
26	1050	1030	1080	748	727	770	880	799	960	686	661	705
27	1060	1020	1090	720	715	728	813	764	838	693	655	739
28	1040	1020	1070	412	184	727	807	785	826	705	685	739
29	---	---	---	228	204	250	780	737	808	706	678	732
30	---	---	---	272	250	288	747	717	770	791	712	865
31	---	---	---	303	286	324	---	---	---	854	831	880
MONTH	1016	868	1100	826	184	1200	838	664	974	765	605	896





## VERMILLION RIVER BASIN

05345000 VERMILLION RIVER NEAR EMPIRE, MN--Continued

PH (STANDARD UNITS), WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	8.0	7.8	8.2	8.2	7.8	8.9	---	---	---	---	---	---
2	8.0	7.9	8.3	8.3	7.9	9.0	---	---	---	---	---	---
3	8.0	7.9	8.3	8.3	7.8	9.0	---	---	---	---	---	---
4	8.1	8.0	8.4	7.9	7.8	8.4	---	---	---	---	---	---
5	8.1	7.9	8.3	8.1	7.7	8.7	---	---	---	---	---	---
6	8.0	7.9	8.3	8.3	7.9	9.0	---	---	---	---	---	---
7	8.0	7.9	8.3	8.2	7.8	8.8	---	---	---	---	---	---
8	8.0	7.8	8.3	8.3	7.8	9.1	---	---	---	---	---	---
9	8.0	7.8	8.3	---	---	---	---	---	---	---	---	---
10	8.0	7.8	8.3	---	---	---	---	---	---	---	---	---
11	8.1	7.9	8.4	---	---	---	---	---	---	---	---	---
12	8.1	7.9	8.4	---	---	---	---	---	---	---	---	---
13	8.1	7.9	8.4	---	---	---	---	---	---	---	---	---
14	8.0	7.8	8.4	---	---	---	---	---	---	---	---	---
15	8.0	7.7	8.5	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	7.8	7.7	8.1	---	---	---	---	---	---	---	---	---
18	8.0	7.8	8.6	---	---	---	---	---	---	---	---	---
19	8.1	7.8	8.6	---	---	---	---	---	---	---	---	---
20	8.0	7.8	8.3	---	---	---	---	---	---	---	---	---
21	8.0	7.7	8.6	---	---	---	---	---	---	---	---	---
22	8.1	7.8	8.7	---	---	---	---	---	---	---	---	---
23	8.1	7.7	8.6	---	---	---	---	---	---	---	---	---
24	8.2	7.9	8.7	---	---	---	---	---	---	7.6	7.2	7.9
25	8.2	7.9	8.6	---	---	---	---	---	---	7.3	7.1	7.6
26	8.1	7.9	8.6	---	---	---	---	---	---	7.6	7.0	8.2
27	8.1	7.8	8.4	---	---	---	---	---	---	7.7	7.2	7.9
28	8.3	8.0	8.8	---	---	---	---	---	---	7.5	7.2	7.9
29	8.3	8.0	8.8	---	---	---	---	---	---	7.5	7.2	8.0
30	8.2	7.8	8.8	---	---	---	---	---	---	7.6	7.2	8.2
31	8.1	7.8	8.8	---	---	---	---	---	---	7.6	7.4	7.8
MONTH	8.1	7.7	8.8	---	---	---	---	---	---	---	---	---
DAY	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
	FEBRUARY			MARCH			APRIL			MAY		
1	---	---	---	8.4	8.0	9.2	8.0	8.0	8.1	8.0	8.0	8.0
2	8.1	7.9	8.5	8.4	8.0	9.1	8.4	8.3	8.4	8.0	7.9	8.0
3	7.9	7.7	8.2	8.2	8.0	8.6	8.4	8.4	8.5	7.9	7.8	8.0
4	7.8	7.6	8.3	7.9	7.6	8.5	8.4	8.4	8.5	7.9	7.9	7.9
5	7.9	7.7	8.3	8.0	7.6	8.7	---	---	---	7.9	7.9	8.0
6	7.9	7.7	8.3	8.1	7.8	8.6	---	---	---	7.9	7.9	8.0
7	8.0	7.7	8.5	8.2	7.9	8.9	---	---	---	7.8	7.8	7.9
8	8.0	7.8	8.4	8.1	7.8	8.7	---	---	---	7.8	7.8	7.9
9	8.2	7.7	8.8	8.1	7.7	8.8	---	---	---	7.9	7.8	7.9
10	---	---	---	8.1	7.7	8.8	---	---	---	7.8	7.8	7.9
11	---	---	---	7.5	7.2	7.9	---	---	---	7.8	7.8	7.9
12	---	---	---	7.5	7.3	7.7	---	---	---	7.9	7.8	7.9
13	8.2	7.9	8.7	7.6	7.5	7.8	7.9	7.6	8.0	7.9	7.8	8.0
14	8.3	7.9	8.9	7.6	7.5	7.7	7.9	7.9	8.0	7.8	7.8	7.9
15	8.3	7.9	8.9	7.7	7.6	7.7	7.9	7.9	8.0	7.9	7.8	7.9
16	8.4	8.1	9.1	7.8	7.7	7.9	7.9	7.8	8.0	7.9	7.9	7.9
17	8.5	8.1	9.1	7.8	7.7	8.0	7.9	7.8	7.9	7.8	7.7	7.9
18	8.4	8.1	9.1	7.9	7.8	8.0	7.9	7.8	7.9	7.8	7.7	7.9
19	8.4	8.1	9.1	7.9	7.8	8.0	---	---	---	7.9	7.9	8.0
20	8.4	8.0	9.1	7.9	7.8	8.1	7.9	7.8	7.9	7.9	7.8	8.0
21	8.3	7.9	9.1	8.0	8.0	8.2	7.8	7.8	7.9	7.9	7.8	7.9
22	8.4	8.1	9.1	8.1	7.9	8.3	7.8	7.8	7.9	7.8	7.8	7.9
23	8.4	8.1	9.1	7.9	7.8	8.1	7.8	7.8	7.9	7.9	7.9	7.9
24	8.4	8.1	9.1	7.8	7.4	8.1	7.8	7.8	7.9	7.9	7.8	7.9
25	8.5	8.0	9.3	7.4	7.2	7.5	7.8	7.8	7.9	7.9	7.8	8.0
26	8.5	8.0	9.3	7.1	6.8	7.3	7.8	7.8	7.9	8.0	7.9	8.0
27	8.4	8.0	9.1	6.7	6.6	6.8	7.9	7.9	7.9	7.9	7.8	8.0
28	8.4	8.0	9.2	7.2	6.6	6.6	7.7	7.9	7.9	7.8	7.8	7.9
29	---	---	---	7.8	7.7	7.9	7.9	7.9	8.0	7.9	7.8	7.9
30	---	---	---	8.0	7.9	8.1	8.0	8.0	8.1	7.9	7.9	7.9
31	---	---	---	8.2	8.1	8.3	---	---	---	7.9	7.7	7.9
MONTH	8.3	7.6	9.3	7.8	6.6	9.2	8.0	7.6	8.5	7.9	7.7	8.0



## CANNON RIVER BASIN

05353800 STRAIGHT RIVER NEAR FARIBAULT, MN

LOCATION.--Lat 44°15'29", long 93°13'51", in W<sub>4</sub>S<sub>4</sub>E<sub>4</sub> sec.9, T.109 N., R.20 W., Rice County, Hydrologic Unit 07040002, on right bank 15 ft downstream from highway bridge, 2.8 mi upstream from Falls Creek and 3.2 mi southeast of Faribault.

DRAINAGE AREA.--442 mi<sup>2</sup>.

PERIOD OF RECORD.--October 1965 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,034.58 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good.

AVERAGE DISCHARGE.--24 years, 255 ft<sup>3</sup>/s, 7.83 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,990 ft<sup>3</sup>/s, May 1, 1973, gage height, 11.20 ft; maximum gage height, 12.74 ft, Mar. 5, 1974 (backwater from ice); minimum discharge, 10 ft<sup>3</sup>/s, Oct. 27, 1976; minimum gage height, 3.66 ft, Nov. 27, 1976.

EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base discharge of 1,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 25	1800	*4,000	*(a)12.83	No other peak greater than base discharge.			

(a) Ice jam.

Minimum discharge, 12 ft<sup>3</sup>/s, Aug. 10, 11, 12, 13, 18, 19; minimum gage height, 3.71 ft, Aug. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
1	22	33	36	e21	e40	e21	259	461	68	57	21	219		
2	19	33	e35	e21	e25	e21	212	352	64	58	21	161		
3	20	33	e35	e21	e20	e21	190	289	62	57	19	121		
4	16	37	e34	e21	e20	e21	210	251	56	46	20	105		
5	16	49	e34	e21	e20	e21	199	243	52	38	45	88		
6	17	44	e33	e21	e20	e21	162	212	52	33	21	77		
7	18	37	e32	e21	e20	e21	140	195	50	28	16	67		
8	19	35	32	e21	e20	e21	124	176	48	34	15	58		
9	18	35	32	e21	e20	e23	107	171	47	37	14	50		
10	18	34	e31	e21	e20	e125	97	156	46	26	13	45		
11	26	33	31	e20	e20	e1030	92	144	42	47	13	41		
12	21	38	31	e20	e20	e825	87	132	43	40	13	37		
13	20	44	e31	e20	e20	e700	81	124	42	34	13	35		
14	21	44	e30	e20	e20	e590	74	117	46	34	19	32		
15	21	41	e29	e20	e20	e510	72	111	43	30	20	31		
16	22	72	e27	e20	e20	e445	69	106	40	33	16	28		
17	23	57	e26	e20	e20	e385	68	98	37	25	14	26		
18	28	46	e25	e20	e20	e315	68	98	34	36	13	23		
19	37	51	e24	e20	e20	e230	68	102	32	32	14	22		
20	32	39	e27	e20	e21	e155	67	190	30	38	19	23		
21	36	32	e28	e20	e21	e125	67	145	29	37	16	21		
22	35	40	e26	e20	e21	e125	74	123	29	31	17	19		
23	34	39	e25	e20	e21	e130	86	108	31	26	18	19		
24	38	39	e23	e20	e21	e650	88	101	29	23	16	18		
25	33	39	e22	e20	e21	e3390	281	108	36	24	16	17		
26	31	44	e22	e20	e21	e3400	477	88	75	22	16	17		
27	32	57	e21	e20	e21	2150	471	80	80	21	20	17		
28	32	38	e21	e20	e21	1390	568	72	63	19	22	15		
29	32	e37	e21	e20	---	889	752	69	57	34	33	14		
30	33	e37	e21	e25	---	544	660	71	49	40	28	15		
31	31	---	e21	e35	---	354	---	72	---	21	27	---		
TOTAL	801	1237	866	650	594	18648	5970	4765	1412	1061	588	1461		
MEAN	25.8	41.2	27.9	21.0	21.2	602	199	154	47.1	34.2	19.0	48.7		
MAX	38	72	36	35	40	3400	752	461	80	58	45	219		
MIN	16	32	21	20	20	21	67	69	29	19	13	14		
AC-FT	1590	2450	1720	1290	1180	36990	11840	9450	2800	2100	1170	2900		
CFSM	.06	.09	.06	.05	.05	1.36	.45	.35	.11	.08	.04	.11		
IN.	.07	.10	.07	.05	.05	1.57	.50	.40	.12	.09	.05	.12		
CAL YR 1988	TOTAL	40615	MEAN	111	MAX	1110	MIN	16	AC-FT	80560	CFSM	.25	IN.	3.42
WTR YR 1989	TOTAL	38053	MEAN	104	MAX	3400	MIN	13	AC-FT	75480	CFSM	.24	IN.	3.20

e Estimated

ZUMBRO RIVER BASIN

05372995 SOUTH FORK ZUMBRO RIVER AT ROCHESTER, MN

LOCATION.--Lat 44°03'42", long 92°27'58", in NW&NE& sec.23, T.107 N., R.14 W., Olmsted County, Hydrologic Unit 07040004, on left bank 50 ft downstream from 37th Street bridge, 0.2 mi upstream from sewer plant, and 2.0 mi downstream from Silver Lake Dam.

DRAINAGE AREA.--303 mi<sup>2</sup>.

PERIOD OF RECORD.--March 1981 to current year.

GAGE.--Water-stage recorder. Datum of gage is 950.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Slight regulation at times from Silver Lake.

AVERAGE DISCHARGE.--8 years (water years 1982-89), 208 ft<sup>3</sup>/s, 9.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,450 ft<sup>3</sup>/s, July 1, 1983, gage height, 14.93 ft; minimum discharge, 10 ft<sup>3</sup>/s, Oct. 23, 1981, result of regulation; minimum gage height, 2.40 ft, Dec. 12, 1988.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of July 6, 1978, reached a stage of about 28.0 ft, on upstream side of bridge, discharge 30,500 ft<sup>3</sup>/s. This is the highest known stage since at least 1908.

EXTREMES FOR CURRENT PERIOD.--Peak discharges greater than base discharge of 1,300 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 12	0730	2,050	8.96	Mar. 24	1900	*3,650	*11.87

Minimum discharge, 11 ft<sup>3</sup>/s, Dec. 12, gage height, 2.40 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1988  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	27	28	e35	e22	235	21	183	213	e65	e39	e31	e120
2	25	29	33	e22	87	22	166	181	e64	e38	e30	e140
3	24	28	33	e21	72	23	202	159	e62	e38	e30	e130
4	23	62	28	e22	68	24	206	153	e61	e38	e29	e120
5	23	69	30	e23	52	24	188	138	e60	e37	e29	e105
6	23	41	30	e24	46	24	155	120	e57	e37	e29	e95
7	23	37	28	e26	44	24	144	106	e55	e37	e28	e90
8	23	35	23	e27	37	24	136	95	e54	e37	e27	e87
9	23	35	24	e27	35	26	127	88	e52	e37	e25	e84
10	24	37	24	e28	32	48	119	70	e50	e37	e24	e80
11	23	34	21	e28	32	550	113	e67	e50	e37	e24	e76
12	23	51	19	e29	32	1640	107	e65	e50	e39	e24	e73
13	24	43	21	e30	34	959	102	e64	e50	e39	e23	e67
14	23	37	23	34	31	799	98	e62	e50	e39	e23	e63
15	22	64	21	35	31	581	95	e63	e49	e38	e23	e60
16	22	55	19	35	27	283	91	e66	e47	e37	e23	e56
17	25	34	19	35	27	e150	96	e68	e46	e37	e23	e54
18	24	37	19	35	26	114	88	e76	e44	e37	e24	e52
19	21	42	20	40	26	116	84	e74	e43	e39	e25	e47
20	31	33	90	39	27	134	82	e70	e42	e40	e25	e50
21	32	22	e40	33	28	119	81	e69	e41	e39	e26	e49
22	25	34	e35	40	23	127	85	e68	e40	e37	e27	e48
23	25	33	e29	44	21	390	102	e67	e40	e36	e28	e47
24	26	31	e26	43	21	3020	149	e69	e42	e36	e29	e46
25	27	28	e23	45	23	1960	159	e67	e44	e35	e30	e45
26	26	101	e25	49	24	975	217	e63	e45	e35	e32	e43
27	26	48	e21	46	23	835	205	e64	e44	e35	e35	e43
28	26	40	e30	53	24	486	286	e67	e42	e34	e38	e42
29	25	40	e35	47	---	315	355	e69	e41	e33	e41	e42
30	27	e39	e25	48	---	237	268	e70	e40	e32	e45	e42
31	27	---	e23	108	---	200	---	e67	---	e31	e56	---
TOTAL	768	1247	872	1138	1188	14250	4489	2738	1470	1140	906	2096
MEAN	24.8	41.6	28.1	36.7	42.4	460	150	88.3	49.0	36.8	29.2	69.9
MAX	32	101	90	108	235	3020	355	213	65	40	56	140
MIN	21	22	19	21	21	21	81	62	40	31	23	42
AC-FT	1520	2470	1730	2260	2360	28260	8900	5430	2920	2260	1800	4160
CFSM	.08	.14	.09	.12	.14	1.52	.49	.29	.16	.12	.10	.23
IN.	.09	.15	.11	.14	.15	1.75	.55	.34	.18	.14	.11	.26

CAL YR 1988	TOTAL 28164	MEAN 77.0	MAX 713	MIN 12	AC-FT 55860	CFSM .25	IN. 3.46
WTR YR 1989	TOTAL 32302	MEAN 88.5	MAX 3020	MIN 19	AC-FT 64070	CFSM .29	IN. 3.97

e Estimated

## ZUMBRO RIVER BASIN

05374900 ZUMBRO RIVER AT KELLOGG, MN

LOCATION.--Lat 44°18'43", long 92°00'14", in SW¼ sec.22, T.110 N., R.10 W., Wabasha County, Hydrologic Unit 07040004, on right bank at downstream side of bridge on U.S. Highway 61, and 4 mi above mouth.

DRAINAGE AREA.--1,400 mi<sup>2</sup>.

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

GAGE.--Water-stage recorder. Datum of gage is 669.47 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--14 years, 869 ft<sup>3</sup>/s, 8.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,300 ft<sup>3</sup>/s, Sept. 23, 1986, gage height, 16.07 ft; minimum daily, 140 ft<sup>3</sup>/s, Dec. 3, 1980; minimum gage height, 1.62 ft, Aug. 3, 1989.

EXTREMES OUTSIDE PERIOD OF RECORD.--A discharge of 33,000 ft<sup>3</sup>/s, occurred on July 22, 1951, at station 05374500, 20 mi upstream; this was the greatest since 1938.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 13	0600	11,700	(a)12.17	Mar. 27	0830	*12,000	*12.65

(a) Backwater from ice.

Minimum discharge, 286 ft<sup>3</sup>/s, Sept. 30, gage height, 1.63 ft; minimum gage height, 1.62 ft, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	339	363	443	e380	e380	e315	853	976	468	350	306	358
2	339	356	442	e380	e440	e312	731	1010	449	387	302	409
3	337	351	428	e380	e400	e311	604	1020	452	422	300	544
4	335	354	421	e375	e380	e310	565	1010	449	420	304	547
5	339	378	414	e376	e360	e310	519	951	438	390	304	524
6	339	398	e402	e380	e350	e310	478	867	428	380	383	537
7	339	407	e401	e381	e350	e311	527	830	450	369	364	478
8	339	397	e400	e380	e350	e315	429	842	431	370	322	423
9	344	389	e399	e378	e352	e320	406	749	397	373	316	417
10	346	388	e399	e378	e353	e450	386	776	406	356	330	417
11	346	384	e398	e375	e355	e850	370	708	467	384	327	392
12	346	385	e385	e375	e350	e4000	344	649	426	383	326	383
13	346	391	e382	e370	e350	e10300	322	649	422	423	332	376
14	344	393	e380	e373	e349	e8000	320	622	397	356	362	369
15	346	398	e385	e380	e348	e3700	326	614	399	347	346	368
16	348	421	e390	e385	e348	e3200	352	612	377	341	347	356
17	351	447	e400	e388	e345	e2300	334	591	392	334	345	351
18	351	470	e400	e390	e340	4740	336	606	387	343	338	352
19	349	462	e400	e390	e335	4100	332	590	378	356	344	348
20	350	452	e399	e385	e330	3930	333	620	363	367	337	323
21	353	447	e399	e385	e325	3080	337	605	339	359	330	331
22	356	438	e398	e380	e320	1030	344	649	322	347	351	339
23	357	424	e400	e380	e320	536	361	604	323	339	367	335
24	360	417	e400	e378	e318	1290	373	605	332	335	385	338
25	360	417	e405	e376	e315	7410	425	563	357	333	360	318
26	359	425	e400	e376	e313	11000	465	556	368	354	346	314
27	358	433	e398	e376	e315	11300	520	548	404	349	337	307
28	403	445	e395	e380	e315	8690	756	491	430	346	345	304
29	421	443	e390	e385	---	3130	809	480	367	327	379	324
30	392	437	e385	e380	---	1610	912	467	385	326	376	289
31	375	---	e380	e380	---	1050	---	481	---	315	351	---
TOTAL	10967	12310	12418	11775	9706	98510	14169	21341	12003	11181	10562	11471
MEAN	354	410	401	380	347	3178	472	688	400	361	341	382
MAX	421	470	443	390	440	11300	912	1020	468	423	385	547
MIN	335	351	380	370	313	310	320	467	322	315	300	289
AC-FT	21750	24420	24630	23360	19250	195400	28100	42330	23810	22180	20950	22750
CFSM	.25	.29	.29	.27	.25	2.27	.34	.49	.29	.26	.24	.27
IN.	.29	.33	.33	.31	.26	2.62	.38	.57	.32	.30	.28	.30

CAL YR 1988 TOTAL 223055 MEAN 609 MAX 4420 MIN 274 AC-FT 442400 CFSM .44 IN. 5.93  
WTR YR 1989 TOTAL 236413 MEAN 648 MAX 11300 MIN 289 AC-FT 468900 CFSM .46 IN. 6.28

e Estimated

WHITEWATER RIVER BASIN

05376000 NORTH FORK WHITEWATER RIVER NEAR ELBA, MN  
(Hydrologic bench-mark station)

LOCATION.--Lat 44°05'30", long 92°03'57", in sec.7, T.107 N., R.10 W., Winona County, Hydrologic Unit 07040003, on left bank 2.3 mi upstream from Middle Fork, 2.4 mi west of Elba, and 3.5 mi upstream from confluence with South Fork.

DRAINAGE AREA.--101 mi<sup>2</sup>.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1939 to September 1941, July 1967 to current year.

REVISED RECORDS.--WRD MN-74: 1967(M), 1969(M), 1971(M), 1972(M), 1973(M). WRD MN-80-2: 1978.

GAGE.--Water-stage recorder. Datum of gage is 769.60 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 12, 1939, nonrecording gage at site 2 mi downstream at different datum. Oct. 12, 1939, to Sept. 30, 1941, water-stage recorder at site 600 ft downstream at present datum. Prior to July 6, 1978, water-stage recorder at same site and present datum (gage destroyed by flood of July 1978), July 6 to Oct. 30, 1978, nonrecording gage at same site and present datum.

REMARKS.--Records good.

AVERAGE DISCHARGE.--24 years (water years 1940-41, 1968-89), 47.6 ft<sup>3</sup>/s, 6.40 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,100 ft<sup>3</sup>/s, June 21, 1974, gage height, 16.32 ft, from floodmark; minimum, 11 ft<sup>3</sup>/s, Feb. 21, 1968.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 600 ft<sup>3</sup>/s and maximum (\*).

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 12	0400	1,350	7.34	Mar. 25	0100	*4,330	*9.33

Minimum discharge, 20 ft<sup>3</sup>/s, Sept. 22, 23-30; minimum gage height, 4.07 ft, Feb. 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	26	27	23	208	23	52	42	29	31	31	34
2	22	27	26	23	45	22	47	40	29	30	31	28
3	22	27	26	22	34	25	49	38	30	29	31	26
4	21	29	27	22	31	25	49	37	29	29	32	26
5	21	31	27	23	30	24	44	36	28	29	33	26
6	22	28	27	25	28	23	40	34	28	29	30	25
7	22	28	27	25	27	23	38	33	28	29	28	25
8	22	27	25	25	26	23	38	33	28	30	27	25
9	23	27	25	23	25	23	36	33	28	30	27	25
10	22	27	25	23	24	24	35	33	28	29	27	25
11	22	27	24	23	24	126	34	32	28	34	27	23
12	22	27	23	24	25	882	35	32	28	34	27	23
13	22	27	25	24	25	454	34	32	28	32	28	23
14	22	26	25	24	25	373	34	33	29	30	30	23
15	22	27	24	25	25	177	34	32	29	30	30	23
16	22	33	23	25	24	70	34	31	28	30	28	22
17	23	30	23	25	23	48	33	32	28	30	27	22
18	23	29	25	25	23	36	33	31	28	33	27	22
19	22	28	25	25	24	32	33	32	28	32	28	22
20	23	27	31	25	24	29	33	32	28	31	28	21
21	25	26	28	25	24	28	33	32	28	31	27	21
22	24	27	27	25	24	27	33	31	28	31	29	21
23	24	27	27	25	24	32	34	30	30	31	27	20
24	25	27	26	26	23	1340	34	32	28	32	27	20
25	25	27	25	27	23	1510	42	31	29	32	26	20
26	25	28	25	26	23	863	42	30	31	32	29	20
27	25	28	26	25	23	443	41	30	31	32	27	20
28	25	28	25	25	24	152	45	30	29	31	30	20
29	25	27	24	25	---	92	50	29	29	33	28	20
30	25	27	23	25	---	70	46	29	29	34	26	20
31	26	---	23	80	---	58	---	29	---	32	29	---
TOTAL	716	830	789	813	908	7077	1165	1011	859	962	882	691
MEAN	23.1	27.7	25.5	26.2	32.4	228	38.8	32.6	28.6	31.0	28.5	23.0
MAX	26	33	31	80	208	1510	52	42	31	34	33	34
MIN	21	26	23	22	23	22	33	29	28	29	26	20
AC-FT	1420	1650	1560	1610	1800	14040	2310	2010	1700	1910	1750	1370
CFSM	.23	.27	.25	.26	.32	2.26	.38	.32	.28	.31	.28	.23
IN.	.26	.31	.29	.30	.33	2.61	.43	.37	.32	.35	.32	.25
CAL YR 1988	TOTAL 11270	MEAN 30.8	MAX 253	MIN 20	AC-FT 22350	CFSM .30	IN. 4.15					
WTR YR 1989	TOTAL 16703	MEAN 45.8	MAX 1510	MIN 20	AC-FT 33130	CFSM .45	IN. 6.15					

## WHITEWATER RIVER BASIN

05376000 NORTH FORK WHITEWATER RIVER NEAR ELBA, MN--Continued  
(Hydrologic bench-mark station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967 to current year.

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

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (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 WATER (DEG C) (00010)	TUR- BID- ITY (NTU) (00076)	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)
NOV												
08...	1110	26	554	562	8.2	8.2	6.5	0.60	769	12.6	K6	K28
JAN												
25...	1050	27	575	590	8.1	8.1	3.5	1.8	781	12.1	>300	72
MAR												
24...	1245	560	246	228	7.4	7.4	1.0	290	773	13.0	E5000	K14000
APR												
05...	1425	49	546	--	8.2	--	9.0	--	780	10.7	--	--
29...	0901	64	626	--	--	--	--	--	--	--	--	--
29...	1031	65	636	--	--	--	--	--	--	--	--	--
MAY												
25...	1430	36	546	544	8.4	8.3	17.5	0.80	765	12.1	72	K12
JUL												
19...	1430	38	531	521	8.4	8.4	18.5	1.0	740	11.9	58	180
SEP												
06...	1145	25	539	532	8.1	8.1	15.5	0.60	775	9.4	110	280

DATE	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)	ALKA- LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	ALKA- LINITY LAB (MG/L AS CACO3) (90410)	CAR- BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	BICAR- BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)	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)
NOV												
08...	74	29	7.8	1.3	264	266	0	320	15	12	0.10	16
JAN												
25...	76	27	13	1.7	270	261	0	329	19	21	0.20	16
MAR												
24...	18	5.9	4.7	11	68	102	0	83	11	11	0.10	4.2
APR												
05...	--	--	--	--	--	--	--	--	--	--	--	--
29...	--	--	--	--	--	--	--	--	--	--	--	--
29...	--	--	--	--	--	--	--	--	--	--	--	--
MAY												
25...	70	28	10	1.6	246	255	5	290	16	14	0.20	11
JUL												
19...	68	27	6.5	1.4	342	258	2	414	13	12	0.10	14
SEP												
06...	71	26	6.1	1.3	256	254	0	312	13	8.6	0.20	16

DATE	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	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,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											
08...	292	0.01	3.3	<0.01	<0.01	0.20	0.14	0.14	0.11	10	59
JAN											
25...	331	0.01	4.1	0.05	0.03	0.40	0.44	0.43	0.39	6	100
MAR											
24...	145	0.05	1.6	3.7	3.7	10	2.4	0.78	0.63	2470	83
APR											
05...	--	--	3.8	--	--	--	--	--	--	--	--
29...	--	--	--	--	--	--	--	--	--	230	--
29...	--	--	--	--	--	--	--	--	--	23	--
MAY											
25...	302	0.03	2.6	0.03	0.03	0.90	0.21	0.19	0.18	16	54
JUL											
19...	296	0.01	1.9	0.02	0.01	0.70	0.11	0.10	0.08	--	--
SEP											
06...	284	0.01	2.1	0.06	0.03	<0.20	0.09	0.09	0.09	20	22

## WHITEWATER RIVER BASIN

05376000 NORTH FORK WHITEWATER RIVER NEAR ELBA, MN--Continued

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

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 08...	1110	<10	<1	53	<0.5	3.0	<1	<3	1	8	<5
JAN 25...	1050	<10	1	54	<0.5	<1.0	10	<3	1	5	<5
MAR 24...	1245	40	1	35	<0.5	<1.0	1	<3	5	120	<5
SEP 06...	1145	<10	<1	55	<0.5	<1.0	2	<3	<1	9	<1

DATE	TIME	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 08...	10	10	3	<0.1	<10	1	<1	<1.0	70	<6	6
JAN 25...	11	11	10	<0.1	<10	1	<1	<1.0	69	<6	10
MAR 24...	<4	<4	44	<0.1	<10	5	<1	<1.0	29	<6	23
SEP 06...	6	6	7	0.2	<10	1	<1	<1.0	71	<6	13

## RADIOCHEMICAL ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

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)	URANIUM NATURAL DIS- SOLVED (UG/L AS U) (22703)
MAR 24...	1245	<0.4	26	13	28	9.8	24	0.07	0.13
SEP 06...	1145	1.0	<0.4	1.7	1.2	1.5	1.0	0.14	0.07

## GARVIN BROOK BASIN

05378235 GARVIN BROOK NEAR MINNESOTA CITY, MN

LOCATION.--Lat 44°04'16", long 91°45'51", in SE1/4 sec. 15, T.107 N., R.8 W., Winona County, Hydrologic Unit 07040003, on left bank, 20 ft downstream from County 23 bridge, 1.8 mi south of Minnesota City, and 2.3 mi upstream from Rollingstone Creek.

PERIOD OF RECORD.--March 1982 to November 1983, January 1984 to current year (partial winter records in 1984).

GAGE.--Water stage recorder and broad-crested weir.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--6 years (water years 1983, 1985-89), 34.8 ft<sup>3</sup>/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge 1,580 ft<sup>3</sup>/s, Sept. 21, 1986, gage height, 6.63 ft; minimum, 12 ft<sup>3</sup>/s, Jan. 4, 1989; minimum gage height, 0.75 ft, Mar. 9, 1982, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,240 ft<sup>3</sup>/s, Mar. 24, gage height, 5.95 ft; minimum discharge, 12 ft<sup>3</sup>/s, Jan. 4; minimum gage height, 0.77 ft, Sept. 11, 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	23	27	e23	36	e29	35	29	e23	e22	26	164
2	19	23	27	e23	e36	e29	35	29	e23	e22	26	36
3	19	23	27	e23	e35	e29	37	29	e23	e22	26	32
4	19	25	26	e22	e34	e29	37	29	e23	e22	27	33
5	18	28	27	e21	e33	e29	35	29	e23	e23	29	31
6	18	24	27	e21	e32	e33	34	28	e23	e22	26	30
7	18	24	26	e21	e31	e45	34	27	e23	e23	26	30
8	20	24	26	e21	e30	e58	33	27	e23	e24	26	30
9	20	24	e27	e21	e30	39	31	27	e23	e24	27	29
10	21	24	e27	e21	e29	37	31	e26	e23	e23	27	29
11	21	24	e28	e21	e28	282	31	e25	e23	28	27	23
12	21	24	e28	e21	e27	178	30	e25	e22	25	28	18
13	22	25	e28	e21	e27	82	30	e25	e22	24	28	37
14	21	25	28	e21	e26	207	30	e25	e22	23	28	20
15	22	28	e28	e21	26	62	30	e26	e22	24	27	23
16	23	43	e28	21	e26	35	31	e25	e22	23	27	26
17	24	28	e27	21	e27	34	29	e24	e22	24	27	26
18	23	27	e27	20	e28	40	28	e25	e22	35	27	25
19	23	27	27	20	e29	37	28	e24	e22	30	27	25
20	24	26	29	19	e29	33	28	e24	e22	25	e28	25
21	25	26	24	20	29	25	27	e25	e22	24	28	25
22	23	26	23	19	e29	31	27	e25	e22	24	30	26
23	23	26	24	20	e28	209	27	e25	e22	25	28	25
24	24	27	23	19	e28	416	28	e24	e23	25	31	24
25	22	27	e24	18	e27	129	25	e23	e23	25	30	25
26	22	27	25	18	26	115	39	e24	e23	25	24	24
27	22	28	26	18	e29	63	30	e25	e22	25	29	24
28	22	27	e25	17	e30	36	33	e24	e22	24	31	24
29	22	27	e25	19	---	37	35	e24	e22	27	29	24
30	22	27	e24	21	---	36	31	e23	e22	26	29	24
31	22	---	e24	43	---	36	---	e23	---	26	39	---
TOTAL	664	787	812	655	825	2480	939	793	674	764	868	937
MEAN	21.4	26.2	26.2	21.1	29.5	80.0	31.3	25.6	22.5	24.6	28.0	31.2
MAX	25	43	29	43	36	416	39	29	23	35	39	164
MIN	18	23	23	17	26	25	25	23	22	22	24	18
AC-FT	1320	1560	1610	1300	1640	4920	1860	1570	1340	1520	1720	1860

CAL YR 1988 TOTAL 9977 MEAN 27.3 MAX 48 MIN 18 AC-FT 19790  
WTR YR 1989 TOTAL 11198 MEAN 30.7 MAX 416 MIN 17 AC-FT 22210

e Estimated

## MISSISSIPPI RIVER MAIN STEM

05378500 MISSISSIPPI RIVER AT WINONA, MN

LOCATION.--Lat 44°03'21", long 91°38'16", in sec.23, T.107 N., R.7 W., Winona County, Hydrologic Unit 07040003, on right bank at Winona pumping station in Winona, 9.5 mi upstream from Trempealeau River, and at mile 725.7 upstream from the Ohio River.

DRAINAGE AREA.--59,200 mi<sup>2</sup>, approximately.

## WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1928 to current year. Gage-height records collected in this vicinity since 1878 are contained in reports of Mississippi River Commission.

GAGE.--Water-stage recorder. Datum of gage is 639.64 ft above National Geodetic Vertical Datum of 1929. June 10, 1928, to Apr. 15, 1931, nonrecording gage at site 800 ft upstream. Prior to Oct. 1, 1929, at datum 0.20 ft higher and Oct. 1, 1929, to Apr. 15, 1931, at datum 0.12 ft lower. Apr. 16, 1931, to Nov. 12, 1934, nonrecording gage at present site and datum. Since Mar. 31, 1937, auxiliary water-stage recorder 2.7 mi upstream at tailwater of navigation dam 5A.

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs, navigation dams, and powerplants at low and medium stages. Flood flow not materially affected by artificial storage.

AVERAGE DISCHARGE.--61 years, 27,710 ft<sup>3</sup>/s, 6.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 268,000 ft<sup>3</sup>/s, Apr. 19, 1965, gage height, 20.77 ft, from floodmark; minimum, 1,940 ft<sup>3</sup>/s, Dec. 12, 1980, gage height, 3.96 ft, result of ice jam; minimum gage height, -3.38 ft, Aug. 31, 1934 (prior to dam construction in 1936); minimum gage height since 1938, after completion of dam, 1.95 ft, Jan. 27, 1944.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of June 18, 1880, reached an elevation of 657.14 ft, discharge, 172,000 ft<sup>3</sup>/s, from information by U.S. Army Corps of Engineers.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 79,400 ft<sup>3</sup>/s, Mar. 31, gage height, 9.86 ft; minimum daily discharge, 5,950 ft<sup>3</sup>/s, Aug. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17300	13100	18300	13100	13500	13000	77800	40200	44100	22000	9800	13000
2	17600	12700	17100	12100	13200	12900	75300	39800	45800	20200	11200	13600
3	16100	13000	16300	12300	12800	12900	69100	41100	47400	20600	12500	15100
4	11900	12900	15500	11700	12900	11800	64900	42500	46200	21600	12500	16500
5	11500	14000	15100	11200	12400	11900	60000	43400	41700	22200	12200	17900
6	10700	14200	15300	11200	12200	12000	57800	43900	35000	22000	12100	19800
7	13200	14300	13800	11200	12300	12000	58200	43000	32100	17200	11400	21200
8	15100	12800	13800	11300	12300	12000	59100	41500	30500	15800	9900	21300
9	14700	13900	13800	11400	12300	12000	62000	40700	29000	12300	8600	20200
10	13200	12300	12300	11400	11300	12000	64700	39800	27000	18300	7500	19700
11	12200	13800	9500	11400	13200	11900	64200	38800	24700	13800	6670	16900
12	11800	13000	8500	11500	14100	15900	64100	38700	21100	15100	6400	15200
13	11800	12900	8900	11500	14800	28500	63500	39200	19100	15200	5950	14200
14	11200	14300	10100	11500	14700	29300	61700	39600	19000	13500	6700	14200
15	11200	15500	10700	11500	14400	27500	59600	38700	20500	12700	8420	13100
16	11500	16400	11000	12000	14400	25500	55600	37000	21500	11900	10800	12700
17	12900	17400	11000	12000	14400	22600	52900	35100	21800	11800	12900	12700
18	12600	17200	10900	12000	14400	20400	52800	32900	22100	10800	13500	12000
19	13200	17400	10900	12000	14400	18600	51700	31000	24000	9720	13200	11900
20	14000	20500	11000	11200	14200	16500	50500	30300	25000	12400	13100	11200
21	13300	21400	13100	12000	14100	14700	49700	30000	24200	14400	13100	11300
22	14100	21400	13000	11900	14000	12600	49100	28200	20200	15900	11700	11300
23	13300	20900	13200	12000	13700	12700	47500	26500	19100	15100	11600	12800
24	13000	19600	14700	12200	12500	13900	45000	26300	18500	15600	11600	12600
25	12200	18400	15200	12200	11600	26000	44700	27400	17900	13600	11700	11800
26	11600	18100	15000	12400	12500	45100	42800	28400	17500	10900	12200	11900
27	10600	17400	14000	12600	13600	51600	39800	29300	18100	11300	12400	11800
28	8820	17400	12900	13100	12900	60900	39700	32100	19400	10100	12300	11800
29	10600	17000	13700	13100	---	73900	40000	37200	21900	9760	11900	11800
30	13300	17600	13200	13100	---	78400	40700	41200	22200	12500	11900	12100
31	12800	---	13100	13000	---	78800	---	42400	---	12600	11600	---
TOTAL	397320	480800	404900	371100	373100	807800	1664500	1126200	796600	467980	337340	431600
MEAN	12820	16030	13060	11970	13320	26060	55480	36330	26550	15100	10880	14390
MAX	17600	21400	18300	13100	14800	78800	77800	43900	47400	22200	13500	21300
MIN	8820	12300	8500	11200	11300	11800	39700	26300	17500	9720	5950	11200
AC-FT	788100	953700	803100	736100	740000	1602000	3302000	2234000	1580000	928200	669100	856100
CFSM	.22	.27	.22	.20	.23	.44	.94	.61	.45	.26	.18	.24
IN.	.25	.30	.25	.23	.23	.51	1.05	.71	.50	.29	.21	.27
CAL YR 1988	TOTAL 5882170	MEAN 16070	MAX 46400	MIN 5500	AC-FT 11670000	CFSM .27	IN. 3.70					
WTR YR 1989	TOTAL 7659240	MEAN 20980	MAX 78800	MIN 5950	AC-FT 15190000	CFSM .35	IN. 4.81					

## MISSISSIPPI RIVER MAIN STEM

05378500 MISSISSIPPI RIVER AT WINONA, MN--Continued  
(National stream-quality accounting network station)

## WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1963 to current year.

PERIOD OF DAILY RECORD.--

CHEMICAL DATA: April 1963 to August 1986 (discontinued).

SPECIFIC CONDUCTANCE: May 1980 to September 1984 (discontinued).

WATER TEMPERATURES: October 1975 to September 1988 (discontinued).

SUSPENDED-SEDIMENT DISCHARGE: September 1975 to September 1988 (discontinued).

REMARKS.--Daily sediment concentrations and loads were estimated on the basis of water records and sediment samples that were collected weekly during April 1 to September 30. No samples were collected October 1 to May 31. Water temperature was measured at the time of sample collection. Letter K indicates non-ideal colony count.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURES: Maximum daily, 29.5°C, Aug. 17, 1988; minimum daily, 0.0°C many days each year.

SEDIMENT CONCENTRATIONS: Maximum daily mean, 393 mg/L July 2, 1978; minimum daily mean, 1 mg/L many days during several years.

SEDIMENT LOADS: Maximum daily 65,300 tons July 2, 1978; minimum daily, 19 tons, Dec. 12, 1980.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, IN CUBIC FEET PER SECOND (00060)	SEDI- MENT, SUS- PENDED (MG/L) (80154)
AUG 01...	1230	9800	16

## PARTICLE-SIZE DISTRIBUTION OF SURFACE BED MATERIAL

## WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	NUMBER OF SAM- PLING POINTS (COUNT) (00063)	BED MAT. SIEVE DIAM. % FINER THAN .062 MM (80164)	BED MAT. SIEVE DIAM. % FINER THAN .125 MM (80165)	BED MAT. SIEVE DIAM. % FINER THAN .250 MM (80166)	BED MAT. SIEVE DIAM. % FINER THAN .500 MM (80167)	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM (80168)	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM (80169)
MAY 03...	1400	1	0	0	13	83	99	100

ROOT RIVER BASIN

05384000 ROOT RIVER NEAR LANESBORO, MN

LOCATION.--Lat 43°44'58", long 91°58'43", in sec.1, T.103 N., R.10 W., Fillmore County, Hydrologic Unit 07040008, on left bank 0.5 mi upstream from highway bridge, 1.2 mi upstream from South Branch, and 2.5 mi northeast of Lanesboro.

DRAINAGE AREA.--615 mi<sup>2</sup>.

PERIOD OF RECORD.--February to November 1910, February 1911 to September 1914, July 1915 to September 1917, August 1940 to September 1985, October 1986 to present. Published as North Branch Root River near Lanesboro, 1910-17. High-flow partial-record station, October 1985 to September 1986.

REVISED RECORDS.--WSP 355: 1912. WSP 1308: 1911(M).

GAGE.--Water-stage recorder. Datum of gage is 791.32 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1917, nonrecording gage at site 0.5 mi downstream at datum about 1.5 ft higher.

REMARKS.--Records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--53 years (water years 1912-14, 1916-17, 1941-85, 1987-89), 352 ft<sup>3</sup>/s, 7.77 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,100 ft<sup>3</sup>/s, Mar. 29, 1962, gage height, 16.11 ft; maximum gage height, 17.83 ft, Mar. 1, 1965, from floodmark (backwater from ice); minimum discharge, 29 ft<sup>3</sup>/s, Aug. 27, 1949, gage height, 1.08 ft; minimum gage height, 0.42 ft, Dec. 3, 1980.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 12	2200	3,650	*(a)10.48	Mar. 24	2330	*6,400	9.31

(a) Ice jam.

Minimum discharge, 68 ft<sup>3</sup>/s, Dec. 2, gage height, 0.46 ft.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	120	111	110	e125	e350	e107	277	485	155	116	114	188
2	119	111	116	e125	e200	e106	250	403	150	116	114	292
3	116	111	173	e125	e150	e105	242	357	145	116	113	326
4	112	119	162	e120	e135	e104	261	332	144	114	111	367
5	111	130	151	e120	e115	e104	350	314	140	111	112	285
6	111	127	151	e115	e110	e107	320	292	136	110	112	230
7	111	127	140	e112	e107	e110	262	272	134	109	111	199
8	111	126	116	e108	e105	e115	233	256	132	109	114	193
9	111	121	115	e105	e103	e122	212	243	131	110	111	189
10	111	119	127	e102	e100	e140	196	234	130	109	92	172
11	111	116	117	e108	e100	e250	185	223	128	117	90	158
12	108	121	145	e112	e100	e2540	176	213	128	118	88	155
13	108	125	141	e114	e110	2540	168	205	129	114	88	152
14	108	123	135	e118	e110	2330	164	202	130	113	88	145
15	110	127	164	e120	e110	1910	158	199	129	110	88	139
16	110	153	142	e120	e110	1030	153	194	125	107	88	136
17	109	169	141	e120	e110	517	150	190	123	107	88	131
18	110	173	132	e120	e100	278	146	187	120	123	87	126
19	110	154	131	e120	e100	264	144	190	119	118	84	122
20	111	145	145	e120	e103	295	144	195	117	121	87	120
21	115	131	168	e120	e106	251	144	198	115	118	86	117
22	117	125	150	e125	e108	229	143	191	113	114	93	117
23	113	151	152	e128	e114	1060	163	182	115	112	92	120
24	113	136	151	e130	e117	4650	177	175	114	110	94	113
25	112	133	150	e127	e117	3490	206	172	115	111	93	108
26	111	138	140	e120	e114	1650	332	165	123	109	96	107
27	111	142	e130	e118	e110	1350	354	156	129	107	102	106
28	111	139	e125	e120	e108	847	401	150	130	106	108	104
29	109	132	e125	e135	---	518	562	145	125	110	121	102
30	109	142	e125	e160	---	389	667	156	119	116	134	102
31	114	---	e125	e190	---	319	---	160	---	114	139	---
TOTAL	3463	3977	4295	3802	3422	27827	7340	7036	3843	3495	3138	4921
MEAN	112	133	139	123	122	898	245	227	128	113	101	164
MAX	120	173	173	190	350	4650	667	485	155	123	139	367
MIN	108	111	110	102	100	104	143	145	113	106	84	102
AC-FT	6870	7890	8520	7540	6790	55190	14560	13960	7620	6930	6220	9760
CFSM	.18	.22	.23	.20	.20	1.46	.40	.37	.21	.18	.16	.27
IN.	.21	.24	.26	.23	.21	1.68	.44	.43	.23	.21	.19	.30

CAL YR 1988	TOTAL 76185	MEAN 208	MAX 2920	MIN 95	AC-FT 151100	CFSM .34	IN. 4.61
WTR YR 1989	TOTAL 76559	MEAN 210	MAX 4650	MIN 84	AC-FT 151900	CFSM .34	IN. 4.63

e Estimated

IOWA RIVER BASIN

05457000 CEDAR RIVER NEAR AUSTIN, MN

LOCATION.--Lat 43°38'11", long 92°58'26", in NE&SE& sec.15, T.102 N., R.18 W., Mower County, Hydrologic Unit 07080201, on left bank 200 ft upstream from abandoned powerhouse, 500 ft downstream from highway bridge, 1.1 mi downstream from Turtle Creek, and 1.1 mi south of Austin.

DRAINAGE AREA.--425 mi<sup>2</sup>.

PERIOD OF RECORD.--May 1909 to September 1914, October 1944 to current year.

REVISED RECORDS.--WSP 1145: 1945, 1948.

GAGE.--Water-stage recorder. Datum of gage is 1,162.10 ft above National Geodetic Vertical Datum of 1929. May 1909 to April 1912, nonrecording gage in tailwater of powerhouse 200 ft downstream at datum 3.1 ft lower. May 1912 to September 1914, nonrecording gage on highway bridge 500 ft downstream at datum 1.1 ft lower.

REMARKS.--Records good except those for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--50 years (water years 1910-14, 1945-89), 207 ft<sup>3</sup>/s, 6.61 in/yr; median of yearly mean discharges, 188 ft<sup>3</sup>/s, 6.13 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,400 ft<sup>3</sup>/s, July 17, 1978, gage height, 20.35 ft, from floodmark in well; no flow for several days in 1911.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 12	0230	2,110	7.27	Mar. 24	2130	*3,290	*9.33

Minimum discharge, 35 ft<sup>3</sup>/s, Aug. 19, 21, gage height, 2.20 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	66	63	89	e60	e54	e45	187	443	153	98	59	1280
2	59	60	86	e60	e50	e45	174	358	119	94	54	1020
3	57	62	85	e59	e50	e45	492	304	116	102	54	508
4	56	69	79	e58	e50	e46	716	274	96	94	67	361
5	55	81	81	e58	e50	e47	408	268	91	79	84	295
6	53	65	81	e58	e50	e48	271	238	66	74	51	246
7	54	61	81	e58	e50	e49	215	213	84	69	43	203
8	53	62	75	e57	e50	e49	195	200	84	72	42	189
9	52	59	75	e57	e50	49	167	202	61	63	43	210
10	54	60	67	e57	e50	278	148	187	78	59	41	194
11	51	55	e63	e56	e50	1720	143	176	106	135	39	165
12	51	67	e61	e55	e50	1870	136	165	98	94	39	142
13	51	68	e61	e54	e50	1090	130	158	98	82	46	126
14	52	65	e60	e54	e50	969	132	152	98	66	45	116
15	53	116	e60	e54	e50	898	123	146	103	60	46	106
16	59	202	e60	e54	e50	423	119	137	96	54	44	98
17	55	220	e60	e53	e50	233	124	130	88	53	40	88
18	57	167	e60	e53	e50	142	119	130	70	163	38	83
19	55	138	e60	e53	e49	119	119	133	68	184	37	79
20	59	108	e60	e60	e48	101	121	129	66	154	38	75
21	66	107	e60	e53	e47	88	123	119	65	110	38	72
22	58	97	e60	e53	e46	105	146	113	77	91	47	71
23	59	103	e60	e53	e46	711	154	111	70	79	45	60
24	58	97	e60	e52	e45	2900	168	120	67	70	44	57
25	61	95	e60	e52	e45	2350	221	125	103	66	41	60
26	55	112	e60	e52	e45	1220	367	113	127	60	64	58
27	57	110	e60	e52	e45	921	387	99	133	57	48	57
28	58	85	e60	e52	e45	656	492	90	133	51	313	57
29	53	106	e60	e52	---	416	785	89	114	87	196	57
30	52	98	e60	e53	---	298	636	116	104	76	149	53
31	58	---	e60	e56	---	228	---	207	---	65	143	---
TOTAL	1737	2858	2064	1708	1365	18159	7728	5445	2872	2661	2078	6186
MEAN	56.0	95.3	66.6	55.1	48.7	586	256	176	95.7	85.8	67.0	206
MAX	66	220	89	60	54	2900	795	443	153	184	313	1280
MIN	51	55	60	52	45	45	119	89	65	51	37	53
AC-FT	3450	5670	4090	3390	2710	36020	15330	10800	5700	5280	4120	12270
CFSM	.13	.22	.16	.13	.11	1.38	.61	.41	.23	.20	.16	.49
IN.	.15	.25	.18	.15	.12	1.59	.66	.46	.25	.23	.18	.54

CAL YR 1988	TOTAL 43924	MEAN 120	MAX 882	MIN 33	AC-FT 87120	CFSM .28	IN. 3.84
WTR YR 1989	TOTAL 54861	MEAN 150	MAX 2900	MIN 37	AC-FT 108800	CFSM .35	IN. 4.80

e Estimated

DES MOINES RIVER BASIN

05476000 DES MOINES RIVER AT JACKSON, MN

LOCATION.--Lat 43°37'10", long 94°59'10", in SE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.24, T.102 N., R.35 W., Jackson County, Hydrologic Unit 07100001, on right bank in storage room of city powerplant in Jackson.

DRAINAGE AREA.--1,220 mi<sup>2</sup>, approximately.

PERIOD OF RECORD.--May 1909 to December 1913, August 1930 to current year (winter record incomplete prior to 1936). Published as Des Moines River near Jackson, 1930-35, as West Fork Des Moines River near Jackson, 1936-44, and as West Fork Des Moines River at Jackson, 1945-69.

REVISED RECORDS.--WSP 1115: 1942. WSP 1175: Drainage area. WSP 1238: 1950. WSP 1308: 1938(M).

GAGE.--Water-stage recorder. Datum of gage is 1,287.75 ft above National Geodetic Vertical Datum of 1929. May 31, 1909, to Dec. 20, 1913, nonrecording gage at site 0.6 mi downstream at datum 0.99 ft lower. Aug. 22, 1930, to Sept. 30, 1944, nonrecording gage at site 7 mi upstream at datum 17.10 ft higher. Oct. 1, 1944, to Oct. 26, 1949, nonrecording gage at site 600 ft upstream at datum 10.64 ft higher. Oct. 27, 1949, to Dec. 15, 1965, water-stage recorder 200 ft downstream at present datum.

REMARKS.--Records good except those for estimated daily discharges, which are fair. Regulation at times by Yankton, Long, Shetek, and Heron Lakes.

AVERAGE DISCHARGE.--54 years (water years 1936-89), 323 ft<sup>3</sup>/s, 3.60 in/yr; median of yearly mean discharges, 240 ft<sup>3</sup>/s, 2.67 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,700 ft<sup>3</sup>/s, Apr. 11, 1969, gage height, 19.45 ft; no flow at times.

EXTREMES FOR CURRENT YEAR.--Peak discharge greater than base discharge of 900 ft<sup>3</sup>/s and maximum (\*):

Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)	Date	Time	Discharge (ft <sup>3</sup> /s)	Gage height (ft)
Mar. 28	1145	*960	*6.68	No other peak greater than base discharge.			

Minimum discharge, 0.35 ft<sup>3</sup>/s, Jan. 14, Feb. 11; minimum gage height, 2.37 ft, Sept. 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	3.4	8.8	e1.2	6.0	2.3	302	152	65	13	37	13
2	9.9	1.9	7.3	e1.2	4.5	2.3	257	145	70	26	e35	12
3	7.9	4.0	7.5	e1.1	3.9	2.3	218	140	75	38	e32	12
4	5.8	8.9	7.5	e1.1	2.9	2.3	212	140	74	41	30	30
5	4.5	12	e7.1	e1.1	2.0	2.3	177	138	73	38	27	23
6	2.5	12	e7.1	e1.1	1.3	2.3	157	124	69	35	23	21
7	2.9	17	e7.0	e1.1	1.1	2.3	150	105	70	32	20	22
8	3.8	15	e6.5	e1.0	1.0	2.3	154	90	65	28	16	21
9	5.1	10	e6.4	e1.0	.86	13	141	88	61	25	12	16
10	6.8	5.7	e6.3	e.95	.82	110	130	89	54	29	9.2	11
11	2.7	4.7	e5.7	.89	.85	186	117	87	48	93	8.1	11
12	1.2	11	e5.0	.91	.95	289	109	84	51	52	7.5	7.5
13	2.2	11	e5.0	.87	1.1	152	110	82	57	62	8.4	5.9
14	3.5	10	e4.5	.74	1.2	152	110	75	50	95	12	5.1
15	3.7	15	e4.2	.84	1.3	76	106	69	44	86	10	6.7
16	4.8	14	e3.9	.97	1.5	98	97	64	32	85	10	11
17	5.9	21	e3.9	1.0	1.7	108	97	58	22	93	7.8	7.4
18	4.1	20	e3.9	.96	2.0	245	87	59	20	123	6.0	4.9
19	3.0	12	e3.9	1.1	1.9	196	82	65	21	131	15	9.9
20	3.4	7.3	e3.9	1.2	1.7	177	80	63	20	132	14	8.1
21	4.6	7.4	e3.9	1.3	2.0	175	80	56	17	129	16	17
22	2.5	8.5	e3.9	1.4	2.2	155	75	52	17	95	13	14
23	5.3	8.7	e3.9	1.6	2.3	199	78	62	25	46	17	8.8
24	4.2	9.6	e3.8	1.9	2.3	286	85	64	25	41	10	8.5
25	5.4	11	e3.5	2.5	2.3	447	88	42	20	46	7.6	7.9
26	5.7	16	e3.2	3.4	2.3	430	107	29	e35	50	12	4.1
27	8.3	14	e2.5	3.6	2.3	661	141	22	40	49	13	2.7
28	1.4	9.5	e1.8	4.2	2.3	889	172	19	36	44	19	2.1
29	11	13	e1.3	4.4	---	752	170	18	32	44	21	1.4
30	9.9	13	e1.2	5.2	---	550	169	41	13	42	16	1.2
31	7.8	---	e1.2	6.6	---	447	---	64	---	39	13	---
TOTAL	161.8	326.6	145.6	56.43	56.58	6811.4	4058	2386	1301	1882	497.6	326.2
MEAN	5.22	10.9	4.70	1.82	2.02	220	135	77.0	43.4	60.7	16.1	10.9
MAX	12	21	8.8	6.6	6.0	889	302	152	75	132	37	30
MIN	1.2	1.9	1.2	.74	.82	2.3	75	18	13	13	6.0	1.2
AC-FT	321	648	289	112	112	13510	8050	4730	2580	3730	987	647
CFSM	.00	.01	.00	.00	.00	.18	.11	.06	.04	.05	.01	.01
IN.	.00	.01	.00	.00	.00	.21	.12	.07	.04	.06	.02	.01
CAL YR 1988	TOTAL 43184.79	MEAN 118	MAX 845	MIN 53	AC-FT 85660	CFSM .10	IN. 1.32					
WTR YR 1989	TOTAL 18009.21	MEAN 49.3	MAX 889	MIN 74	AC-FT 35720	CFSM .04	IN. .55					

e Estimated

## 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 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 1989

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Prairie River basin						
05212700	Prairie River near Taconite, Minn.	Lat 47°23'20", long 93°22'50", in NW¼SW¼ sec.27, T.57 N., R.24 W., Itasca County, Hydrologic Unit 07010103, on left bank 125 feet upstream from bridge on County Highway 7, 1.5 miles downstream from outlet of Lawrence Lake and 5 miles north of Taconite.	360	1967-83#, 1987-89	7-25-89	186
Crow Wing River basin						
05243100	Shell River near Park Rapids, Minn.	Lat 46°51'45", long 95°11'30", in NW¼NE¼ sec.14, T.139 N., R.36 W., Becker County, Hydrologic Unit 07010106, at bridge on County Highway 42, 8.8 miles northwest of Hubbard, 7.5 miles southwest of Park Rapids.	-	1975-76, 1984, 1988-89	7-25-89	.56
05243250	Blueberry River at Menahga, Minn.	Lat 46°45'31", long 95°06'01", in NW¼NW¼ sec.22, T.138 N., R.35 W., Wadena County, Hydrologic Unit 07010106, at bridge on U.S. Highway 71 at Menahga.	-	1975-76, 1984, 1988-89	8-2-89	1.09
05243712	Fish Hook River near Park Rapids, Minn.	Lat 46°52'42", long 95°02'02", in SW¼SW¼ sec.6, T.139 N., R.34 W., Hubbard County, Hydrologic Unit 07010106, site 0.1 mile upstream from mouth, 3.2 miles south of Park Rapids.	-	1975-76, 1984, 1988-89	8-3-89	13.9
05243805	Shell River near Sebeka, Minn.	Lat 46°47'16", long 95°01'02", in NW¼NW¼ sec.8, T.138 N., R.34 W., Wadena County, Hydrologic Unit 07010106, at bridge on County Highway 23, 6 miles west of Huntersville, 11.4 miles northeast of Sebeka.	-	1975-76, 1988-89	8-3-89	64
05243830	Shell River near Nimrod, Minn.	Lat 46°48'26", long 94°53'21", in NW¼SW¼ sec.32, T.139 N., R.33 W., Hubbard County, Hydrologic Unit 07010106, at bridge on County Highway 13, 500 feet upstream from mouth, 7 miles southwest of Badoura, 2.2 miles north of Huntersville, 11.6 miles north of Nimrod.	-	1965, 1975-76, 1988-89	8-3-89	97

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Crow Wing River basin--Continued						
05244000	Crow Wing River at Nimrod, Minn.	Lat 46°38'25", long 94°52'44", in SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.32, T.137 N., R.33 W., Wadena County, Hydrologic Unit 07010106, 200 feet upstream from bridge on County Highway 121, 0.2 mile north of Nimrod, 0.7 mile upstream of Cat River.	41,010	1910-14#, 1931-81#, 1982-86+, 1988-89	7-20-89 8-2-89	192 149
05244335	Willow Creek near Henning, Minn.	Lat 46°23'02", long 95°26'33", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.26, T.134 N., R.38 W., Otter Tail County, Hydrologic Unit 07010107, at bridge on County Highway 50, about 1.2 miles upstream from mouth, 4.4 miles north of Henning, 5.8 miles west of Deer Creek.	-	1972-73, 1988-89	7-21-89	1.61
05244343	South Bluff Creek near Deer Creek, Minn.	Lat 46°23'47", long 95°13'05", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.27, T.134 N., R.36 W., Otter Tail County, Hydrologic Unit 07010107, at bridge on county road, 0.1 mile north of junction with County Highway 50, 4.9 miles east of Deer Creek.	-	1971-73, 1988-89	7-21-89	.86
05244349	Oak Creek near Wadena, Minn.	Lat 46°27'53", long 95°12'19", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.34, T.135 N., R.36 W., Otter Tail County, Hydrologic Unit 07010107, at box culvert on U.S. Highway 10, 3.5 miles northwest of Wadena.	-	1968, 1972-73, 1988-89	7-21-89	.25
05244350	Leaf River near Wadena, Minn.	Lat 46°28'09", long 95°10'33", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.36, T.135 N., R.36 W., Otter Tail County, Hydrologic Unit 07010107, at bridge on County Highway 75, 2 miles northwest of Wadena.	334	1967, 1970, 1973-74, 1976, 1988-89	7-21-89	13.5
05244403	Wing River near Wadena, Minn.	Lat 46°28'13", long 94°59'23", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.29, T.135 N., R.34 W., Wadena County, Hydrologic Unit 07010707, at bridge on county road, 1 mile upstream from mouth, 5 miles north of Verdale, 7 miles northeast of Wadena.	162	1967-71, 1973, 1976, 1988-89	7-21-89	8.82
05244491	Swan Creek near Aldrich, Minn.	Lat 46°24'8", long 94°45'36", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.19, T.134 N., R.32 W., Cass County, Hydrologic Unit 07010106, at culvert on County Highway 32, 1.4 miles upstream from mouth, 4 miles northeast of Staples, 9 miles northeast of Aldrich.	-	1975-76, 1988-89	7-20-89	2.90
05244495	Crow Wing River near Staples, Minn.	Lat 46°22'06", long 94°43'50", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.33, T.134 N., R.32 W., Cass County, Hydrologic Unit 07010106, at bridge on County Highway 33, 2.1 miles east of Staples.	-	1974-76, 1988-89	7-20-89	263
05244900	Spruce Creek near Milona, Minn.	Lat 46°02'56", long 95°13'21", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.21, T.130 N., R.36 W., Douglas County, Hydrologic Unit 07010108, at bridge on County Highway 14, 3.4 miles east of Milona.	-	1972-74, 1988-89	7-20-89	5.20
05245200	Eagle Creek at Browerville, Minn.	Lat 46°05'35", long 94°51'53", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.5, T.130 N., R.33 W., Todd County, Hydrologic Unit 07010108, at bridge on County Highway 21, 0.5 mile upstream from mouth, 0.5 mile north of Browerville.	77	1970-71, 1973, 1976, 1985, 1988-89	7-20-89	1.72

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Watab River basin						
05269800	Watab River near Sartell, Minn.	Lat 45°37'09", long 94°13'38", in NE¼SE¼ sec.20, T.125 N., R.28 W., Stearns County, Hydrologic Unit 07010201, at bridge on county road, 1.1 miles west of Sartell.	90.1	1969-70, 1974, 1976, 1979-80, 1987-89	9-28-89	4.76
Sauk River basin						
05270230	Sauk River at New Munich, Minn.	Lat 45°37'32", long 94°45'39", in NE¼NW¼ sec.19, T.125 N., R.32 W., Stearns County, Hydrologic Unit 07010202, at bridge on County Highway 30, 0.5 mile southwest of New Munich.	559	1968-70, 1974, 1976, 1988-89	9-27-89	51
05270250	Stearns County ditch No. 44 near New Munich, Minn.	Lat 45°35'58", long 94°46'03", in NE¼NE¼ sec.36, T.125 N., R.33 W., Stearns County, Hydrologic Unit 07010202, at bridge on county road, 0.4 mile upstream from mouth, 2.3 miles southwest of New Munich.	29.9	1969-70, 1974, 1976-77, 1979-80, 1988-89	9-27-89	.31
05270280	Getchell Creek near New Munich, Minn.	Lat 45°34'36", long 94°45'55", in NE¼SE¼ sec.1, T.124 N., R.33 W., Stearns County, Hydrologic Unit 07010202, at bridge on County Highway 12, 0.5 mile upstream from mouth, 4 miles south of New Munich.	65.7	1969-70, 1974, 1976-77, 1979-80, 1988-89	9-27-89	.44
05270350	Sauk River near Farming, Minn.	Lat 45°29'56", long 94°37'44", in NE¼NW¼ sec.6, T.123 N., R.31 W., Stearns County, Hydrologic Unit 07010202, at bridge on county road, 1.9 miles southwest of Farming.	766	1969-70, 1974, 1976, 1988-89	9-27-89	63
05270440	Sauk River at Cold Spring, Minn.	Lat 45°27'22", long 94°25'21", in SW¼SW¼ sec.14, T.123 N., R.30 W., Stearns County, Hydrologic Unit 07010202, 0.3 mile downstream from dam at Cold Spring, 0.3 mile upstream from sewage effluent outfall.	-	1976, 1988-89	9-27-89	86
05270455	Mill Creek at Rockville, Minn.	Lat 45°28'20", long 94°20'21", in SW¼SW¼ sec.9, T.123 N., R.29 W., Stearns County, Hydrologic Unit 07010202, at box culvert on State Highway 23, at Rockville, 0.2 mile upstream from mouth.	51.6	1969-70, 1974, 1976-77, 1979-80, 1987-89	9-27-89	2.35
05270500	Sauk River near St. Cloud, Minn.	Lat 45°33'35", long 94°14'00", in SE¼SW¼ sec.8, T.124 N., R.28 W., Stearns County, Hydrologic Unit 07010203, on right bank 0.5 mile northwest of Waite Park, 3 miles west of St. Cloud, and 5 miles upstream from mouth.	925	1909-13, 1929-23, 1934-81#, 1988-89	9-27-89 9-28-89	82 *95
Plum Creek basin						
05272600	Plum Creek near Clearwater, Minn.	Lat 45°25'35", long 94°04'47", in NE¼NE¼ sec.33, T.123 N., R.27 W., Stearns County, Hydrologic Unit 07010203, at culvert on State Highway 152, 1.7 miles northwest of Clearwater.	23.3	1969-70, 1974, 1977-80, 1988-89	9-28-89	.71
Clearwater River basin						
05273100	Three Mile Creek near Fairhaven, Minn.	Lat 45°21'10", long 94°09'57", in NW¼NE¼ sec.26, T.122 N., R.28 W., Stearns County, Hydrologic Unit 07010203, 2.5 miles northeast of Fairhaven on State Highway 45.	-	1978, 1980, 1987-89	9-28-89	.39

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Clearwater River basin--Continued						
05273498	Clearwater River above Clearwater, Minn.	Lat 45°24'40", long 94°03'41", in NW¼NE¼ sec.3, T.122 N., R.27 W., Wright-Stearns County, Hydrologic Unit 07010203, on county line, at culvert on County Road 145 at southwest corner of Clearwater.	174	1969-70, 1974, 1976-80, 1988-89	9-28-89	6.57
Crow River basin						
05275970	North Fork Crow River near Georgeville, Minn.	Lat 45°29'06", long 94°55'37", in SE¼SE¼ sec.3, T.123 N., R.34 W., Stearns County, Hydrologic Unit 07010204, at bridge on County Highway 32, 2 miles east of U.S. Highway 71, 4 miles north of Georgeville.	166	1969-72, 1973-74, 1977, 1985, 1988-89	9-29-89	10.2
05278040	Middle Fork Crow River near Manannah, Minn.	Lat 45°15'01", long 94°38'43", in NE¼NE¼ sec.36, T.121 N., R.32 W., Meeker County, Hydrologic Unit 07010204, at bridge on north-south township road, 1 mile west of Manannah.	-	1988-89	9-28-89	3.94
05278050	Grove Creek near Manannah, Minn.	Lat 45°14'23", long 94°36'26", in NE¼NE¼ sec.6, T.120 N., R.31 W., Meeker County, Hydrologic Unit 07010204, on County Highway 46, 1.2 miles southeast of Manannah, 8.5 miles northwest of Litchfield.	47.9	1969-71, 1977, 1989	9-28-89	.16
05278100	North Fork Crow River at Forest City, Minn.	Lat 45°12'26", long 94°28'00", in NW¼NE¼ sec.17, T.120 N., R.30 W., Meeker County, Hydrologic Unit 07010204, at bridge on County Highway 2, 0.1 mile north of Forest City.	757	1969-71, 1977, 1988-89	9-28-89	14.1
05278150	Washington Creek near Kingston, Minn.	Lat 45°09'47", long 94°18'43", in NW¼NE¼ sec.34, T.120 N., R.29 W., Meeker County, Hydrologic Unit 07010204, at bridge on County Highway 21, 2.1 miles south of Kingston.	81.0	1969-71, 1976, 1987-89	9-28-89	0
05278830	Buffalo Creek near Buffalo Lake, Minn.	Lat 44°46'05", long 94°32'48", in SW¼NE¼ sec.15, T.115 N., R.31 W., Renville County, Hydrologic Unit 07010205, at bridge on County Highway 25 just upstream from right bank tributary (County Judicial Ditch No. 15), 2 miles northwest of Stewart, 2 miles northeast of town of Buffalo Lake.	127	1969-72, 1975-76, 1988-89	9-29-89	.70
05278835	Renville County Judicial ditch No. 15 near Buffalo Lake, Minn.	Lat 44°46'05", long 94°32'55", in NW¼SE¼ sec.15, T.115 N., R.31 W., Renville County, Hydrologic Unit 07010205, 0.1 mile upstream from mouth, in vicinity of County Highway 25 bridge over Buffalo Creek, 2 miles northwest of Stewart, 2 miles northeast of town of Buffalo Lake.	94.9	1969-72, 1975-76, 1988-89	9-29-89	.57
05278930	Buffalo Creek near Glencoe, Minn.	Lat 44°45'50", long 94°05'27", in SW¼SW¼ sec.16, T.115 N., R.27 W., McLeod County, Hydrologic Unit 07010205, at bridge on County Highway 1, 2.6 miles east of Glencoe.	374	1972, 1973-80#, 1988-89	9-29-89	1.41

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Rum River basin						
05284660	Rum River near Milaca, Minn.	Lat 45°46'44", long 93°39'29", in NW¼NW¼ sec.24, T.38 N., R.27 W., Mille Lacs County, Hydrologic Unit 07010207, at bridge on County Highway 9, 1.8 miles north of Milaca.	671	1968-70, 1975-76, 1980, 1988-89	9-26-89	7.41
05284750	Rum River at Spencer Brook, Minn.	Lat 45°31'45", long 93°26'21", in NW¼NE¼ sec.15, T.35 N., R.25 W., Isanti County, Hydrologic Unit 07010207, at bridge on County Highway 7, 200 feet downstream from Spencer Brook, 0.5 mile north of town of Spencer Brook, 7.5 miles southeast of Princeton.	1,000	1957-59, 1960-64#, 1965, 1970, 1972, 1978-80, 1988-89	9-25-89	38
05284810	Green Lake Brook at West Point, Minn.	Lat 45°33'49", long 93°23'20", in NE¼SE¼ sec.36, T.36 N., R.25 W., Isanti County, Hydrologic Unit 07010207, at bridge on State Highway 47, 0.2 mile upstream from mouth, 0.5 mile north of West Point.	29.7	1965, 1969-70, 1975-76, 1979-80, 1987-89	9-25-89	7.93
05284950	Stanchfield Creek at Springvale, Minn.	Lat 45°36'58", long 93°18'06", in SW¼SW¼ sec.11, T.36 N., R.24 W., Isanti County, Hydrologic Unit 07010207, at bridge on County Springvale, 3 miles northeast of Walbo.	92.6	1965, 1968-70, 1975-76, 1988-89	9-26-89	4.85
05284985	Bekins Creek near Cambridge, Minn.	Lat 45°35'34", long 93°13'29", in NW¼SW¼ sec.21, T.36 N., R.23 W., Isanti County, Hydrologic Unit 07010207, at bridge on County Highway 33, 0.8 mile north of Cambridge.	-	1965, 1987-89	9-26-89	.68
05285000	Rum River at Cambridge, Minn.	Lat 45°34'20", long 93°14'00", in NE¼NW¼ sec.32, T.36 N., R.23 W., Isanti County, Hydrologic Unit 07010207, at old bridge in city park below State Highway 64 bridge in Cambridge.	1,160	1909-14#, 1965, 1969-70, 1975, 1979, 1988-89	9-26-89	68
05285300	Long Lake outlet near Isanti, Minn.	Lat 45°26'31", long 93°19'14", in SW¼SW¼ sec.10, T.34 N., R.24 W., Isanti County, Hydrologic Unit 07010207, at culvert on county road, 4.5 miles northeast of St. Francis, 5.3 miles southwest of Isanti.	15.4	1965, 1969-70, 1975-76, 1987-89	9-25-89	.28
05285800	Seelye Brook near St. Francis, Minn.	Lat 45°21'58", long 93°22'20", in SW¼NE¼ sec.7, T.33 N., R.24 W., Anoka County, Hydrologic Unit 07010207, at bridge on County Highway 55, 0.9 mile upstream from mouth, 1.6 miles south of St. Francis.	37.5	1965, 1969-70, 1974, 1976-77, 1980, 1987-89	9-25-89	1.75
05286300	Cedar Creek near Anoka, Minn.	Lat 45°17'57", long 93°21'59", in SW¼SW¼ sec.32, T.33 N., R.24 W., Anoka County, Hydrologic Unit 07010207, at bridge on county road, 0.5 mile upstream from mouth, 4.3 miles southwest of Cedar, 7 miles north of Anoka.	84.8	1965, 1968-70, 1974, 1976, 1988-89	9-25-89	15
Minnesota River basin						
05304800	Dry Weather Creek near Montevideo, Minn.	Lat 45°3'00", long 95°46'00", in NE¼NW¼ sec.11, T.118 N., R.41 W., Chippewa County, Hydrologic Unit 07020005, at bridge on county road, 7.4 miles northwest of Montevideo.	105	1969-70, 1973-74, 1976, 1980, 1983, 1988-89	9-20-89	.06

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements	
					Date	Discharge (ft <sup>3</sup> /s)
Minnesota River basin--Continued						
05311350	Yellow Medicine River near Minneota, Minn.	Lat 44°37'25", long 95°59'30", in NW <sup>1</sup> SW <sup>1</sup> sec.1, T.113 N., R.43 W., Lyon County, Hydrologic Unit 07020004, at bridge on County Highway 3, 3 miles upstream from South Branch Yellow Medicine River, 4.4 miles north of Minneota.	189	1963-66, 1969, 1973-76, 1988-89	9-19-89	.46
05311400	South Branch Yellow Medicine River at Minneota, Minn.	Lat 44°33'50", long 95°59'50", in SE <sup>1</sup> SE <sup>1</sup> sec.26, T.113 N., R.43 W., Lyon County, Hydrologic Unit 07020004, on downstream side of bridge on State Highway 68, 0.5 mile northwest of Minneota and 6 miles upstream from mouth.	a111	1960-81#, 1982-87#, 1988-89	9-14-89	<.01
05314950	Redwood River near Russell, Minn.	Lat 44°17'52", long 95°58'25", in SW <sup>1</sup> SW <sup>1</sup> sec.25, T.110 N., R.43 W., Lyon County, Hydrologic Unit 07020006, at bridge on county road, 1.2 miles southeast of Russell.	131	1965-69, 1973-74, 1988-89	9-19-89	.83
05314970	Coon Creek near Russell, Minn.	Lat 44°19'22", long 95°58'42", in NE <sup>1</sup> NE <sup>1</sup> sec.23, T.110 N., R.43 W., Lyon County, Hydrologic Unit 07020006, at bridge on county road, 1.3 miles west of Russell.	91.0	1965-69, 1973-74, 1988-89	9-19-89	0
05315300	Three mile Creek near Ghent, Minn.	Lat 44°31'30", long 95°50'12", in SE <sup>1</sup> NE <sup>1</sup> sec.7, T.112 N., R.41 W., Lyon County, Hydrologic Unit 07020006, at bridge on County Highway 65, 2.9 miles northeast of Ghent.	73.4	1969, 1973-76, 1979-81, 1988-89	9-19-89	1.24
05316880	Cottonwood River near Lamberton, Minn.	Lat 44°15'17", long 95°18'40", in SE <sup>1</sup> SE <sup>1</sup> sec.8, T.109 N., R.37 W., Redwood County, Hydrologic Unit 07020008, 0.5 mile downstream from Pell Creek, 2.2 miles upstream from dam, 2.3 miles upstream from County Road 6, and 2.5 miles northwest of Lamberton.	a430	1966-69, 1973-74, 1988-89	9-15-89	.29
05320020	Le Sueur River near New Richland, Minn.	Lat 45°56'43", long 93°27'21", in SW <sup>1</sup> NE <sup>1</sup> sec.34, T.106 N., R.22 W., Waseca County, Hydrologic Unit 07020011, at bridge on County Highway 56, 3.8 miles northeast of New Richland.	75.6	1969, 1971, 1976, 1980, 1987-89	7-5-89	1.23
05320040	Boot Creek near New Richland, Minn.	Lat 43°56'07", long 93°30'52", in NW <sup>1</sup> NE <sup>1</sup> sec.6, T.105 N., R.22 W., Waseca County, Hydrologic Unit 07020011, at bridge on county road, 0.5 mile upstream from mouth, 3 miles northwest of New Richland.	48.6	1969, 1971, 1976, 1980, 1987-89	7-5-89	1.06
05320060	Little Le Sueur River near Wilton, Minn.	Lat 44°00'06", long 93°30'32", in SE <sup>1</sup> NE <sup>1</sup> sec.7, T.106 N., R.22 W., Waseca County, Hydrologic Unit 07020011, at bridge on County Highway 51, 0.3 mile upstream from mouth, and 1.5 miles southeast of Wilton.	23.9	1969, 1971, 1976, 1980, 1987-89	7-5-89	.66
05320480	Maple River near Rapidan, Minn.	Lat 44°03'54", long 94°01'32", in SW <sup>1</sup> sec.13, T.107 N., R.27 W., Blue Earth County, Hydrologic Unit 07020011, at bridge on County Highway 35, 3.0 miles southeast of Rapidan, 3.3 miles upstream from mouth.	343	1972-89+	8-16-89	.22

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Cannon River basin						
05351400	Devil Creek near Morristown, Minn.	Lat 44°15'15", long 93°28'04", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.9, T.109 N., R.22 W., Rice County, Hydrologic Unit 07040002, 2 miles northwest of Morristown, on County Highway 16.	-	1965, 1985, 1987-89	7-14-89	0
05351800	Mackenzie Creek near Warsaw, Minn.	Lat 44°15'18", long 93°21'24", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.109 N., R.21 W., Rice County, Hydrologic Unit 07040002, at State Highway 60, 2 miles east of Warsaw.	-	1965, 1985, 1987-89	7-14-89	.24
Rollingstone Creek basin						
05378400	Rollingstone Creek near Minnesota City, Minn.	Lat 44°05'52", long 91°46'44", in NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.3, T.107 N., R.8 W., Winona County, Hydrologic Unit 07040003, at bridge on county road, 1.4 miles west of Minnesota City.	49.7	1969-71, 1977, 1979-80, 1985, 1989	9-20-89	22
Burns Valley Creek basin						
05379050	Burns Valley Creek at Winona, Minn.	Lat 33°01'30", long 91°37'15", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.35, T.107 N., R.7 W., Winona County, Hydrologic Unit 07040003, at bridge on County Highway 17, at southeast edge of Winona.	14.3	1967-71, 1974, 1977, 1979, 1985, 1989	4-21-89	7.95
Pleasant Valley Creek basin						
05379090	Pleasant Valley Creek at Winona, Minn.	Lat 44°01'12", long 91°36'08" in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.36, T.107 N., R.7 W., Winona County, Hydrologic Unit 07040003, at bridge on County Highway 15, at southeast edge of Winona.	12.0	1967-71, 1974-76, 1979-80, 1985, 1989	9-20-89	6.31
Cedar Creek basin						
05379100	Cedar Creek near LaMoille, Minn.	Lat 44°00'25", long 91°29'45", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.1, T.106 N., R.6 W., Winona County, Hydrologic Unit 07040003, at bridge on U.S. Highway 14, 1.2 miles northwest of LaMoille.	-	1937, 1940, 1985, 1989	4-21-89 9-19-89	9.25 7.78
Trout Creek basin						
05380400	Trout Creek at LaMoille, Minn.	Lat 43°59'45", long 91°27'39", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.7, T.106 N., R.5 W., Winona County, Hydrologic Unit 07040003, at bridge on U.S. Highway 14, 0.7 mile southeast of LaMoille.	-	1937, 1985, 1989	4-21-89 9-19-89	13.8 10.9
Dakota Creek basin						
05382250	Dakota Creek at Dakota, Minn.	Lat 43°55'00", long 91°21'48", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.12, T.105 N., R.5 W., Winona County, Hydrologic Unit 07040006, at U.S. Highway 14, at Dakota, southeast of LaMoille.	-	1985, 1989	9-19-89	3.97
Pine Creek basin						
05383520	Pine Creek at La Crescent, Minn.	Lat 43°49'04", long 91°19'30", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.16, T.104 N., R.4 W., Houston County, Hydrologic Unit 07040006 at bridge on County Highway 25, 1 mile southwest of La Crescent.	55.2	1971, 1977, 1980, 1985, 1989	9-19-89	24

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Root River basin						
05383740	North Branch Root River near Chatfield, Minn.	Lat 43°49'12", long 92°10'03", in SE½SE½ sec.8, T.104 N., R.11 W., Fillmore County, Hydrologic Unit 07040008, at bridge on County Highway 5, 1.6 miles upstream from Middle Branch Root River, 1.7 miles southeast of Chatfield.	a225	1969-71, 1976-77, 1985, 1989	9-21-89	32
05383840	Spring Valley Creek near Wykoff, Minn.	Lat 43°44'11", long 92°17'41", in SE½SE½ sec.8, T.103 N., R.12 W., Fillmore County, Hydrologic Unit 07040008, at culvert on township road, 2.5 miles northwest of Wykoff.	-	1988-89	9-21-89	13
05383860	Bear Creek near Fillmore, Minn.	Lat 43°45'12", long 92°17'17", in NW¼SW¼ sec.4, T.103 N., R.12 W., Fillmore County, Hydrologic Unit 07040008, at culvert on township road, 1 mile west of Fillmore, 13.5 miles north of Wykoff.	-	1985, 1989	9-21-89	8.47
05383895	Upper Bear Creek near Chatfield, Minn.	Lat 43°48'40", long 92°11'45", in NW¼SE½ sec.18, T.104 N., R.11 W., Fillmore County, Hydrologic Unit 07040008, at culvert on County Highway 5, 1.5 miles south of Chatfield.	-	1985, 1989	9-21-89	2.0
05383900	Middle Branch Root River near Chatfield, Minn.	Lat 43°48'24", long 92°11'18", in SE½SE½ sec.18, T.104 N., R.11 W., Fillmore County, Hydrologic Unit 07040008, at bridge of County Highway 7, 1 mile upstream from North Branch Root River 2.7 miles south of Chatfield.	a250	1969-71, 1977, 1985, 1988-1989	9-21-89	31
05383920	Rice Creek near Fountain, Minn.	Lat 43°48'04", long 92°06'51", in NW¼NE¼ sec.23, T.104 N., R.11 W., Fillmore County, Hydrologic Unit 07040008, at culvert on township road, 3.5 miles north of Fountain, 3 miles southeast of Chatfield.	-	1985, 1989	9-21-89	1.88
05383940	Trout Run near Pilot Mound, Minn.	Lat 43°49'04", long 92°02'59", in NE¼NE¼ sec.17, T.104 N., R.10 W., Fillmore County, Hydrologic Unit 07040008, at bridge on State Highway 30, 1.3 miles west of Pilot Mound.	30.3	1971, 1977, 1980, 1985, 1988-89	9-21-89	23
05384020	Canfield Creek near Cherry Grove, Minn.	Lat 43°35'59", long 92°14'11", in NW¼NE¼ sec.35, T.102 N., R.12 W., Fillmore County, Hydrologic Unit 07040008, at triple culverts on County Road 14, 2.5 miles northeast of Cherry Grove, 7 miles north of Minnesota-Iowa border.	-	1985, 1989	4-18-89	0
05384030	Willow Creek at Preston, Minn.	Lat 43°39'34", long 92°05'40", in SW¼SE¼ sec.1, T.102 N., R.11 W., Fillmore County, Hydrologic Unit 07040008, at bridge on County Highway 12, 0.5 mile upstream from mouth, 1.0 mile southwest of Preston.	-	1969, 1985, 1989	4-18-89	4.13
05384035	South Branch Root River at Preston, Minn.	Lat 43°40'01", long 92°05'00", in NW¼SW¼ sec.6, T.102 N., R.10 W., Fillmore County, Hydrologic Unit 07040008, at bridge on County Highway 17 at south edge of Preston.	-	1965-69, 1985, 1989	4-18-89	38

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Root River basin--Continued						
05384050	Watson Creek near Preston, Minn.	Lat 43°42'39", long 91°02'58", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.20, T.103 N., R.10 W., Fillmore County, Hydrologic Unit 07040008, at culvert on County Road 117, 3 miles northeast of Preston.	-	1989	4-18-89	4.18
05384450	Pine Creek near Rushford, Minn.	Lat 43°51'12", long 91°48'16", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.32, T.105 N., R.8 W., Winona County, Hydrologic Unit 07040008, at bridge on County Highway 2, 4.5 miles northwest of Rushford.	49.4	1971, 1976-77, 1980, 1989	9-20-89	13
05384900	Money Creek near Houston, Minn.	Lat 43°47'42", long 91°35'40", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.19, T.104 N., R.6 W., Houston County, Hydrologic Unit 07040008, at bridge on State Highway 76, 2.7 miles northwest of Houston.	74.2	1969-71, 1974, 1976-77, 1985, 1989	4-20-89 9-20-89	35 27
05385200	Weisel Creek near Tawney, Minn.	Lat 43°35'52", long 91°48'47", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.32, T.102 N., R.8 W., Fillmore County, Hydrologic Unit 07040008, at culvert on County Road 18, 1.5 miles southwest of Tawney.	-	1985, 1989	4-18-89	8.39
05385300	Riceford Creek at Yucatan, Minn.	Lat 43°40'52", long 91°41'13", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 33, T.103 N., R.7 W., Houston County Hydrologic Unit 07040008, at bridge on township road, 0.4 mile east of Yucatan, 0.7 mile upstream from mouth.	61.1	1971, 1974, 1976-77, 1985, 1989	4-20-89 9-20-89	24 20
05385400	Beaver Creek near Sheldon, Minn.	Lat 43°42'24", long 91°36'01", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.19, T.103 N., R.6 W., Houston County, Hydrologic Unit 07040008, at bridge on County Highway 10, 1.3 miles upstream from mouth, 2 miles north of Sheldon.	52.6	1971, 1974, 1976-77, 1980, 1985, 1989	4-20-89 9-20-89	28 25
05385500	South Fork Root River near Houston, Minn.	Lat 43°44'19", long 91°33'50", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.103 N., R.6 W., Houston County, Hydrologic Unit 07040008, on left bank, 50 feet downstream from State Highway 76 bridge, 0.5 mile upstream from Badger Creek, 1.5 mile south of Houston.	275	1953-83# 1985-89+	4-20-89	118
05386050	Silver Creek near Houston, Minn.	Lat 43°47'10", long 91°29'52", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.25, T.104 N., R.6 W., Houston County, Hydrologic Unit 07040008, at bridge on County Highway 21, 4 miles northeast of Houston.	17.3	1971, 1974, 1976-77, 1980, 1985, 1989	4-20-89 9-20-89	8.15 7.12
05386060	Crystal Creek near Houston, Minn.	Lat 43°46'20", long 91°28'36", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.31, T.104 N., R.5 W., Houston County, Hydrologic Unit 07040008, at bridge on Highway 16, 4.5 miles east of Houston.	-	1985, 1989	4-20-89 9-20-89	6.59 6.10
05386120	Indian-Spring Thompson Creek at Hokah, Minn.	Lat 43°45'29", long 91°20'42", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.5, T.103 N., R.4 W., Houston County, Hydrologic Unit 07040008, on County Road 18 at Hokah.	-	1985, 1989	9-19-89	15
Crooked Creek basin						
05387040	Crooked Creek at Reno, Minn.	Lat 43°35'22", long 91°16'47", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.35, T.102 N., R.4 W., Houston County, Hydrologic Unit 07060001, at bridge on State Highway 26, 0.8 mile southwest of Reno.	69.7	1971, 1976-77, 1980, 1983, 1985, 1989	9-19-89	32

"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 1989--Continued

Station no.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of record	Measurements Date	Discharge (ft <sup>3</sup> /s)
Winnepago Creek basin						
05387200	Winnepago Creek near New Albin, Iowa	Lat 43°31'04", long 91°18'28", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.27, T.101 N., R.4 W., Houston County, Hydrologic Unit 07060001, at bridge on County Highway 5, 1.3 miles northwest of New Albin, Iowa.	59.0	1960-71, 1976-77, 1980, 1983, 1985, 1989	9-19-89	30
Upper Iowa River basin						
05387270	Beaver Creek near LeRoy, Minn.	Lat 43°30'28", long 92°23'25", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.33, T.101 N., R.13 W., Fillmore County, Hydrologic Unit 07060002, at bridge on State Highway 56, 1.5 miles northwest of Chester, Iowa 5.8 miles east of LeRoy.	26.4	1971, 1976, 1984-85, 1989	4-18-89	2.63
05387500	Pine Creek near Canton, Minn.	Lat 43°30'02", long 91°57'24", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.31, T.101 N., R.9 W., Fillmore County, Hydrologic Unit 07060002, on Minnesota-Iowa border, 2 miles southwest of Canton.	-	1985, 1989	4-18-89	.98
05388325	Bee Creek near Eitzen, Minn.	Lat 43°30'09", long 91°34'11", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ T.101 N., R.6 W., Houston County, Hydrologic Unit 07060002, on Minnesota-Iowa border, at Bee, 5.5 miles west of Eitzen, tributary to Waterloo Creek in Iowa.	-	1985, 1989	4-20-89 9-19-89	6.65 5.98
Iowa River basin						
05457160	Rose Creek near Austin, Minn.	Lat 43°36'48", long 92°58'10", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.26, T.102 N., R.18 W., Mower County, Hydrologic Unit 07080201, at bridge on County Highway 29, 0.3 mile upstream from mouth, 3.8 miles south of Austin.	65.8	1969, 1971, 1974, 1976, 1980, 1984-85, 1989	9-22-89	9.39
05457220	Woodbury Creek near Lyle, Minn.	Lat 43°30'37", long 93°00'34", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.32, T.101 N., R.18 W., Mower County, Hydrologic Unit 07080201, at bridge on State Highway 105, 3.3 miles west of Lyle, 0.2 mile above mouth.	40.4	1971, 1974, 1976, 1984-85, 1989	9-22-89	1.18
05457280	Otter Creek at Lyle, Minn.	Lat 43°30'00", long 92°55'52", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.36, T.101 N., R.18 W., Mower County, Hydrologic Unit 07080201, at bridge on county road on Minnesota-Iowa border in Lyle.	38.3	1971, 1974, 1984-85, 1989	9-22-89	3.29
Des Moines River basin						
05476989	East Fork Des Moines River near Ceylon, Minn.	Lat 43°33'53", long 94°39'15", in NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.11, T.101 N., R.32 W., Martin County, Hydrologic Unit 07010003, at bridge on County Road 23, 2.4 miles northwest of Ceylon.	a154	1986-89+	9-15-89	.21

# Operated as a continuous record site.

+ Operated as a high-flow partial record site.

&lt; Less than.

\* Discharge from stage/discharge rating for station.

a Approximately.

## HIGH-FLOW PARTIAL-RECORD STATIONS



Wild Rice River near Hendrum, April 1969  
stage: 31.25 feet  
discharge: 8140 cubic feet per second  
peak stage: 31.42 feet, April 1967



EXPLANATION

△ Partial-record high-flow station

River Basins in Volume I



Hudson Bay basin



Great Lakes basin

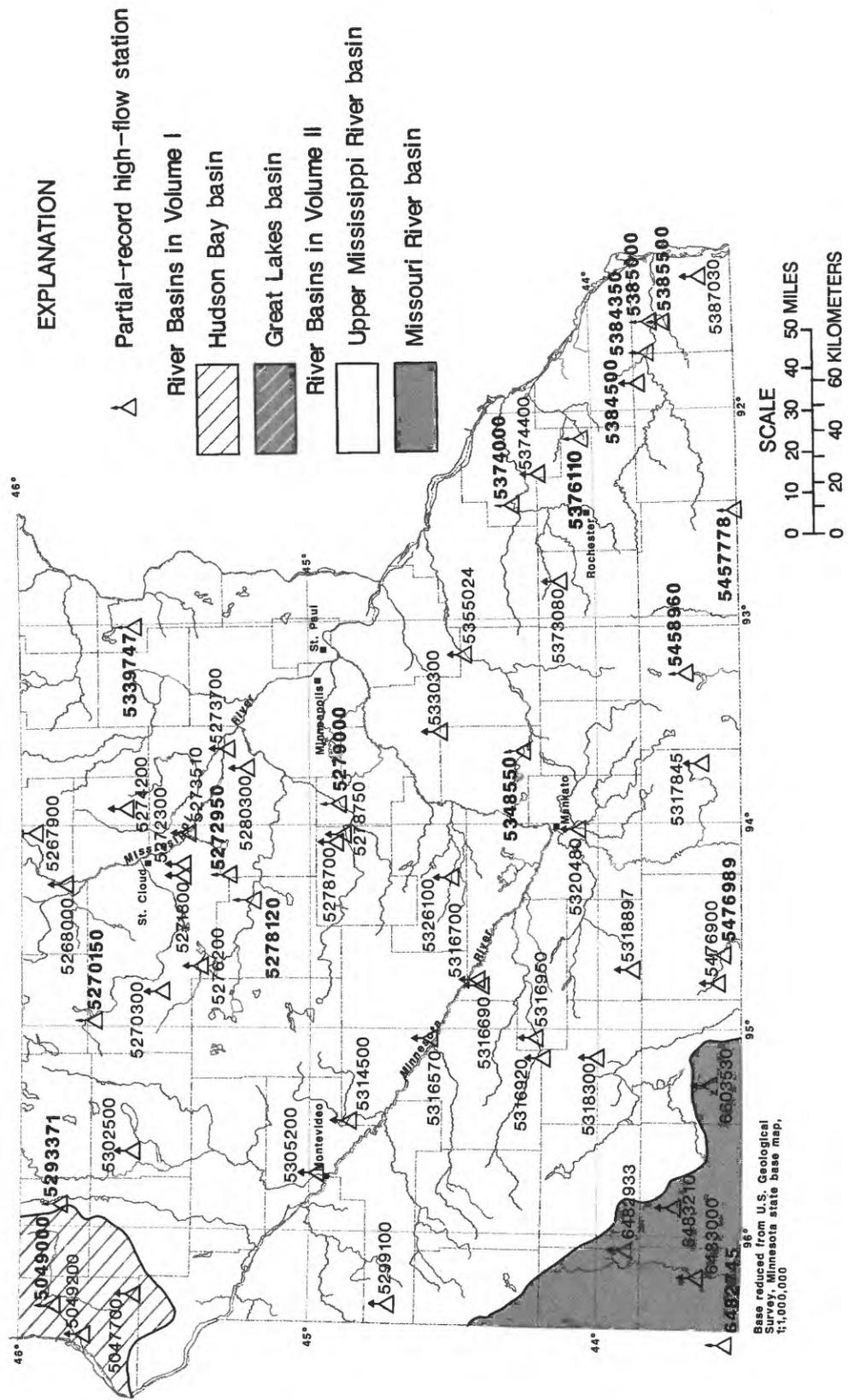
River Basins in Volume II



Upper Mississippi River basin



Missouri River basin



Base reduced from U.S. Geological Survey, Minnesota state base map, 1:1,000,000

Figure 9.--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 1989

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Discharge (ft <sup>3</sup> /s)
Mississippi River main stem							
05200200	Hennepin Creek near Becida, MN	Lat 47°23'52", long 95°05'12", in NW <sup>1</sup> / <sub>4</sub> NE <sup>1</sup> / <sub>4</sub> sec.11, T.145 N., R.35 W., Hubbard County, Hydrologic Unit 07010101, gages upstream and downstream from culvert on Stumphges Rapids Trail approximately 0.5 mile west of Hubbard County Road 3, 3 miles north of Becida, 1.5 miles upstream from mouth.	41.4	1979-89	4-4-89	a13.75	78
Leech Lake River basin							
05205200	Boy River near Remer, MN	Lat 47°04'51", long 94°05'54", in SE <sup>1</sup> / <sub>4</sub> SE <sup>1</sup> / <sub>4</sub> sec.28 T.142 N., R.27 W., Cass County, Hydrologic Unit 07010102, at bridge on County Highway 53, 1.9 miles upstream from Boy Lake and 9 miles northwest of Remer.	310	1986-89	4-5-89	11.24	b350
Smith Creek basin							
05210200	Smith Creek near Hill City, MN	Lat 47°04'58", long 93°34'59", in SE <sup>1</sup> / <sub>4</sub> NW <sup>1</sup> / <sub>4</sub> sec.13, T.53 N., R.26 W., Itasca County, Hydrologic Unit 07010101, at culvert on U.S. Highway 169, 6.2 miles north of Hill City.	8.00	1961-89	4-30-89	4.69	36
Willow River basin							
05221020	Willow River below Palisade, MN	Lat 46°42'36", long 93°33'21", in NW <sup>1</sup> / <sub>4</sub> NE <sup>1</sup> / <sub>4</sub> sec.30, T.49 N., R.25 W., Aitkin County, Hydrologic Unit 07010103, at bridge on County Highway 3, 3.2 miles west of Palisade.	445	1972-89	4-16-89	14.45	b2,160
Pine River basin							
05229450	Pine River near Pine River, MN	Lat 46°41'39", long 94°22'11", in NE <sup>1</sup> / <sub>4</sub> SE <sup>1</sup> / <sub>4</sub> sec.8., T.137 N., R.29 W., Cass County, Hydrologic Unit 07010105, at bridge 2.3 miles southeast of Pine River, on U.S. Highway 371, 4.9 miles upstream of upper Whitefish Lake.	285	1986-89	4-6-89	3.66	b640
Crow Wing River basin							
05244200	Cat River near Nimrod, MN	Lat 46°37'49", long 94°55'51", in SW <sup>1</sup> / <sub>4</sub> SW <sup>1</sup> / <sub>4</sub> sec.36, T.137 N., R.34 W., Wadena County, Hydrologic Unit 07010106, at bridge on State Highway 227, 2.5 miles west of Nimrod, 3.0 miles upstream from mouth.	49.2	1961-89	4-15-89	5.85	155

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual Gage height (feet)	maximum Discharge (ft <sup>3</sup> /s)
Crow Wing River basin--Continued							
05244440	Leaf River near Aldrich, MN	Lat 46°27'25", long 94°50'29", in SW <sup>1</sup> / <sub>4</sub> SW <sup>1</sup> / <sub>4</sub> sec.34, T.135 N., R.33 W., Wadena County, Hydrologic Unit 07010107, at bridge on County Highway 29, 3.3 miles upstream from mouth, 7.0 miles northeast of Aldrich.	860	1972-89	4-16-89	13.47	1,780
05245800	Sevenmile Creek near Pillager, MN	Lat 46°20'32", long 94°32'56", in SW <sup>1</sup> / <sub>4</sub> SE <sup>1</sup> / <sub>4</sub> sec.11, T.133 N., R.31 W., Cass County, Hydrologic Unit 07010106, at downstream wing wall of bridge on township road, 3.5 miles northwest of Pillager, 3.2 miles upstream from mouth.	18.3	1979-89	4-15-89	12.06	b64
Nokasippi River basin							
05261520	Nokasippi River near Fort Ripley, MN	Lat 46°12'02", long 94°19'03" on line between secs.13 and 24, T.43 N., R.32 W., Crow Wing County, Hydrologic Unit 07010104, at bridge on County Highway 2, 3 miles northeast of Fort Ripley.	178	1967-70+, 1974+, 1976+, 1986-89	4-8-89	12.12	560
Platte River basin							
05267900	Hillman Creek near Pierz,	Lat 45°58'27", long 94°04'21", in NE <sup>1</sup> / <sub>4</sub> SE <sup>1</sup> / <sub>4</sub> sec.9, T.40 N., R.30 W., Morrison County, Hydrologic Unit 07010201, at bridge on county highway, 1.1 miles upstream from mouth, 1.5 miles east of Pierz.	46.7	1964-89	4-7-89	13.79	b220
05268000	Platte River above Royalton, MN	Lat 45°50'43", long 94°17'40", in SE <sup>1</sup> / <sub>4</sub> NW <sup>1</sup> / <sub>4</sub> sec.26, T.39 N., R.32 W., Morrison County, Hydrologic Unit 07010201, at bridge on County Highway 27, 0.6 mile north of Royalton, 6.6 miles upstream from mouth.	335	1929-36, 1972-89	4-8-89	12.65	b1,880
Sauk River basin							
05270300	Sauk River tributary at Spring Hill, MN	Lat 45°31'22", long 94°48'31", in SW <sup>1</sup> / <sub>4</sub> NE <sup>1</sup> / <sub>4</sub> sec.27, T.124 N., R.33 W., Stearns County, Hydrologic Unit 07010202, at culvert on State Highway 4, 1.0 mile east of Spring Hill, 2.7 miles upstream from mouth.	7.06	1960-89	4-2-89	c10.24	117
Johnson Creek basin							
05271800	Johnson Creek tributary at Luxemburg, MN	Lat 45°26'30", long 94°14'46", in NW <sup>1</sup> / <sub>4</sub> NE <sup>1</sup> / <sub>4</sub> sec.30, T.123 N., R.28 W., Stearns County, Hydrologic Unit 07010203, at culverts on State Highway 15, 0.8 mile south of Luxemburg.	3.82	1964-89	3-29-89	d	e25
05272300	Johnson Creek near St. Augusta, MN	Lat 45°27'49", long 94°09'19", in NW <sup>1</sup> / <sub>4</sub> SW <sup>1</sup> / <sub>4</sub> sec.13, T.123 N., R.28 W., Stearns County, Hydrologic Unit 07010203, at bridge on County Highway 7, 1.0 mile south of St. Augusta, 3.3 miles upstream from mouth.	46.7	1964-89	3-29-89	c13.49	b170

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Annual maximum Discharge (ft <sup>3</sup> /s)
Clearwater River basin							
05272950	Clearwater River near South Haven, MN	Lat 45°16'45", long 94°15'04", in NE¼NW¼ in sec.19, T.121 N., R.28 W., Wright County, Hydrologic Unit 07010203, at culvert 3.4 miles southeast of Kimball, 0.25 mile downstream of Scott Lake Outlet, 2.0 miles southeast of South Haven.	-	1985-89	3-30-89	14.32	b131
Mississippi River main stem							
05273510	Mississippi River at Clearwater, MN	Lat 45°25'15", long 94°02'37", in NW¼SW¼ sec.23, T.34 N., R.30 W., Sherburne County, Hydrologic Unit 07010203, on left bank 700 ft upstream from bridge, on State Highway 24 at Clearwater.	-	1972-89	4-10-89	c13.33	18,000
Otsego Creek basin							
05273700	Otsego Creek near Otsego, MN	Lat 45°17'19", long 93°38'59", in SW¼NE¼ sec.13, T.131 N., R.24 W., Wright County, Hydrologic Unit 07010203, at culvert on County Highway 39, 1.3 miles upstream from mouth, 1.9 miles west of Otsego.	3.11	1964-89	3-26-89	5.91	b88
Elk River basin							
05274200	Stony Brook tributary near Foley, MN	Lat 45°38'42", long 93°54'54", in NE¼NW¼ sec.2, T.36 N., R.29 W., Benton County, Hydrologic Unit 07010203, at culvert on State Highway 25, 0.3 mile upstream from mouth, 1.5 miles south of Foley.	2.26	1960-89	3-26-89	8.13	35
Crow River basin							
05276200	North Fork Crow River at Paynesville, MN	Lat 45°23'09", long 94°42'41", in SW¼SE¼ sec.9, T.122 N., R.32 W., Stearns County, Hydrologic Unit 07010204, at bridge on county road at northeast edge of Paynesville city limits.	238	1973-89	4-1-89	c3.94	565
05278120	North Fork Crow River near Kingston, MN	Lat 45°12'13", long 94°23'16", in SW¼SE¼ sec.13, T.120 N., Meeker County, Hydrologic Unit 07010204, at bridge on State Highway 24, 3.7 miles west of Kingston, 3.9 miles east of Forest City.	-	1986-89	3-27-89	13.69	b500
05278700	Otter Creek near Lester Prairie, MN	Lat 44°54'23", long 94°04'24", in SE¼SE¼ sec.28, T.117 N., R.27 W., McLeod County, Hydrologic Unit 07010205, at culvert on State Highway 7, 2.1 miles northwest of Lester Prairie, 4.4 miles upstream from mouth.	30.2	1961-89	3-28-89	f8.26	77
05278750	Otter Creek tributary near Lester Prairie, MN	Lat 44°53'34", long 94°04'24", in SE¼SE¼ sec.33, T.117 N., R.27 W., McLeod County, Hydrologic Unit 07010205, at culvert on County Highway 63, 1.7 miles northwest of Lester Prairie, 3.3 miles upstream from mouth.	1.54	1962-89	3-26-89	9.06	b31

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Annual maximum Discharge (ft <sup>3</sup> /s)
Crow River basin--Continued							
05279000	South Fork Crow River near Mayer, MN	Lat 44°54'20", long 93°53'05", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.30, T.117 N., R.25 W., Carver County, Hydrologic Unit 07010205, near center of span on downstream side of bridge on State Highway 7, 1.3 miles north of Mayer, 4.3 miles southwest of Watertown, 16 miles upstream from confluence with North Fork.	1,170	1934-79#, 1980-84, 1987-89	3-30-89	7.15	b960
05280300	School Lake Creek tributary near St. Michael, MN	Lat 45°12'09", long 93°41'31", in NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.15, T.120 N., R.24 W., Wright County, Hydrologic Unit 07010204, at culvert on county highway, 0.2 mile upstream from mouth, 1.5 miles southwest of St. Michael.	2.04	1964-89	3-26-89	9.24	b39
Minnesota River basin							
05293371	Pomme de terre River near Elbow Lake, MN	Lat 46°57'47", long 95°53'07", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.19, T.129 N., R.41 W., Grant County, Hydrologic Unit 07020002, at bridge on County Road 47, 4 miles southeast of Elbow Lake, 2.5 miles south of the outlet of Pomme de Terre Lake, in a national water fowl production area.	340	1986-89	4-6-89	d	e200
05299100	Lazarus Creek tributary near Canby, MN	Lat 44°43'04", long 96°19'42", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.6, T.114 N., R.45 W., Yellow Medicine County, Hydrologic Unit 07020003, at culvert on State Highway 68, 2.7 miles west of Canby, 4.2 miles upstream from mouth.	2.97	1960-89	3-26-89	12.30	b82
05302500	Little Chippewa River near Starbuck, MN	Lat 45°36'52", long 95°37'12", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.30, T.125 N., R.39 W., Pope County, Hydrologic Unit 07020005, at downstream wing wall on triple box culvert on State Highway 28, 4.4 miles west of Starbuck.	69.6	1979-89	3-27-89	12.73	b73
05305200	Spring Creek near Montevideo, MN	Lat 44°58'41", long 95°42'57", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.5, T.117 N., R.40 W., Chippewa County, Hydrologic Unit 07020005, at culvert on State Highway 29, 1.2 miles upstream from mouth, 2.0 miles north of Montevideo.	16.0	1959-89	3-26-89	14.68	128
05314500	Hawk Creek near Maynard, MN	Lat 44°52'10", long 95°28'58", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.7, T.116 N., R.38 W., at Renville and Chippewa County line, Hydrologic Unit 07020004, at right downstream side of bridge on State Highway 23, 3.0 miles southwest of Maynard.	474	1949-54#, 1981-89	3-28-89	15.81	b825
05316570	Beaver Creek at Beaver Falls, MN	Lat 44°35'03", long 95°02'49", in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.22, T.113 N., R.35 W., Renville County, Hydrologic Unit 07020004, at bridge on County Highway 2 in Beaver Falls, 2.2 miles upstream from mouth, 3.8 miles northwest of Morton.	194	1972-89	3-27-89	10.77	b700

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Discharge (ft <sup>3</sup> /s)
Minnesota River basin--Continued							
05316690	Spring Creek tributary near Sleepy Eye, MN	Lat 44°23'54", long 94°45'35", in NW¼ sec.25, T.111 N., R.33 W., Brown County, Hydrologic Unit 07020007, at culvert on county highway, 0.1 mile upstream from mouth, 7.5 miles north of Sleepy Eye.	3.69	1966-89	3-26-89	d	e25
05316700	Spring Creek near Sleepy Eye, MN	Lat 44°24'12", long 94°44'41", in NE¼SE¼ sec.24, T.111 N., R.33 W., Brown County, Hydrologic Unit 07020007, at culvert on county highway, 4.3 miles upstream from mouth, 7.5 miles north of Sleepy Eye.	31.3	1959-89	3-26-89	11.05	170
05316920	Cottonwood River tributary No. 2 near Sanborn, MN	Lat 44°10'34", long 95°07'15", in SW¼NW¼ sec.12, T.108 N., R.36 W., Cottonwood County, Hydrologic Unit 07020008, at culvert on U.S. Highway 71, 2.4 miles south of Sanborn.	.42	1966-89	3-24-89	4.87	b13
05316950	Cottonwood River near Springfield, MN	Lat 44°12'12", long 95°02'53", on line between secs.33 and 34, T.109 N., R.35 W., Brown County, Hydrologic Unit 07020008, at bridge on County Highway 2, 1.3 miles downstream from Mound Creek, 1.0 mile upstream from Coal Mine Creek, 3.5 miles southwest of Springfield.	773	1973-89	3-26-89	23.86	b4,020
05317845	East Branch Blue Earth River near Walters, MN	Lat 43°37'58", long 93°42'28", in SE¼SE¼ sec.16, T.102 N., R.24 W., Faribault County, Hydrologic Unit 07020009, at left downstream wing wall of box culvert on State Highway 22, 2.5 miles northwest of Walters.	29.6	1979-89	3-23-89	16.59	b295
05318300	Watowan River near Delft, MN	Lat 43°59'55", long 95°07'11", in NE¼SE¼ sec.11, T.108 N., R.36 W., Cottonwood County, Hydrologic Unit 07020010, at culvert on U.S. Highway 71, 1.7 miles northwest of Delft.	13.0	1960-89	3-25-89	15.78	b34
05318897	South Fork Watowan River near Ormsby, MN	Lat 43°53'08", long 94°41'27", in SE¼NW¼ sec.21, T.105 N., R.32 W., Watowan County, Hydrologic Unit 07020010, at right downstream wing wall of bridge on township road, 2.6 miles north of Ormsby, 5.0 miles upstream from mouth at Willow Creek.	109	1979-89	3-25-89	10.54	111
05320480	Maple River near Rapidan, MN	Lat 44°03'54", long 94°01'32", in SW¼ sec.13, T.107 N., R.27 W., Blue Earth County, Hydrologic Unit 07020011, at bridge on County Highway 35, 3.0 miles southeast of Rapidan, 3.3 miles upstream from mouth.	343	1972-89	3-24-89	10.08	b1,450
05326100	Middle Branch Rush River near Gaylord, MN	Lat 44°30'27", long 94°15'00", in SW¼NW¼ sec.18, T.112 N., on line between R.28 W. and R.29 W., Sibley County, Hydrologic Unit 07020012, at downstream side of bridge on township road, 3.0 miles southwest of Gaylord, 10.5 miles upstream from the main branch of Rush River.	68.5	1979-89	3-24-89	13.34	b220

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Annual maximum Discharge (ft <sup>3</sup> /s)
Minnesota River basin--Continued							
05330300	Sand Creek near New Prague, MN	Lat 44°32'37", long 93°32'16", in NE¼NW¼ sec.1, T.112 N., R.23 W., Le Sueur County, Hydrologic Unit 07020012, at culvert on State Highway 13 and 19, 1.9 miles east of New Prague.	62.4	1960-89	3-27-89	10.73	b200
St. Croix River basin							
05335170	Crooked Creek near Hinckley, MN	Lat 46°00'42", long 92°31'45", in NE¼NE¼ sec.30, T.41 N., R.17 W., Pine County, Hydrologic Unit 07030001, at triple box culvert on State Highway 48, 2.7 miles upstream from mouth, 8 miles south of Duxbury, 19 miles east of Hinckley.	93	1966-70+, 1974-76+, 1979-80+, 1986-89	5-25-89	15.52	1,630
05336200	Glaisby Brook near Kettle River, MN	Lat 46°27'19", long 92°51'34", in SE¼NW¼ sec.22, T.46 N., R.20 W., Carlton County, Hydrologic Unit 07030003, at bridge on State Highways 27 and 73, 1.0 mile upstream from mouth, 2.4 miles south of Kettle River.	27.5	1960-70#, 1971-89	4-5-89	5.04	304
05336550	Wolf Creek tributary near Sandstone, MN	Lat 46°09'45", long 92°51'58", in NE¼SE¼ sec.33, T.43 N., R.20 W., Pine County, Hydrologic Unit 07030003, at culvert on U.S. Highway 61, 0.2 mile upstream from mouth, 2.2 miles north of Sandstone.	5.46	1960-89	5-24-89	15.98	16
05339747	Goose Creek at Harris, MN	Lat 45°35'11", long 92°58'39", in SW¼SW¼ sec.21, T.36 N., R.21 W., Chisago County, Hydrologic Unit 07030005, at culverts on County Highway 9, 0.15 mile east of County Highway 30 in Harris, 8 miles above mouth.	160	1986-89	4-7-89	5.40	b97
Cannon River basin							
05348550	Cannon River below Sabre Lake near Kilkenney, MN	Lat 44°17'50", long 93°37'44", in NE¼NE¼ sec. 31, T.110 N., R.23 W., LeSueur County, Hydrologic Unit 07040002, at right downstream side of bridge, on township road, 0.25 mile downstream of Sabre Lake, 3 miles southeast of Kilkenney.	-	1985-89	3-26-89	11.66	116
05355024	Cannon River at Northfield, MN	Lat 44°27'19", long 93°09'46", in NE¼NE¼ sec.1, T.111 N., R.20 W., Rice County, Hydrologic Unit 07040002, on left bank at downstream side of Fifth Street bridge in Northfield.	934	1980-89	3-27-89	901.59	b5,120
Zumbro River basin							
05373080	Milliken Creek near Concord, MN	Lat 44°07'13", long 92°49'08", in NW¼NW¼ sec.36, T.108 N., R.17 W., Dodge County, Hydrologic Unit 07040004, at bridge on County Road 9, 8.0 miles upstream from mouth, 2.1 miles southeast of Concord.	22.2	1979-89	3-25-89	14.35	b196

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Discharge (ft <sup>3</sup> /s)
Zumbro River basin--Continued							
05374400	Long Creek near Potsdam, MN	Lat 44°10'48", long 92°17'23", at quarter corner on north line of sec.8, T.108 N., R.12 W., Wabasha County, Hydrologic Unit 07040004, at culvert on county highway, 2.6 miles northeast of Potsdam.	4.46	1966-89	3-24-89	17.90	b200
Whitewater River basin							
05376110	Middle Fork Whitewater River near State Park Group Camp near St. Charles, MN	Lat 44°03'21", long 92°03'13", in SW $\frac{1}{4}$ sec.20, T.107 N., R.10 W., Olmsted County, Hydrologic Unit 07040003, at wooden bridge near Group Camp in Whitewater State Park.	-	1986-89	3-24-89	c64.10	†
Root River basin							
05384350	Root River at Rushford, MN	Lat 43°48'11", long 91°45'10", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec.23, T.104 N., R.8 W., Fillmore County, Hydrologic Unit 07040008, on right downstream side of U.S. Highway 16 bridge on south side of Rushford.	-	1985-89	3-24-89	d	e3,500
05384500	Rush Creek near Rushford, MN	Lat 43°50'00", long 91°46'40", on line between secs.3 and 10, T.104 N., R.8 W., Fillmore County, Hydrologic Unit 07040008, on downstream side near center of span of highway bridge, 1.5 miles northwest of Rushford, 3.0 miles upstream from mouth.	129	1942-79#, 1980-89	3-24-89	6.21	1,950
05385000	Root River near Houston, MN	Lat 43°46'07", long 91°34'11", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.33, T.104 N., R.6 W., Houston County, Hydrologic Unit 07040008, on right bank 0.2 mile north of Houston, 1.6 miles upstream of South Fork Root River, 18.2 miles upstream from mouth.	1,270	1909-17, 1929, 1930-84#, 1985-89	3-24-89	c9.99	4,890
05385500	South Fork Root River near Houston, MN	Lat 43°44'19", long 91°33'50", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec.9, T.103 N., R.6 W., Houston County, Hydrologic Unit 07040008, on left bank, 50 feet downstream from State Highway 76 bridge, 0.5 mile upstream from Badger Creek, 1.5 mile south of Houston.	275	1953-83#, 1985-89	3-24-89	c8.95	1,220
Crooked Creek basin							
05387030	Crooked Creek at Freeburg, MN	Lat 43°36'37", long 91°21'39", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.30, T.102 N., R.4 W., Houston County, Hydrologic Unit 07060001, on right downstream wing wall of bridge on State Highway 249 at Freeburg, 6.5 miles upstream from mouth.	44.2	1979-89	3-23-89	10.72	440
Iowa River basin							
05457778	Little Cedar River near Johnsburg, MN	Lat 43°30'52", long 92°45'19", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.33, T.101 N., R.16 W., Mower County, Hydrologic Unit 07080201, at bridge on County Road 6, 1 mile northeast of Johnsburg, 1 mile north Minnesota-Iowa border.	46	1986-89	3-24-89	10.87	†

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Annual maximum Discharge (ft <sup>3</sup> /s)
Iowa River basin--Continued							
05458960	Bancroft Creek at Bancroft, MN	Lat 43°42'09", long 93°21'23", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec.21, T.103 N., R.21 W., Freeborn County, Hydrologic Unit 07080202, at bridge on County Road 14, 1.6 miles northeast of Fountain Lake, 1 mile north of Interstate 90.	29.1	1985+, 1986-89	3-23-89	6.96	475
Des Moines River basin							
05476900	Fourmile Creek near Dunnell, MN	Lat 43°34'57", long 94°46'26", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.2, T.101 N., R.33 W., Martin County, Hydrologic Unit 07100003, at bridge on State Highway 4, 0.6 mile upstream from mouth, 1.6 miles north of Dunnell.	14.0	1960-89	3-25-89	10.26	52
05476989	East Fork Des Moines River near Ceylon, MN	Lat 43°33'53", long 94°39'15", in NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.11, T.101 N., R.32 W., Martin County, Hydrologic Unit 07010003, at bridge on County Road 23, 2.4 miles northwest of Ceylon.	154	1986-89	3-25-89	g	a120
Big Sioux River basin							
06482745	Beaver Creek at Valley Springs, S.D.	Lat 43°35'10", long 96°28'20", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.3, T.101 N., R.47 W., Minnehaha County, South Dakota Hydrologic Unit 10170203, at bridge on County Road 103 (Valley Drive), 1 mile west of South Dakota-Minnesota border, 2.5 miles south of interstate 90.	104	1986-89	3-23-89	c20.19	b455
06482933	Chanarambi Creek near Edgerton, MN	Lat 43°53'59", long 96°03'39", in NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.18, T.105 N., R.43 W., near Murray and Pipestone County line, Hydrologic Unit 10170204, at right downstream wing wall of bridge on township road, 3.8 miles northeast of Edgerton, 7.4 miles upstream from mouth.	56.1	1979-89	3-24-89	12.00	b48
06483000	Rock River at Luverne, MN	Lat 43°39'15", long 96°12'03", in SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.11, T.102 N., R.45 W., Rock County, Hydrologic Unit 10170204, at bridge on Main Street (County Highway 4) in Luverne.	425	1911-14#, 1972-89	3-24-88	f5.40	1,250
06483210	Kanaranzi Creek tributary No. 2 near Wilmont, MN	Lat 43°43'32", long 95°52'20", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.15, T.103 N., R.42 W., Nobles County, Hydrologic Unit 10170204, at culvert on County Highway 15, 3.5 miles southwest of Wilmont, 3.7 miles upstream from mouth.	2.14	1966-89	3-25-89	c4.83	69

"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 1989--Continued

Station No.	Station name	Location	Drainage area (mi <sup>2</sup> )	Period of Record	Date	Annual maximum Gage height (feet)	Annual maximum Discharge (ft <sup>3</sup> /s)
Little Sioux River basin							
06603530	Little Sioux River near Spafford, MN	Lat 43°36'08", long 95°15'27", in NE¼NE¼ sec.34, T.102 N., R.37 W., Jackson County, Hydrologic Unit 10230003, at bridge on county highway, 1.6 miles downstream from Jackson County ditch No. 11, 5.8 miles east of Spafford.	41.1	1962-89	7-11-89	a6.97	51

+ Operated as low flow site.

# Operated as a continuous-record gaging station.

† Discharge not determined.

a Backwater from aquatic growth or debris.

b Backwater from ice, discharge estimated.

c Not annual maximum gage height.

d Peak stage unknown.

e Discharge estimated.

f Affected by shifting control.

g Peak stage did not reach bottom of pipe.

## 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 1989

Stream	Tributary	Location	Drainage area (mi <sup>2</sup> )	Period of record	Date	Discharge (ft <sup>3</sup> /s)
Mississippi River main stem						
Mississippi River	Gulf of Mexico	Lat 47°15'00", long 93°35'12", in NE¼NW¼ sec.13, T.55 N., R.26 W., Itaska County, Hydrologic Unit 07010103, at dam at outlet of Pokegama Lake, 3.5 miles northwest of Grand Rapids (05210700).	a3,360	1929-30, 1944-45, 1948-55, 1957-75, 1983-89	5-4-89	1,770
					9-26-89	1,100
Crow Wing River basin						
Shell River	Crow Wing River	Lat 46°56'08", long 96°16'40", in NW¼NE¼ sec.30, T.140 N., R.36 W., Becker County, Hydrologic Unit 07010106, at culvert on State Highway 34, 1 mile west of Osage.	-	1989	7-25-89	*1.76
Shell River	Crow Wing River	Lat 46°53'55", long 96°16'06", in NW¼SW¼ sec.32, T.140 N., R.36 W., Becker County, Hydrologic Unit 07010106, at culvert on County Highway 47, 1.5 miles south of Osage.	-	1989	7-25-89	*.45
Shell River	Crow Wing River	Lat 46°52'46", long 96°14'48", in SW¼SW¼ sec.4, T.139 N., R.36 W., Becker County, Hydrologic Unit 07010106, at culvert on County Road 123, 3 miles south of Osage.	-	1989	7-25-89	*.20
Shell River	Crow Wing River	Lat 46°52'37", long 96°13'28", in SW¼SW¼ sec.3, T.139 N., R.36 W., Becker County, Hydrologic Unit 07010106, at double culverts on township road, 2 miles east of County Highway 47, 3.5 miles southeast of Osage.	-	1989	7-25-89	*.40
Shell River	Crow Wing River	Lat 46°51'45", long 95°11'30", in NW¼NE¼ sec.14, T.139 N., R.36 W., Becker County, Hydrologic Unit 07010106, at bridge on County Highway 42, 8.8 miles northwest of Hubbard, 7.5 miles southwest of Park Rapids (05243100).	-	1973-76, 1984, 1988-89	7-25-89	*.56
Shell River	Crow Wing River	Lat 46°51'04", long 95°9'44", in SW¼SW¼ sec.18, T.139 N., R.35 W., Hubbard County, Hydrologic Unit 07010206, at bridge on County Road 34, on Becker-Hubbard County line .7 mile southwest of Park Rapids.	-	1989	7-25-89	*1.38
Shell River	Crow Wing River	Lat 46°48'27", long 95°06'05", in SE¼SE¼ sec.33, T.139 N., R.35 W., Hubbard County, Hydrologic Unit 07010106, at bridge on State Highway 71, 8 miles south of Park Rapids.	-	1989	7-25-89	.67
Straight River	Shell River	Lat 46°55'14", long 95°15'08", on line between secs.20 and 29, T.140 N., R.36 W., Becker County, Hydrologic Unit 07010106, at outlet of Straight Lake at State Highway 34 at Osage (05243720).	-	1943, 1974-76, 1984, 1986-89	10-19-88	20
					12-1-88	25
					1-4-89	23
					2-15-89	21
					3-28-89	29
					5-2-89	33
					6-1-89	27
					6-28-89	24
					7-25-89	14
					9-14-89	20

a Approximately.

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 systemtically over a period of years for use in hydrologic analyses. Letter E indicates estimated value.

05270120 SAUK RIVER BELOW MUD LAKE NEAR LITTLE SAUK, MN

DATE	TIME	TEMPER- ATURE WATER (DEG C) (00010)	CUBIC FEET PER SECOND (00061)	CON- DUCT- ANCE (US/CM) (00095)	OXYGEN, DIS- SOLVED (MG/L) (00300)	PH (STAND- ARD UNITS) (00400)	TOT IT FIELD MG/L AS CACO3 (39086)	WH IT FIELD MG/L AS CO3 (00452)
SEP 1988								
27...	1600	14.0	--	475	4.4	7.8	230	0
NOV								
02...	1600	5.0	1.4	507	14.9	8.5	--	--
JAN 1989								
12...	1630	0.0	3.2	494	5.2	7.7	--	--
FEB								
15...	1300	0.5	0.62	555	4.5	7.6	--	--
MAR								
07...	1000	1.0	0.0	541	4.7	7.7	286	0
MAR								
29...	1500	0.5	21	466	7.8	7.7	--	--
30...	1300	1.5	--	470	8.8	7.5	196	0
APR								
11...	1045	2.5	100	379	9.6	7.7	155	0
25...	1640	17.0	26	356	22.0	9.3	170	26
MAY								
10...	1310	16.0	35	426	14.0	8.6	190	5
23...	1300	21.5	29	439	9.7	8.4	196	2
JUN								
20...	1355	22.0	-1.0	415	5.5	8.4	202	0
JUL								
18...	1355	22.5	4.1	347	3.4	7.8	172	0
AUG								
15...	1355	20.5	E1.0	395	--	7.4	--	--

DATE	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3 (00453)	SOLIDS TOTAL AT 105 DEG C, SUS- PENDED (MG/L) (00530)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHOROUS DIS- TOTAL (MG/L AS P) (00665)	PHOS- PHOROUS ORTHO, DIS- SOLVED (MG/L AS P) (00761)
SEP 1988							
27...	280	<1	0.13	1.1	<0.10	0.07	0.02
MAR 1989							
07...	349	5	0.36	0.9	0.35	0.05	0.02
MAR							
*28-30	--	--	0.32	0.9	0.42	0.09	0.05
30...	239	--	--	--	--	--	--
APR							
11...	189	<1	0.56	1.8	1.90	0.20	0.10
25...	154	14	0.04	0.9	<0.10	0.09	0.01
MAY							
10...	232	7	0.03	0.5	<0.10	0.05	<0.01
23...	235	<1	0.04	0.7	<0.10	0.05	0.01
JUN							
20...	246	1	--	--	--	--	0.04
JUL							
18...	210	<1	0.08	2.0	<0.10	0.11	0.06
AUG							
15...	--	5	0.12	1.1	<0.10	0.16	0.04

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454924094550701 SAUK LAKE SITE 1 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (000003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
SEP 1988									
26...	1340	1.0	3.3	388	8.6	17.5	1.00	--	10.3
26...	1345	3.0	--	384	8.6	17.0	--	--	10.7
NOV									
03...	1355	1.0	4.3	403	8.9	5.0	1.28	741	14.5
03...	1356	3.3	--	425	8.9	4.5	--	--	15.7
JAN 1989									
12...	0855	--	4.3	549	7.5	0.5	--	759	4.3
12...	0900	3.0	--	546	7.6	0.5	--	--	4.7
12...	0905	3.5	--	549	7.5	0.5	--	--	2.9
FEB									
16...	0900	2.0	3.5	555	7.6	1.5	--	790	4.0
APR									
26...	1539	--	6.2	--	--	--	1.30	770	--
26...	1540	3.0	6.2	370	8.7	8.0	1.34	770	14.3
26...	1541	5.2	--	374	8.5	7.0	--	--	12.6
MAY									
24...	1139	--	4.1	--	--	--	1.25	748	--
24...	1140	0.5	4.1	410	8.3	19.0	1.25	748	7.3
24...	1143	3.5	--	409	8.3	19.0	--	--	7.2
JUN									
21...	1343	1.0	3.3	401	8.4	23.5	1.00	760	7.0
21...	1345	2.3	--	400	8.4	23.5	--	--	6.8
JUL									
19...	1320	1.0	4.6	332	8.8	24.0	1.40	760	10.2
19...	1321	4.0	--	338	8.8	24.0	--	--	10.2
AUG									
16...	1408	2.0	3.9	334	8.6	24.0	1.19	770	7.9
16...	1410	3.0	--	361	8.3	22.5	--	--	6.5

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454856094544602 SAUK LAKE SITE 2 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM-PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOCATION, TOTAL (FEET) (81903)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	TRANS-PAR-ENCY (SECCHI DISK) (M) (00078)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	BICAR-BONATE WATER FIELD HCO3 (00450)	BICAR-BONATE WATER DIS IT FIELD HCO3 (00453)	CAR-BONATE WATER FIELD CO3 (00447)
SEP 1988												
26...	1420	1.0	--	371	8.5	17.5	--	--	8.7	--	--	--
26...	1422	5.0	--	372	8.5	16.5	--	--	8.6	--	--	--
26...	1424	8.0	--	373	8.5	16.0	--	--	8.1	--	--	--
26...	1426	12.0	--	374	8.5	16.0	--	--	7.5	--	--	--
26...	1428	17.0	--	375	8.4	16.0	--	--	6.4	--	--	--
26...	1430	22.0	--	378	8.3	15.5	--	--	5.4	--	--	--
26...	1432	23.0	--	382	8.2	15.5	--	--	3.8	--	--	--
26...	1434	24.0	--	388	8.0	15.5	--	--	1.4	--	--	--
26...	1436	25.0	--	412	7.8	14.0	--	--	0	--	--	--
26...	1438	27.0	--	458	7.5	12.0	--	--	0	--	--	--
26...	1440	29.0	--	475	7.4	8.5	--	--	0	--	--	--
26...	1442	31.0	--	480	7.4	8.0	--	--	0	--	--	--
26...	1444	33.0	--	481	7.4	7.5	--	--	0	--	--	--
26...	1446	37.0	--	484	7.3	7.5	--	--	0	--	--	--
26...	1448	42.0	--	492	7.3	7.0	--	--	0	--	--	--
26...	1450	52.0	--	513	7.2	6.5	--	--	0	--	--	--
26...	1452	62.0	--	559	7.1	6.5	--	--	0	--	--	--
26...	1500	--	63.0	372	8.5	16.5	0.90	720	8.6	--	207	--
NOV												
03...	1410	1.0	--	376	8.9	5.5	--	--	13.5	--	--	--
03...	1411	5.0	--	378	8.9	5.0	--	--	12.5	--	--	--
03...	1412	15.0	--	379	8.9	5.0	--	--	12.0	--	--	--
03...	1413	25.0	--	379	8.9	5.0	--	--	12.0	--	--	--
03...	1414	35.0	--	379	8.9	5.0	--	--	12.0	--	--	--
03...	1415	45.0	--	379	8.9	5.0	--	--	11.9	--	--	--
03...	1416	49.0	--	379	8.8	5.0	--	--	11.9	--	--	--
03...	1430	--	50.0	378	8.9	5.0	1.43	741	12.5	212	--	2
JAN 1989												
12...	1125	--	51.0	400	8.7	2.0	--	760	12.1	--	209	--
FEB												
16...	1030	--	53.0	418	8.1	2.5	--	790	6.9	--	222	--

DATE	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3 (00452)	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3 (00419)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	RESIDUE TOTAL AT 105 SUS-PENDED (MG/L) (00530)	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)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
SEP 1988											
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--	--
26...	4	--	176	5	<0.10	<0.01	0.9	0.08	0.02	44.0	0.70
NOV											
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--	--
03...	--	176	--	32	<0.10	0.04	0.7	0.04	<0.01	81.0	<1.2
JAN 1989											
12...	12	--	191	1	<0.10	0.11	1.0	0.02	0.01	0.6	<0.1
FEB											
16...	0	--	182	7	<0.10	0.14	0.8	0.02	<0.01	0.2	<0.1

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454856094544602 SAUK LAKE SITE 2 AT SAUK CENTRE, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BICAR- BONATE WATER WHIT FIELD MG/L AS HCO3 (00450)
APR 1989										
26...	1505	--	55.0	--	--	--	1.30	770	--	183
26...	1508	3.0	--	355	8.7	9.5	--	--	14.7	--
26...	1509	10.0	--	371	8.4	7.5	--	--	11.9	--
26...	1510	15.0	--	407	7.8	5.5	--	--	3.6	--
26...	1511	20.0	--	427	7.7	4.5	--	--	1.0	--
26...	1512	30.0	--	442	7.6	4.0	--	--	0.2	--
26...	1513	40.0	--	459	7.4	4.0	--	--	0.3	--
26...	1514	50.0	--	473	7.3	3.5	--	--	0.2	--
26...	1515	54.0	--	477	7.3	4.0	--	--	0.4	--
MAY										
24...	1205	1.0	--	361	9.0	19.0	--	--	11.8	--
24...	1207	8.0	--	362	9.0	19.0	--	--	11.8	--
24...	1210	10.0	--	371	8.9	16.0	--	--	15.4	--
24...	1212	12.0	--	385	8.7	11.5	--	--	13.3	--
24...	1216	16.0	--	393	8.1	9.0	--	--	5.3	--
24...	1218	20.0	--	394	7.9	8.5	--	--	3.2	--
24...	1220	30.0	--	409	7.7	7.0	--	--	0.6	--
24...	1222	40.0	--	441	7.5	5.5	--	--	1.5	--
24...	1225	43.5	--	447	7.5	5.0	--	--	1.1	--
24...	1230	--	44.5	--	--	--	2.13	750	--	179
JUN										
21...	1253	1.0	--	372	8.9	22.0	--	--	9.2	--
21...	1255	10.0	--	374	8.8	21.5	--	--	8.2	--
21...	1256	13.0	--	386	8.4	17.5	--	--	5.3	--
21...	1257	15.0	--	398	8.2	16.0	--	--	3.6	--
21...	1258	17.0	--	412	7.6	12.5	--	--	0.6	--
21...	1259	20.0	--	417	7.9	10.5	--	--	0.3	--
21...	1300	30.0	--	444	7.6	7.0	--	--	0.2	--
21...	1301	40.0	--	474	7.4	6.0	--	--	0.2	--
21...	1302	47.0	--	484	7.2	5.5	--	--	0.2	--
21...	1315	--	48.0	--	--	--	2.70	770	--	229
JUL 1989										
19...	1222	2.0	--	335	8.8	25.0	--	--	9.0	--
19...	1223	8.0	--	335	8.8	24.5	--	--	8.9	--
19...	1224	12.0	--	340	8.5	24.0	--	--	4.6	--
19...	1225	15.0	--	370	7.9	18.5	--	--	0.4	--
19...	1227	20.0	--	388	7.7	11.0	--	--	0.5	--
19...	1229	30.0	--	411	7.3	7.5	--	--	0.7	--
19...	1231	40.0	--	429	7.0	6.0	--	--	0.8	--
19...	1240	--	52.0	--	--	--	1.25	763	--	190
AUG										
16...	1302	2.0	46.0	316	8.9	23.5	1.01	770	8.0	184
16...	1303	5.0	--	317	8.8	23.5	--	--	8.1	--
16...	1304	10.0	--	325	8.6	23.0	--	--	3.0	--
16...	1305	15.0	--	353	8.0	20.5	--	--	0.2	--
16...	1307	20.0	--	396	7.6	13.0	--	--	0.1	--
16...	1308	30.0	--	422	7.2	8.0	--	--	0.0	--
16...	1309	40.0	--	436	7.1	7.0	--	--	0.0	--
16...	1311	45.0	--	459	6.9	6.0	--	--	0.0	--



## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454856094544602 SAUK LAKE SITE 2 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 26, 88 1500	NOV 03, 88 1430	JAN 12, 89 1125	FEB 16, 89 1030	APR 26, 89 1505
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton					
CHLOROPHYTA (GREEN ALGAE)					
.CHLOROPHYCEAE					
..CHLOROCOCCALES					
...OOCYSTACEAE					
...ANKISTRODESMUS	--	--	1 1	--	--
...CLOSTERIOPSIS	94 3	--	--	94 12	--
...OOCYSTIS	31 <1	--	--	31 4	--
...SELENASTRUM	--	--	--	--	110 <1
CHRYSTOPHYTA (YELLOW-GREEN ALGAE)					
.BACILLARIOPHYCEAE					
..CENTRALES					
...COSCINODISCACEAE					
...MELOSIRA	94 3	17 <1	--	94 12	--
...STEPHANODISCUS	160 4	1800 78	--	160 20	6500 54
..PENNALES					
...ACHNANTHACEAE					
...COCCONEIS	31 <1	17 <1	--	31 4	--
...FRAGILARIACEAE					
...FRAGILARIA	--	17 <1	--	--	--
...SYNEDRA	--	--	--	--	2700 23
...GOMPHONEMATACEAE					
...GOMPHONEMA	--	17 <1	--	--	--
...NITZSCHIACEAE					
...NITZSCHIA	31 <1	--	--	31 4	--
.CHRYSTOPHYCEAE					
..CHROMULINALES					
...CHROMULINACEAE					
...CHRYSOCOCCUS	--	17 <1	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)					
.CYANOPHYCEAE					
..OSCILLATORIALES					
...NOSTOCACEAE					
...ANABAENA	160 4	--	--	160 20	--
...APHANIZOMENON	1700 46	310 13	51 34	29 4	--
EUGLENOPHYTA (EUGLENOIDS)					
.CRYPTOPHYCEAE					
..CRYPTOMONIDALES					
...CRYPTOCHRYSIDACEAE					
...RHODOMONAS	750 20	33 1	12 8	1 <1	2000 17
...CRYPTOMONODACEAE	470 13	66 3	6 4	1 <1	340 3
...CRYPTOMONAS					
.EUGLENOPHYCEAE					
..EUGLENALES					
...EUGLENACEAE					
...TRACHELOMONAS	--	--	--	--	110 <1
PYRRHOPHYTA (FIRE ALGAE)					
.DINOPHYCEAE					
..DINOKONTAE					
...CERATIACEAE					
...CERATIUM	130 4	17 <1	--	130 16	--
Zooplankton					
ARTHROPODA (ARTHROPODS)					
.CRUSTACEA					
..CALANOIDA					
...DIAPTOMIDAE					
...DIAPTOMUS	3 <1	5 <1	4 3	8 1	1 <1
...CLADOCERA					
...CHYDORIDAE	11 <1	7 <1	--	--	--
...DAPHNIDAE					
...CERIODAPHNIA	--	2 <1	--	--	--
...DAPHNIA	13 <1	7 <1	64 43	9 1	--
...CYCLOPOIDA					
..CYCLOPIDAE					
...CYCLOPS	4 <1	3 <1	5 4	5 <1	1 <1
...TROPOCYCLOPS	2 <1	--	--	--	--
ROTIFERA (ROTIFERS)					
.MONOGONONTA					
..FLOSCULARIACEAE					
...TESTUDINELLIDAE					
...FILINIA	--	--	--	--	4 <1
..PLOIMA					
...ASPLANCHNIDAE					
...ASPLANCHNA	--	--	3 2	--	--
...BRACHIONIDAE					
...KERATELLA	--	1 <1	--	4 <1	4 <1

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454856094544602 SAUK LAKE SITE 2 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1610	JUN 21, 89 1210	JUL 19, 89 1120	AUG 16, 89 1148
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton				
CHLOROPHYTA (GREEN ALGAE)				
.CHLOROPHYCEAE				
..CHLOROCOCCALES				
...OOCYSTACEAE				
...ANKISTRODESMUS	210 3	120 13	280 13	130 3
...OOCYSTIS	--	31 3	150 7	230 5
...QUADRIGULA	--	--	25 1	--
...SELENASTRUM	--	--	--	45 <1
...SCENEDESMACEAE				
...SCENEDESMUS	--	--	25 1	45 <1
..TETRASPORALES				
...PALMELLACEAE				
...SPHAEROCYSTIS	--	93 10	130 6	90 2
..VOLVOCALES				
...CHLAMYDOMONADACEAE				
...CHLAMYDOMONAS	--	62 7	25 1	90 2
...VOLVOCAEAE				
...EUDORINA	--	--	--	45 <1
CHRYSOPHYTA (YELLOW-GREEN ALGAE)				
.BACILLARIOPHYCEAE				
..CENTRALES				
...COSCINODISCAEAE				
...MELOSIRA	--	--	--	360 7
...STEPHANODISCUS	4300 54	--	51 2	45 <1
..PENNALES				
...ACHNANTHACEAE				
...COCCONEIS	--	31 3	--	--
...FRAGILARIACEAE				
...ASTERIONELLA	550 7	--	--	--
...FRAGILARIA	140 2	31 3	--	--
...SYNEDRA	1800 23	--	25 1	45 <1
...GOMPHONEMATAEAE				
...GOMPHONEMA	--	31 3	25 1	--
...NITZSCHIACEAE				
...NITZSCHIA	68 <1	--	100 5	45 <1
.CHRYSOPHYCEAE				
..CHROMULINALES				
...MALLOMONADACEAE	--	--	25 1	45 <1
...MALLOMONAS	--	--	25 1	45 <1
CYANOPHYTA (BLUE-GREEN ALGAE)				
.CYANOPHYCEAE				
..CHROOCOCCALES				
...CHROOCOCCACEAE	--	--	25 1	--
...ANACYSTIS	--	--	--	45 <1
..OSCILLATORIALES				
...NOSTOCACEAE				
...ANABAENA	--	--	330 15	450 9
...APHANIZOMENON	--	--	680 31	2500 49
EUGLENOPHYTA (EUGLENOIDS)				
.CRYPTOPHYCEAE				
..CRYPTOMONIDALES				
...CRYPTOCHRYSIDACEAE				
...RHODOMONAS	480 6	280 31	100 5	320 6
...CRYPTOMONADACEAE				
...CRYPTOMONAS	410 5	160 18	100 5	450 9
PYRRHOPHYTA (FIRE ALGAE)				
.DINOPHYCEAE				
..DINOKONTAE				
...GYMNODINIACEAE				
...GYMNODINIUM	--	--	25 1	--
..PERIDINIALES				
...CERATIACEAE				
...CERATIUM	--	62 7	51 2	--
...PERIDINIACEAE				
...PERIDINIUM	--	--	--	45 <1

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454856094544602 SAUK LAKE SITE 2 AT SAUK CENTRE, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1610	JUN 21, 89 1210	JUL 19, 89 1120	AUG 16, 89 1148
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton				
ARTHROPODA (ARTHROPODS)				
. CRUSTACEA				
.. CALANOIDA				
... DIAPTOMIDAE				
... DIAPTOMUS	--	--	--	16 <1
. CLADOCERA				
... BOSMINIDAE				
... BOSMINA	6 <1	--	--	--
... CHYDORIDAE	2 <1	--	--	27 <1
... DAPHNIDAE				
... DAPHNIA	2 <1	--	--	16 <1
. CYCLOPOIDA				
... CYCLOPIDAE				
... CYCLOPS	4 <1	--	--	--
... MESOCYCLOPS	1 <1	--	--	6 <1
ROTIFERA (ROTIFERS)				
. MONOGONONTA				
. FLOSCULARIACEAE				
... TESTUDINELLIDAE				
... FILINIA	23 <1	--	--	3 <1
. PLOIMA				
... ASPLANCHNIDAE				
... ASPLANCHNA	2 <1	--	--	--
... BRACHIONIDAE				
... KELLICOTTIA	4 <1	--	--	--
... KERATELLA	22 <1	--	--	8 <1
... SYNCHAETIDAE				
... POLYARTHRA	5 <1	--	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094560003 SAUK LAKE SITE 3 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
SEP 1988									
26...	1537	1.0	9.3	367	8.6	18.0	0.80	--	10.0
26...	1539	8.0	--	368	8.6	18.0	--	--	9.8
NOV									
03...	1330	1.0	7.6	360	9.0	6.0	1.52	741	13.1
03...	1331	6.6	--	364	9.1	5.0	--	--	13.2
JAN 1989									
12...	1515	3.0	--	396	8.8	1.5	--	760	12.9
12...	1516	6.0	--	389	8.8	3.0	--	--	12.2
12...	1517	8.0	--	387	8.8	3.5	--	--	11.6
FEB									
16...	1500	3.0	--	415	8.6	1.0	--	790	12.2
16...	1501	8.0	--	409	8.6	2.0	--	--	11.2
APR									
26...	1345	3.0	7.6	371	8.6	8.5	1.43	770	12.6
26...	1346	6.6	--	381	8.5	7.5	--	--	11.5
MAY									
24...	1512	1.0	11.0	377	8.8	18.0	2.35	748	10.6
24...	1516	6.0	--	378	8.8	18.0	--	--	10.5
24...	1518	10.5	--	377	8.8	18.0	--	--	10.4
JUN									
21...	1227	1.0	10.2	380	8.7	21.0	1.92	--	9.2
21...	1228	5.0	--	382	8.7	20.5	--	--	8.9
21...	1229	8.0	--	396	8.4	20.0	--	--	5.4
21...	1230	9.7	--	401	8.3	20.0	--	--	2.9
JUL									
19...	1053	2.0	10.1	334	8.8	25.0	1.40	762	8.9
19...	1054	5.0	--	335	8.8	24.5	--	--	8.7
19...	1055	9.0	--	336	8.6	24.0	--	--	6.9
AUG									
16...	1136	2.0	8.8	327	8.9	23.5	0.79	770	10.2
16...	1137	5.0	--	328	8.9	23.5	--	--	9.2
16...	1138	8.0	--	329	8.8	23.5	--	--	9.9

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094561004 SAUK LAKE SITE 4 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE OF (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3 (00450)
SEP 1988										
27...	1150	1.0	--	365	8.4	16.0	--	--	6.8	--
27...	1152	10.0	--	365	8.4	16.0	--	--	6.8	--
27...	1154	15.0	--	365	8.4	16.0	--	--	6.7	--
27...	1156	20.0	--	366	8.4	16.0	--	--	6.7	--
27...	1158	25.0	--	366	8.3	16.0	--	--	6.6	--
27...	1200	30.0	--	366	8.3	16.0	--	--	6.6	--
27...	1202	35.0	--	366	8.3	16.0	--	--	6.6	--
27...	1204	40.0	--	366	8.3	16.0	--	--	6.4	--
27...	1206	43.0	--	366	8.3	16.0	--	--	6.5	--
27...	1500	--	45.1	365	8.4	16.0	0.94	720	6.8	199
NOV										
03...	1229	1.0	--	360	9.1	5.5	--	--	12.8	--
03...	1230	5.0	--	362	9.1	5.0	--	--	12.5	--
03...	1231	15.0	--	363	9.1	5.0	--	--	12.1	--
03...	1232	25.0	--	363	9.1	5.0	--	--	12.1	--
03...	1233	35.0	--	363	9.1	5.0	--	--	12.0	--
03...	1234	44.5	--	363	9.0	5.0	--	--	11.7	--
03...	1245	--	45.4	362	9.1	5.0	1.34	742	12.5	195
JAN 1989										
12...	1655	--	45.0	390	8.8	2.5	--	760	11.7	201
12...	1700	3.0	--	390	8.8	2.0	--	--	12.1	--
12...	1701	10.0	--	387	8.8	2.5	--	--	11.4	--
12...	1702	20.0	--	394	8.6	3.0	--	--	9.2	--
12...	1703	25.0	--	399	8.4	3.0	--	--	7.9	--
12...	1704	30.0	--	404	8.3	3.5	--	--	6.6	--
12...	1705	35.0	--	413	8.2	3.5	--	--	5.3	--
12...	1706	40.0	--	427	8.1	3.5	--	--	4.1	--
12...	1707	44.0	--	449	8.0	4.0	--	--	3.1	--
FEB										
16...	1320	--	45.0	403	8.4	2.5	--	790	9.1	234
16...	1323	3.0	--	402	8.5	2.0	--	--	10.0	--
16...	1324	10.0	--	403	8.2	3.5	--	--	8.1	--
16...	1325	20.0	--	417	8.1	3.0	--	--	6.8	--
16...	1326	30.0	--	427	7.9	3.0	--	--	4.6	--
16...	1327	37.0	--	443	7.8	4.0	--	--	2.8	--
16...	1328	44.0	--	486	7.7	4.0	--	--	1.0	--
APR										
26...	1400	--	46.2	358	8.8	8.5	1.22	770	14.0	172
26...	1401	3.00	--	356	8.8	8.5	--	--	15.3	--
26...	1402	15.0	--	361	8.7	8.0	--	--	13.6	--
26...	1403	25.0	--	380	8.4	7.5	--	--	11.0	--
26...	1404	35.0	--	405	8.0	6.5	--	--	7.8	--
26...	1405	45.2	--	407	7.9	6.0	--	--	6.6	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094561004 SAUK LAKE SITE 4 AT SAUK CENTRE, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- FLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BICAR- BONATE WATER WEIGHT FIELD MG/L AS HCO3 (00450)
MAY 1989										
24...	1548	1.0	--	377	8.8	18.5	--	--	10.4	--
24...	1552	10.0	--	377	8.8	18.5	--	--	10.9	--
24...	1554	16.0	--	379	8.8	17.5	--	--	10.4	--
24...	1556	20.0	--	386	8.4	13.0	--	--	8.0	--
24...	1558	25.0	--	387	8.2	12.0	--	--	7.5	--
24...	1559	30.0	--	387	8.2	11.5	--	--	7.1	--
24...	1600	35.0	--	387	8.1	10.5	--	--	6.2	--
24...	1601	44.0	--	390	8.0	10.0	--	--	3.5	--
24...	1610	--	45.2	378	8.8	18.0	2.46	748	10.6	208
JUN										
21...	1156	1.0	--	385	8.8	20.5	--	--	9.4	--
21...	1157	10.0	--	386	8.8	20.5	--	--	9.1	--
21...	1158	20.0	--	389	8.7	20.0	--	--	8.4	--
21...	1159	30.0	--	395	8.4	18.0	--	--	7.2	--
21...	1201	40.0	--	399	8.3	17.5	--	--	6.2	--
21...	1202	43.0	--	401	8.1	17.0	--	--	5.5	--
21...	1203	45.0	--	421	7.8	11.5	--	--	0.4	--
21...	1210	--	45.9	386	8.8	20.5	2.13	770	9.2	187
JUL										
19...	1104	2.0	--	333	8.8	25.0	--	--	9.2	--
19...	1105	10.0	--	336	8.7	24.5	--	--	8.2	--
19...	1107	15.0	--	339	8.6	24.5	--	--	7.3	--
19...	1108	20.0	--	349	8.3	24.0	--	--	4.9	--
19...	1109	22.0	--	360	8.0	23.0	--	--	1.9	--
19...	1110	25.0	--	368	7.8	22.0	--	--	0.3	--
19...	1112	30.0	--	376	7.7	19.5	--	--	0.2	--
19...	1115	40.0	--	387	7.6	17.0	--	--	0.4	--
19...	1117	44.0	--	389	7.5	16.5	--	--	0.5	--
19...	1120	--	45.2	334	8.8	25.0	1.25	762	8.7	171
19...	1130	22.0	45.2	360	8.0	23.0	--	762	1.9	222
19...	1140	44.0	45.2	389	7.5	16.5	--	762	0.5	237
AUG										
16...	1148	2.0	44.0	325	8.9	23.5	0.82	770	11.1	150
16...	1149	5.0	--	328	8.8	23.5	--	--	9.1	--
16...	1150	10.0	--	330	8.8	23.5	--	--	8.0	--
16...	1152	15.0	--	334	8.5	23.0	--	--	5.3	--
16...	1153	25.0	--	336	8.4	23.0	--	--	4.5	178
16...	1154	30.0	--	347	8.0	22.5	--	--	0.4	--
16...	1155	40.0	--	404	7.4	17.5	--	--	0.1	230



ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094561004 SAUK LAKE SITE 4 AT SAUK CENTRE, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	CAR- BONATE WATER WH IT FIELD MG/L AS CO3 (00447)	ALKA- LINITY WAT WH TOT IT FIELD MG/L AS CACO3 (00419)	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDEDE (MG/L) (00530)	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- 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 1989										
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	10	184	2	<0.10	0.02	0.7	0.06	<0.01	3.6	0.70
JUN										
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	14	176	17	<0.10	0.03	0.8	0.03	<0.01	3.8	<0.20
JUL										
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	12	160	<1	<0.10	0.03	0.6	0.04	<0.01	12.0	0.40
19...	0	182	<1	<0.10	0.22	1.3	0.06	0.04	--	--
19...	0	194	<1	<0.10	0.94	1.5	0.34	0.23	--	--
AUG										
16...	21	157	10	<0.10	0.04	0.5	0.06	<0.01	40.0	<0.80
16...	--	--	--	--	--	--	--	--	--	--
16...	--	--	--	--	--	--	--	--	--	--
16...	4	154	10	<0.10	0.08	0.5	0.05	<0.01	40.0	<0.80
16...	--	--	--	--	--	--	--	--	--	--
16...	0	188	10	<0.10	1.00	1.1	0.24	0.18	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094561004 SAUK LAKE SITE 4 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 27, 88 1500	NOV 03, 88 1245	JAN 12, 89 1655	FEB 16, 89 1320	APR 26, 89 1400
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton					
CHLOROPHYTA (GREEN ALGAE)					
.CHLOROPHYCEAE					
..CHLOROCOCCALES					
...COELASTRACEAE					
....COELASTRUM					
	--	--	3 <1	--	--
...OOCYSTACEAE					
....CLOSTERIOPSIS					
	--	13 <1	--	--	--
....OOCYSTIS					
	11 1	--	11 2	--	--
...SCENEDESMACEAE					
..SCENEDESMUS					
	--	--	1 <1	--	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)					
.BACILLARIOPHYCEAE					
..CENTRALES					
...COSCINODISCAEAE					
....CYCLOTELLA					
	--	--	1 <1	--	--
....MELOSIRA					
	22 2	--	22 3	--	--
....STEPHANODISCUS					
	420 38	1500 83	420 62	--	20000 80
..PENNALES					
...ACHNANTHACEAE					
....COCCONEIS					
	11 1	--	11 2	--	--
...CYMBELLACEAE					
....CYMBELLA					
	--	--	1 <1	--	--
...FRAGILARIACEAE					
....ASTERIONELLA					
	--	--	16 2	2 3	--
....FRAGILARIA					
	--	40 2	--	--	--
....SYNEDRA					
	11 1	66 4	11 2	--	3700 15
CYANOPHYTA (BLUE-GREEN ALGAE)					
.CYANOPHYCEAE					
..OSCILLATORIALES					
...NOSTOCACEAE					
....ANABAENA					
	43 4	--	43 6	--	--
....APHANIZOMENON					
	500 45	79 4	50 7	18 22	--
EUGLENOPHYTA (EUGLENOIDS)					
.CRYPTOPHYCEAE					
..CRYPTOMONIDALES					
...CRYPTOCHRYSIDACEAE					
....RHODOMONAS					
	11 1	26 1	59 9	16 20	1400 6
....CRYPTOMONADACEAE					
....CRYPTOMONAS					
	22 2	13 <1	1 <1	3 4	--
Zooplankton					
ARTHROPODA (ARTHROPODS)					
.CRUSTACEA					
..CALANOIDA					
...DIAPTOMIDAE					
....DIAPTOMUS					
	5 <1	15 <1	13 2	14 17	7 <1
..CLADOCERA					
...CHYDORIDAE					
	23 2	25 1	--	23 28	1 <1
...DAPHNIDAE					
....DAPHNIA					
	4 <1	13 <1	5 <1	2 3	--
...CYCLOPOIDA					
....CYCLOPIDAE					
....CYCLOPS					
	2 <1	4 <1	1 <1	--	--
....TROPOCYCLOPS					
	1 <1	--	--	--	--
ROTIFERA (ROTIFERS)					
.MONOGONONTA					
..FLOSCULARIACEAE					
...TESTUDINELLIDAE					
....FILINIA					
	--	--	--	--	84 <1
...PLOIMA					
....BRACHIONIDAE					
....KERATELLA					
	--	1 <1	2 <1	1 2	37 <1
....SYNCHAETIDAE					
....SYNCHAETA					
	--	--	--	--	2 <1

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094561004 SAUK LAKE SITE 4 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1610	JUN 21, 89 1210	JUL 19, 89 1120	AUG 16, 89 1148
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton				
CHLOROPHYTA (GREEN ALGAE)				
.CHLOROPHYCEAE				
..CHLOROCOCCALES				
...OOCYSTACEAE				
... ANKISTRODESMUS	22 2	--	150 5	--
... OOCYSTIS	--	72 5	31 <1	160 3
...SCENEDESMACEAE				
... SCENEDESMUS	11 <1	--	--	--
..TETRASPORALES				
...PALMELLACEAE				
... SPHAEROCYSTIS	--	--	62 2	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)				
.BACILLARIOPHYCEAE				
..CENTRALES				
...COSCINODISACEAE				
... MELOSIRA	--	36 2	190 6	680 11
... STEPHANODISCUS	440 31	--	--	--
..PENNALES				
...ACHNANTHACEAE				
...COCCONEIS				
... FRAGILARIACEAE	--	--	--	52 <1
... ASTERIONELLA	150 11	--	--	--
... FRAGILARIA	56 4	1400 88	--	--
... SYNEDRA	44 3	--	31 <1	110 2
...NITZSCHIA				
... NITZSCHIA	11 <1	--	31 <1	--
.CHRYSOPHYCEAE				
..CHROMULINALES				
...CHROMULINACEAE				
... CHRYSOCOCCUS	11 <1	--	--	--
...MALLONADACEAE				
... MALLONAS	11 <1	--	--	--
...OCHROMONADACEAE				
... DINOBRYON	22 2	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)				
.CYANOPHYCEAE				
..CHROCOCCALES				
...CHROCOCCACEAE				
... ANACYSTIS	--	--	--	110 2
..OSCILLATORIALES				
...NOSTOCACEAE				
... ANABAENA	--	--	190 6	1200 20
... APHANIZOMENON	--	18 1	990 30	3400 56
EUGLENOPHYTA (EUGLENOIDS)				
.CRYPTOPHYCEAE				
..CRYPTOMONIDALES				
...CRYPTOCHRYSIDACEAE				
... RHODOMONAS	490 35	18 1	1200 36	110 2
...CRYPTOMONODACEAE				
... CRYPTOMONAS	22 2	--	340 10	52 <1
PYRRHOPHYTA (FIRE ALGAE)				
.DINOPHYCEAE				
..PERIDINIALES				
...CERATIAACEAE				
... CERATIUM	--	36 2	62 2	110 2

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454756094561004 SAUK LAKE SITE 4 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1610	JUN 21, 89 1210	JUL 19, 89 1120	AUG 16, 89 1148
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton				
ARTHROPODA (ARTHROPODS)				
CRUSTACEA				
CALANOIDA				
... DIAPTOMIDAE				
... DIAPTOMUS	6 <1	--	--	18 <1
GLADOCERA				
... BOSMINIDAE				
... BOSMINA	5 <1	--	--	--
... CHYDORIDAE	4 <1	--	--	110 2
... DAPHNIDAE				
... DAPHNIA	5 <1	--	--	7 <1
... CYCLOPOIDA				
... CYCLOPIDAE				
... CYCLOPS	3 <1	--	--	4 <1
... MESOCYCLOPS	--	--	--	5 <1
ROTIFERA (ROTIFERS)				
MONOGONONTA				
FLOSCULARIACEAE				
TESTUDINELLIDAE				
... FILINIA	5 <1	--	--	2 <1
PLOIMA				
... ASPLANCHNIDAE				
... ASPLANCHNA	1 <1	--	--	--
... BRACHIONIDAE				
... KELLICOTTIA	5 <1	--	--	--
... KERATELLA	50 4	--	--	17 <1
... SYNCHAETIDAE				
... SYNCHAETA	2 <1	--	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454755094562505 SAUK LAKE SITE 5 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE OF (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
SEP 1988									
27...	1130	1.0	7.2	363	8.6	16.0	0.82	--	8.3
27...	1132	7.0	--	364	8.6	16.0	--	--	8.3
NOV									
03...	1215	1.0	9.6	362	9.0	5.5	1.43	742	13.3
03...	1216	8.5	--	363	9.0	5.0	--	--	12.8
JAN 1989									
12...	1600	3.0	7.7	391	9.0	1.5	--	760	12.6
12...	1601	6.0	--	391	9.0	2.0	--	--	12.6
12...	1602	8.0	--	392	8.9	2.5	--	--	12.5
FEB									
16...	1245	3.5	5.2	387	8.6	0.5	--	790	12.3
16...	1246	6.5	--	397	8.6	1.5	--	--	11.3
APR									
26...	1435	3.0	6.1	354	8.9	9.5	1.28	770	15.9
26...	1436	5.1	--	354	8.9	9.5	--	--	15.7
MAY									
24...	1527	1.0	16.5	377	8.8	18.5	2.41	748	10.0
24...	1530	10.0	--	379	8.8	18.0	--	--	10.1
24...	1533	16.0	--	378	8.8	17.5	--	--	9.9
JUN									
21...	1138	1.0	10.4	384	8.8	21.0	2.04	776	10.0
21...	1140	7.0	--	384	8.8	21.0	--	--	9.9
21...	1141	9.5	--	384	8.8	20.5	--	--	8.8
JUL									
19...	1202	2.0	10.8	331	8.9	25.0	1.16	763	10.2
19...	1203	5.0	--	331	8.9	25.0	--	--	10.2
19...	1204	10.0	--	331	8.8	25.5	--	--	10.1
AUG									
16...	1240	2.0	8.6	324	9.0	23.5	0.82	770	12.2
16...	1241	5.0	--	327	8.9	23.5	--	--	9.9
16...	1243	8.0	--	329	8.8	23.5	--	--	9.3

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454656094560006 SAUK LAKE SITE 6 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- FLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE OF (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
SEP 1988									
27...	1300	1.0	7.1	362	8.6	16.0	0.70	--	9.4
27...	1302	6.0	--	362	8.6	16.0	--	--	9.4
NOV									
03...	1000	1.0	6.0	355	9.0	5.0	1.49	742	13.0
03...	1001	5.0	--	363	9.0	4.5	--	--	12.5
JAN 1989									
18...	1145	3.0	9.0	389	8.7	2.0	--	760	13.8
18...	1146	6.0	--	383	8.7	2.5	--	--	13.0
18...	1147	8.0	--	384	8.7	3.0	--	--	10.5
FEB									
17...	0945	3.0	9.0	406	8.7	1.5	--	790	11.5
17...	0946	8.0	--	411	8.7	3.5	--	--	12.1
APR									
26...	1325	3.0	8.6	387	8.4	8.5	1.31	770	11.7
26...	1326	7.6	--	398	8.3	8.0	--	--	10.2
MAY									
24...	1645	1.0	12.8	375	8.8	17.5	2.29	748	10.7
24...	1648	6.0	--	375	8.8	17.5	--	--	10.9
24...	1649	12.3	--	375	8.8	17.0	--	--	10.3
JUN									
21...	1027	1.0	11.0	391	8.3	18.5	1.46	776	7.8
21...	1029	6.0	--	399	8.2	17.5	--	--	6.0
21...	1030	10.0	--	400	8.1	17.5	--	--	4.5
JUL									
19...	1034	2.0	9.8	344	8.6	24.5	1.25	763	7.6
19...	1035	5.0	--	344	8.6	24.0	--	--	7.5
19...	1036	8.5	--	345	8.6	24.0	--	--	7.2
AUG									
16...	1109	2.0	9.1	325	8.9	23.5	0.76	770	10.7
16...	1110	5.0	--	327	8.9	23.5	--	--	9.0
16...	1111	8.0	--	328	8.8	23.5	--	--	8.5

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454656094554607 SAUK LAKE SITE 7 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOCATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BICAR- BONATE WATER WH IT FIELD HCO3 (00450)
SEP 1988										
27...	1315	1.0	--	360	8.7	16.5	--	--	9.7	--
27...	1317	10.0	--	362	8.6	16.5	--	--	9.0	--
27...	1319	24.0	--	362	8.6	16.5	--	--	8.8	--
27...	1330	--	25.6	362	8.6	16.5	0.73	720	9.0	186
NOV										
03...	1030	--	25.0	361	9.0	5.0	1.31	742	12.5	193
03...	1031	1.0	--	359	9.0	5.0	--	--	12.8	--
03...	1032	5.0	--	361	9.0	5.0	--	--	12.5	--
03...	1033	15.0	--	362	9.0	4.0	--	--	12.3	--
03...	1034	24.0	--	363	9.0	5.0	--	--	11.9	--
JAN 1989										
18...	1110	--	24.0	390	8.6	3.0	--	760	11.7	199
FEB										
16...	1640	--	25.5	396	8.7	3.0	--	790	13.0	207
APR										
26...	1255	--	25.2	368	8.6	8.5	1.28	770	13.3	201
26...	1300	3.0	--	367	8.6	8.5	--	--	13.4	--
26...	1301	10.0	--	368	8.6	8.5	--	--	13.2	--
26...	1302	15.0	--	372	8.5	8.0	--	--	12.6	--
26...	1303	20.0	--	388	8.4	8.0	--	--	10.9	--
26...	1304	24.2	--	406	8.0	8.0	--	--	7.9	--
MAY										
24...	1712	1.0	--	374	8.8	17.5	--	--	10.7	--
24...	1714	5.0	--	374	8.8	17.5	--	--	10.7	--
24...	1715	10.0	--	375	8.8	17.5	--	--	10.8	--
24...	1716	15.0	--	376	8.8	17.5	--	--	10.7	--
24...	1718	20.0	--	376	8.7	17.5	--	--	10.5	--
24...	1720	26.5	--	381	8.6	16.5	--	--	6.0	--
24...	1730	--	27.5	375	8.8	17.5	2.59	748	10.7	218
JUN										
21...	1040	1.0	--	398	8.3	18.0	--	--	7.3	--
21...	1041	5.0	--	397	8.3	17.5	--	--	7.1	--
21...	1042	10.0	--	398	8.3	17.5	--	--	6.9	--
21...	1044	20.0	--	398	8.3	17.5	--	--	6.8	--
21...	1045	26.5	--	403	8.1	16.5	--	--	4.3	--
21...	1055	--	27.6	398	8.3	17.5	1.95	770	7.1	220
JUL										
19...	0938	2.0	--	339	8.7	24.5	--	--	7.9	--
19...	0939	5.0	--	340	8.6	24.5	--	--	7.8	--
19...	0941	13.0	--	341	8.6	24.0	--	--	7.1	--
19...	0943	20.0	--	342	8.6	24.0	--	--	7.0	--
19...	0944	25.0	--	347	8.4	24.0	--	--	5.4	--
19...	0950	--	26.4	340	8.6	24.5	1.13	766	7.8	191
19...	1000	13.0	26.4	341	8.6	24.0	--	766	7.1	180
19...	1010	25.0	26.4	347	8.4	24.0	--	766	5.4	196
AUG										
16...	1012	2.0	26.0	326	8.8	23.5	0.70	770	9.4	159
16...	1013	5.0	--	328	8.8	23.5	--	--	8.1	--
16...	1014	10.0	--	329	8.7	23.0	--	--	7.7	--
16...	1015	15.0	--	330	8.7	23.0	--	--	6.9	174
16...	1017	20.0	--	338	8.4	23.0	--	--	3.9	--
16...	1018	25.0	--	345	8.0	22.5	--	--	0.9	190

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454656094554607 SAUK LAKE SITE 7 AT SAUK CENTRE, MN--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	CAR- BONATE WATER WH IT FIELD MG/L AS CO3 (00447)	ALKA- LINITY WAT WH TOT IT FIELD MG/L AS CACO3 (00419)	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDE (MG/L) (00530)	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 PHOS- PHORUS 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)
SEP 1988										
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	--	--	--	--	--	--	--	--	--	--
27...	10	168	11	<0.10	<0.01	0.8	0.10	0.01	57.0	0.50
NOV										
03...	12	168	27	<0.10	0.02	0.9	0.03	<0.01	36.0	<0.60
03...	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--
03...	--	--	--	--	--	--	--	--	--	--
JAN 1989										
18...	12	186	<1	<0.10	0.04	1.2	0.02	<0.01	0.50	<0.10
FEB										
16...	16	196	4	<0.10	0.04	0.8	0.02	<0.01	0.50	<0.10
APR										
26...	2	169	6	0.13	0.03	0.5	0.06	<0.01	36.0	0.90
26...	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--
26...	--	--	--	--	--	--	--	--	--	--
MAY										
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	--	--	--	--	--	--	--	--	--	--
24...	14	198	<1	<0.10	0.02	0.6	0.02	<0.01	2.90	<0.50
JUN										
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	--	--	--	--	--	--	--	--	--	--
21...	0	180	4	<0.10	0.13	0.9	0.04	0.02	2.80	<0.20
JUL										
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	--	--	--	--	--	--	--	--	--	--
19...	2	160	<1	<0.10	0.05	0.6	0.04	<0.01	15.0	<0.30
19...	4	154	<1	<0.10	0.02	0.8	0.05	<0.01	--	--
19...	2	164	1	<0.10	0.03	0.7	0.05	<0.01	--	--
AUG										
16...	15	155	21	<0.10	0.07	0.7	0.06	<0.01	44.0	<0.80
16...	--	--	--	--	--	--	--	--	--	--
16...	--	--	--	--	--	--	--	--	--	--
16...	9	157	13	<0.10	0.08	0.6	0.07	0.01	--	--
16...	--	--	--	--	--	--	--	--	--	--
16...	3	161	17	<0.10	0.16	0.6	0.05	<0.01	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454658094554607 SAUK LAKE SITE 7 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 27, 88 1330	NOV 03, 88 1030	JAN 18, 89 1110	FEB 16, 89 1640	APR 26, 89 1255
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton					
CHLOROPHYTA (GREEN ALGAE)					
.CHLOROPHYCEAE					
..CHLOROCOCCALES					
...OOCYSTACEAE					
...ANKISTRODESMUS	19 1	--	19 4	22 3	190 <1
...CLOSTERIOPSIS	38 2	--	38 7	--	--
..TETRASPORALES					
...PALMELLACEAE					
...SPHAEROCYSTIS	--	13 <1	1 <1	--	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)					
.BACILLARIOPHYCEAE					
..CENTRALES					
...COSCINODISCEAE					
...MELOSIRA	19 1	40 2	19 4	--	--
...STEPHANODISCUS	270 14	1300 72	270 53	370 53	19000 83
..PENNALES					
...ACHNANTHACEAE					
...ACHNANTHES	--	--	1 <1	--	--
...FRAGILARIACEAE					
...ASTERIONELLA	--	--	7 2	1 <1	--
...SYNEDRA	--	120 7	--	22 3	2600 11
...NITZSCHIACEAE					
...NITZSCHIA	--	--	--	22 3	190 <1
CYANOPHYTA (BLUE-GREEN ALGAE)					
.CYANOPHYCEAE					
..OSCILLATORIALES					
...NOSTOCACEAE					
...ANABAENA	--	13 <1	19 4	110 16	--
...APHANIZOMENON	1300 68	190 11	17 3	8 1	--
EUGLENOPHYTA (EUGLENOIDS)					
.CRYPTOPHYCEAE					
..CRYPTOMONIDALES					
...CRYPTOCHRYSIDACEAE					
...RHODOMONAS	96 5	66 4	19 4	4 <1	560 2
...CRYPTOMONODACEAE					
...CRYPTOMONAS	57 3	--	5 1	1 <1	--
PYRRHOPHYTA (FIRE ALGAE)					
.DINOPHYCEAE					
..DINOKONTAE					
...CERATIACEAE					
...CERATIUM	57 3	--	57 11	22 3	--
Zooplankton					
ARTHROPODA (ARTHROPODS)					
.CRUSTACEA					
..CALANOIDA					
...DIAPTOMIDAE					
...DIAPTOMUS	20 1	22 1	26 5	100 14	10 <1
...CLADOCERA					
...CHYDORIDAE	60 3	24 1	--	--	--
...DAPHNIDAE					
...DAPHNIA	--	15 <1	5 1	2 <1	--
...CYCLOPOIDA					
...CYCLOPIDAE	5 <1	2 <1	--	4 <1	2 <1
...CYCLOPS					
ROTIFERA (ROTIFERS)					
.MONOGONONTA					
..FLOSCULARIACEAE					
...TESTUDINELLIDAE					
...FILINIA	--	--	--	2 <1	54 <1
...PLOIMA					
...BRACHIONIDAE	--	2 <1	4 <1	10 1	31 <1
...KERATELLA	--	--	--	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454656094554607 SAUK LAKE SITE 7 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1730	JUN 21, 89 1055	JUL 19, 89 0950	AUG 16, 89 1012
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton				
CHLOROPHYTA (GREEN ALGAE)				
.CHLOROPHYCEAE				
..CHLOROCOCCALES				
...OOCYSTACEAE				
...ANKISTRODESMUS	15 <1	10 1	--	68 <1
...CLOSTERIOPSIS	--	--	--	68 <1
...OOCYSTIS	15 <1	10 1	130 5	68 <1
...QUADRIGULA	--	--	26 <1	--
.TETRASPORALES				
..PALMELLACEAE				
...SPHAEROCYSTIS	--	10 1	79 3	68 <1
.VOLVOCALES				
..CHLAMYDOMONADACEAE				
...CHLAMYDOMONAS	--	--	26 <1	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)				
.BACILLARIOPHYCEAE				
..CENTRALES				
...COSCIDINODISCACEAE				
...CYCLOTELLA	--	--	26 <1	--
...MELOSIRA	--	50 5	260 10	820 10
...STEPHANODISCUS	170 11	20 2	--	--
.PENNALES				
..ACHNANTHACEAE				
...COCONEIS	--	--	--	68 <1
..FRAGILARIACEAE				
...ASTERIONELLA	180 11	30 3	--	--
...FRAGILARIA	--	760 76	--	--
...SYNEDRA	46 3	--	--	--
..NAVICULACEAE				
...NAVICULA	15 <1	--	--	--
..NITZSCHIACEAE				
...NITZSCHIA	15 <1	--	26 <1	--
.CHRYSOPHYCEAE				
..CHROMULINALES				
...CHROMULINACEAE	15 <1	--	--	--
...CHRYSOCOCCLUS	15 <1	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)				
.CYANOPHYCEAE				
..CHROOCOCCALES				
...CHROOCOCCACEAE	--	10 1	79 3	--
...ANACYSTIS	--	--	52 2	68 <1
..OSCILLATORIALES				
...NOSTOCACEAE				
...ANABAENA	--	--	260 10	1000 13
...APHANIZOMENON	--	--	1200 44	5200 66
EUGLENOPHYTA (EUGLENOIDS)				
.CRYPTOPHYCEAE				
..CRYPTOMONIDALES				
...CRYPTOCHRYSIDACEAE	680 43	50 5	290 11	68 <1
...RHODOMONAS	380 24	10 1	130 5	270 3
..CRYPTOMONODACEAE				
...CRYPTOMONAS	380 24	10 1	130 5	270 3
PYRRHOPHYTA (FIRE ALGAE)				
.DINOPHYCEAE				
..PERIDINIALES				
...CERATIACEAE				
...CERATIUM	--	30 3	--	--
..PERIDINIACEAE				
...PERIDINIUM	--	--	26 <1	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454656094554607 SAUK LAKE SITE 7 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1730	JUN 21, 89 1055	JUL 19, 89 0950	AUG 16, 89 1012
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton				
ARTHROPODA (ARTHROPODS)				
. CRUSTACEA				
.. CALANOIDA				
... DIAPTOMIDAE				
... DIAPTOMUS	2 4 <1	8 <1	17 <1	10 <1
.. GLADOCERA				
... BOSMINIDAE				
... BOSMINA	6 <1	--	--	--
... CHYDORIDAE	4 <1	--	9 <1	56 <1
... DAPHNIDAE				
... DAPHNIA	1 <1	4 <1	1 <1	8 <1
... SIDIDAE				
... DIAPHANOSOMA	--	--	1 <1	1 <1
.. CYCLOPOIDA				
... CYCLOPIDAE				
... CYCLOPS	2 2 <1	--	6 <1	3 <1
... MESOCYCLOPS	--	--	2 <1	2 <1
ROTIFERA (ROTIFERS)				
. MONOGONONTA				
.. FLOSCULARIACEAE				
... TESTUDINELLIDAE				
... FILINIA	--	--	1 <1	3 <1
.. FLOIMA				
... BRACHIONIDAE				
... KELLICOTTIA	8 <1	--	2 <1	--
... KERATELLA	30 2	2 <1	6 <1	9 <1

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454657094553008 SAUK LAKE SITE 8 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- FLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE OF (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
SEP 1988									
27...	1310	1.0	8.3	361	8.6	16.5	0.79	--	9.6
27...	1312	7.0	--	362	8.6	16.0	--	--	9.2
NOV									
03...	1145	1.0	9.9	361	9.1	5.5	1.68	--	13.1
03...	1146	9.0	--	362	9.1	5.0	--	--	13.1
JAN 1989									
18...	1320	3.0	8.0	394	8.8	1.5	3.00	760	12.8
18...	1321	7.0	--	389	8.8	2.5	--	--	12.5
FEB									
17...	0900	3.0	8.5	404	8.7	2.0	--	790	11.4
17...	0901	7.5	--	398	8.7	3.5	--	--	10.4
APR									
26...	1235	3.0	9.2	365	8.7	9.0	1.16	770	14.1
26...	1240	8.2	--	366	8.7	9.0	--	--	13.9
MAY									
24...	1658	1.0	10.6	374	8.8	18.0	2.19	747	10.1
24...	1700	5.0	--	374	8.8	18.0	--	--	10.1
24...	1702	8.0	--	376	8.6	18.0	--	--	9.3
24...	1704	10.0	--	391	8.2	17.5	--	--	3.3
JUN									
21...	1111	1.0	9.5	386	8.5	19.5	1.31	776	8.9
21...	1112	5.0	--	393	8.4	19.0	--	--	6.6
21...	1114	7.0	--	399	8.1	17.5	--	--	4.7
21...	1115	9.0	--	404	8.0	17.0	--	--	2.2
JUL									
19...	0926	2.0	9.0	333	8.7	24.5	1.28	762	8.7
19...	0928	5.0	--	331	8.8	24.5	--	--	8.9
19...	0929	8.0	--	331	8.8	24.5	--	--	8.8
AUG									
16...	1001	2.0	8.7	324	8.9	23.5	0.70	770	10.4
16...	1002	5.0	--	325	8.8	23.5	--	--	9.7
16...	1003	7.5	--	324	8.9	23.5	--	--	10.4

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454657094553008 SAUK LAKE SITE 9 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE OF (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)
SEP 1988									
27...	1400	1.0	11.2	361	8.6	16.0	0.73	--	9.7
27...	1402	10.0	--	362	8.6	16.0	--	--	9.5
NOV									
03...	0930	1.0	10.0	356	9.0	4.5	1.52	742	12.8
03...	0931	5.0	--	362	9.0	4.5	--	--	12.8
03...	0932	9.0	--	363	9.0	4.5	--	--	12.6
JAN 1989									
18...	1046	3.0	10.5	388	8.8	3.0	--	760	12.8
18...	1047	6.0	--	381	8.8	3.5	--	--	12.0
18...	1048	9.5	--	389	8.5	4.0	--	--	7.3
FEB									
17...	0830	3.0	6.8	403	8.7	2.5	--	790	11.0
17...	0831	8.0	--	403	8.5	4.5	--	--	7.0
APR									
26...	1215	3.0	11.5	406	8.2	9.0	1.52	770	9.9
26...	1220	10.5	--	408	8.1	9.0	--	--	6.8
MAY									
24...	1753	1.0	11.9	375	8.8	18.0	2.29	748	10.4
24...	1756	6.0	--	375	8.8	17.5	--	--	10.2
24...	1758	9.0	--	375	8.7	17.5	--	--	10.1
24...	1800	11.0	--	383	8.1	15.5	--	--	4.7
JUN									
21...	0958	1.0	10.6	395	8.5	18.5	1.49	776	8.0
21...	1000	5.0	--	399	8.2	17.5	--	--	6.0
21...	1002	10.0	--	403	8.0	16.5	--	--	2.5
JUL									
19...	0910	2.0	9.4	341	8.6	23.5	1.07	765	7.4
19...	0911	5.0	--	342	8.5	23.5	--	--	7.3
19...	0912	8.5	--	345	8.4	23.5	--	--	6.1
AUG									
16...	0946	2.0	9.6	315	8.8	23.5	0.70	770	12.2
16...	0948	5.0	--	317	8.9	23.5	--	--	11.4
16...	0949	8.0	--	318	8.8	23.5	--	--	10.2

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454517094573810 SAUK LAKE SITE 10 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE OF (MM HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3 (00450)
SEP 1988										
27...	1015	1.0	--	357	8.8	15.5	--	--	8.2	--
27...	1017	6.0	--	358	8.8	15.0	--	--	7.9	--
27...	1030	--	7.8	358	8.8	15.0	0.43	720	8.0	180
NOV										
03...	1700	1.0	--	426	8.9	4.0	--	--	12.6	--
03...	1701	6.8	--	446	8.9	3.5	--	--	10.3	--
03...	1715	--	7.8	436	8.9	4.0	1.10	740	11.4	217
JAN 1989										
13...	1010	--	7.9	450	8.1	3.5	--	760	8.8	267
FEB										
14...	1600	--	8.0	458	8.0	2.0	--	769	6.3	265
14...	1630	--	8.0	496	7.7	5.0	--	770	1.0	266
APR										
26...	0925	--	8.5	428	8.8	12.5	1.13	770	15.3	190
26...	0930	3.0	--	429	8.8	12.5	--	--	15.5	--
26...	0935	8.0	--	428	8.8	12.5	--	--	15.1	--
MAY										
24...	1830	--	8.3	421	8.4	18.0	1.62	750	5.6	218
24...	1831	1.0	--	406	8.7	18.5	--	--	10.0	--
24...	1832	7.3	--	436	8.0	17.5	--	--	1.7	--
JUN										
21...	1450	1.0	--	409	8.9	24.0	--	--	11.0	--
21...	1451	5.0	--	433	8.8	23.0	--	--	9.1	--
21...	1453	6.0	--	449	8.6	22.5	--	--	6.5	--
21...	1454	7.9	--	471	8.1	22.0	--	--	1.1	--
21...	1500	--	8.9	440	8.6	23.0	1.52	770	6.9	187
JUL										
19...	1411	2.0	--	343	8.8	25.0	--	--	10.2	--
19...	1413	5.0	--	342	8.8	25.0	--	--	10.2	--
19...	1415	7.0	--	357	8.4	24.0	--	--	4.5	--
19...	1420	--	7.9	342	8.8	25.0	0.76	760	10.2	160
AUG										
16...	1500	2.0	7.1	311	9.3	26.0	0.55	770	16.1	138
16...	1501	4.0	--	321	9.0	23.5	--	--	10.1	--
16...	1505	6.0	--	339	8.3	23.0	--	--	1.0	--



## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454517094573810 SAUK LAKE SITE 10 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 27, 88 1030	NOV 03, 88 1715	JAN 13, 89 1010	FEB 14, 89 1600	APR 26, 89 0925
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton					
CHLOROPHYTA (GREEN ALGAE)					
.CHLOROPHYCEAE					
..CHLOROCOCCALES					
...COELASTRACEAE					
...COELASTRUM	--	--	--	14 3	--
...OOCYSTACEAE					
...ANKISTRODESMUS	99 5	62 4	2 2	99 23	230 1
...OOCYSTIS	14 <1	--	--	14 3	--
...SELENASTRUM	--	87 5	--	--	--
...SCENEDESMACEAE					
...CRUCIGENIA	28 1	--	--	28 6	--
...SCENEDESMUS	14 <1	37 2	--	28 6	--
...TETRASPORALES					
...PALMELLACEAE					
...SPHAEROCYSTIS	--	--	--	1 <1	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)					
.BACILLARIOPHYCEAE					
..CENTRALES					
...COSCINODISCACEAE					
...CYCLOTELLA	70 4	--	2 2	70 16	450 2
...MELOSIRA	230 12	62 4	--	28 6	230 1
...STEPHANODISCUS	380 20	330 21	7 7	28 6	18000 82
...PENNALES					
...ACHNANTHACEAE					
...ACHNANTHES	--	12 <1	4 4	2 <1	--
...COCCONEIS	--	12 <1	2 2	--	--
...RHOICOSPHENIA	--	--	--	1 <1	--
...CYMBELLACEAE					
...CYMBELLA	--	--	2 2	--	--
...FRAGILARIACEAE					
...ASTERIONELLA	--	--	--	--	450 2
...FRAGILARIA	--	36 2	3 3	--	680 3
...SYNEDRA	--	24 2	--	--	230 1
...GOMPHONEMATACEAE					
...GOMPHONEMA	--	12 <1	--	--	--
...NAVICULACEAE					
...NAVICULA	--	12 <1	--	--	--
...NITZSCHIACEAE					
...NITZSCHIA	14 <1	12 <1	--	14 3	450 2
.CHRYSOPHYCEAE					
..CHROMULINALES					
...CHROMULINACEAE					
...CHRYSOCOCCLUS	--	25 2	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)					
.CYANOPHYCEAE					
..OSCILLATORIALES					
...NOSTOCACEAE					
...ANABAENA	28 1	--	--	28 6	--
...APHANIZOMENON	350 18	25 2	14 13	9 2	--
EUGLENOPHYTA (EUGLENOIDS)					
.CRYPTOPHYCEAE					
..CRYPTOMONIDALES					
...CRYPTOCHRYSIDACEAE					
...RHODOMONAS	14 <1	760 48	--	29 7	1100 5
...CRYPTOMONODACEAE	270 14	50 3	14 13	3 <1	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454517094573810 SAUK LAKE SITE 10 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 27, 88 1030	NOV 03, 88 1715	JAN 13, 89 1010	FEB 14, 89 1600	APR 26, 89 0925
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton					
ARTHROPODA (ARTHROPODS)					
.CRUSTACEA					
..CALANOIDA					
...DIAPYLOMIDAE					
...DIAPYLOMUS	2 <1	1 <1	50 45	10 2	6 <1
..CLADOCERA					
...BOSMINIDAE					
...BOSMINA	8 <1	10 <1	--	8 2	--
...CHYDORIDAE	310 16	9 <1	--	--	--
..DAPHNIDAE					
...CERIODAPHNIA	11 <1	--	--	11 3	--
...DAPHNIA	16 <1	1 <1	3 3	--	--
..CYCLOPOIDA					
...CYCLOPIDAE					
...CYCLOPS	8 <1	--	--	--	--
...MESOCYCLOPS	3 <1	--	--	3 <1	--
...TROPYCYCLOPS	2 <1	--	--	2 <1	--
ROTIFERA (ROTIFERS)					
.MONOGONONTA					
..FLOSCULARIACEAE					
...TESTUDINELLIDAE					
...FILINIA	--	--	--	--	14 <1
..PLOIMA					
...ASPLANCHNIDAE					
...ASPLANCHNA	--	--	4 4	--	--
...BRACHIONIDAE					
...KELLICOTTIA	--	--	--	--	2 <1
...KERATELLA	--	20 1	2 3	4 <1	7 <1
...SYNCHAETIDAE					
...POLYARTERA	--	11 <1	--	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454517094573810 SAUK LAKE SITE 10 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1830	JUN 21, 89 1500	JUL 19, 89 1420	AUG 16, 89 1505
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton				
CHLOROPHYTA (GREEN ALGAE)				
.CHLOROPHYCEAE				
..CHLOROCOCCALES				
...OOCYSTACEAE				
....ANKISTRODESMUS	57 3	25 4	120 2	--
....OOCYSTIS	2 28 2	--	300 5	--
....QUADRIGULA	28 2	8 1	--	--
....SELENASTRUM	--	--	59 1	--
...SCENEDESMACEAE				
....SCENEDESMUS	--	25 4	--	--
..TETRASPORALES				
...PALMELLACEAE				
....SPHAEROCYSTIS	14 <1	8 1	--	--
..VOLVOCALES				
...CHLAMYDOMONADACEAE				
....CHLAMYDOMONAS	--	8 1	240 4	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)				
.BACILLARIOPHYCEAE				
..CENTRALES				
...COSCINODISCACEAE				
....CYCLOTELLA	14 <1	17 2	--	--
....MELOSIRA	42 2	50 7	1900 32	--
....STEPHANODISCUS	260 14	220 32	--	--
..PENNALES				
...ACHNANTHACEAE				
....ACHNANTHES	--	8 1	--	--
....COCCONEIS	--	8 1	--	--
...FRAGILARIACEAE				
....ASTERIONELLA	140 8	--	--	--
....FRAGILARIA	14 <1	110 16	--	--
....SYNEDRA	--	--	59 1	--
...GOMPHONEMATACEAE				
....GOMPHONEMA	14 <1	25 4	59 1	--
...NITZSCHIACEAE				
....NITZSCHIA	28 2	50 7	--	--
.CHRYSOPHYCEAE				
..CHROMULINALES				
...OCHROMONADACEAE				
....DINOBRION	280 16	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)				
.CYANOPHYCEAE				
..CHROCOCCALES				
...CHROCOCCACEAE	--	8 1	--	--
....ANACYSTIS	--	--	59 1	--
..OSCILLATORIALES				
...NOSTOCACEAE				
....ANABAENA	--	33 5	590 10	--
....APHANIZOMENON	14 <1	--	770 13	--
EUGLENOPHYTA (EUGLENOIDS)				
.CRYPTOPHYCEAE				
..CRYPTOMONIDALES				
...CRYPTOCHRYSIDACEAE				
....RHODOMONAS	340 19	25 4	770 13	--
...CRYPTOMONODACEAE				
....CRYPTOMONAS	200 11	8 1	890 15	--
PYRRHOPHYTA (FIRE ALGAE)				
.DINOPHYCEAE				
..PERIDINIALES				
...PERIDINIACEAE				
....PERIDINIUM	--	--	59 1	--
....KELLICOTTIA	8 <1	--	--	--
....KERATELLA	65 4	2 <1	9 <1	--
...SYNCHAETIDAE				
....POLYARTHRA	3 <1	--	--	--
....SYNCHAETA	--	2 <1	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454517094573810 SAUK LAKE SITE 10 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1830	JUN 21, 89 1500	JUL 19, 89 1420	AUG 16, 89 1505
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton				
ARTHROPODA (ARTHROPODS)				
. CRUSTACEA				
.. CALANOIDA				
... DIAPTOMIDAE				
... DIAPTOMUS	8 <1	--	5 <1	--
.. CLADOCERA				
... BOSMINIDAE				
... BOSMINA	160 9	--	--	--
... CHYDORIDAE	22 1	20 3	4 <1	--
... DAPHNIDAE				
... CERIODAPHNIA	3 <1	2 <1	--	--
... DAPHNIA	7 <1	1 <1	10 <1	--
.. CYCLOPOIDA				
... CYCLOPIDAE				
... CYCLOPS	26 1	7 1	--	--
... MESOCYCLOPS	--	--	2 <1	--
ROTIFERA (ROTIFERS)				
. MONOGONONTA				
.. FLOSCULARIACEAE				
... TESTUDINELLIDAE				
... FILINIA	--	--	2 <1	--
.. FLOITMA				
... ASPLANCHNIDAE				
... ASPLANCHNA	8 <1	13 2	--	--
... BRACHIONIDAE				
... KELLICOTTIA	8 <1	--	--	--
... KERATELLA	65 4	2 <1	9 <1	--
... SYNCHAETIDAE				
... POLYARTHRA	3 <1	--	--	--
... SYNCHAETA	--	2 <1	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454427094571811 SAUK LAKE SITE 11 AT SAUK CENTRE, MN

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	SAM- PLING DEPTH (FEET) (00003)	DEPTH AT SAMPLE LOC- ATION, TOTAL (FEET) (81903)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	TRANS- PAR- ENCY (SECCHI DISK) (M) (00078)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3 (00450)
SEP 1988										
27...	0915	1.0	--	371	8.8	15.0	--	--	8.2	--
27...	0917	5.0	--	370	8.8	15.0	--	--	8.1	--
27...	0930	--	6.2	370	8.8	15.0	0.49	720	8.2	173
NOV										
03...	1430	1.0	7.4	432	8.9	4.0	1.22	740	12.7	215
03...	1431	6.4	--	440	8.8	4.0	--	--	13.1	--
JAN 1989										
18...	1430	--	6.7	498	8.1	2.5	--	760	8.0	271
FEB										
15...	1600	3.0	7.5	532	8.0	1.5	--	782	7.0	283
15...	1630	6.5	--	635	7.8	3.0	--	782	2.2	291
APR										
26...	1025	--	8.8	451	8.8	13.0	0.98	770	15.4	185
26...	1030	3.0	--	447	8.9	13.5	--	--	17.4	--
26...	1035	7.8	--	455	8.7	12.5	--	--	13.4	--
MAY										
24...	1915	1.0	--	437	8.8	18.5	--	--	12.6	--
24...	1917	7.0	--	496	8.2	17.5	--	--	0.6	--
24...	1920	--	7.7	466	8.5	18.0	1.49	750	6.6	185
JUN										
21...	1530	1.0	--	437	8.8	23.5	--	--	10.3	--
21...	1532	4.0	--	473	8.3	20.0	--	--	9.9	--
21...	1534	6.5	--	493	7.8	18.5	--	--	1.2	--
21...	1545	--	7.5	468	8.3	20.5	1.62	770	7.1	224
JUL										
19...	1447	2.0	--	362	8.8	26.0	--	--	11.0	--
19...	1448	4.0	--	364	8.6	25.5	--	--	9.0	--
19...	1450	6.5	--	373	8.1	24.0	--	--	3.1	--
19...	1500	--	7.3	363	8.7	26.0	0.61	760	10.0	194
AUG										
16...	1533	2.0	7.7	325	9.0	24.5	0.73	770	11.3	152
16...	1535	4.0	--	330	8.9	23.0	--	--	7.3	--
16...	1538	6.5	--	335	8.6	23.0	--	--	3.7	--



## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454427094571811 SAUK LAKE SITE 11 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 27, 88 0930	NOV 03, 88 1430	JAN 18, 89 1430	FEB 15, 89 1600	APR 26, 89 1025
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton					
CHLOROPHYTA (GREEN ALGAE)					
.CHLOROPHYCEAE					
..CHLOROCOCCALES					
...CHLOROCOCCACEAE					
....TETRAEDRON	25 <1	--	--	--	--
...OOCYSTACEAE					
....ANKISTRODESMUS	250 9	380 7	8 3	--	230 <1
...OOCYSTIS	50 2	--	--	--	--
....SELENASTRUM	75 3	230 5	--	--	--
...SCENEDESMACEAE					
....SCENEDESMUS	150 5	47 <1	8 3	--	--
..TETRASPORALES					
...PALMELLACEAE					
....SPHAEROCYSTIS	25 <1	--	--	--	--
CHRYSOPHYTA (YELLOW-GREEN ALGAE)					
.BACILLARIOPHYCEAE					
..CENTRALES					
...COSCINODISCAEAE					
....CYCLOTELLA	200 7	280 5	8 3	--	--
....MELOSIRA	450 16	47 <1	12 4	--	--
....STEPHANODISCUS	650 23	2200 43	32 11	--	25000 89
..PENNALES					
...ACHNANTHACEAE					
....ACHNANTHES	--	--	4 2	3 4	230 <1
...COCCONEIS	50 2	--	31 11	--	--
...RHODOSPHENIA	--	--	4 2	--	--
...CYMBELLACEAE					
....CYMBELLA	--	--	8 3	--	--
....EPITHEMIA	--	--	4 2	--	--
...FRAGILARIACEAE					
....ASTERIONELLA	--	--	4 2	--	450 2
....FRAGILARIA	25 <1	--	8 3	--	680 2
....SYNEDRA	--	47 <1	8 3	--	--
...GOMPHONEMACEAE					
....GOMPHONEMA	--	--	12 4	--	230 <1
...NAVICULACEAE					
....NAVICULA	--	47 <1	--	--	230 <1
....PINNULARIA	--	--	4 2	--	--
...NITZSCHIACEAE					
....NITZSCHIA	--	--	8 3	--	680 2
...SURIRELLACEAE					
....SURIRELLA	--	--	--	--	230 <1
.CHRYSOPHYCEAE					
..CHROMULINALES					
...CHROMULINACEAE					
....CHRYSOCOCCLUS	--	47 <1	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)					
.CYANOPHYCEAE					
..OSCILLATORIALES					
...NOSTOCACEAE					
....ANABAENA	130 5	--	--	--	--
....APHANIZOMENON	130 5	47 <1	8 3	2 3	--
EUGLENOPHYTA (EUGLENOIDS)					
.CRYPTOPHYCEAE					
..CRYPTOMONIDALES					
...CRYPTOCHRYSIDACEAE					
....RHODOMONAS	25 <1	1500 29	82 28	55 55	230 <1
...CRYPTOMONODACEAE					
....CRYPTOMONAS	320 11	230 5	4 2	7 8	--
EUGLENOPHYCEAE					
..EUGLENALES					
...EUGLENACEAE					
....TRACHELOMONAS	--	--	--	1 2	--
PYRRHOPHYTA (FIRE ALGAE)					
.DINOPHYCEAE					
..DINOKONTAE					
...CERATIACEAE					
....CERATIUM	25 <1	--	--	--	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454427094571811 SAUK LAKE SITE 11 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	SEP 27, 88 0930	NOV 03, 88 1430	JAN 18, 89 1430	FEB 15, 89 1600	APR 26, 89 1025
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton					
ARTHROPODA (ARTHROPODS)					
. CRUSTACEA					
.. CALANOIDA					
... DIAPTOMIDAE					
... DIAPTOMUS	4 <1	4 <1	11 4	11 11	1 <1
.. CLADOCERA					
... BOSMINIDAE					
... BOSMINA	15 <1	2 <1	--	--	--
... CHYDORIDAE	190 7	3 <1	--	--	9 <1
... DAPHNIDAE					
... CERIODAPHNIA	13 <1	--	--	13 13	--
... DAPHNIA	9 <1	5 <1	3 1	--	--
.. CYCLOPOIDA					
... CYCLOPIDAE					
... CYCLOPS	2 <1	--	--	--	--
... MESOCYCLOPS	1 <1	--	--	1 2	--
... TROPOCYCLOPS	2 <1	--	--	2 3	--
ROTIFERA (ROTIFERS)					
. MONOGONONTA					
.. FLOSCULARIACEAE					
... TESTUDINELLIDAE					
... FILINIA	--	--	--	--	31 <1
.. FLOIMA					
... ASPLANCHNIDAE					
... ASPLANCHNA	--	--	1 <1	--	--
... BRACHIONIDAE					
... KERATELLA	--	1 <1	5 2	3 3	8 <1
... SYNCHAETIDAE					
... POLYARTHRA	3 <1	--	--	--	--
... SYNCHAETA	--	--	--	--	2 <1

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454427094571811 SAUK LAKE SITE 11 AT SAUK CENTRE, MN--Continued

## PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1920	JUN 21, 89 1545	JUL 19, 89 1500	AUG 16, 89 1533
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Phytoplankton				
CHLOROPHYTA (GREEN ALGAE)				
.CHLOROPHYCEAE				
..CHLOROCOCCALES				
...OOCYSTACEAE				
....ANKISTRODESMUS	450 8	--	400 6	--
....CLOSTERIOPSIS	--	--	--	42 <1
....OOCYSTIS	45 <1	--	660 10	290 5
....SELENASTRUM	180 3	--	130 2	84 2
..SCENEDESMACEAE				
....CRUCIGENIA	--	--	--	84 2
....SCENEDESMUS	--	--	270 4	210 4
.TETRASPORALES				
..PALMELLACEAE				
....SPHAEROCYSTIS	--	--	66 1	130 2
..VOLVOCALES				
..CHLAMYDOMONADACEAE				
....CHLAMYDOMONAS	--	34 4	930 15	42 <1
CHRYSOPHYTA (YELLOW-GREEN ALGAE)				
.BACILLARIOPHYCEAE				
..CENTRALES				
...COSCINODISCACEAE				
....CYCLOTELLA	90 2	--	--	--
....MELOSIRA	90 2	34 4	930 15	1500 28
....STEPHANODISCUS	1100 20	34 4	--	--
..PENNALES				
...ACHNANTHACEAE				
....COCCONEIS	--	34 4	--	42 <1
....RHOICOSPHENIA	--	34 4	--	--
..CYMBELLACEAE				
....CYMBELLA	--	34 4	--	--
...FRAGILARIACEAE				
....ASTERIONELLA	45 <1	--	--	--
....FRAGILARIA	--	34 4	--	--
....SYNEDRA	45 <1	--	--	--
..GOMPHONEMATACEAE				
....GOMPHONEMA	--	34 4	66 1	42 <1
CHRYSOPHYCEAE				
..CHROMULINALES				
...MALLONADACEAE				
....MALLOMONAS	90 2	--	--	--
...OCHROMONADACEAE				
....DINOBRYON	130 2	--	--	--
CYANOPHYTA (BLUE-GREEN ALGAE)				
.CYANOPHYCEAE				
..CHROOCOCCALES				
...CHROOCOCCACEAE				
....ANACYSTIS	--	--	--	330 6
..OSCILLATORIALES				
...NOSTOACEAE				
....ANABAENA	--	--	730 11	170 3
....APHANIZOMENON	--	--	460 7	1400 26
EUGLENOPHYTA (EUGLENOIDS)				
.CRYPTOPHYCEAE				
..CRYPTOMONIDALES				
...CRYPTOCHRYSIDACEAE				
....RHODOMONAS	2200 39	170 18	860 13	42 <1
...CRYPTOMONADACEAE				
....CRYPTOMONAS	860 15	400 42	270 4	590 11
.EUGLENOPHYCEAE				
..EUGLENALES				
...EUGLENACEAE				
....EUGLENA	--	--	--	42 <1
....TRACHELONAS	45 <1	34 4	--	--
PYRRHOPHYTA (FIRE ALGAE)				
.DINOPHYCEAE				
..DINOKONTAE				
...GYMNODINIACEAE				
....GYMNODINIUM	--	--	--	42 <1
..PERIDINIALES				
...CERATIACEAE				
....CERATIUM	--	--	66 1	42 <1
...PERIDINIACEAE				
....PERIDINIUM	--	--	130 2	--

## ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS

454427094571811 SAUK LAKE SITE 11 AT SAUK CENTRE, MN--Continued

PHYTOPLANKTON ANALYSES, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE TIME	MAY 24, 89 1920	JUN 21, 89 1545	JUL 19, 89 1500	AUG 16, 89 1533
	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT	CELLS PER- /ML CENT
Zooplankton				
ARTHROPODA (ARTHROPODS)				
.CRUSTACEA				
..CALANOIDA				
...DIAPTOMIDAE				
...DIAPTOMUS	5 <1	--	12 <1	5 <1
..CLADOCERA				
...BOSMINIDAE				
...BOSMINA	44 <1	--	--	--
...CHYDORIDAE	10 <1	7 <1	12 <1	76 1
...DAPHNIDAE				
...CERIODAPHNIA	3 <1	78 8	--	6 <1
...DAPHNIA	2 <1	--	43 <1	29 <1
...SIDIDAE				
...DIAPHANOSOMA	--	--	--	6 <1
..CYCLOPOIDA				
...CYCLOPIDAE				
...CYCLOPS	27 <1	2 <1	2 <1	--
...MESOCYCLOPS	--	--	4 <1	5 <1
...TROPYCYCLOPS	--	--	1 <1	3 <1
ROTIFERA (ROTIFERS)				
.MONOGONONTA				
..FLOSCULARIACEAE				
...TESTUDINELLIDAE				
...FILINIA	2 <1	--	380 6	12 <1
..PLOIMA				
...ASPLANCHNIDAE				
...ASPLANCHNA	10 <1	--	2 <1	3 <1
...BRACHIONIDAE				
...KELLICOTTIA	7 <1	--	--	1 <1
...KERATELLA	110 2	--	4 <1	10 <1
...SYNCHAETIDAE				
...POLYARTHRA	14 <1	--	--	5 <1

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

Samples are collected at sites other than gaging stations and partial-record stations to give better areal coverage in a river basin. Such sites are referred to as miscellaneous sites. Letter E indicates estimated value. Letter K indicates non-ideal colony count.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM- ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO- CHEM- ICAL, 5 DAY (MG/L) (00310)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
		05270500 SAUK RIVER NEAR ST. CLOUD, MN (LAT 45 33 35N LONG 094 14 00W)									
MAR 1989 23...	1000	E300	720	7.9	0.5	780	10.3	--	--	--	--
MAY 25...	1115	E700	581	8.2	17.5	--	--	--	--	--	--
		05305400 CHIPPEWA RIVER AT MONTEVIDEO (LAT 44 56 53N LONG 095 43 50W)									
AUG 1989 15...	1430	7.6	1300	8.4	27.0	771	11.7	43	6.7	K65000	K5100
		05311000 MINNESOTA RIVER AT MONTEVIDEO, MINN (LAT 44 56 00N LONG 095 44 00W)									
AUG 1989 15...	1000	47	850	8.4	22.5	771	6.2	43	5.5	K1500	280
SEP 14...	1345	22	935	8.3	15.5	755	9.9	24	4.5	540	75
		05313510 YELLOW MEDICINE RIVER ON HWY 67 NEAR GRANITE FALL (LAT 44 43 44N LONG 095 26 37W)									
AUG 1989 17...	1045	0.79	986	8.1	25.0	776	7.7	30	4.6	K18	770
		05314550 HAWK CREEK AT MOUTH NEAR SACRED HEART (LAT 44 44 11N LONG 095 25 21W)									
AUG 1989 16...	1230	5.5	1440	8.4	23.0	774	9.5	36	4.9	62	350
		05314560 MINNESOTA RIVER NEAR SACRED HEART (LAT 44 43 54N LONG 095 25 14W)									
AUG 1989 16...	1630	59	800	8.8	29.5	773	11.6	50	6.6	K13	740
		05314740 MINNESOTA RIVER NEAR DELHI (LAT 44 37 11N LONG 095 10 39W)									
AUG 1989 17...	1445	57	846	8.6	25.0	776	9.3	50	7.1	K4	K200

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDEDED (MG/L) (00530)	RESIDUE VOLA- TILE, SUS- PENDEDED (MG/L) (00535)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO- GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
	05270500		SAUK RIVER NEAR ST. CLOUD, MN (LAT 45 33 35N LONG 094 14 00W)								
MAR 1989 23...	--	--	--	2.0	--	--	--	--	--	--	--
MAY 25...	--	--	--	0.51	--	--	--	--	--	--	--
	05305400		CHIPPEWA RIVER AT MONTEVIDEO (LAT 44 56 53N LONG 095 43 50W)								
AUG 1989 15...	13	<1	1.9	1.6	<10	2.1	2.0	160	3.2	3.2	500
	05311000		MINNESOTA RIVER AT MONTEVIDEO, MINN (LAT 44 56 00N LONG 095 44 00W)								
AUG 1989 15...	31	2	0.20	0.15	10	0.24	0.04	53	1.6	0.90	1100
SEP 14...	12	<1	0.50	0.49	--	0.22	0.22	--	1.5	1.1	--
	05313510		YELLOW MEDICINE RIVER ON HWY 67 NEAR GRANITE FALL (LAT 44 43 44N LONG 095 26 37W)								
AUG 1989 17...	27	12	<0.10	<0.10	<10	0.02	0.01	37	0.70	0.40	1600
	05314550		HAWK CREEK AT MOUTH NEAR SACRED HEART (LAT 44 44 11N LONG 095 25 21W)								
AUG 1989 16...	22	12	<0.10	<0.10	<10	0.03	0.01	30	1.1	0.50	730
	05314560		MINNESOTA RIVER NEAR SACRED HEART (LAT 44 43 54N LONG 095 25 14W)								
AUG 1989 16...	37	33	<0.10	<0.10	<10	0.02	0.02	63	1.0	1.0	960
	05314740		MINNESOTA RIVER NEAR DELHI (LAT 44 37 11N LONG 095 10 39W)								
AUG 1989 17...	35	15	<0.10	<0.10	<10	0.02	0.02	21	1.6	0.80	730

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC, DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INORGANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANKTON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANKTON CHROMO FLUOROM (UG/L) (70954)
	05270500 SAUK RIVER NEAR ST. CLOUD, MN (LAT 45 33 35N LONG 094 14 00W)										
MAR 1989 23...	--	--	--	--	--	--	--	--	--	--	--
MAY 1989 25...	--	--	--	--	--	--	--	--	--	--	--
	05305400 CHIPPEWA RIVER AT MONTEVIDEO (LAT 44 56 53N LONG 095 43 50W)										
AUG 1989 15...	0.74	0.63	330	0.62	0.55	8.7	1.6	15	9.0	15.0	1.2
	05311000 MINNESOTA RIVER AT MONTEVIDEO, MINN (LAT 44 56 00N LONG 095 44 00W)										
AUG 1989 15...	0.24	0.14	470	0.14	0.10	9.2	2.1	28	19	48.0	3.9
SEP 1989 14...	0.28	0.17	--	0.16	0.14	7.2	1.3	--	--	15.0	1.4
	05313510 YELLOW MEDICINE RIVER ON HWY 67 NEAR GRANITE FALL (LAT 44 43 44N LONG 095 26 37W)										
AUG 1989 17...	0.07	0.01	410	0.02	<0.01	4.9	0.8	44	25	8.70	0.60
	05314550 HAWK CREEK AT MOUTH NEAR SACRED HEART (LAT 44 44 11N LONG 095 25 21W)										
AUG 1989 16...	0.54	0.38	420	0.37	0.34	7.9	1.0	34	17	27.0	2.4
	05314560 MINNESOTA RIVER NEAR SACRED HEART (LAT 44 43 54N LONG 095 25 14W)										
AUG 1989 16...	0.21	0.06	520	0.06	0.05	8.2	1.5	34	24	44.0	4.3
	05314740 MINNESOTA RIVER NEAR DELHI (LAT 44 37 11N LONG 095 10 39W)										
AUG 1989 17...	0.24	0.05	290	0.06	0.04	8.0	3.1	24	13	22.0	2.2

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM- ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO- CHEM- ICAL, 5 DAY (MG/L) (00310)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)
05316541		REDWOOD RIVER BELOW RAMSEY CREEK AT REDWOOD FALL (LAT 44 33 03N LONG 095 07 28W)									
AUG 1989 22...	0945	1.9	1330	8.6	22.5	764	6.0	44	6.4	180	200
05316580		MINNESOTA RIVER AT MORTON (LAT 44 32 46N LONG 094 59 45W)									
AUG 1989 22...	1300	67	908	8.4	26.0	771	9.1	36	6.4	71	300
05316685		MINNESOTA RIVER NEAR FAIRFAX (LAT 44 26 01N LONG 094 43 01W)									
AUG 1989 23...	1045	74	958	8.2	25.5	776	7.3	41	3.6	K70	74
05316760		MINNESOTA RIVER NEAR NEW ULM (LAT 44 21 43N LONG 094 29 50W)									
AUG 1989 24...	1030	82	1000	8.1	25.0	779	6.0	38	5.4	K42	K46
05317250		MINNESOTA RIVER AT COURTLAND (LAT 44 15 28N LONG 094 20 29W)									
AUG 1989 24...	1430	103	984	8.2	25.5	778	8.8	39	4.6	K23	210
05317500		MINNESOTA RIVER AT JUDSON, MN (LAT 44 12 00N LONG 094 11 36W)									
AUG 1989 29...	0930	156	992	8.3	23.0	778	6.9	26	4.6	110	46
05322000		BLUE EARTH RIVER AT MOUTH AT MANKATO (LAT 44 09 48N LONG 094 02 12W)									
AUG 1989 29...	1700	79	720	8.6	26.5	777	12.3	26	8.2	90	89
SEP 13...	1445	78	764	8.2	19.0	782	11.6	25	13	500	44
05325050		MINNESOTA RIVER AT US HWY 14 BRIDGE AT MANKATO (LAT 44 11 29N LONG 094 00 34W)									
AUG 1989 29...	1430	252	929	8.4	25.0	778	10.3	28	8.0	86	120

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	RESIDUE TOTAL AT 105 DEG. C, SUS- PENDE (MG/L) (00530)	RESIDUE VOLA- TILE, SUS- PENDE (MG/L) (00535)	NITRO- GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	NITRO- GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	NITRO- GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO- GEN, AM- MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO- GEN, AM- MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO- GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
05316541 REDWOOD RIVER BELOW RAMSEY CREEK AT REDWOOD FALL(LAT 44 33 03N LONG 095 07 28W)											
AUG 1989 22...	8	8	<0.10	<0.10	21	0.15	0.07	130	1.1	0.80	4000
05316580 MINNESOTA RIVER AT MORTON (LAT 44 32 46N LONG 094 59 45W)											
AUG 1989 22...	38	17	<0.10	<0.10	55	0.02	0.02	12	1.7	0.70	1400
05316685 MINNESOTA RIVER NEAR FAIRFAX (LAT 44 26 01N LONG 094 43 01W)											
AUG 1989 23...	30	16	<0.10	<0.10	--	0.02	0.02	--	1.5	1.5	1900
05316760 MINNESOTA RIVER NEAR NEW ULM (LAT 44 21 43N LONG 094 29 50W)											
AUG 1989 24...	22	6	0.42	0.42	<10	0.07	0.07	53	0.80	0.80	1400
05317250 MINNESOTA RIVER AT COURTLAND (LAT 44 15 28N LONG 094 20 29W)											
AUG 1989 24...	48	3	0.30	0.30	<10	0.04	0.04	150	0.70	0.70	1800
05317500 MINNESOTA RIVER AT JUDSON, MN (LAT 44 12 00N LONG 094 11 36W)											
AUG 1989 29...	24	8	0.40	0.36	<10	0.05	0.04	47	1.3	0.70	1300
05322000 BLUE EARTH RIVER AT MOUTH AT MANKATO (LAT 44 09 48N LONG 094 02 12W)											
AUG 1989 29...	41	14	<0.10	<0.10	<10	0.02	0.02	12	1.5	0.70	1200
SEP 13...	30	<1	0.12	0.12	--	0.03	0.03	--	1.4	0.80	--
05325050 MINNESOTA RIVER AT US HWY 14 BRIDGE AT MANKATO (LAT 44 11 29N LONG 094 00 34W)											
AUG 1989 29...	53	18	0.40	0.33	<10	0.12	0.12	49	2.1	1.2	1100

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INORGANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
05316541	REDWOOD RIVER BELOW RAMSEY CREEK AT REDWOOD FALL (LAT 44 33 03N LONG 095 07 28W)										
AUG 1989 22...	0.21	0.13	930	0.11	0.12	7.5	1.1	61	21	4.60	0.90
05316580	MINNESOTA RIVER AT MORTON (LAT 44 32 46N LONG 094 59 45W)										
AUG 1989 22...	0.20	0.05	460	0.03	0.04	7.3	4.3	30	24	8.80	1.5
05316685	MINNESOTA RIVER NEAR FAIRFAX (LAT 44 26 01N LONG 094 43 01W)										
AUG 1989 23...	0.21	0.08	--	0.08	0.02	7.1	3.1	36	18	7.90	1.2
05316760	MINNESOTA RIVER NEAR NEW ULM (LAT 44 21 43N LONG 094 29 50W)										
AUG 1989 24...	0.38	0.28	--	0.27	0.24	6.6	2.0	25	4.7	7.10	1.3
05317250	MINNESOTA RIVER AT COURTLAND (LAT 44 15 28N LONG 094 20 29W)										
AUG 1989 24...	0.25	0.20	--	0.21	0.17	6.4	2.9	31	14	12.0	2.4
05317500	MINNESOTA RIVER AT JUDSON, MN (LAT 44 12 00N LONG 094 11 36W)										
AUG 1989 29...	0.38	0.17	400	0.16	0.13	5.4	2.3	21	12	30.0	3.3
05322000	BLUE EARTH RIVER AT MOUTH AT MANKATO (LAT 44 09 48N LONG 094 02 12W)										
AUG 1989 29...	0.16	0.02	280	0.02	0.01	4.6	>5.0	24	13	30.0	3.5
SEP 13...	0.16	0.04	--	0.04	<0.01	4.2	2.3	--	--	28.0	1.6
05325050	MINNESOTA RIVER AT US HWY 14 BRIDGE AT MANKATO (LAT 44 11 29N LONG 094 00 34W)										
AUG 1989 29...	0.35	0.16	290	0.16	0.14	5.2	3.9	23	10	--	--

## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) (00310)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI KF AGAR PER 100 ML) (31673)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (MG/L) (00530)	
		05325200	MINNESOTA RIVER AT ST. PETER (LAT 44 18 26N LONG 093 57 35W)										
AUG 1989	30...	1115	252	85	8.3	21.5	778	8.0	34	6.4	320	K220	10
		05326400	RUSH RIVER NEAR HENDERSON, MN (LAT 44 29 57N LONG 093 54 18W)										
AUG 1989	30...	1445	2.2	72	8.1	19.5	774	8.1	20	1.3	K710	1500	32
		05326450	MINNESOTA RIVER AT HENDERSON (LAT 44 31 46N LONG 093 54 02W)										
AUG 1989	31...	1100	286	85	8.2	21.5	770	7.7	28	6.9	K1400	K380	27
		05376100	MIDDLE FORK WHITEWATER RIVER NR ST. CHARLES, MN (LAT 44 02 20N LONG 092 07 00W)										
MAR 1989	11...	1345	--	30	--	--	--	--	--	--	--	--	--
	11...	1352	--	29	--	--	--	--	--	--	--	--	--
	11...	1356	--	30	--	--	--	--	--	--	--	--	--
	11...	1400	--	31	--	--	--	--	--	--	--	--	--
	11...	1600	--	33	--	--	--	--	--	--	--	--	--
	11...	1605	--	30	--	--	--	--	--	--	--	--	--
	11...	1610	--	32	--	--	--	--	--	--	--	--	--
	11...	1822	--	25	--	--	--	--	--	--	--	--	--
	11...	1825	--	23	--	--	--	--	--	--	--	--	--
	11...	1830	--	23	--	--	--	--	--	--	--	--	--
	11...	1835	--	23	--	--	--	--	--	--	--	--	--
	24...	1150	--	22	--	--	--	--	--	--	--	--	--
	24...	1155	--	22	--	--	--	--	--	--	--	--	--
	24...	1157	--	21	--	--	--	--	--	--	--	--	--
	24...	1200	--	23	--	--	--	--	--	--	--	--	--
	24...	1204	--	27	--	--	--	--	--	--	--	--	--
	24...	1240	--	21	--	--	--	--	--	--	--	--	--
	24...	1243	--	21	--	--	--	--	--	--	--	--	--
	24...	1246	--	66	--	--	--	--	--	--	--	--	--
	24...	1250	--	23	--	--	--	--	--	--	--	--	--
	24...	1610	--	--	--	--	--	--	--	--	--	--	--
	24...	1630	--	21	--	--	--	--	--	--	--	--	--
	24...	1635	--	20	--	--	--	--	--	--	--	--	--
	24...	1640	--	21	--	--	--	--	--	--	--	--	--
	24...	1642	--	20	--	--	--	--	--	--	--	--	--
	24...	1646	--	21	--	--	--	--	--	--	--	--	--
	24...	1650	--	22	--	--	--	--	--	--	--	--	--
APR	05...	1245	--	--	--	9.0	--	--	--	--	--	--	--
	29...	1115	--	61	--	9.5	--	--	--	--	--	--	--
	29...	1120	--	53	--	9.5	--	--	--	--	--	--	--





## ANALYSIS OF SAMPLES COLLECTED AT MISCELLANEOUS SITES

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
05384500		RUSH CREEK NEAR RUSHFORD, MN (LAT 43 50 00N LONG 091 46 40W)						
APR 1989								
05...	1200	E54	490	8.2	8.5	781	11.2	2.10
MAY								
25...	1130	E55	445	7.9	16.0	770	8.0	1.80
06483000		ROCK RIVER AT LUVERNE, MN (LAT 43 39 15N LONG 096 12 03W)						
MAY 1989								
03...	1145	87	790	8.1	11.5	--	--	1.80
JUN								
27...	1700	200	510	7.5	24.5	--	--	4.00

## MISCELLANEOUS WATER QUALITY DATA COLLECTED AT CONTINUOUS-RECORD STATIONS

## WATER QUALITY DATA AT STREAMFLOW STATIONS

Field and laboratory determinations of miscellaneous water-quality parameters 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.

## QUALITY DATA AT STREAMFLOW STATIONS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## 05280000 CROW RIVER AT ROCKFORD, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	BAROMETRIC PRESURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
APR 19...	1015	465	544	9.4	9.5	777	16.3	<0.10
MAY 25...	1245	390	672	8.3	20.5	--	--	0.74

## 05286000 RUM RIVER NEAR ST. FRANCIS, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	BAROMETRIC PRESURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
APR 19...	1300	790	221	8.6	10.0	775	11.7	0.34
JUL 19...	1400	165	357	8.4	23.0	--	--	<0.10

## 05294000 POMME DE TERRE RIVER AT APPLETON, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
MAY 04...	1345	197	950	8.3	13.0	<0.10
JUL 18...	1045	66	925	8.4	20.0	0.21

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

05301000 MINNESOTA RIVER NEAR LAC QUI PARLE, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) (00310)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
AUG 14...	1600	40	777	8.5	25.0	770	7.8	62	6.9	K24	43

DATE	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (MG/L) (00530)	RESIDUE VOLA-TILE, SUS-PENDED (MG/L) (00535)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
AUG 14...	22	<1	<0.10	<0.10	<10	0.26	0.11	320	2.0	1.0	3500

DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INOR-GANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
AUG 14...	0.26	0.12	860	0.14	0.11	10	2.4	47	20	82.0	5.80

05316500 REDWOOD RIVER NEAR REDWOOD FALLS, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
MAY 04...	0950	62	1670	8.3	13.0	<0.10
JUN 27...	1045	93	1200	8.1	23.0	3.70

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

05317000 COTTONWOOD RIVER NEAR NEW ULM, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) (00310)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)
MAR 21...	1230	126	450	7.9	1.0	--	--	--	--	--
JUL 18...	1625	58	642	8.4	20.5	--	--	--	--	--
AUG 23...	1615	11	866	8.2	28.0	775	9.2	55	4.4	K580

DATE	STREP-TOCOCCHI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDEDED (MG/L) (00530)	RESIDUE VOLA-TILE, SUS-PENDEDED (MG/L) (00535)	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, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
MAR 21...	--	--	--	--	3.70	--	--	--	--	--
JUL 18...	--	--	--	--	<0.10	--	--	--	--	--
AUG 23...	K140	47	16	0.120	0.12	0.03	0.03	1.4	0.90	2300

DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDEDED TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INOR-GANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
MAR 21...	--	--	--	--	--	--	--	--	--	--
JUL 18...	--	--	--	--	--	--	--	--	--	--
AUG 23...	0.10	0.01	0.01	<0.01	5.1	2.6	46	10	3.30	0.70

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

05319500 WATONWAN RIVER NEAR GARDEN CITY, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) (00310)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS./100 ML) (31673)
AUG 25...	1045	5.5	859	8.2	21.5	774	6.7	28	5.2	320	680

DATE	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDE (MG/L) (00530)	RESIDUE VOLA-TILE, SUS-PENDE (MG/L) (00535)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
AUG 25...	17	7	<0.10	<0.10	<10	0.01	0.01	280	0.50	0.40	2200

DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDE TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INOR-GANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
AUG 25...	0.23	0.15	0.17	0.12	5.1	2.2	43	24	9.10	2.70

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

05320500 LE SUEUR RIVER NEAR RAPIDAN, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) (00310)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR PER (COLS./100 ML) (31673)
APR 20...	0950	101	657	8.7	10.5	--	11.9	--	--	--	--
JUL 18...	1430	36	631	8.4	22.0	--	--	--	--	--	--
AUG 28...	1600	8.4	684	8.3	27.0	773	11.7	24	3.5	430	630

DATE	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDE (MG/L) (00530)	RESIDUE VOLA-TILE, SUS-PENDE (MG/L) (00535)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
APR 20...	--	--	--	2.60	--	--	--	--	--	--	--
JUL 18...	--	--	--	<0.10	--	--	--	--	--	--	--
AUG 28...	9	3	<0.10	<0.10	<10	0.02	0.02	86	0.50	0.50	2500

DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	PHOS-PHORUS ORTHO, TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDE TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INOR-GANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
APR 20...	--	--	--	--	--	--	--	--	--	--	--
JUL 18...	--	--	--	--	--	--	--	--	--	--	--
AUG 28...	0.05	0.01	430	0.01	<0.01	3.7	1.1	61	43	12.0	1.10

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## 05327000 HIGH ISLAND CREEK NEAR HENDERSON, MN

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) (00340)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) (00310)	COLI-FORM, FECAL, UM-MF (COLS./100 ML) (31625)	STREP-TOCOCCI, FECAL, KF AGAR (COLS. PER 100 ML) (31673)
AUG 31...	1400	2.9	850	7.7	18.0	769	5.9	24	1.8	1500	1700
DATE	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (MG/L) (00530)	RESIDUE VOLA-TILE, SUS-PENDED (MG/L) (00535)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)
AUG 31...	29	1	0.10	0.10	<10	0.18	0.18	38	0.80	0.80	390
DATE	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (GM/KG AS C) (00693)	CARBON, INOR-GANIC, TOT IN BOT MAT (G/KG AS C) (00686)	CHLOR-A PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70953)	CHLOR-B PHYTO-PLANK-TON CHROMO FLUOROM (UG/L) (70954)
AUG 31...	0.15	0.06	390	0.07	0.05	6.0	0.9	30	27	5.80	0.80

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## 05337400 KNIFE RIVER NEAR MORA, MN

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	OXYGEN, DIS- SOLVED (MG/L) (00300)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
APR 21...	1000	114	116	8.1	7.5	12.1	0.17
JUL 19...	1100	9.2	242	7.8	20.5	--	0.17

## 05353800 STRAIGHT RIVER NEAR FARIBAULT, MN

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
APR 05...	0920	E204	660	8.4	5.0	773	11.1	6.00
JUL 19...	1030	30	678	8.8	20.5	771	18.0	<0.10

## 05476000 DES MOINES RIVER AT JACKSON, MN

DATE	TIME	DIS- CHARGE, INST. CUBIC FEET PER SECOND (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)
MAY 03...	1355	134	1010	8.8	14.0	<0.10
JUN 27...	1300	40	1110	8.7	25.0	<0.10

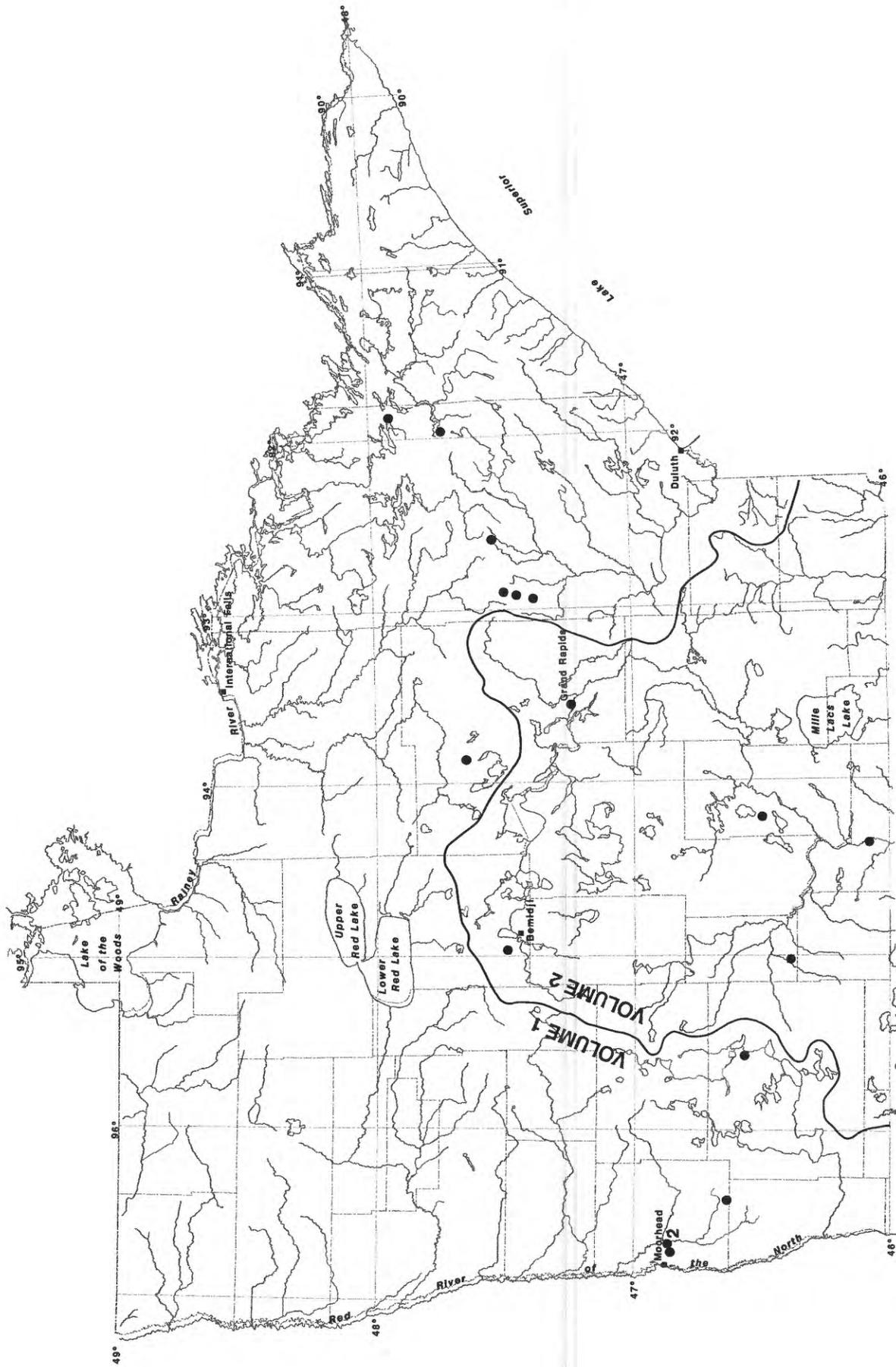


Sediment coring, Goose Lake

GROUND-WATER LEVELS

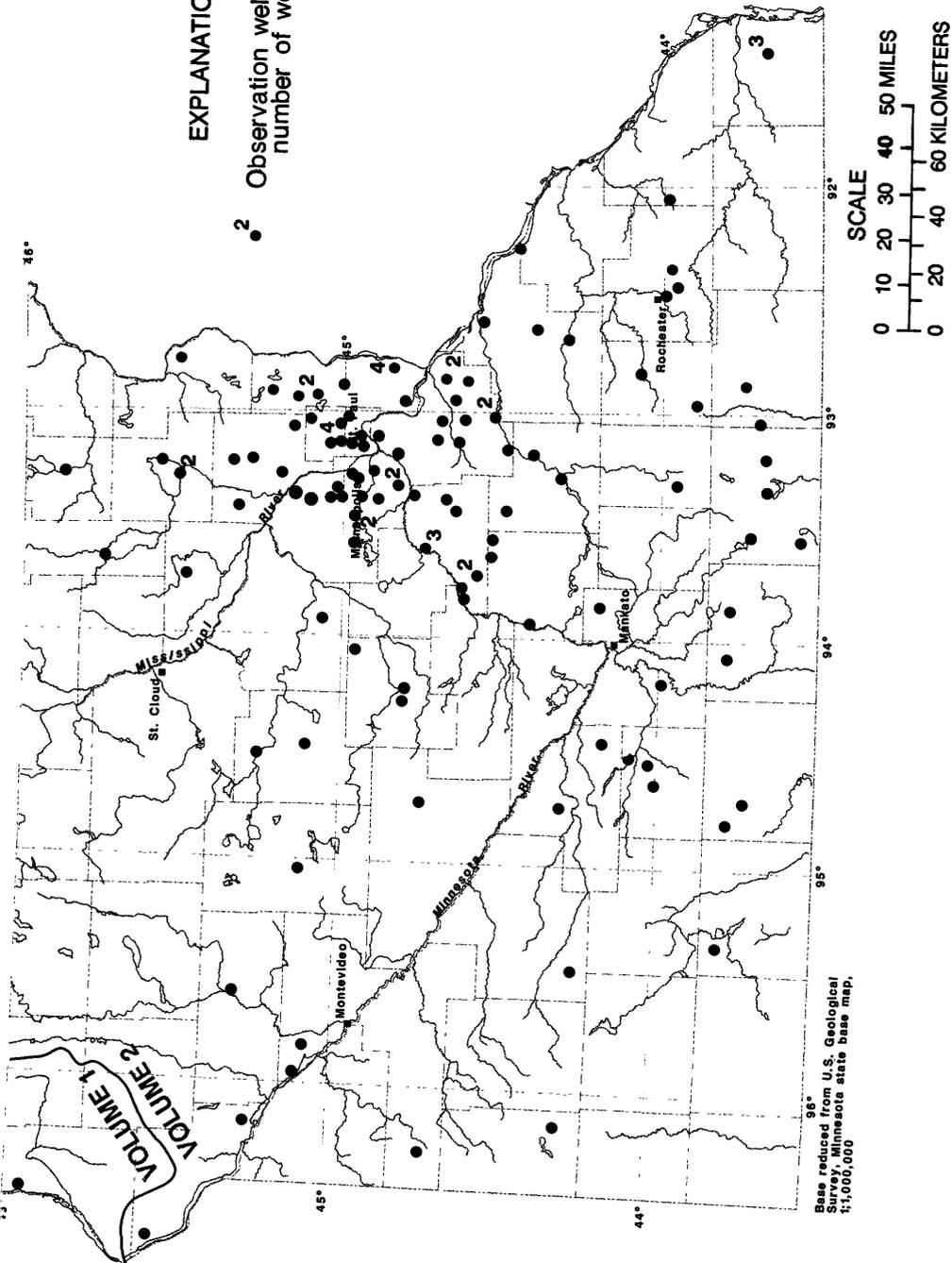


Installing a well, Leech Lake Indian Reservation, 1988



**EXPLANATION**

● Observation well, figure denotes number of wells in cluster



**Figure 10.—Location of ground-water wells**

GROUND-WATER LEVELS

ANOKA COUNTY

450927093033802. Local number, 031N22W23CBC02.

LOCATION.--Lat 45°09'27", long 93°03'38", in SW¼NW¼SW¼ sec.23, T.31 N., R.22 W., Hydrologic Unit 07010206, at city of Centerville.

Owner: U.S. Geological Survey.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 277 ft (84.4 m), screened 272 to 277 ft (82.9 to 84.4 m).

DATUM.--Land-surface datum is 901.6 ft (274.8 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder platform, 2.20 ft (0.67 m) above land-surface datum.

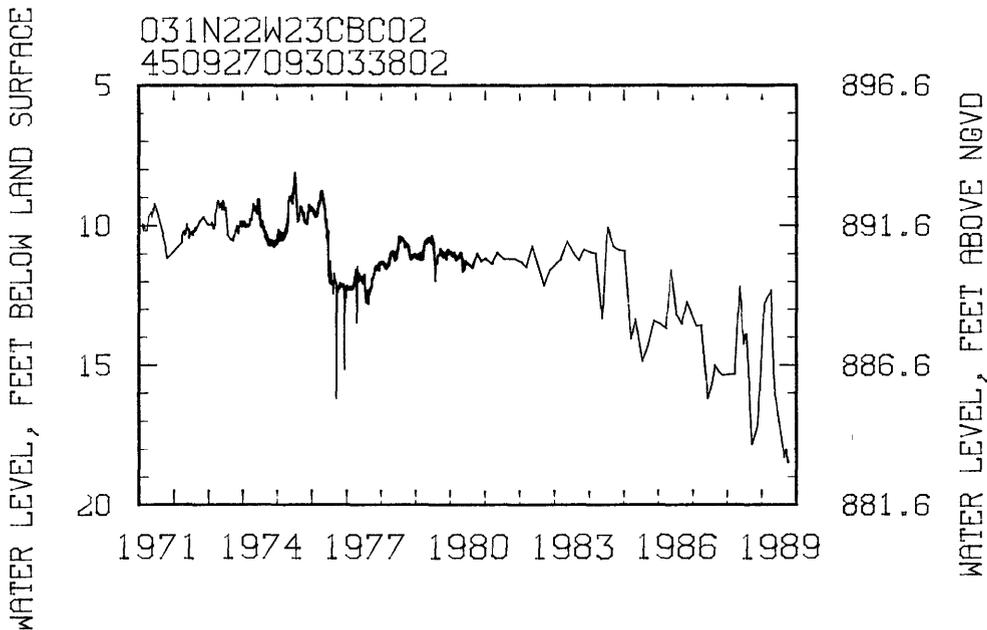
REMARKS.--Water level affected by nearby flowing wells.

PERIOD OF RECORD.--February 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 8.10 ft (2.47 m) below land-surface datum, July 5, 1975; lowest, 18.48 ft (5.63 m) below land-surface datum, Sept. 29, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 15	17.09	Aug. 20	18.29	Sep. 05	18.00
Jan. 26	12.72	25	18.08	10	18.00
Apr. 04	12.27	31	18.14	15	18.01
May 10	15.83			20	18.28
				25	18.38
				29	18.48
				30	18.43



451210093170201. Local number, 031N24W01CBB01.

LOCATION.--Lat 45°12'10", long 93°17'02", in NW¼NW¼SW¼ sec.1, T.31 N., R.24 W., Hydrologic Unit 07010206, at Golf Course.

Owner: City of Coon Rapids.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 193 ft (58.8 m), screened 163 to 193 ft (49.7 to 58.8 m).

DATUM.--Altitude of land-surface datum is 897 ft (273 m). Measuring point: Top of breather pipe, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--December 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.43 ft (5.61 m) below land-surface datum, May 13, 1986; lowest, 41.10 ft (12.53 m) below land-surface datum, Sept. 21, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 29	24.73	Apr. 04	24.56	May 22	32.44	Aug. 16	37.00	Sep. 21	41.10

## GROUND-WATER LEVELS

## ANOKA COUNTY--Continued

451742093122102. Local number, 032N23W04AAD02.

LOCATION.--Lat 45°17'42", long 93°12'21", in SE¼NE¼NE¼ sec.4, T.32 N., R.23 W., Hydrologic Unit 07030005, 1.5 mi (2.4 km) east of Soderville.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in. (0.05 m), depth 21 ft (6.4 m), screened 19 to 21 ft (5.8 to 6.4 m).

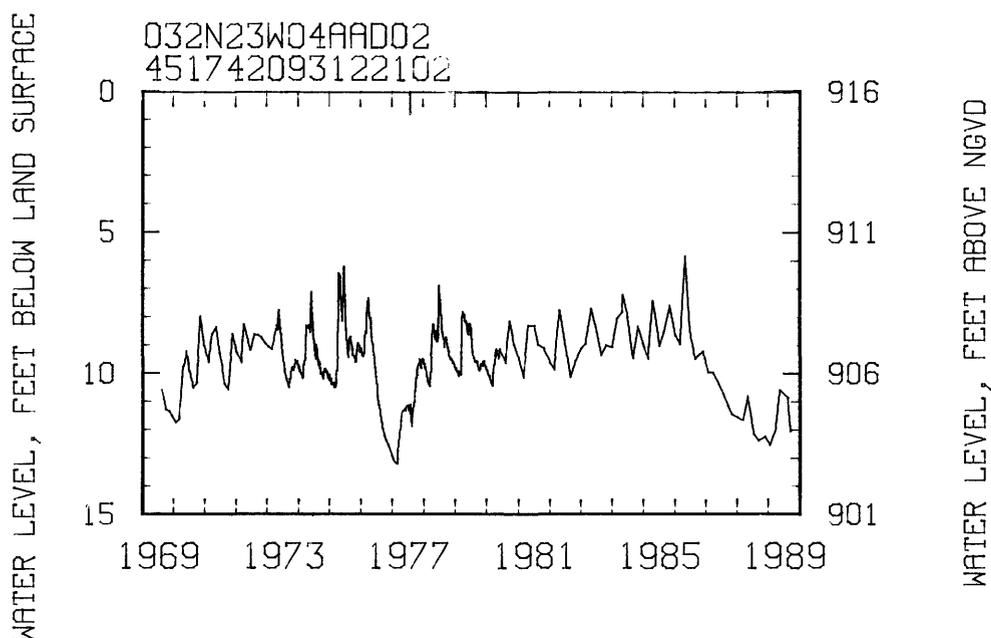
DATUM.--Altitude of land-surface datum is 916 ft (279 m). Measuring point: Top of casing, 3.50 ft (1.07 m) above land-surface datum.

PERIOD OF RECORD.--August 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.82 ft (1.77 m) below land-surface datum, May 13, 1986; lowest, 13.22 ft (4.03 m) below land-surface datum, Mar. 5-9, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 29	12.24	Jan. 26	12.57	Apr. 04	11.95	May 22	10.58	Aug. 16	10.87	Sep. 21	12.06



452305093141501. Local number, 033N23W05BAB01.

LOCATION.--Lat 45°23'05", long 93°14'15", in NW¼NE¼NW¼ sec.5, T.33 N., R.23 W., Hydrologic Unit 07010207, at 1300 229th Ave. NE, Bethel.

Owner: Friendship Baptist Church.

AQUIFER.--Franconian Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 141 ft (43.0 m), cased to 126 ft (38.4 m).

DATUM.--Altitude of land-surface datum is 923 ft (281 m). Measuring point: Top of well cap, 0.80 ft (0.24 m) above land-surface datum.

PERIOD OF RECORD.--April 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 19.45 ft (5.93 m) below land-surface datum, July 10, 1986; lowest, 23.64 ft (7.21 m) below land-surface datum, Jan. 26, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 29	23.47	Jan. 26	23.64	Apr. 04	23.41	May 22	23.27	Aug. 16	23.56	Sep. 21	23.39

GROUND-WATER LEVELS

ANOKA COUNTY--Continued

451938093223101. Local number, 033N24W30ABB01.

LOCATION.--Lat 45°19'38", long 93°22'31", in NW¼NW¼NE¼ sec.30, T.33 N., R.24 W., Hydrologic Unit 07010207, at 4324 Viking Blvd.

Owner: Northwestern Bell Telephone Co.

AQUIFER.--Ironton-Galesville Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 280 ft (85.3 m), cased to 223 ft (68.0 m).

DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Top of casing, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 26.64 ft (8.11 m) below land-surface datum, May 13, 1986; lowest, 32.89 ft (10.02 m) below land-surface datum, Sept. 15, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 29	32.83	Jan. 26	32.82	Apr. 04	31.96	May 22	31.96	Aug. 16	32.88	Sep. 21	32.77

BELTRAMI COUNTY

473023094570901. Local number, 147N34W35ADC01.

LOCATION.--Lat 47°30'23", long 94°57'09", in SW¼SE¼NE¼ sec.35, T.147 N., R.34 W., Hydrologic Unit 07010101, on Clarence Hart farm.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in. (0.03 m), depth 20 ft (6.1 m), screened 18 to 20 ft (5.5 to 6.1 m).

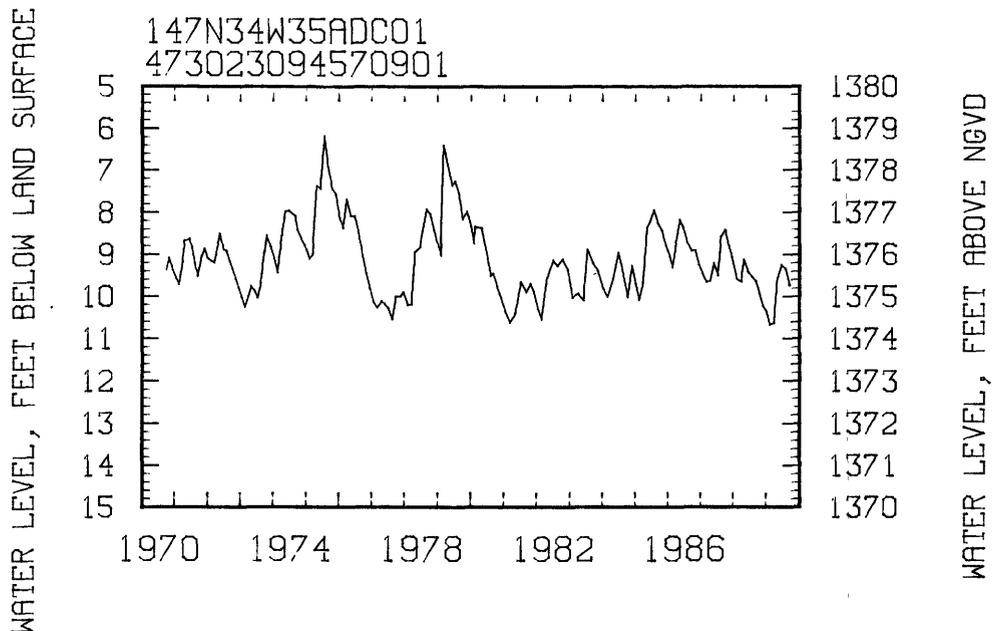
DATUM.--Altitude of land-surface datum is 1,383 ft (421 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--October 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 6.17 ft (1.88 m) below land-surface datum, Aug. 1, 1975; lowest, 10.69 ft (3.26 m) below land-surface datum, Feb. 13, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Oct. 17	9.92	Jan. 06	10.37	Mar. 31	10.63	Jun. 19	9.26	Sep. 14	9.74
Nov. 28	10.23	Feb. 13	10.69	May 08	9.58	Jul. 31	9.35		



## GROUND-WATER LEVELS

## BIG STONE COUNTY

451517096104501. Local number, 121N44W27CCC01.

LOCATION.--Lat 45°15'17", long 96°10'45", in SW¼SW¼SW¼ sec.27, T.121 N., R.44 W., Hydrologic Unit 07010001, north of Correll.

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 16 ft (4.9 m), screened 14 to 16 ft (4.3 to 4.9 m).

DATUM.--Altitude of land-surface datum is 1,018 ft (310 m). Measuring point: Top of casing, 3.10 ft (0.94 m) above land-surface datum.

PERIOD OF RECORD.--September 1972 to February 1974, August 1976 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.16 ft (0.65m) below land-surface datum, June 12, 1986; lowest, 8.99 ft (2.74 m) below land-surface datum, Feb. 8, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Oct. 12	7.92	Jan. 05	8.18	Apr. 28	7.43	Aug. 16	7.62

453330096420201. Local number, 124N48W17AAA01.

LOCATION.--Lat 45°33'30", long 96°42'02", in NE¼NE¼NE¼ sec.17, T.124 N., R.48 W., Hydrologic Unit 07020001, 0.5 mi (0.8 km) east of Beardsley.

Owner: U.S. Geological Survey.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in. (0.05 m), depth 282 ft (86.0 m), screened 242 to 282 ft (73.8 to 86.0 m).

DATUM.--Altitude of land-surface datum is 1,086.8 ft (331.3 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 3.60 ft (1.10 m) above land-surface datum.

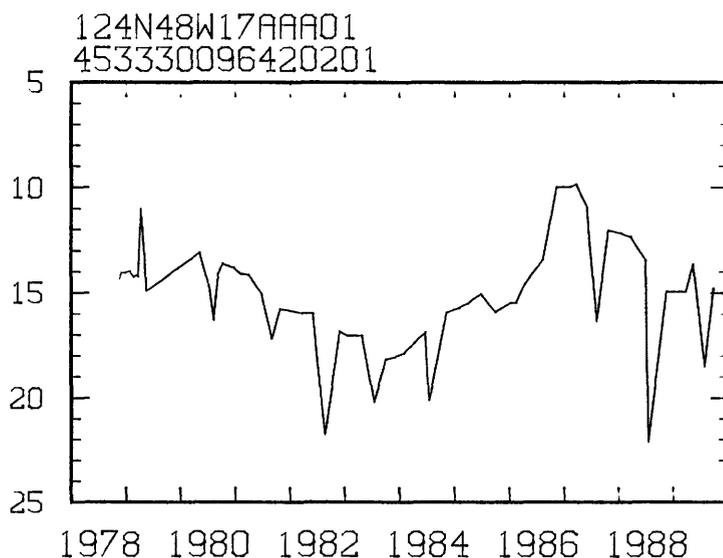
PERIOD OF RECORD.--November 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 9.77 ft (2.98 m) below land-surface datum, Mar. 23, 1987; lowest, 22.10 ft (6.74 m) below land-surface datum, July 21, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 18	14.85	Mar. 24	14.89	May 16	13.57	Aug. 02	18.49	Sep. 27	14.74

WATER LEVEL, FEET BELOW LAND SURFACE



1081.8  
1076.8  
1071.8  
1066.8  
1061.8

WATER LEVEL, FEET ABOVE NGVD

## GROUND-WATER LEVELS

## BLUE EARTH COUNTY

440050094102801. Local number, 106N28W03DBA01.

LOCATION.--Lat 44°00'50", long 94°10'28", in NE¼NW¼SE¼ sec.3, T.106 N., R.28 W., Hydrologic Unit 07020010, at Farmland Industries Ammonia Plant, 3.2 mi (5.2 km) north of Vernon Center.  
 Owner: Farmland Industries.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in. (0.41 m), depth 390 ft (119 m), cased to 150 ft (45.7 m).  
 DATUM.--Altitude of land-surface datum is 1,005 ft (306 m). Measuring point: Top of recorder floor, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--October 1973 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 71.81 ft (21.89 m) below land-surface datum, Apr. 26, 1983;  
 lowest, 76.50 ft (23.32 m) below land-surface datum, Sept. 27, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 02	75.40	Jul. 05	76.04	Aug. 05	76.09
Mar. 02	75.70	10	76.04	10	76.27
Apr. 06	75.44	15	76.03	15	76.28
Jun. 25	75.71	20	76.09	20	76.18
30	75.80	25	76.18	Sep. 27	76.50
		31	76.15		

441134093505301. Local number, 108N25W04BBC01.

LOCATION.--Lat 44°11'34", long 93°50'53", in SW¼NW¼NW¼ sec.4, T.108 N., R.25 W., Hydrologic Unit 07020011, at 1.3 mi (2.1 km) west of Madison Lake at waste treatment plant.  
 Owner: City of Madison Lake.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 6 in. (0.15 m), depth 313 ft (95.4 m), cased to 296 ft (90.2 m).  
 DATUM.--Altitude of land-surface datum is 1,036 ft (316 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--May 1979 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 92.52 ft (28.20 m) below land-surface datum, July 17, 1986;  
 lowest, 95.42 ft (29.08 m) below land-surface datum, July 16, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 02	94.24	Mar. 02	94.53	Apr. 06	94.49	Jun. 14	94.62	Aug. 03	94.79	Sep. 27	95.20

## BROWN COUNTY

441030094254501. Local number, 108N30W09ADD01.

LOCATION.--Lat 44°10'30", long 94°25'45", in SE¼SE¼NE¼ sec.9, T.108 N., R.30 W., Hydrologic Unit 07020007, 3.7 mi (6.0 km) northeast of Hanska.  
 Owner: Erwin Kjelshus.

AQUIFER.--Deposits of Pleistocene Age.

WELL CHARACTERISTICS.--Bored unused water-table well, diameter 16 in. (0.41 m), depth 32 ft (9.8 m), cased to 32 ft (9.8 m), open end.  
 DATUM.--Altitude of land-surface datum is 1,003 ft (306 m). Measuring point: Top of concrete cover, at land-surface datum.

REMARKS.--Measured by Erwin Kjelshus. Water level used in monthly Water Resources Review.  
 PERIOD OF RECORD.--July 1942 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 1.82 ft (0.55 m) below land-surface datum, Apr. 28, 1986;  
 lowest, 22.00 ft (6.71 m) below land-surface datum, Mar. 2, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 04	11.61	Dec. 07	11.53	Apr. 16	10.50	Jun. 01	7.68	Aug. 05	9.00
17	12.25	24	11.70	May 01	7.30	11	7.65	16	10.20
29	13.38	Jan. 17	12.64	12	6.57	30	7.60	31	11.50
Nov. 10	13.95	Mar. 29	8.40	21	6.85	Jul. 07	8.22	Sep. 14	10.90
						22	7.78	29	12.43

GROUND-WATER LEVELS

BROWN COUNTY--Continued

441800094434301. Local number, 110N32W30DDB01.

LOCATION.--Lat 44°18'00", long 94°43'43", in NW¼SE¼SE¼ sec.30, T.110 N., R.32 W., Hydrologic Unit 07020008, in Sleepy Eye at hospital.

Owner: City of Sleepy Eye.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in. (0.05 m), depth 176 ft (53.6 m).

DATUM.--Altitude of land-surface datum is 1,030 ft (314 m). Measuring point: Top of casing, 1.30 ft (0.40 m) above land-surface datum.

REMARKS.--Water level affected by pumping from nearby wells.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 46.80 ft (14.26 m) below land-surface datum, Apr. 1, 1987; lowest, 118.1 ft (36.00 m) below land-surface datum, Sept. 15, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Oct. 03	59.40	Dec. 01	56.70	Feb. 01	55.70	Apr. 03	54.20	Jun. 02	54.70	Aug. 01	61.70
Nov. 01	58.40	Jan. 03	56.10	Mar. 01	54.70	May 01	54.70	Jul. 01	60.70	Sep. 01	62.70

CHIPPEWA COUNTY

450447095490101. Local number, 119N41W29DDD01.

LOCATION.--Lat 45°04'47", long 95°40'01", in SE¼SE¼SE¼ sec.29, T.119 N., R.41 W., Hydrologic Unit 07020005, 5 mi (6.1 km) north of Watson.

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 19 ft (5.8 m), screened 17 to 19 ft (5.2 to 5.8 m).

DATUM.--Altitude of land-surface datum is 992 ft (302 m). Measuring point: Top of casing, 3.75 ft (1.14 m) above land-surface datum.

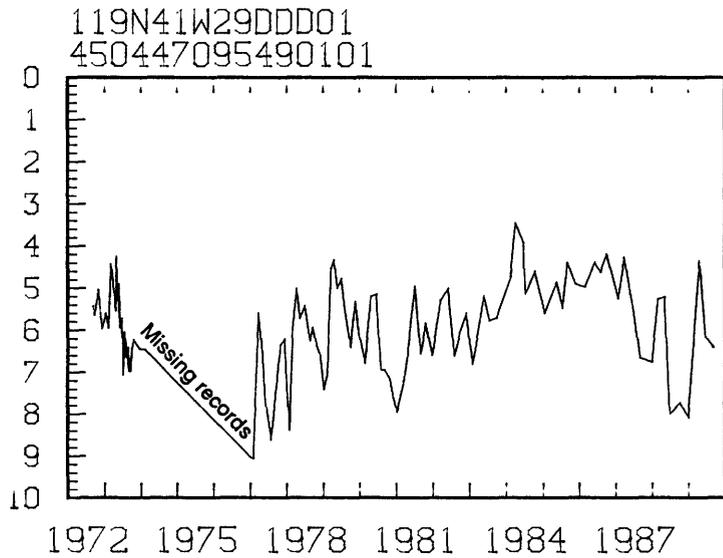
PERIOD OF RECORD.--September 1972 to February 1974, January 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 3.43 ft (1.05 m) below land-surface datum, Apr. 10, 1984; lowest, 9.06 ft (2.76 m) below land-surface datum, Feb. 8, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Oct. 12	7.71	Jan. 04	8.08	Apr. 28	4.32	Jun. 29	6.14	Sep. 07	6.38

WATER LEVEL, FEET BELOW LAND SURFACE



WATER LEVEL, FEET ABOVE NGVD



GROUND-WATER LEVELS

DAKOTA COUNTY

445044093102401. Local number, 027N23W09ABD01.

LOCATION.--Lat 44°50'44", long 93°10'24", in SE¼NW¼NE¼ sec.9, T.27 N., R.23 W., Hydrologic Unit 07020012, at Eagan.

Owner: City of Eagan, Timberline Addition.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 10 in. (0.25 m), depth 503 ft (153 m), cased to 401 ft (122 m).

DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Hole in well cap, 2.60 ft (0.79 m) above land-surface datum.

REMARKS.--Water-level affected by pumping.

PERIOD OF RECORD.--December 1965, April 1966, December 1966, March 1967, December 1970, August 1971, August 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 141.40 ft (43.10 m) below land-surface datum, Apr. 5, 1966; lowest, 171.40 ft (52.24 m) below land-surface datum, Aug. 2, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Nov. 02	158.37	Mar. 14	163.09	Aug. 01	170.37	Sep. 26	168.57
Jan. 20	161.92	May 16	167.50	21	169.16		

445330093054301. Local number, 028N22W19DCC02.

LOCATION.--Lat 44°53'30", long 93°05'43", in SW¼SW¼SE¼ sec.19, T.28 N., R.22 W., Hydrologic Unit 07010206, in West St. Paul.

Owner: U.S. Geological Survey, 2-N.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in. (0.15 m), depth 539 ft (164 m), cased to 407 ft (124 m).

DATUM.--Land-surface datum is 1,036 ft (316.0 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.60 ft (0.79 m) above land-surface datum.

REMARKS.--Water-level affected by regional pumping.

PERIOD OF RECORD.--January 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 309.13 ft (94.22 m) below land-surface datum, Apr. 4, 1988; lowest, 328.0 ft (99.97 m) below land-surface datum, July 31, 1975.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	314.40	Dec. 01	312.07	Feb. 01	311.57	Apr. 01	311.05	Jun. 01	312.63	Aug. 01	319.10
05	313.29	05	311.47	05	311.55	05	310.64	05	315.41	05	321.93
10	314.11	10	312.11	10	311.32	10	310.22	10	316.34	10	323.24
15	313.92	15	312.34	15	311.65	15	310.65	15	314.49	15	316.96
20	312.86	20	311.68	20	310.60	20	311.87	20	319.19	20	317.26
25	312.36	25	311.62	25	310.99	25	313.32	25	319.18	25	317.03
31	311.68	31	311.45	28	310.88	30	311.43	30	319.89	31	317.58
Nov. 01	311.85	Jan. 01	311.29	Mar. 01	311.25	May 01	311.11	Jul. 01	318.10	Sep. 01	317.64
05	311.64	05	311.45	05	311.08	05	311.53	05	319.47	05	314.51
10	312.40	10	311.74	10	311.27	10	311.75	10	320.40	10	315.63
15	311.41	15	311.59	15	310.67	15	314.79	15	321.26	15	316.79
20	312.03	20	312.04	20	310.61	20	314.74	20	318.77	20	317.72
25	311.20	25	311.56	25	310.68	25	314.71	25	321.66	25	315.94
30	311.97	31	310.80	31	311.07	31	312.39	31	318.81	30	317.85

## GROUND-WATER LEVELS

## DAKOTA COUNTY--Continued

443146093002201. Local number, 112N18W08ABA01.

LOCATION.--Lat 44°31'46", long 93°00'22", in NE¼NW¼NE¼ sec.8, T.112 N., R.18 W., Hydrologic Unit 07040002, northeast of Randolph.

Owner: U.S. Geological Survey

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in. (0.03 m), depth 44 ft (13.4 m), screened 42 to 44 ft (12.8 to 13.4 m).

DATUM.--Altitude of land-surface datum is 880 ft (268 m). Measuring point: Top of casing, 3.40 ft (1.04 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.13 ft (5.53 m) below land-surface datum, May 3, 1983; lowest, 23.80 ft (7.25 m) below land-surface datum, Feb. 21, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	21.74	Jan. 24	22.19	Apr. 05	21.39	May 17	21.26	Aug. 15	21.16	Sep. 22	21.16

443134093010601. Local number, 112N18W08BBC01.

LOCATION.--Lat 44°31'34", long 93°01'06", in SW¼NW¼NW¼ sec.8, T.112 N., R.18 W., Hydrologic Unit 07040002, at Randolph Fire Station.

Owner: City of Randolph.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled fire protection artesian well, diameter 10 in. (0.25 m), depth 150 ft (45.7 m), cased to 64 ft (19.5 m).

DATUM.--Altitude of land-surface datum is 883 ft (269 m). Measuring point: Top of 3/4-inch (0.02 m) breather pipe, 2.20 ft (0.67 m) above land-surface datum.

PERIOD OF RECORD.--July 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.47 ft (3.19 m) below land-surface datum, May 3, 1983; lowest, 19.70 ft (6.00 m) below land-surface datum, Aug. 11, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	15.95	Jan. 24	15.74	Apr. 05	13.92	May 17	14.84	Aug. 15	17.14	Sep. 22	17.24

442830093085201. Local number, 112N19W30DBD01.

LOCATION.--Lat 44°28'30", long 93°08'52", in SE¼NW¼SE¼ sec.30, T.112 N., R.19 W., Hydrologic Unit 07040002, at Northfield waste treatment plant.

Owner: City of Northfield.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 6 in. (0.15 m), depth 275 ft (83.8 m), cased to 212 ft (64.6 m).

DATUM.--Altitude of land-surface datum is 890 ft (271 m). Measuring point: Center of pressure gauge, 2.05 ft (0.62 m) above land-surface datum.

PERIOD OF RECORD.--May 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.54 ft (5.65 m) above land-surface datum, July 12, 1983; lowest, 7.70 ft (2.35 m) above land-surface datum, Dec. 1, 1988, Jan. 24, 1989, Aug. 2, 1989.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 01	+7.70	Jan. 24	+7.70	Apr. 05	+8.50	May 17	+9.65	Aug. 02	+7.70	Sep. 22	+8.50

## GROUND-WATER LEVELS

## DAKOTA COUNTY--Continued

443645093014701. Local number, 113N18W07BAC01.

LOCATION.--Lat 44°36'45", long 93°01'47", in SW¼NE¼NW¼ sec.7, T.113 N., R.18 W., Hydrologic Unit 07040001, west of Hampton.

Owner: Eugene Dohmen.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in. (0.41 m), depth 325 ft (99.1 m), cased to 65 ft (19.8 m).

DATUM.--Altitude of land-surface datum is 915 ft (217 m). Measuring point: Hole in pump base, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to August 1977, January 1978, June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 23.15 ft (7.05 m) below land-surface datum, Dec. 4, 1986; lowest, 33.19 ft (10.12 m) below land-surface datum, Aug. 12, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Nov. 01	30.73	Jan. 24	31.10	Mar. 31	31.00	Jun. 15	31.05	Aug. 15	32.42	Sep. 22	32.00

444205092500001. Local number, 114N17W10AAA01.

LOCATION.--Lat 44°42'05", long 92°50'00", in NE¼NE¼NE¼ sec.10, T.114 N., R.17 W., Hydrologic Unit 07040001, southeast of Hastings.

Owner: John Conzemius.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in. (0.10 m), depth 151 ft (46.0 m), depth of casing unknown.

DATUM.--Altitude of land-surface datum is 827 ft (252 m). Measuring point: Top of platform, 2.50 ft (0.76 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 94.10 ft (28.68 m) below land-surface datum, Mar. 31, 1987; lowest, 107.4 ft (32.74 m) below land-surface datum, Mar. 12, 1978.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	99.87	Dec. 01	100.55	Feb. 01	101.13	Apr. 01	98.41	Jun. 01	98.99	Aug. 01	100.63
05	100.01	05	100.31	05	100.82	05	97.93	05	99.03	05	100.64
10	99.93	10	100.57	10	100.89	10	97.59	10	99.25	10	101.15
15	99.79	15	100.88	15	101.22	15	97.44	15	99.34	15	100.97
20	100.01	20	100.80	20	100.80	20	97.50	20	99.36	20	100.91
25	100.11	25	100.85	25	100.92	25	97.72	25	99.47	25	100.97
31	100.00	31	100.70	28	101.16	30	98.05	30	99.54	31	100.89
Nov. 01	100.16	Jan. 01	100.68	Mar. 01	101.19	May 01	98.03	Jul. 01	99.51	Sep. 01	101.09
05	100.13	05	100.59	05	101.27	05	98.11	05	99.63	05	101.03
10	100.39	10	100.89	10	101.03	10	98.36	10	99.84	10	101.15
15	100.14	15	100.82	15	100.94	15	98.42	15	100.02	15	101.13
20	100.46	20	101.01	20	100.62	20	98.68	20	100.38	20	101.28
25	100.40	25	100.86	25	100.51	25	98.71	25	100.53	25	101.47
30	100.54	31	100.90	31	98.68	31	98.99	31	100.64	30	101.43

444047092521901. Local number, 114N17W16CBB01.

LOCATION.--Lat 44°40'47", long 92°52'19", in NW¼NW¼SW¼ sec.16, T.114 N., R.17 W., Hydrologic Unit 07040001, Kirby Avenue, 0.5 mi (0.8 km) north of 190th Street.

Owner: Jim Huneke Construction Company.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic water-table well, diameter 4 in. (0.10 m), depth 170 ft (51.8 m), screened 164 to 170 ft (50.0 to 51.8 m).

DATUM.--Altitude of land-surface datum is 823 ft (251 m). Measuring point: Top of casing, 1.10 ft (0.34 m) above land-surface datum.

PERIOD OF RECORD.--March 1976, March 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 73.32 ft (22.34 m) below land-surface datum, Mar. 31, 1987; lowest, 87.75 ft (26.75 m) below land-surface datum, June 27, 1978.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	79.96	Jan. 24	80.19	Mar. 31	80.24	May 17	79.90	Aug. 15	81.79	Sep. 20	81.94

## GROUND-WATER LEVELS

## DAKOTA COUNTY--Continued

443827092521801. Local number, 114N17W33BBC01.

LOCATION.--Lat 44°38'27", long 92°52'18", in SW¼NW¼NW¼ sec.33, T.114 N., R.17 W., Hydrologic Unit 07040001, 39 ft (11.9 m) south of irrigation well.

Owner: Rainer Kimmes.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 16 in. (0.41 m), depth 290 ft (88.4 m), cased to 25 ft (7.6 m).

DATUM.--Altitude of land-surface datum is 862 ft (263 m). Measuring point: Hole in plate over well, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--August 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 46.14 ft (14.06 m) below land-surface datum, Dec. 1, 1986; lowest, 79.20 ft (24.14 m) below land-surface datum, July 11, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	65.07	Jan. 24	64.74	Mar. 31	64.64	May 17	64.98	Aug. 15	71.54	Sep. 20	69.10

444117092595701. Local number, 114N18W17AAB01.

LOCATION.--Lat 44°41'17", long 92°59'57", in NW¼NE¼NE¼ sec.17, T.114 N., R.18 W., Hydrologic Unit 07040001, 180th Street, 0.25 mi (0.40 km) west of Emery Avenue.

Owner: Joe Ries.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in. (0.41 m), depth 280 ft (85.3 m), cased to 39 ft (11.9 m).

DATUM.--Altitude of land-surface datum is 905 ft (276 m). Measuring point: Edge of vent pipe, 1.40 ft (0.43 m) above land-surface datum.

PERIOD OF RECORD.--June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 57.30 ft (17.46 m) below land-surface datum, Dec. 1, 1986; lowest, 74.15 ft (22.60 m) below land-surface datum, Sept. 13, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	73.67	Jan. 24	69.15	May 17	70.15	Sep. 20	70.90

443801092571301. Local number, 114N18W35CCB01.

LOCATION.--Lat 44°38'01", long 92°57'13", in NW¼SW¼SW¼ sec.35, T.114 N., R.18 W., Hydrologic Unit 07040001, Goodwin Avenue, 1.1 mi (1.8 km) south of Northfield Boulevard.

Owner: Al Wagner, Jr.

AQUIFER.--Buried gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 203 ft (61.9 m), screened 173 to 203 ft (52.7 to 61.9 m).

DATUM.--Altitude of land-surface datum is 898 ft (274 m). Measuring point: Hole in pump base, 1.25 ft (0.38 m) above land-surface datum.

PERIOD OF RECORD.--June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 16.83 ft (5.12 m) below land-surface datum, Dec. 1, 1986; lowest, 38.28 ft (11.67 m) below land-surface datum, Sept. 13, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	32.54	Jan. 24	32.01	Mar. 31	31.59	May 17	31.64	Aug. 15	36.32	Sep. 20	34.65

GROUND-WATER LEVELS

DAKOTA COUNTY--Continued

444220093055001. Local number, 114N19W04DAC01.

LOCATION.--Lat 44°42'20", long 93°05'50", in SW¼NE¼SE¼ sec.4, T.114 N., R.19 W., Hydrologic Unit 07040001, 2.1 mi (3.4 km) southeast of Rosemount.

Owner: University of Minnesota Agricultural Experiment Station (Plant Pathology).

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 6 in. (0.15 m), depth 415 ft (126 m), cased to 355 ft (108 m).

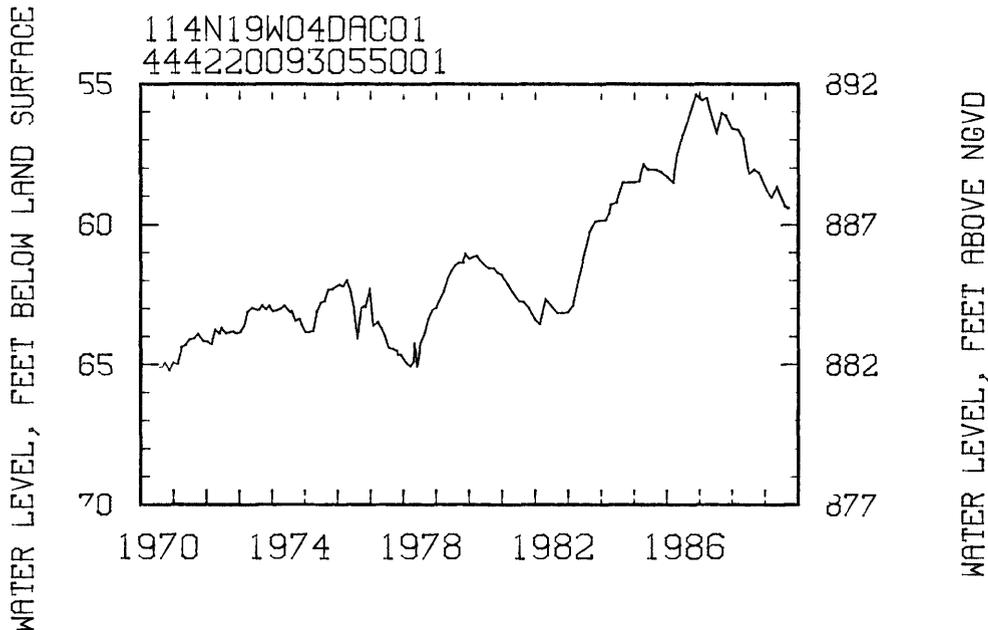
DATUM.--Altitude of land-surface datum is 947 ft (289 m). Measuring point: Top of 1-inch breather pipe, 2.10 ft (0.64 m) above land-surface datum.

PERIOD OF RECORD.--August 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 55.36 ft (16.87 m) below land-surface datum, Dec. 1, 1986; lowest, 65.23 ft (19.88 m) below land-surface datum, Nov. 27, 1970.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	58.17	Jan. 24	58.80	Mar. 16	59.07	May 17	58.66	Aug. 15	59.37	Sep. 22	59.45



443934093043201. Local number, 114N19W22DDD01.

LOCATION.--Lat 44°39'34", long 93°04'32", in SE¼SE¼SE¼ sec.22, T.114 N., R.19 W., Hydrologic Unit 07040001, west of Empire.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in. (0.03 m), depth 24 ft (7.3 m), screened 22 to 24 ft (6.7 to 7.3 m).

DATUM.--Altitude of land-surface datum is 875 ft (267 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--April 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.52 ft (1.68 m) below land-surface datum, May 2, 1986; lowest, 9.33 ft (2.84 m) below land-surface datum, Sept. 13, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Nov. 01	9.22	Mar. 27	6.23	May 17	7.62	Sep. 22	8.80
Jan. 24	9.01	31	7.46	Aug. 15	8.78		

GROUND-WATER LEVELS

DODGE COUNTY

435336092553201. Local number, 105N18W13DDD01.  
 LOCATION.--Lat 43°53'36", long 92°55'32", in SE¼SE¼SE¼ sec.13, T.105 N., R.18 W., Hydrologic Unit 07080201, 3 mi (4.8 km) west of Hayfield.  
 Owner: James Barry.  
 AQUIFER.--Buried sand and gravel of Pleistocene Age.  
 WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in. (0.13 m), depth 82 ft (25.0 m), screen information not available.  
 DATUM.--Altitude of land-surface datum is 1,288 ft (393 m). Measuring point: Top of casing, 1.80 ft (0.55 m) above land-surface datum.  
 PERIOD OF RECORD.--June 1975 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 37.61 ft (11.46 m) below land-surface datum, June 6, 1984; lowest, 46.25 ft (14.10 m) below land-surface datum, Mar. 30, 1978.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Oct. 06	43.00	Jan. 18	43.20	May 02	43.48	Jul. 28	43.83
Nov. 18	42.92	Mar. 09	43.65	Jun. 09	43.38		

440448092485501. Local number, 107N17W13BBA01.  
 LOCATION.--Lat 44°04'48", long 92°48'55", in NE¼NW¼NW¼ sec.13, T.107 N., R.17 W., Hydrologic Unit 07040004, in city of Wasioja.  
 Owner: Wasioja Township Garage.  
 AQUIFER.--Galena Formation of Middle Ordovician Age.  
 WELL CHARACTERISTICS.--Drilled maintenance artesian well, diameter 6 in. (0.15 m), depth 100 ft (30.5 m), cased to 52 ft (15.8 m).  
 DATUM.--Altitude of land-surface datum is 1,185 ft (361 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.  
 PERIOD OF RECORD.--January 1975 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 12.94 ft (3.94 m) below land-surface datum, May 23, 1983; lowest, 26.88 ft (8.19 m) below land-surface datum, Jan. 5, 1978.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 06	25.03	Jan. 18	25.77	Mar. 09	25.95	May 02	24.99	Jun. 09	25.12	Jul. 28	25.74

FARIBAULT COUNTY

434558093540001. Local number, 104N26W36CAC01.  
 LOCATION.--Lat 43°45'58", long 93°54'00", in SW¼NE¼SW¼ sec.36, T.104 N., R.26 W., Hydrologic Unit 07020011, at Easton Creamery.  
 Owner: City of Easton.  
 AQUIFER.--Platteville Formation of Middle Ordovician Age.  
 WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 6 in. (0.15 m), depth 145 ft (44.2 m), cased to 120 ft (36.6 m).  
 DATUM.--Altitude of land-surface datum is 1,060 ft (323 m). Measuring point: Top of well cap, 1.20 ft (0.37 m) above land-surface datum.  
 PERIOD OF RECORD.--August 1979, April 1980, May 1981 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.97 ft (9.13 m) below land-surface datum, May 10, 1983; lowest, 36.36 ft (11.08 m) below land-surface datum, Aug. 2, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	33.67	Mar. 01	33.97	Apr. 05	34.96	Jun. 15	33.88	Aug. 02	36.36	Sep. 28	34.83

GROUND-WATER LEVELS

FARIBAULT COUNTY--Continued

434902094042901. Local number, 104N27W16ABA01.

LOCATION.--Lat 43°49'02", long 94°04'29", in NE¼NW¼NE¼ sec.16, T.104 N., R.27 W., Hydrologic Unit 07020011, at Bass Lake Baptist Camp.

Owner: Baptist Church.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 240 ft (73.2 m), cased to 190 ft (57.9 m).

DATUM.--Altitude of land-surface datum is 1,050 ft (320 m). Measuring point: Hole in well cap, 0.90 ft (0.27 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 27.48 ft (8.38 m) below land-surface datum, May 10, 1983; lowest, 31.76 ft (9.68 m) below land-surface datum, Mar. 3, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Dec. 01	31.47	Mar. 03	31.76	Apr. 05	31.57	Jun. 15	31.52

FREEBORN COUNTY

433434093331201. Local number, 101N23W02DAC01.

LOCATION.--Lat 43°34'34", long 93°33'12", in SW¼NE¼SE¼ sec.2, T.101 N., R.23 W., Hydrologic Unit 07080203, 3 mi (4.8 km) southwest of Conger.

Owner: Richard Steele.

AQUIFER.--Upper Carbonates of Devonian and Ordovician Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in. (0.41 m), depth 373 ft (114 m), cased to 156 ft (47.6 m).

DATUM.--Altitude of land-surface datum is 1,280 ft (390 m). Measuring point: Vent pipe, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--July 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 65.58 ft (19.99 m) below land-surface datum, Mar. 8, 1983; lowest, 75.45 ft (23.00 m) below land-surface datum, Aug. 2, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	71.45	Mar. 01	71.30	Apr. 05	71.14	Jun. 15	71.74	Aug. 02	75.45	Sep. 28	72.10

433846093220601. Local number, 102N21W09CCB01.

LOCATION.--Lat 43°38'46", long 93°22'06", in NW¼SW¼SW¼ sec.9, T.102 N., R.21 W., Hydrologic Unit 07080202, at Freeborn County Courthouse.

Owner: Freeborn County.

AQUIFER.--Cedar Valley Formation of Middle Devonian Age.

WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 5 in. (0.13 m), depth 150 ft (45.7 m), cased to 138 ft (42.1 m).

DATUM.--Altitude of land-surface datum is 1,240 ft (378 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--November 1981 to current year.

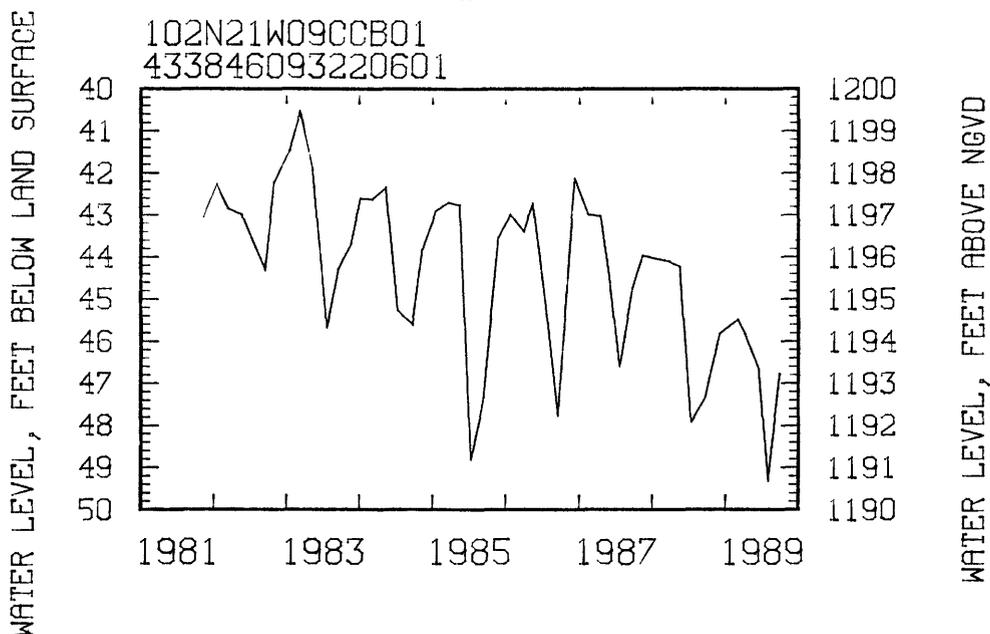
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 40.50 ft (12.34 m) below land-surface datum, Mar. 8, 1983; lowest, 49.32 ft (15.03 m) below land-surface datum, Aug. 2, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	45.79	Mar. 01	45.45	Apr. 05	45.80	Jun. 15	46.64	Aug. 02	49.32	Sep. 28	46.76

GROUND-WATER LEVELS

FREEBORN COUNTY--Continued



434032093111801. Local number, 103N20W36CCB01.  
 LOCATION.--Lat 43°40'32", long 93°11'18", in NE¼SW¼SW¼ sec.36, T.103 N., R.20 W., Hydrologic Unit 07080201, at Pillsbury Grain Station.  
 Owner: Pillsbury Co.  
 AQUIFER.--Cedar Valley Formation of Middle Devonian Age.  
 WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 5 in. (0.13 m), depth 231 ft (70.4 m), cased to 136 ft (41.4 m).  
 DATUM.--Altitude of land-surface datum is 1,255 ft (383 m). Measuring point: Top of casing, 1.80 ft (0.55 m) above land-surface datum.  
 PERIOD OF RECORD.--July 1981 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 48.40 ft (14.75 m) below land-surface datum, May 10, 1984; lowest, 55.95 ft (17.05 m) below land-surface datum, July 13, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	53.10	Mar. 01	52.75	Apr. 05	52.59	Jun. 15	52.94	Aug. 02	53.93	Sep. 28	53.27

434308093322001. Local number, 103N23W13CDA01.  
 LOCATION.--Lat 43°43'08", long 93°32'20", in NE¼SE¼SW¼ sec.13, T.103 N., R.23 W., Hydrologic Unit 07020011, 3.3 m (5.3 km) northeast of Alden.  
 Owner: Oakview Golf Course.  
 AQUIFER.--Galena Formation of Middle Ordovician Age.  
 WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 6 in. (0.15 m), depth 270 ft (82.3 m), cased to 158 ft (48.2 m).  
 DATUM.--Altitude of land-surface datum is 1,250 ft (381 m). Measuring point: Hole in well cap, 1.90 ft (0.58 m) above land-surface datum.  
 PERIOD OF RECORD.--July 1981 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 42.00 ft (12.80 m) below land-surface datum, May 10, 1983; lowest, 48.77 ft (14.87 m) below land-surface datum, Aug. 2, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Dec. 01	46.70	Mar. 01	45.96	Apr. 05	46.00	Aug. 02	48.77	Sep. 28	47.56

## GROUND-WATER LEVELS

## GOODHUE COUNTY

441737092400501. Local number, 110N15W31BBD01.

LOCATION.--Lat 44°17'37", long 92°40'05", in SE¼NW¼NW¼ sec.31, T.110 N., R.15 W., Hydrologic Unit 07040004, at Zumbrota Fire Station.

Owner: City of Zumbrota, well 3.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in. (0.30 m), depth 210 ft (64.0 m), cased to 50 ft (15.2 m).

DATUM.--Altitude of land-surface datum is 1,000 ft (305 m). Measuring point: Hole in pump base, 2.20 ft (0.67 m) above land-surface datum.

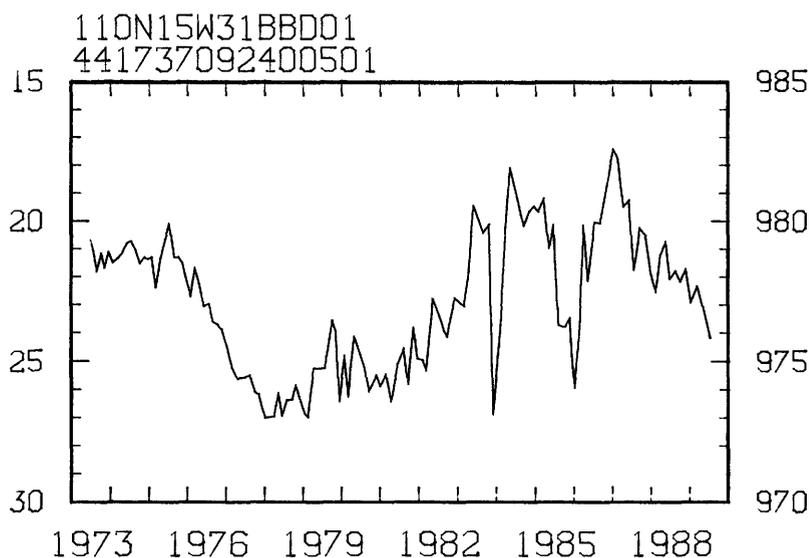
PERIOD OF RECORD.--June 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 17.38 ft (5.29 m) below land-surface datum, Jan 7, 1987; lowest, 27.00 ft (8.23 m) below land-surface datum, Jan. 5, 1978.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL						
Oct. 04	22.16	Nov. 23	21.68	Jan. 13	22.91	Mar. 14	22.30	May 03	23.02	Jul. 14	24.15

WATER LEVEL, FEET BELOW LAND SURFACE



442401092372501. Local number, 111N15W21CDA01.

LOCATION.--Lat 44°24'01", long 92°37'25", in NE¼SE¼SW¼ sec.21, T.111 N., R.15 W., Hydrologic Unit 07040004, in Goodhue clerk's office.

Owner: City of Goodhue, creamery well.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 12 in. (0.30 m), depth 310 ft (94.5 m), cased to 175 ft (53.3 m).

DATUM.--Altitude of land-surface datum is 1,125 ft (343 m). Measuring point: Top of 1¼ in (0.03 m) elbow, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--June 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 119.00 ft (36.27 m) below land-surface datum, Feb. 26, 1987; lowest, 156.5 ft (47.70 m) below land-surface datum, May 26, 1983.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR Oct.OBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL						
Oct. 04	124.85	Nov. 23	124.97	Jan. 13	126.35	Mar. 14	126.22	May 03	127.87	Jul. 14	128.84

## GROUND-WATER LEVELS

## GOODHUE COUNTY--Continued

443012092362201. Local number, 113N15W27EAB01.

LOCATION.--Lat 44°30'12", long 92°26'22", in NW¼NE¼NW¼ sec.27, T.113 N., R.15 W., Hydrologic Unit 07040002, at Red Wing.

Owner: City of Red Wing, Anderson Park.

AQUIFER.--Eau Claire-Mount Simon Sandstones of Late Cambrian Age.

WELL CHARACTERISTIC.--Drilled unused artesian well, diameter 12 in. (0.30 m), depth 560 ft (171 m), cased to 243 ft (74.1 m).

DATUM.--Altitude of land-surface datum is 800 ft (244 m). Measuring point: Edge of casing, 2.70 ft (0.82 m) above land-surface datum.

PERIOD OF RECORD.--April 1976, June 1978 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 100.50 ft (30.63 m) below land-surface datum, Apr. 20, 1983; lowest, 109.07 ft (33.24 m) below land-surface datum, Aug. 23, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Oct. 04	107.47	Jan. 30	100.62	May 08	103.52	Jun. 26	105.58	Sep. 29	107.77
Dec. 05	104.79	Mar. 14	102.86	Jun. 20	104.84	Aug. 23	109.07		

## GROUND-WATER LEVELS

## HENNEPIN COUNTY

444815093194901. Local number, 027N24W30AAA01.

LOCATION.--Lat 44°48'15", long 93°19'49", in NE¼NE¼ sec.30, T.27 N., R.24 W., Hydrologic Unit 07020012, at 4001 West 110th Street, Bloomington.

Owner: Transfiguration Church.

AQUIFER.--Buried Sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 139 ft (42.4 m), screened 135 to 139 ft (41.2 to 42.4 m).

DATUM.--Altitude of land-surface datum is 832 ft (254 m). Measuring point: Top of casing, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--March 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 63.97 ft (19.50 m) below land-surface datum, Mar. 2, 1979; lowest, 72.04 ft (21.96 m) below land-surface datum, Sept. 26, 1989.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 02	70.84	Jan. 20	71.09	Mar. 14	70.87	May 10	71.13	Aug. 01	71.81	Sep. 26	72.04

444801093202801. Local number, 027N24W30BDA01.

LOCATION.--Lat 44°48'01", long 93°20'28", in NE¼SE¼NW¼ sec.30, T.27 N., R.24 W., Hydrologic Unit 07020012, in Bloomington.

Owner: City of Bloomington, at Southwood Terrace.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in. (0.30 m), depth 330 ft (101 m), cased to 269 ft (82.0 m).

DATUM.--Altitude of land-surface datum is 815 ft (248 m). Measuring point: Top of recorder platform, 2.20 ft (0.67 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--March 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 63.05 ft (19.22 m) below land-surface datum, Apr. 15, 1969; lowest, 84.86 ft (25.87 m) below land-surface datum, July 1, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	79.03	Dec. 01	77.88	Feb. 01	77.86	Apr. 01	77.45	Jun. 01	79.30	Aug. 05	82.71
05	78.17	05	77.58	05	77.63	05	77.20	05	81.99	10	83.91
10	80.06	10	77.76	10	77.57	10	77.11	10	81.84	15	81.23
15	80.84	15	78.04	15	77.85	15	77.00	15	78.67	20	81.64
20	77.90	20	77.90	20	77.42	20	78.61	20	82.26	25	82.36
25	77.79	25	77.84	25	77.45	25	78.45	25	81.07	31	80.17
31	77.55	31	77.65	28	77.63	30	77.59	30	81.74	Sep. 01	79.22
Nov. 01	77.67	Jan. 01	77.63	Mar. 01	77.69	May 01	78.74	Jul. 01	80.12	05	79.25
05	77.57	05	77.59	05	77.69	05	78.21	05	82.42	10	80.18
10	77.84	10	77.76	10	77.44	10	78.62			15	81.77
15	77.74	15	77.59	15	77.59	15	80.44			20	80.90
20	77.82	20	77.86	20	77.47	20	79.04			25	82.23
25	77.66	25	77.66	25	77.54	25	78.07			30	82.34
30	77.82	31	77.57	31	77.61	31	78.58				

445356093145301. Local number, 028N24W23ADD01.

LOCATION.--Lat 44°53'56", long 93°14'53", in SE¼SE¼NE¼ sec.23, T.28 N., R.24 W., Hydrologic Unit 07010206, at 5728 Cedar Avenue, Minneapolis.

Owner: Hope Lutheran Church.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 6 in. (0.15 m), depth 245 ft (74.7 m), cased to 172 ft (52.4 m).

DATUM.--Altitude of land-surface datum is 835 ft (254 m). Measuring point: Top of casing, 0.30 ft (0.09 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 36.50 ft (11.13 m) below land-surface datum, Jan. 22, 1986; lowest, 60.17 ft (18.34 m) below land-surface datum, June 21, 1988.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 02	41.52	Jan. 25	40.40	Mar. 15	40.34	May 17	41.82	Aug. 01	57.03	Sep. 15	48.22

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

450116093205301. Local number, 029N24W06CCC01.

LOCATION.--Lat 45°51'16", long 93°20'53", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.6, T.29 N., R.24 W., Hydrologic Unit 07010206, at 3610 Unity Avenue North, Robbinsdale.

Owner: Minnesota Department of Transportation.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in. (0.13 m), depth 200 ft (61.0 m), cased to 152 ft (46.3 m).

DATUM.--Altitude of land-surface datum is 870 ft (265 m). Measuring point: Top of casing, 3.50 ft (1.07 m) above above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--March 1973 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.54 ft (7.48 m) below land-surface datum, Dec. 28-29, 1975; lowest, 53.03 ft (16.16 m) below land-surface datum, June 15, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	38.69	Dec. 01	32.56	Feb. 01	33.35	Apr. 01	32.89	Jun. 01	39.42	Aug. 01	48.93
05	37.34	05	32.17	05	32.03	05	32.84	05	41.45	05	47.27
10	35.23	10	32.66	10	33.24	10	32.56	10	42.36	10	51.48
15	38.97	15	32.74	15	33.61	15	33.28	15	40.55	15	43.73
20	34.84	20	33.53	20	32.38	20	36.47	20	46.00	20	42.95
25	33.92	25	32.01	25	33.06	25	39.19	25	44.13	25	42.68
31	32.68	31	32.33	28	32.88	30	35.61	30	46.61	31	42.73
Nov. 01	33.07	Jan. 01	31.94	Mar. 01	33.40	May 01	35.51	Jul. 01	45.26	Sep. 01	42.72
05	32.87	05	33.21	05	32.74	05	37.13	05	47.37	05	39.55
10	33.11	10	33.11	10	33.16	10	37.83	10	48.02	10	39.69
15	32.58	15	32.83	15	33.24	15	40.59	15	49.08	15	41.40
20	32.14	20	33.24	20	32.58	20	42.41	20	44.22	20	41.27
25	31.70	25	33.72	25	32.78	25	41.92	25	49.77	25	37.95
30	32.65	31	32.88	31	33.31	31	37.91	31	47.65	30	40.93

445833093154301. Local number, 029N24W26BAB01.

LOCATION.--Lat 44°58'33", long 93°15'43", in NW $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.26, T.29 N., R.24 W., Hydrologic Unit 07010206, at 425 Portland Avenue.

Owner: Minneapolis Star and Tribune.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in. (0.41 m), depth 445 ft (136 m), cased to 252 ft (76.8 m).

DATUM.--Altitude of land-surface datum is 835 ft (254 m). Measuring point: Top of steel cover, 7.60 ft (7.90 m) below land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--June 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 56.45 ft (17.21 m) below land-surface datum, Jan. 10, 1983; lowest, 149.36 ft (45.52 m) below land-surface datum, Aug. 16, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 15	86.85	Jan. 05	72.59	Mar. 05	63.52	May 05	77.09
25	70.20	10	71.39	15	69.93	10	101.43
Nov. 20	64.81	15	64.31	20	69.78	25	98.12
25	67.32	20	72.11	25	67.60	31	85.64
30	69.51	Feb. 05	63.43	31	73.56	Jun. 10	93.04
Dec. 05	70.70	10	69.33	Apr. 05	76.61	20	140.97
10	68.40	15	70.59	10	72.21	25	104.89
15	70.10	20	63.76	15	68.71	Jul. 25	134.20
20	71.60	25	66.83	20	93.20	Aug. 17	121.84
25	66.01	28	69.55	25	99.92	28	115.42
31	65.41			30	66.95		

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

445829093162901. Local number, 029N24W27ABD01.

LOCATION.--Lat 44°58'29", long 93°16'29", in SE¼NW¼NE¼ sec.27, T.29 N., R.24 W., Hydrologic Unit 07010206, at 911 LaSalle Avenue, Minneapolis.

Owner: American Linen Supply Co.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age and Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in. (0.41 m), depth 1,094 ft (333 m), cased to 812 ft (248 m).

DATUM.--Altitude of land-surface datum is 850 ft (259 m). Measuring point: Hole in pump base, 22.00 ft (6.71 m) below land-surface datum.

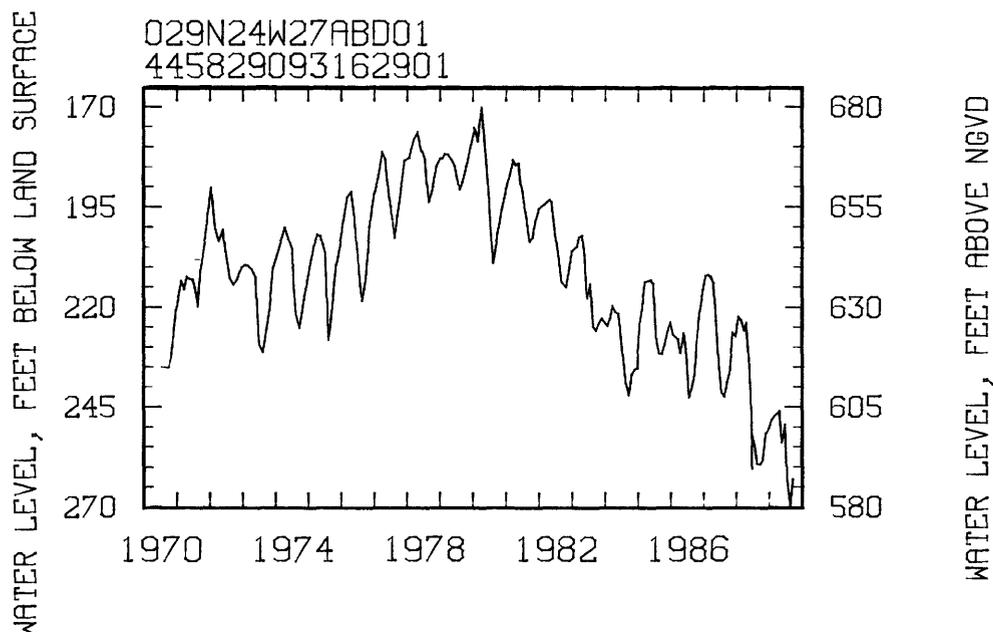
REMARKS.--Water level affected by regional pumping.

PERIOD OF RECORD.--July 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 169.8 ft (51.76 m) below land-surface datum, Apr. 15, 1980; lowest, 269.92 ft (82.27 m) below land-surface datum, Aug. 28, 1989.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Oct. 25	258.11	Dec. 27	250.17	Feb. 27	247.03	Apr. 24	245.80	Jun. 26	249.14	Aug. 28	269.92
Nov. 28	251.33	Jan. 27	248.10	Mar. 28	246.33	May 24	253.83	Jul. 25	263.87	Sep. 25	262.91



445158093225101. Local number, 116N21W07DAD01.

LOCATION.--Lat 44°51'58", long 93°22'51", in SE¼NE¼SE¼ sec.7, T.116 N., R.21 W., Hydrologic Unit 07020012, at Braemer Golf Course.

Owner: City of Edina, well 14.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 16 in. (0.41 m), depth 420 ft (128 m), cased to 325 ft (99.1 m).

DATUM.--Altitude of land-surface datum is 848 ft (258 m). Measuring point: Vent pipe at land-surface datum.

PERIOD OF RECORD.--April 1965 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.26 ft (9.53 m) below land-surface datum, Apr. 4, 1966; lowest, 64.00 ft (19.51 m) below land-surface datum, Aug. 15, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Nov. 30	50.82	Apr. 14	50.00	May 31	53.98	Aug. 22	62.88
Jan. 12	51.88	May 02	52.00	Aug. 15	64.00		

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

445618093211801. Local number, 117N21W16CDB01.

LOCATION.--Lat 44°56'18", long 93°21'18", in NW¼SE¼SW¼ sec.16, T.117 N., R.21 W., Hydrologic Unit 07010206, at 2565 Wooddale Avenue South, St. Louis Park.

Owner: D-A Lubricant Co.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 691 ft (211 m), screened 651 to 661 ft (198 to 202 m).

DATUM.--Altitude of land-surface datum is 917.2 ft (279.6 m), National Geodetic Vertical Datum of 1929.

Measuring point: Hole in well seal, 3.60 ft (1.10 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--April 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 130.25 ft (39.70 m) below land-surface datum, Feb. 6, 1987; lowest, 155.46 ft (47.38 m) below land-surface datum, Sept. 20, 1988.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 28	145.44	Jan. 25	139.82	Mar. 15	137.26	May 16	136.67	Aug. 22	151.75	Sep. 26	152.60

445347093213901. Local number, 117N21W32DAD01.

LOCATION.--Lat 44°53'47", long 93°21'39", in SE¼NE¼SE¼ sec.32, T.117 N., R.21 W., Hydrologic Unit 07010206, at Hanson Road and Benton Avenue.

Owner: City of Edina, well 9.

AQUIFER.--Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 16 in. (0.41 m), depth 1,130 ft (344 m), cased to 1,010 ft (308 m).

DATUM.--Land-surface datum is 933.3 ft (284.5 m) National Geodetic Vertical Datum of 1929. Measuring point: Hole in east side of pump base, 2.00 ft (0.61 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--August 1961 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 230.81 ft (70.35 m) below land-surface datum, Apr. 20, 1962; lowest, 395.71 ft (120.61 m) below land-surface datum, Sept. 27, 1988.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 30	383.75	May 05	394.00	May 31	355.23

445646093395301. Local number, 117N24W13BBC04.

LOCATION.--Lat 44°45'46", long 93°39'53", in SW¼NW¼NW¼ sec.13, T.117 N., R.24 W., Hydrologic Unit 07010206, at 3-Point Road.

Owner: City of Mound, well 4.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 10 in. (0.25 m), depth 729 ft (222 m), cased to 600 ft (183 m).

DATUM.--Altitude of land-surface datum is 945 ft (288 m): Measuring point: Top of breather pipe, 2.35 ft (0.71 m) above land-surface datum.

PERIOD OF RECORD.--November 1985 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 65.30 ft (19.90 m) below land-surface datum, Mar. 4, 1980; lowest, 72.49 ft (22.09 m) below-land surface datum, Sept. 12, 1988.

## WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 17	71.63	Jan. 25	71.24	Mar. 16	70.92	May 16	70.85	Aug. 01	71.85	Sep. 15	72.05

GROUND-WATER LEVELS

HENNEPIN COUNTY--Continued

445740093333001. Local number, 117N23W11BBD01.

LOCATION.--Lat 44°57'40", long 93°33'30", in SE¼NW¼ sec.11, T.117 N., R.23 W., Hydrologic Unit 07010206, 2 mi (3.2 km) southwest of Wayzata, at Lake Minnetonka.

Owner: Minnetonka Boat Works, Inc., Orono.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in. (0.15 m), depth 437 ft (133 m), cased to 270 ft (82.3 m).

DATUM.--Altitude of land-surface datum is 930.8 ft (283.7 m) National Geodetic Vertical Datum of 1929. Measuring point: Wood floor of instrument shelter, 3.30 ft (1.01 m) above land-surface datum.

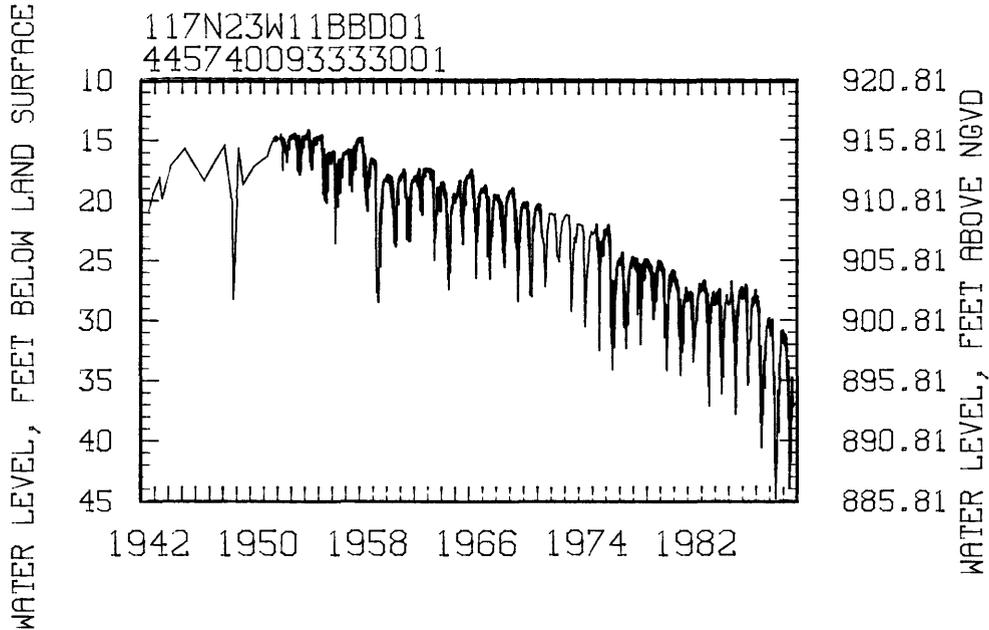
REMARKS.--Water level affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 14.05 ft (4.33 m) below land-surface datum, Apr. 30, 1954; lowest, 44.77 ft (13.65 m) below land-surface datum, June 28, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 05	33.52	Dec. 05	31.08	Feb. 05	31.56	Apr. 05	31.95	Jun. 05	35.48	Aug. 05	40.65
10	34.80	10	31.59	10	31.27	10	32.19	10	38.06	10	41.70
15	35.21	20	31.00	15	31.48	15	32.30	15	35.88	15	39.86
20	33.54	25	31.19	20	31.66	20	32.44	20	38.05	20	38.02
25	32.84	31	30.96	25	31.78	25	34.72	25	37.66	25	38.13
31	32.91	Jan. 05	30.75	28	31.48	30	33.37	30	37.92	31	37.14
Nov. 05	32.40	10	31.51	Mar. 05	31.40	May 05	33.46	Jul. 05	41.06	Sep. 05	34.89
10	32.14	15	31.64	10	31.12	10	33.80	08	43.92	10	34.66
15	31.74	20	31.82	15	31.94	15	36.21	10	42.31	15	36.38
20	31.30	25	31.34	20	31.34	20	35.41	15	42.52	20	36.91
25	30.83	31	30.99	25	31.33	25	34.20	20	38.98	25	36.85
30	30.85			31	31.45	31	33.31	25	40.49	30	37.10



## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

450223093231801. Local number, 118N21W07DCB01.

LOCATION.--Lat 45°02'23", long 93°23'18", in NW¼SW¼SE¼ sec.7, T.118 N., R.21 W., Hydrologic Unit 07010206, at 47th Avenue North and Aquila Avenue.

Owner: City of New Hope.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in. (0.41 m), depth 422 ft (129 m), cased to 339 ft (103 m).

DATUM.--Altitude of land-surface datum is 933 ft (284 m). Measuring point: Top of wood platform, 3.00 ft (0.91 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--October 1965 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 60.46 ft (18.43 m) below land-surface datum, Dec. 17, 1967; lowest, 77.56 ft (23.64 m) below land-surface datum, July 11, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	69.68	Dec. 01	68.26	Feb. 01	67.97	Apr. 01	68.28	Jun. 01	68.99	Aug. 01	73.39
05	69.28	05	67.42	05	67.36	05	68.56	05	71.50	05	75.54
10	69.57	10	68.61	10	67.86	10	68.23	10	72.74	10	76.21
15	69.76	15	67.91	15	68.56	15	68.70	15	70.75	15	72.91
20	69.18	20	67.97	20	66.27	20	69.69	20	73.70	20	72.45
25	68.29	25	67.41	25	67.14	25	70.75	25	72.49	25	72.57
31	67.72	31	67.26	28	68.12	30	69.02	30	72.67	31	71.62
Nov. 01	67.85	Jan. 01	67.17	Mar. 01	68.15	May 01	68.88	Jul. 01	72.22	Sep. 01	71.17
20	68.15	05	67.50	05	67.69	05	68.91	05	75.16	05	70.18
25	67.00	10	67.91	10	67.82	10	68.80	10	75.38	10	70.63
30	68.19	15	67.46	15	68.08	15	71.27	15	76.31	15	71.20
		20	67.89	20	67.31	20	70.74	20	72.40	20	72.10
		25	67.65	25	68.09	25	70.28	25	75.28	25	70.67
		31	67.45	31	68.40	31	68.67	31	72.99	30	73.22

445905093224401. Local number, 118N21W32CBB01.

LOCATION.--Lat 44°59'05", long 93°22'44", in NW¼NW¼SW¼ sec.32, T.118 N., R.21 W., Hydrologic Unit 07010206, at Winnetka Avenue and Highway 55, Golden Valley.

Owner: Red Owl Store.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 6 in. (0.16 m), depth 95 ft (29.0 m), screened 87 to 95 ft (26.5 to 29.0 m).

DATUM.--Altitude of land-surface datum is 895 ft (273 m). Measuring point: Top of well cap, 0.80 ft (0.24 m) above land-surface datum.

PERIOD OF RECORD.--May 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 17.72 ft (5.40 m) below land-surface datum, May 12, 1986; lowest, 21.23 ft (6.47 m) below land-surface datum, Mar. 15, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 28	20.69	Jan. 25	21.13	Mar. 15	21.23	May 17	21.16	Aug. 22	21.13	Sep. 26	21.17

445857093223101. Local number, 118N21W32CBD01.

LOCATION.--Lat 44°58'57", long 93°22'31", in SE¼NW¼SW¼ sec.32, T.118 N., R.21 W., Hydrologic Unit 07010206, at 760 Harold Avenue, Golden Valley.

Owner: Golden Valley Methodist Church.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in. (0.15 m), depth 265 ft (80.8 m), cased to 200 ft (61.0 m).

DATUM.--Altitude of land-surface datum is 890 ft (271 m). Measuring point: Top of well cap, 0.70 ft (0.21 m) above land-surface datum.

PERIOD OF RECORD.--February 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.33 ft (9.55 m) below land-surface datum, May 12, 1986; lowest, 39.49 ft (12.04 m) below land-surface datum, Jul. 28, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 28	35.88	Jan. 25	36.46	May 16	37.92	Aug. 22	39.24	Sep. 26	38.30

## GROUND-WATER LEVELS

## HENNEPIN COUNTY--Continued

450854093212801. Local number, 119N21W04BBA01.

LOCATION.--Lat 45°08'54", long 93°21'28", in NE¼NW¼NW¼ sec.4, T.119 N., R.21 W., Hydrologic Unit 07010206, 109th Avenue North, 0.15 mi (0.24 km) east of Zane Avenue North, Brooklyn Park.

Owner: Walter Tessman.

AQUIFER.--Superficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation water-table well, diameter 12 in. (0.30 m), depth 80 ft (24.4 m), screened 62 to 80 ft (18.9 to 24.4 m).

DATUM.--Altitude of land-surface datum is 876 ft (267 m). Measuring point: Hole in pump base, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--September 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 15.18 ft (4.63 m) below land-surface datum, May 13, 1986; lowest, 22.40 ft (6.83 m) below land-surface datum, Jul. 28, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 28	21.52	Jan. 31	21.80	May 16	21.65	Aug. 22	21.67	Sep. 26	21.61

## GROUND-WATER LEVELS

## HOUSTON COUNTY

433935091251801. Local number, 102N05W03DCC01.

LOCATION.--Lat 43°39'35", long 91°25'18", in SW¼SW¼SE¼ sec.3, T.102 N., R.5 W., Hydrologic Unit 07060001, 3 mi (4.8 km) east of Caledonia.

Owner: U.S Geological Survey.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 4 in. (0.10 m), depth 360 ft (110 m), cased to 309 ft (94.2 m).

DATUM.--Altitude of land-surface datum is 1,210 ft (369 m). Measuring point: Top of casing, 2.50 ft (0.76 m) above land-surface datum.

PERIOD OF RECORD.--June 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 213.76 ft (65.15 m) below land-surface datum, July 17, 1985; lowest, 245.50 ft (74.82 m) below land-surface datum, June 4, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Feb. 01	231.59	Jun. 20	233.98	Aug. 23	235.30	Sep. 29	236.23

433935091252001. Local number, 102N05W03DCC02.

LOCATION.--Lat 43°39'35", long 91°25'20", in SW¼SW¼SE¼ sec.3, T.102 N., R.5 W., Hydrologic Unit 07060001, 3 mi (4.8 km) east of Caledonia.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 650 ft (198 m), cased to 614 ft (187 m).

DATUM.--Altitude of land-surface datum is 1,210 ft (369 m). Measuring point: Top of casing, 2.50 ft (0.76 m) above land-surface datum.

PERIOD OF RECORD.--November 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 441.50 ft (134.56 m) below land-surface datum, June 4, 1981; lowest, 450.93 ft (137.44 m) below land-surface datum, Sept. 29, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Feb. 01	449.24	Jun. 20	450.09	Aug. 23	450.92	Sep. 29	450.93

443935091252901. Local number, 102N05W03DCC03.

LOCATION.--Lat 44°39'35", long 91°25'19", in SW¼SW¼SE¼ sec.3, T.102 N., R.5 W., Hydrologic Unit 07060001, 3 mi (4.8 km) east of Caledonia.

Owner: U.S. Geological Survey

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 888 ft (271 m), cased to 858 ft (262 m).

DATUM.--Altitude of land-surface datum is 1,210 ft (369 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--July 1982 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 522.00 ft (159.10 m) below land-surface datum, Nov. 10, 1983; lowest, 526.00 ft (160.32 m) below land-surface datum, Sept. 29, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Feb. 01	525.25	Jun. 20	525.55	Aug. 23	525.93	Sep. 29	526.00

## GROUND-WATER LEVELS

## HUBBARD COUNTY

465142094433201. Local number, 139N32W16AAA01.

LOCATION.--Lat 46°51'42", long 94°43'32", in NE¼NE¼NE¼ sec.16, T.139 N., R.32 W., Hydrologic Unit 07010106, at Badoura Nursery.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in. (0.03 m), depth 21 ft (6.4 m), screened 19 to 21 ft (5.8 to 6.4 m).

DATUM.--Altitude of land-surface datum is 1,419 ft (433 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

REMARKS.--Measured weekly by Archie Hakala.

PERIOD OF RECORD.--September 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.63 ft (3.24 m) below land-surface datum, Sept. 24, 1985; lowest, 15.97 ft (4.87 m) below land-surface datum, Mar. 21, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 04	15.34	Dec. 05	15.56	Feb. 07	15.81	Apr. 04	15.80	Jun. 06	14.81	Aug. 08	15.29
11	15.37	13	15.59	14	15.83	11	15.59	13	14.82	15	15.32
17	15.38	20	15.62	21	15.86	18	15.39	20	14.85	22	15.35
25	15.41	28	15.65	28	15.89	25	15.23	27	14.85	28	15.38
Nov. 01	15.43	Jan. 03	15.67	Mar. 07	15.92	May 02	15.10	Jul. 11	14.96	Sep. 05	15.10
15	15.48	10	15.70	14	15.95	09	15.07	18	15.01	13	14.97
22	15.51	17	15.73	21	15.97	16	14.94	31	15.21	19	14.97
29	15.51	23	15.75	28	15.95	23	14.89			26	14.83
		31	15.78			30	14.82				

## ISANTI COUNTY

453125093181101. Local number, 035N24W14BCD01.

LOCATION.--Lat 45°31'25", long 93°18'11", in SE¼SW¼NW¼ sec.14, T.35 N., R.24 W., Hydrologic Unit 07010207, northwest of Isanti.

Owner: Allen Kluck.

AQUIFER.--Eau Claire - Mount Simon Formations of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 300 ft (91.4 m), cased to 105 ft (32.0 m).

DATUM.--Altitude of land-surface datum is 940 ft (287 m). Measuring point: Hole in pump base, 0.10 ft (0.03 m) above land-surface datum.

PERIOD OF RECORD.--February 1968 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 11.18 ft (3.40 m) below land-surface datum, June 24, 1986; lowest, 15.99 ft (4.87 m) below land-surface datum, Sept. 30, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Dec. 06	15.45	Apr. 07	15.37	Jun. 22	15.36	Aug. 04	15.62	Sep. 30	15.99

453058093175901. Local number, 035N24W14CDC01.

LOCATION.--Lat 45°30'58", long 93°17'59", in SW¼SE¼SW¼ sec.14, T.35 N., R.24 W., Hydrologic Unit 07010207, northwest of Isanti.

Owner: Ernest Kluck.

AQUIFER.--Surficial outwash sand of Pleistocene Age.

WELL CHARACTERISTICS.--Driven unused water-table well, diameter 1½ in. (0.03 m), depth 17 ft (5.18 m), screen information not available.

DATUM.--Altitude of land-surface datum is 930 ft (283 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--March 1968 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.50 ft (0.76 m) below land-surface datum, June 24, 1986; lowest, 10.72 ft (3.27 m) below land-surface datum, Sept. 30, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Dec. 06	8.59	Apr. 07	10.37	Jun. 22	10.01	Aug. 04	10.41	Sep. 30	10.72

## GROUND-WATER LEVELS

## ISANTI COUNTY--Continued

453410093140001. Local number, 036N23W32ACB01.

LOCATION.--Lat 45°34'10", long 93°14'00", in NW¼SW¼NE¼ sec.32, T.36 N., R.23 W., Hydrologic Unit 07010207, in Cambridge.

Owner: City of Cambridge, well 4.

AQUIFER.--Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 20 in. (0.51 m), depth 630 ft (192 m), cased to 352 ft (107 m).

DATUM.--Altitude of land-surface datum is 960 ft (293 m). Measuring point: Edge of vent pipe, 3.00 ft (0.91 m) above land-surface datum.

REMARKS.--Measured weekly by Thomas Minar. Water level affected by pumping.

PERIOD OF RECORD.--July 1972 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 0.60 ft (0.18 m) below land-surface datum, June 21, 1984; lowest, 18.50 ft (5.64 m) below land-surface datum, July 6, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

WATER DATE	LEVEL						
Oct. 06	8.46	Jul. 24	17.00	Aug. 21	18.00	Sep. 11	16.00
Jul. 06	18.50	Aug. 07	17.00	Sep. 05	18.00		

## ITASCA COUNTY

471448093322001. Local number, 055N25W17ACD01.

LOCATION.--Lat 47°14'48", long 93°32'20", in SE¼SW¼NE¼ sec.17, T.55 N., R.25 W., Hydrologic Unit 07010103, at west end of 13th Street NW, Grand Rapids.

Owner: U.S. Geological Survey.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 4 in. (0.10 m), depth 147 ft (44.8 m), screened 143 to 147 ft (43.6 to 44.8 m).

DATUM.--Altitude of land-surface datum is 1,318 ft (402 m). Measuring point: Top of platform, 1.60 ft (0.49 m) above land-surface datum.

PERIOD OF RECORD.--April 1962 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.04 ft (8.85 m) below land-surface datum, June 1, 1966; lowest, 33.92 ft (10.34 m) below land-surface datum, May 17, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Oct. 27	31.45	Jan. 22	32.00	Apr. 25	32.04	Aug. 16	32.90
Dec. 07	31.90	Feb. 26	32.18	Jun. 16	32.52		

## JACKSON COUNTY

434742095191501. Local number, 104N37W19DBD01.

LOCATION.--Lat 43°47'42", long 95°19'15", in SE¼NW¼SE¼ sec.19, T.104 N., R.37 W., Hydrologic Unit 07100001, at Heron Lake.

Owner: City of Heron Lake, old railroad well.

AQUIFER.--Sioux Quartzite of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 16 in. (0.41 m), depth 323 ft (98.4 m), screened 205 to 225 ft (62.5 to 68.6 m).

DATUM.--Altitude of land-surface datum is 1,420 ft (433 m). Measuring point: Edge of breather pipe, 2.60 ft (0.79 m) above land-surface datum.

PERIOD OF RECORD.--August 1972, July 1973, September 1976, July 1978 to current year.

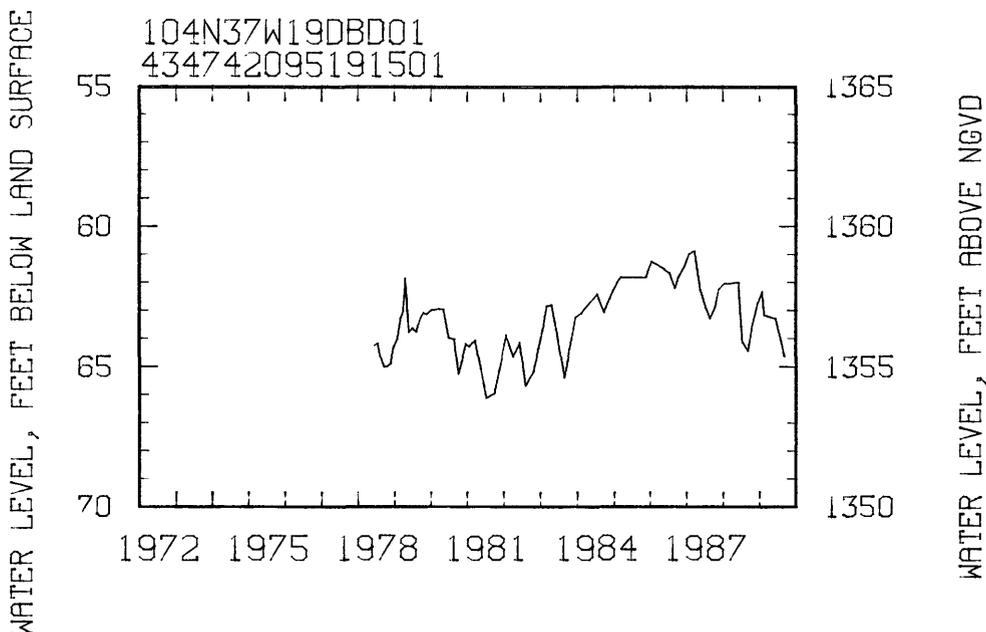
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 59.16 ft (18.03 m) below land-surface datum, Aug. 11, 1972; lowest, 66.10 ft (20.15 m) below land-surface datum, July 14, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Oct. 24	63.48	Dec. 16	62.71	Jan. 31	62.30	Feb. 22	63.15	Jun. 14	63.29	Sep. 14	64.60

GROUND-WATER LEVELS

JACKSON COUNTY--Continued



KANABEC COUNTY

455236093172301. Local number, 039N24W11DDC01.

LOCATION.--Lat 45°52'36", long 93°17'23", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.11, T.39 N., R.24 W., Hydrologic Unit 07030004, intersection of Forest Avenue and U.S. Highway 65.

Owner: City of Mora, well 3.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, diameter 12 in. (0.30 m), depth 170 ft (51.8 m), screened 150 to 170 ft (45.7 to 51.8 m).

DATUM.--Altitude of land-surface datum is 1,011 ft (308 m). Measuring point: Edge of vent pipe, 2.40 ft (0.73 m) above land-surface datum.

PERIOD OF RECORD.--March 1968 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.10 ft (8.87 m) below land-surface datum, May 27, 1986; lowest, 46.34 ft (14.12 m) below land-surface datum, Mar. 13, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 04	45.06	Dec. 05	45.12	Feb. 07	46.05	Apr. 03	45.52	Jun. 05	44.57	Aug. 07	45.40
11	45.41	13	45.58	14	46.16	10	45.88	12	44.50	14	45.40
17	45.10	19	45.05	21	46.09	18	45.50	19	44.90	21	46.00
25	45.25	27	45.40	27	45.65	24	45.54	26	45.10	28	45.60
Nov. 01	45.50	Jan. 04	45.30	Mar. 07	46.29	May 02	45.22	Jul. 03	44.45	Sep. 05	45.45
07	44.84	10	45.40	13	46.34	08	44.92	11	43.02	11	45.40
14	45.23	17	45.80	20	46.11	15	45.10	17	45.14	18	45.90
22	45.22	23	45.63	28	45.75	22	44.83	24	45.30	25	45.40
28	45.17	30	45.82			30	44.60	31	44.90		

## GROUND-WATER LEVELS

## LE SUEUR COUNTY

442522093543901. Local number, 111N26W14ADA01.

LOCATION.--Lat 44°25'22", long 93°54'39", in NE¼SE¼NE¼ sec.14, T.111 N., R.26 W., Hydrologic Unit 07020012, 0.85 mi (1.37 km) south of Le Sueur.

Owner: Merle Moser.

AQUIFER.--Buried gravel of Pleistocene Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in. (0.41 m), depth 242 ft (73.8 m), screened 212 to 242 ft (64.6 to 73.8 m).

DATUM.--Altitude of land-surface datum is 855 ft (261 m). Measuring point: Edge of vent pipe, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--January 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 71.82 ft (21.89 m) below land-surface datum, Feb. 11, 1987; lowest, 84.55 ft (25.77 m) below land-surface datum, Mar. 9, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 02	78.78	Mar. 02	79.57	Apr. 06	79.77	Jun. 14	80.17	Aug. 03	81.06	Sep. 27	81.44

443234093333501 Local number, 112N23W02BAB01.

LOCATION.--Lat 44°32'34", long 93°33'35", in NW¼NE¼NW¼ sec.2, T.112 N., R.23 W., Hydrologic Unit 07020012, just east of New Prague.

Owner: Holy Trinity Lutheran Church.

AQUIFER.--St. Lawrence Formation of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 180 ft (54.9 m), cased to 155 ft (47.2 m).

DATUM.--Altitude of land-surface datum is 1,005 ft (306 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 93.56 ft (28.51 m) below land-surface datum, Feb. 3, 1987; lowest, 99.42 ft (30.30 m) below land-surface datum, July 26, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	96.86	Jan. 24	96.47	Mar. 22	96.18	May 23	96.17	Aug. 15	97.53	Sep. 22	96.87

4431470933374501. Local number, 112N23W06DDD01.

LOCATION.--Lat 44°31'47", long 93°37'45", in SE¼SE¼SE¼ sec.6, T.112 N., R.23 W., Hydrologic Unit 07020012, 3 mi (4.8 km) southwest of New Prague.

Owner: Friedens Lutheran Church.

AQUIFER.--St. Lawrence Formation of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 5 in. (0.13 m), depth 265 ft (80.8 m), cased to 209 ft (63.7 m).

DATUM.--Altitude of land-surface datum is 1,019 ft (311 m). Measuring point: Top of casing, 1.70 ft (0.52 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

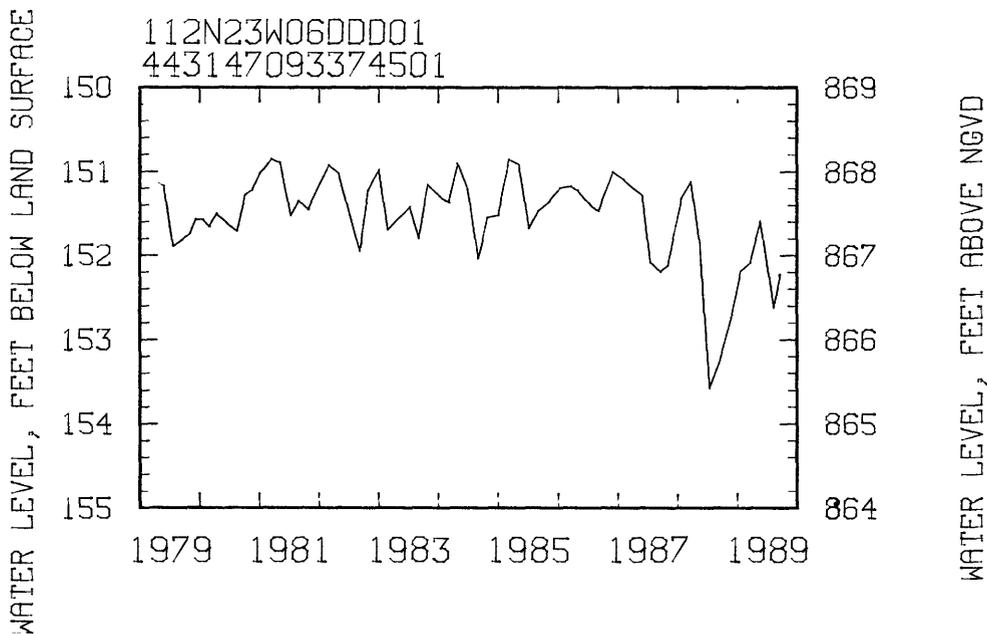
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 150.85 ft (45.97 m) below land-surface datum, Mar. 18, 1981; lowest, 153.58 ft (46.81 m) below land-surface datum, July 19, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	152.67	Jan. 24	152.19	Mar. 22	152.09	May 23	151.59	Aug. 15	152.63	Sep. 22	152.23

## GROUND-WATER LEVELS

LE SUEUR COUNTY--Continued



## LINCOLN COUNTY

441705096084501. Local number, 110N44W33DCD01.

LOCATION.--Lat 44°17'05", long 96°08'45", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec.33, T.110 N., R.44 W., Hydrologic Unit 07020006, at Tyler.

Owner: U.S. Geological Survey.

AQUIFER.--Dakota Sandstone of Early Cretaceous Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 8 in. (0.20 m), depth 967 ft (295 m), screened 890 to 900 ft (271 to 274 m).

DATUM.--Altitude of land-surface datum is 1,738 ft (530 m). Measuring point: Top of recorder platform, 3.50 ft (1.07 m) above land-surface datum.

PERIOD OF RECORD.--November 1969 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 247.41 ft (75.41 m) below land-surface datum, Mar. 23, 1987; lowest, 250.82 ft (76.44 m) below land-surface datum, Nov. 12, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 03	248.60	Jan. 04	248.98	Mar. 06	248.92	May 11	248.80	Jul. 13	248.96	Sep. 14	248.98

## MARTIN COUNTY

434359094422201. Local number, 103N32W08CCD01.

LOCATION.--Lat 43°43'59", long 94°42'22", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.8, T.103 N., R.32 W., Hydrologic Unit 07020009, 1.5 mi (2.4 km) south of Trimont.

Owner: Robert Olson.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 16 in. (0.41 m), depth 412 ft (126 m), screened 372 to 412 ft (113 to 126 m).

DATUM.--Altitude of land-surface datum is 1,242 ft (379 m). Measuring point: Vent pipe, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--July 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 90.50 ft (27.58 m) below land-surface datum, Apr. 14, 1987; lowest, 96.22 ft (29.32 m) below land-surface datum, July 21, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Dec. 01	92.43	Mar. 01	92.27	Apr. 05	92.04	Jun. 14	92.22	Sep. 27	93.95

## GROUND-WATER LEVELS

## MARTIN COUNTY--Continued

434725094483001. Local number, 104N33W28BAB01.

LOCATION.--Lat 43°47'25", long 94°48'30", in NW¼NE¼NW¼ sec.28, T.104 N., R.33 W., Hydrologic Unit 07020009, 6.6 mi (10.6 km) northwest of Trimont.

Owner: Kenneth Schafer.

AQUIFER.--Sioux Quartzite of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in. (0.13 m), depth 178 ft (54.2 m), cased to 121 ft (36.9 m).

DATUM.--Altitude of land-surface datum is 1,290 ft (393 m). Measuring point: Top of casing, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 82.99 ft (25.29 m) below land-surface datum, Apr. 14, 1987; lowest, 85.93 ft (26.19 m) below land-surface datum, Sep. 27, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	85.05	Mar. 01	85.29	Apr. 05	85.19	Jun. 14	85.45	Aug. 02	85.60	Sep. 27	85.93

## MC LEOD COUNTY

444758094132101. Local number, 115N28W05ACC01.

LOCATION.--Lat 44°47'58", long 94°13'21", in SW¼SW¼NE¼ sec.5, T.115 N., R.28 W., Hydrologic Unit 07010205, northwest of Glencoe.

Owner: Graupmann Farms, Inc.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 472 ft (144 m), screened 432 to 472 ft (132 to 144 m).

DATUM.--Altitude of land-surface datum is 1,036 ft (316 m). Measuring point: Edge of vent pipe, 2.00 ft (0.61 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 80.50 ft (24.54 m) below land-surface datum, Aug. 20, 1979; lowest, 109.65 ft (33.42 m) below land-surface datum, Oct. 1, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Nov. 03	90.80	Jan. 31	87.70	Jun. 13	87.88	Aug. 24	99.74	Sep. 26	103.66

444819094164701. Local number, 116N29W35DDC01.

LOCATION.--Lat 44°48'19", long 94°16'47", in SW¼SE¼SE¼ sec.35, T.116 N., R.29 W., Hydrologic Unit 07010205, 1.3 mi (2.1 km) south of Biscay.

Owner: Charles Johnson.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 269 ft (82.0 m), screened 229 to 269 ft (69.8 to 82.0 m).

DATUM.--Altitude of land-surface datum is 1,050 ft (320 m). Measuring point: Edge of vent pipe, 1.00 ft (0.30 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.21 ft (7.37 m) below land-surface datum, Jan. 23, 1986; lowest, 34.80 ft (10.61 m) below land-surface datum, Aug. 26, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Nov. 03	31.97	Jan. 31	32.18	Jun. 13	32.59	Aug. 24	34.80	Sep. 26	34.34

## GROUND-WATER LEVELS

## MC LEOD COUNTY--Continued

445721094031201. Local number 117N27W10DAA01.

LOCATION.--Lat 44°57'21", long 94°03'12", in NE¼NE¼SE¼ sec.10, T.117 N., R.27 W., Hydrologic Unit 07010205, 0.1 mi (0.2 km) south of Winsted.

Owner: Winsted Farmers Coop.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled industrial artesian well, diameter 4 in. (0.10 m), depth 129 ft (39.3 m), screened 125 to 129 ft (38.1 to 39.3 m).

DATUM.--Altitude of land-surface datum is 1,015 ft (309 m). Measuring point: Top of casing, 1.40 ft (0.43 m) above land-surface datum.

PERIOD OF RECORD.--November 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 30.63 ft (9.33 m) below land-surface datum, Dec. 10, 1986; lowest, 45.50 ft (13.87 m) below land-surface datum, Oct. 7, 1987.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Nov. 03	38.51	Jan. 31	39.75	Mar. 16	40.00	Aug. 24	43.27	Sep. 26	40.76

## MEEKER COUNTY

450632094290801. Local number, 119N30W19AAB01.

LOCATION.--Lat 45°06'32", long 94°29'08", in NW¼NE¼NE¼ sec.19, T.119 N., R.30 W., Hydrologic Unit 07010204, on Ted Carlson farm.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1½ in. (0.04 m), depth 26 ft (7.9 m), screened 24 to 26 ft (7.3 to 7.9 m).

DATUM.--Altitude of land-surface datum is 1,130 ft (344 m). Measuring point: Top of casing, 3.30 ft (1.01 m) above land-surface datum.

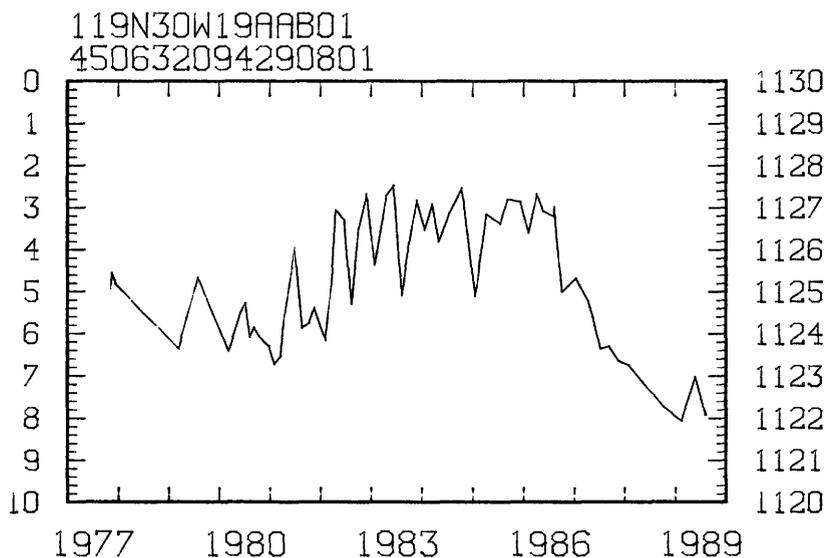
PERIOD OF RECORD.--November 1977 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.47 ft (1.75 m) below land-surface datum, June 14, 1983; lowest 8.09 ft (2.47 m) below land-surface datum, Feb. 13, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 05	7.73	Dec. 02	7.90	Feb. 13	8.09	May 25	7.03	Aug. 08	7.94

WATER LEVEL, FEET BELOW LAND SURFACE



WATER LEVEL, FEET ABOVE NGVD

GROUND-WATER LEVELS

MEEKER COUNTY--Continued

451542094322301. Local number, 121N31W26BDC01.  
 LOCATION.--Lat 45°15'42", long 94°32'23", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.26, T.121 N., R.31 W., Hydrologic Unit 07010204, on Keith Langmo farm.  
 Owner: U.S. Geological Survey.  
 AQUIFER.--Surficial sand of Pleistocene Age.  
 WELL CHARACTERISTICS.--Bored observation water-table well, diameter 1 $\frac{1}{2}$  in. (0.04 m), depth 16 ft (4.9 m), screened 14 to 16 ft (4.3 to 4.9 m).  
 DATUM.--Altitude of land-surface datum is 1,112 ft (339 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.  
 PERIOD OF RECORD.--November 1977 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 2.70 ft (0.82 m) below land-surface datum, Aug. 18, 1986; lowest, 9.16 ft (2.79 m) below land-surface datum, Feb. 13, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

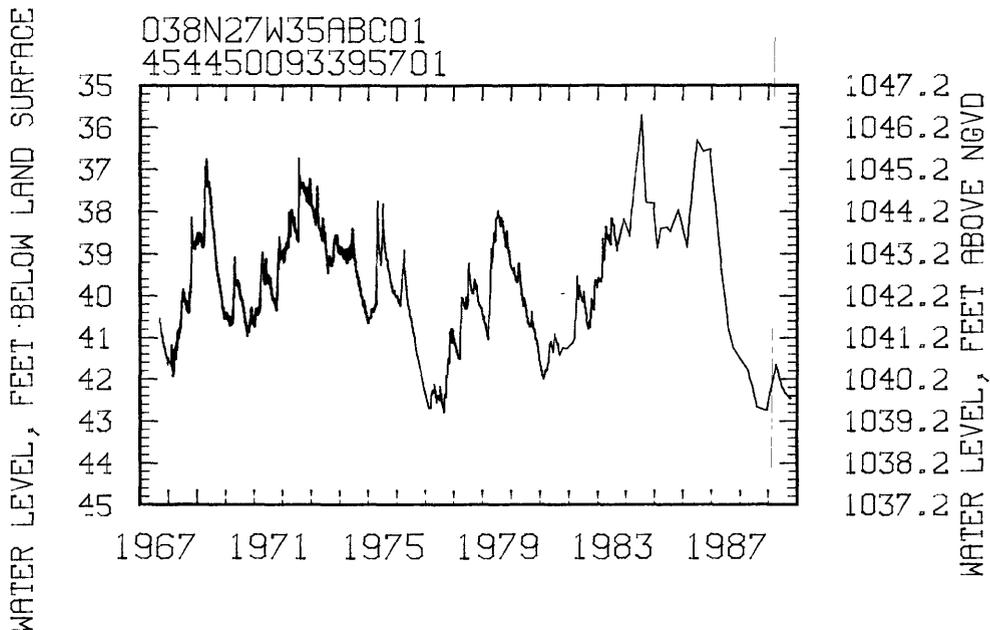
DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 05	8.73	Dec. 02	8.92	Feb. 13	9.16	May 25	8.22	Aug. 08	9.12

MILLE LACS COUNTY

454450093395701. Local number, 038N27W35ABC01.  
 LOCATION.--Lat 45°44'50", long 93°39'57", in SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$  sec.35, T.38 N., R.27 W., Hydrologic Unit 07010207, in Milaca.  
 Owner: City of Milaca, creamery well.  
 AQUIFER.--Buried sand and gravel of Pleistocene Age.  
 WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in. (0.30 m), depth 82 ft (25.0 m), screened 67 to 82 ft (20.4 to 25.0 m).  
 DATUM.--Land-surface datum is 1,082.2 ft (329.8 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of breather pipe, 4.00 ft (1.21 m) above land-surface datum.  
 REMARKS.--Water level affected by pumping.  
 PERIOD OF RECORD.--September 1967 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 35.72 ft (10.89 m) below land-surface datum, July 20, 1984; lowest, 42.81 ft (13.05 m) below land-surface datum, Aug. 27, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Dec. 06	42.77	Apr. 07	41.67	Jun. 22	42.21	Aug. 04	42.36	Sep. 30	42.48



## GROUND-WATER LEVELS

## MORRISON COUNTY

460444094212501. Local number, 130N29W08DCC01.

LOCATION.--Lat 46°04'44", long 94°21'25", in SW¼SW¼SE¼ sec.8, T.130 N., R.29 W., Hydrologic Unit 07010104, at Camp Ripley.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled observation water-table well, diameter 2 in. (0.05 m), depth 59 ft (18.0 m), screened 56 to 59 ft (17.1 to 18.0 m).

DATUM.--Land-surface datum is 1,149.0 ft (350.2 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.10 ft (0.64 m) above land-surface datum.

REMARKS.--Water levels used in monthly Water Resources Review.

PERIOD OF RECORD.--April 1949 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 7.35 ft (2.24 m) below land-surface datum, July 28, 1972; lowest, 19.75 ft (6.02 m) below land-surface datum, Aug. 4, 1961.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 07	17.07	Dec. 09	16.77	Feb. 03	17.42	Apr. 07	16.60	Jun. 02	15.97	Aug. 04	16.56
10	16.75	16	17.08	10	17.42	14	16.13	09	15.81	11	15.92
14	16.82	23	16.86	17	17.24	21	15.95	16	16.57	18	16.29
21	16.75	30	17.12	24	17.51	28	15.89	23	16.10	25	16.21
28	16.58	Jan. 06	16.92	Mar. 03	17.25	May 05	15.96	30	16.66	Sep. 01	16.23
Nov. 04	16.76	13	17.01	10	17.47	12	15.95	Jul. 07	15.67	08	15.88
23	16.88	20	17.18	17	17.26	19	15.94	15	16.00	15	15.83
		27	17.31	24	17.23	26	16.06	21	15.72	22	15.76
				31	16.91			28	16.20	29	15.64

## MOWER COUNTY

434010093010801. Local number, 102N18W05ACB01.

LOCATION.--Lat 43°40'10", long 93°01'08", in NW¼SW¼NE¼ sec.5, T.102 N., R.18 W., Hydrologic Unit 07080201, in Austin.

Owner: Church of Latter Day Saints.

AQUIFER.--Cedar Valley Formation of Middle Devonian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 5 in. (0.13 m), depth 100 ft (30.5 m), cased to 77 ft (23.5 m).

DATUM.--Altitude of land-surface datum is 1,230 ft (375 m). Measuring point: Top of casing, 0.80 ft (0.24 m) above land-surface datum.

PERIOD OF RECORD.--July 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 33.69 ft (10.27 m) below land-surface datum, May 10, 1984; lowest, 38.44 ft (11.71 m) below land-surface datum, July 10, 1985.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	37.27	Mar. 01	37.67	Apr. 05	37.34	Jun. 15	37.60	Aug. 02	38.20	Sep. 28	37.58

434417093521001. Local number, 103N17W09DAA01.

LOCATION.--Lat 43°44'17", long 93°52'10", in NE¼NE¼SE¼ sec.9, T.103 N., R.17 W., Hydrologic Unit 07080201, in Brownsdale.

Owner: Land O'Lakes, creamery well.

AQUIFER.--Cedar Valley Formation of Middle Devonian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in. (0.10 m), depth 130 ft (39.6 m), casing information not available.

DATUM.--Altitude of land-surface datum is 1,280 ft (390 m). Measuring point: Top of well cap, 0.40 ft (0.12 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 35.97 ft (10.96 m) below land-surface datum, May 2, 1984; lowest, 45.20 ft (13.78 m) below land-surface datum, Mar. 30, 1978.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 06	40.80	Jan. 18	40.85	May 02	40.60	Jun. 09	41.23	Jul. 28	41.49
Nov. 18	40.70	Mar. 09	41.28						

## GROUND-WATER LEVELS

## OLMSTED COUNTY--Continued

445538092232601. Local number, 105N13W04CAA01.

LOCATION.--Lat 44°55'38", long 92°23'26", in NW¼NW¼SW¼ sec.4, T.105 N., R.13 W., Hydrologic Unit 07040004, 1 mile (1.6 km) east of Simpson.

Owner: Robert Sheehan.

AQUIFER.--Galena Formation of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in. (0.10 m), depth 75 ft (22.9 m), cased to 23 ft (7.0 m).

DATUM.--Altitude of land-surface datum is 1,270 ft (387 m): Measuring point: Top of well cap, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--March 1987 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 25.19 ft (7.68 m) below land-surface datum, June 1, 1988; lowest, 31.78 ft (9.69 m) below land-surface datum, October 12, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Oct. 12	31.78	Dec. 20	30.88	Feb. 22	31.12	Apr. 26	29.47	Jul. 26	30.50	Sep. 19	31.36
Nov. 21	31.65	Jan. 18	30.73	Mar. 29	30.85	Jun. 27	29.44	Aug. 30	31.62		

## GROUND-WATER LEVELS

## OLMSTED COUNTY

435920092273801. Local number, 106N14W14ADB01.

LOCATION.--Lat 43°59'20", long 92°27'38", in NW¼SE¼NE¼ sec.14, T.106 N., R.14 W., Hydrologic Unit 07040004, in Rochester.

Owner: Golden Hill School Dist. #1371.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in. (0.15 m), depth 478 ft (146 m), cased to 397 ft (121 m).

DATUM.--Altitude of land-surface datum is 1,065 ft (325 m). Measuring point: Edge of well cap, 1.80 ft (0.55 m) above land-surface datum.

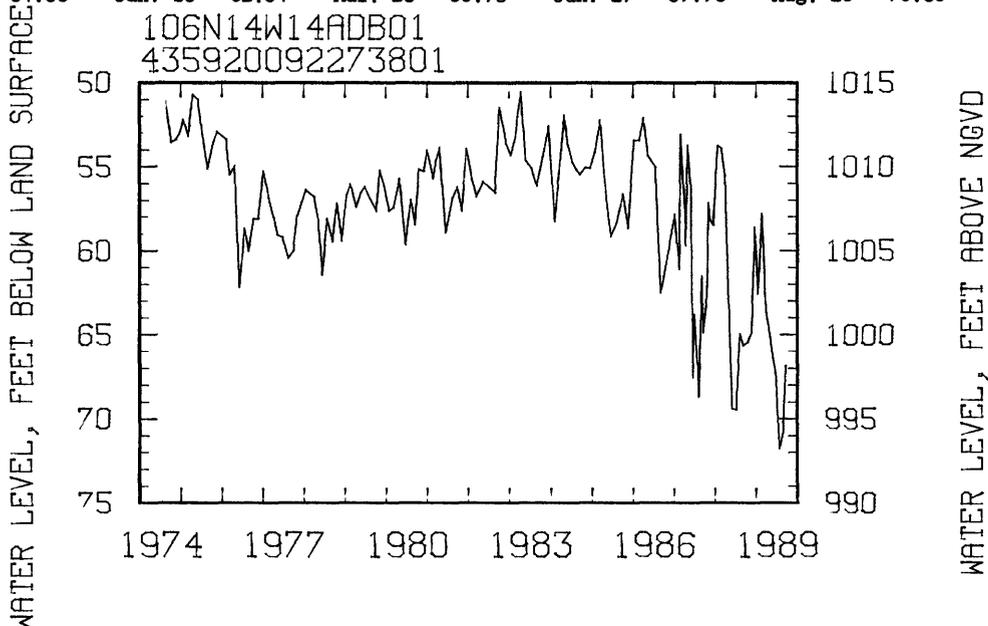
REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--August 1974 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 50.58 ft (15.42 m) below land-surface datum, Apr. 12, 1983; lowest, 71.86 ft (21.90 m) below land-surface datum, July 28, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Oct. 12	65.48	Dec. 20	58.59	Feb. 22	57.78	Apr. 28	64.90	Jul. 26	71.86	Sep. 19	66.86
Nov. 21	64.89	Jan. 18	62.64	Mar. 29	63.75	Jun. 27	67.79	Aug. 29	70.63		



435757092224201. Local number, 106N13W22CCB01.

LOCATION.--Lat 43°5'57", long 92°22'42", in NW¼SW¼SW¼ sec. 22, T.106 N., R.13 W., Hydrologic Unit 07040004, at Burr Oak School.

Owner: Independent School District 535.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 6 in. (0.15 m) depth 510 ft (155 m), cased to 430 ft (131 m).

DATUM.--Altitude of land-surface datum is 1,090 ft (332 m): Measuring point: Top of well cap, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--February 1987 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 28.01 ft (8.54 m) below land-surface datum, Feb. 25, 1987; lowest, 32.18 ft (9.81 m) below land-surface datum, Aug. 30, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Oct. 12	31.10	Dec. 20	31.00	Feb. 22	31.70	Apr. 26	31.53	Jul. 26	31.70	Sep. 19	31.83
Nov. 21	31.40	Jan. 18	31.32	Mar. 29	31.34	Jun. 27	30.94	Aug. 30	32.18		

## GROUND-WATER LEVELS

## RAMSEY COUNTY

445955093011001. Local number, 029N22W14CAB01.

LOCATION.--Lat 44°59'55", long 93°01'10", in NW¼NE¼SW¼ sec.14, T.29 N., R.22 W., Hydrologic Unit 07010206, at Goodrich Golf Course.

Owner: Ramsey County.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 523 ft (159 m), cased to 303 ft (92.4 m).

DATUM.--Altitude of land-surface datum is 969 ft (295 m). Measuring point: Edge of vent pipe, 2.50 ft (0.76 m) above land-surface datum.

PERIOD OF RECORD.--May 1965, April 1966 to August 1966, August 1971, May 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 124.62 ft (37.98 m) below land-surface datum, Feb. 6, 1987; lowest, 140.60 ft (42.85 m) below land-surface datum, Apr. 6, 1966.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	129.72	Jan. 17	129.86	Mar. 31	130.10	May 15	136.11	Jul. 24	139.19	Sep. 18	136.53

445955093011002. Local number, 029N22W14CAB02.

LOCATION.--Lat 44°59'55", long 93°01'10", in NW¼NE¼SW¼ sec.14, T.29 N., R.22 W., Hydrologic Unit 07010206, at Goodrich Golf Course.

Owner: U.S. Geological Survey.

AQUIFER.--Buried gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation artesian well, diameter 2 in. (0.05 m), depth 81 ft (24.7 m), screened 78 to 81 ft (23.8 to 24.7 m).

DATUM.--Altitude of land-surface datum is 970 ft (296 m). Measuring point: Top of casing, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--October 1966 to August 1971, August 1977, June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 30.80 ft (9.38 m) below land-surface datum, Oct. 28, 1986; lowest, 45.36 ft (13.83 m) below land-surface datum, June 3, 1968.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	38.10	Jan. 17	38.88	Mar. 31	39.59	May 15	39.84	Jul. 24	39.65	Sep. 18	38.42

445955093011003. Local number, 029N22W14CAB03.

LOCATION.--Lat 44°59'55", long 93°01'10", in NW¼NE¼SW¼ sec.14, T.29 N., R.22 W., Hydrologic Unit 07010206, at Goodrich Golf Course.

Owner: U.S. Geological Survey.

AQUIFER.--Buried gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in. (0.05 m), depth 52 ft (15.8 m), screened 49 to 52 ft (14.9 to 15.8 m).

DATUM.--Altitude of land-surface datum is 970 ft (296 m). Measuring point: Top of casing, 1.80 ft (0.55 m) above land-surface datum.

PERIOD OF RECORD.--October 1966 to August 1971, June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 8.97 ft (2.73 m) below land-surface datum, Oct. 28, 1986; lowest, 25.43 ft (7.75 m) below land-surface datum, June 3, 1968.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	20.72	Jan. 17	21.65	Mar. 31	22.97	May 15	23.26	Jul. 24	23.57	Sep. 18	22.23

GROUND-WATER LEVELS

RAMSEY COUNTY--Continued

450001093024701. Local number, 029N22W16ADD01.

LOCATION.--Lat 45°00'01", long 93°02'47", in SE½SE¼NE¼ sec.16, T.29 N., R.22 W., Hydrologic Unit 07010206, at 1955 English St.

Owner: Maplewood Bowl.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in. (0.10 m), depth 163 ft (49.7 m), screened 158 to 163 ft (48.2 to 49.7 m).

DATUM.--Altitude of land-surface datum is 900 ft (274 m). Measuring point: Top of well cap, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--January 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 65.99 ft (20.11 m) below land-surface datum, Feb. 6, 1987; lowest, 73.18 ft (22.31 m) below land-surface datum, Jan. 14, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	71.27	Jan. 17	71.70	Mar. 13	71.83	May 15	71.76	Jul. 24	72.40	Sep. 18	72.85

445918092590901. Local number, 029N22W24ADA01.

LOCATION.--Lat 44°59'18", long 92°59'09", in NE½SE¼NE¼ sec.24, T.29 N., R.22 W., Hydrologic Unit 07010206, at 1555 Century Avenue.

Owner: Northern States Power Co., Maplewood Gas Plant.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled fire protection artesian well, diameter 12 in. (0.30 m), depth 523 ft (159 m), cased to 420 ft (128 m).

DATUM.--Land-surface datum is 996.5 ft (303.7 m) National Geodetic Vertical Datum of 1929. Measuring point: Edge of 2 in (0.05 m) breather pipe, 2.40 ft (0.73 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--August 1970 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 131.90 ft (40.20 m) below land-surface datum, Mar. 9, 1987; lowest, 151.0 ft (46.02 m) below land-surface datum, May 14, 1981.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 30	135.90	Jan. 31	137.06	May 15	141.92	Jul. 24	148.30

445700093051001. Local number, 029N22W31DDD01.

LOCATION.--Lat 44°57'00", long 93°05'10", in SE½SE¼SE¼ sec.31, T.29 N., R.22 W., Hydrologic Unit 07010206, at 261 East 5th Street, St. Paul.

Owner: Control Data Corp.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in. (0.30 m), depth 298 ft (91 m), cased to 151 ft (46.0 m).

DATUM.--Altitude of land-surface datum is 750 ft (229 m). Measuring point: Top of recorder platform, 9.00 ft (2.74 m) below land-surface datum.

REMARKS.--Water level affected by pumping of nearby wells.

PERIOD OF RECORD.--December 1971 to current year.

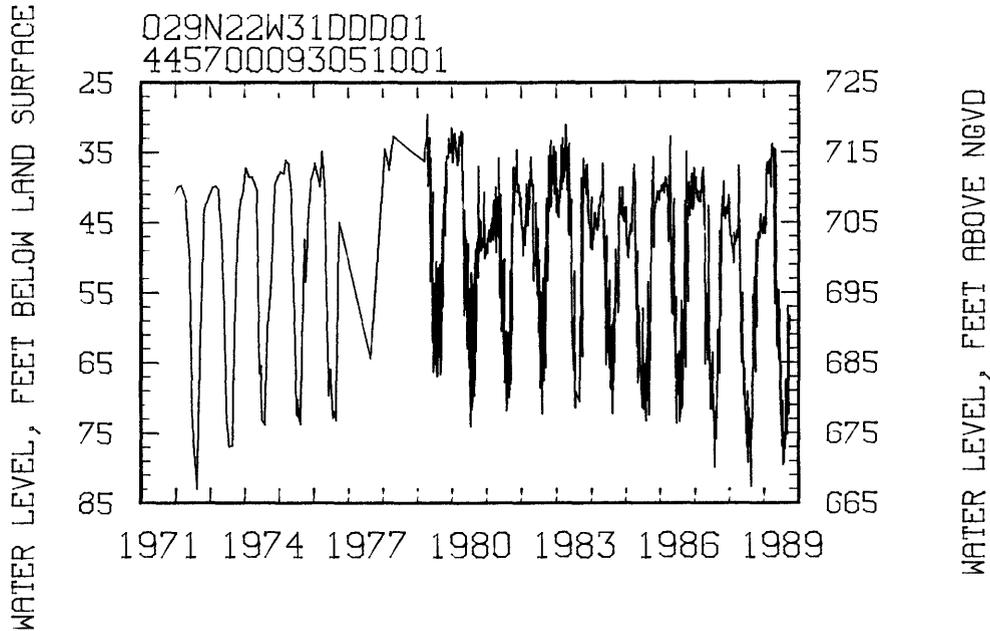
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 28.76 ft (8.76 m) below land-surface datum, Apr. 7, 1986; lowest, 83.28 ft (25.38 m) below land-surface datum, Aug. 4, 1989.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	55.54	Dec. 01	46.19	Feb. 01	37.68	Apr. 01	34.31	Jun. 01	62.16	Aug. 01	79.16
05	47.58	05	46.04	05	37.95	05	35.51	05	64.49	05	75.32
10	55.06	10	45.64	10	37.93	10	34.43	10	57.47	10	77.33
15	59.89	15	46.59	15	38.08	15	36.77	15	63.96	15	74.79
20	48.96	20	45.15	20	36.37	20	53.75	20	72.29	20	67.41
25	48.31	25	44.33	25	36.45	25	56.63	25	65.45	25	74.24
31	46.45	31	44.88	28	36.88	30	34.54	30	74.02	31	75.27
Nov. 01	47.00	Jan. 01	44.47	Mar. 01	37.52	May 01	36.77	Jul. 01	68.94	Sep. 01	69.41
05	46.45	05	44.23	05	36.02	05	37.06	05	74.49	05	72.45
10	47.33	10	46.58	10	37.06	10	56.13	10	76.95	10	56.80
15	46.72	15	44.42	15	40.05	15	62.78	15	70.54	15	65.23
20	45.48	20	45.43	20	35.13	20	56.31	20	75.41	20	72.29
25	43.77	25	37.48	25	33.76	25	61.97	25	79.54	25	58.26
30	46.23	31	36.46	31	35.65	31	54.64	31	77.90	30	60.23

GROUND-WATER LEVELS

RAMSEY COUNTY--Continued



450026093084201. Local number, 029N23W11CCC01.  
 LOCATION.--Lat 45°00'26", long 93°08'42", in SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.11, T.29 N., R.23 W., Hydrologic Unit 07010206, at 2204 North Lexington Avenue, Roseville.  
 Owner: Lexington Court Apartments.  
 AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.  
 WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in. (0.15 m), depth 325 ft (99.1 m), cased to 192 ft (58.5 m).  
 DATUM.--Altitude of land-surface datum is 945 ft (288 m). Measuring point: Top of well cap, 1.40 ft (0.43 m) above land-surface datum.  
 PERIOD OF RECORD.--January 1971 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 104.77 ft (31.93 m) below land-surface datum, Mar. 30, 1987; lowest, 111.19 ft (33.89 m) below land-surface datum, Aug. 18, 1975.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	107.95	Jan. 17	107.99	Mar. 13	108.22	May 10	108.60	Jul. 24	110.63	Sep. 18	109.99

## GROUND-WATER LEVELS

## RAMSEY COUNTY--Continued

445751093072301. Local number, 029N23W25CCD01.

LOCATION.--Lat 44°57'51", long 93°07'23", SE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.25, T.29 N., R.23 W., Hydrologic Unit 07010206, at 760 North Dale Street, St. Paul.

Owner: Burlington Northern, Inc., Dale Street Shops.

AQUIFER.--Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 8 in. (0.20 m), depth 999 ft (304 m), cased to 955 ft (291 m).

DATUM.--Land-surface datum is 859.5 ft (262.0 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder floor, 4.60 ft (1.40 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--December 1970, November 1976 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 161.05 ft (49.08 m) below land-surface datum, May 10, 1980; lowest, 226.05 ft (68.90 m) below land-surface datum, Sept. 18, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	220.60	Dec. 01	218.66	Feb. 01	216.05	Apr. 01	213.00	Jun. 01	214.60	Aug. 01	220.28
05	220.61	05	218.48	05	215.85	05	212.94	05	214.21	05	221.32
10	220.01	10	218.51	10	215.64	10	213.42	10	214.95	10	222.51
15	220.81	15	218.62	15	215.48	15	213.78	15	214.95	15	223.18
20	221.18	20	218.10	20	214.78	20	213.55	20	214.76	20	224.00
25	220.98	25	218.02	25	214.23	25	213.58	25	215.27	25	225.10
31	220.73	31	217.02	28	214.13	30	214.07	30	215.72	31	225.59
Nov. 01	220.68	Jan. 01	216.75	Mar. 01	214.39	May 01	214.03	Jul. 01	215.76	Sep. 01	225.92
05	220.58	05	216.67	05	214.43	05	213.60	05	215.63	05	225.88
10	220.74	10	216.74	10	214.04	10	213.86	10	215.87	10	225.86
15	219.95	15	216.68	15	213.28	15	213.93	15	217.05	15	225.90
20	220.35	20	217.15	20	212.88	20	214.30	20	217.78	20	225.25
25	218.96	25	216.34	25	213.05	25	214.38	25	218.76	25	225.16
30	218.59	31	215.46	31	213.02	31	214.59	31	220.13	30	225.28

445739093081201. Local number, 029N23W35BAD01.

LOCATION.--Lat 44°57'39", long 93°08'12", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.35, T.29 N., R.23 W., Hydrologic Unit 07010208, Victoria Street, 0.35 mi (0.56 km) north of University Avenue.

Owner: City of St. Paul.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 16 in. (0.41 m), depth 234 ft (71.3 m), screened 174 to 234 ft (53.0 to 71.3 m).

DATUM.--Altitude of land-surface datum is 888 ft (261 m). Measuring point: Top of coupling, 0.50 ft (0.15 m) above land-surface datum.

PERIOD OF RECORD.--May 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 118.83 ft (36.21 m) below land-surface datum, Feb. 2, 1987; lowest, 133.03 ft (40.54 m) below land-surface datum, May 5, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	120.35	Jan. 17	119.76	Mar. 13	119.37	May 10	119.92	Jul. 24	120.95	Sep. 15	121.10

450414093012701. Local number, 030N22W23CBB01.

LOCATION.--Lat 45°04'14", long 93°01'27", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.23, T.30 N., R.22 W., Hydrologic Unit 07010206, Hoffman Road, 0.85 mi (1.4 km) southwest of Highway 61.

Owner: White Bear Town Hall.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 96 ft (29.3 m), screened 91 to 96 ft (27.7 to 29.3 m).

DATUM.--Altitude of land-surface datum is 928 ft (283 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--April 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 17.54 ft (5.34 m) below land-surface datum, Oct. 28, 1986; lowest, 27.85 ft (8.49 m) below land-surface datum, Sept. 21, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 15	25.62	Jan. 27	25.72	Apr. 04	25.72	May 22	26.62	Aug. 16	27.63	Sep. 21	27.85

## GROUND-WATER LEVELS

## RAMSEY COUNTY--Continued

450238093082501. Local number, 030N23W35BDC01.

LOCATION.--Lat 45°02'38", long 93°08'25", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.35, T.30 N., R.23 W., Hydrologic Unit 07010206, southeast corner of Arbogast Street and Richmond Avenue.  
Owner: City of Shoreview.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 12 in. (0.30 m), depth 510 ft (155 m), cased to 465 ft (142 m).

DATUM.--Altitude of land-surface datum is 960 ft (293 m). Measuring point: Hole in shelter floor, 1.50 ft (0.46 m) above land-surface datum.

PERIOD OF RECORD.--April 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 129.26 ft (39.39 m) below land-surface datum, Mar. 1, 1987; lowest, 146.01 ft (44.50 m) below land-surface datum, July 28, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	135.03	Jan. 01	138.00	Mar. 01	139.49	May 01	135.28	Jul. 01	143.18	Sep. 01	143.60
05	134.85	05	138.13	05	135.91	05	135.04	05	143.78	05	139.23
10	135.29	10	138.68	10	135.28	10	135.12	10	144.37	10	139.43
15	134.61	15	138.56	15	135.18	15	136.21	15	145.12	15	138.56
20	134.80	20	139.07	20	134.98	20	136.82	20	144.50	20	142.69
25	134.27	25	138.78	25	134.93	25	136.86	25	145.01	25	142.39
30	134.50	31	138.62	31	135.15	31	136.04	31	144.74	30	143.05
Dec. 01	134.55	Feb. 01	139.13	Apr. 01	135.10	Jun. 01	136.11	Aug. 01	144.73		
05	134.21	05	138.98	05	135.03	05	136.34	05	142.80		
10	134.53	10	139.13	10	134.89	10	140.74	10	141.44		
15	134.81	15	139.56	15	135.70	15	140.65	15	143.47		
20	134.23	20	138.74	20	135.34	20	141.52	20	143.11		
25	138.12	25	139.06	25	135.54	25	142.20	25	143.60		
31	138.15	28	139.36	30	135.54	30	142.65	31	143.47		

## REDWOOD COUNTY

441323095280701. Local number, 109N38W30BBD01.

LOCATION.--Lat 44°13'23", long 95°28'07", in SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.30, T.109 N., R.38 W., Hydrologic Unit 07020008, at city of Walnut Grove.

Owner: Plum Creek Cheese Co.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 5 in. (0.13 m), depth 240 ft (73.2 m), casing depth not available.

DATUM.--Altitude of land-surface datum is 1,218 ft (371 m). Measuring point: Top of well seal, 0.55ft (0.17 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 24.20 ft (7.37 m) below land-surface datum, April 3, 1984; lowest, 26.80 ft (8.16 m) below land-surface datum, Sept. 26, 1984.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 24	26.41	Jan. 31	26.22	May 24	26.07	Jul. 27	26.17	Sep. 15	26.36
Dec. 16	26.27	Feb. 22	26.29						

## RICE COUNTY

441912093162901. Local number, 110N20W19BDC01.

LOCATION.--Lat 44°19'12", long 93°16'29", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.19, T.110 N., R.20 W., Hydrologic Unit 07040002, just north of Faribault.

Owner: St. Lawrence Cemetery Assn.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 400 ft (122 m), cased to 357 ft (110 m).

DATUM.--Altitude of land-surface datum is 985 ft (300 m). Measuring point: Top of casing, 1.60 ft (0.49 m) above land-surface datum.

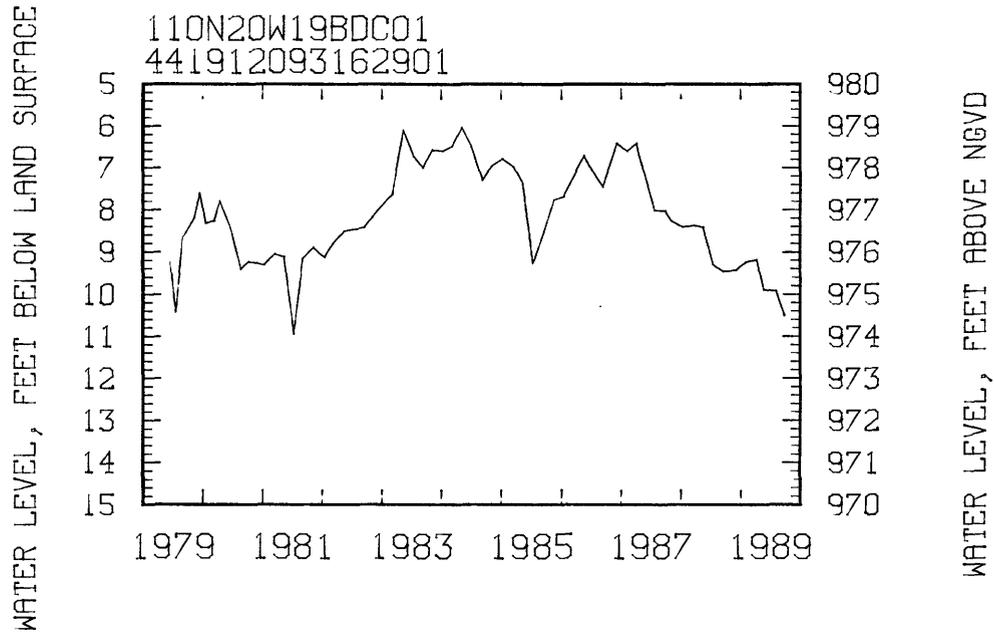
PERIOD OF RECORD.--June 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 6.02 ft (1.83 m) below land-surface datum, May 2, 1984; lowest: 10.94 ft (3.33 m) below land-surface datum, July 10, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 01	9.42	Jan. 24	9.24	Apr. 05	9.17	May 17	9.89	Aug. 02	9.93	Sep. 22	10.50

## GROUND-WATER LEVELS



442543093113701. Local number, 111N20W11CDC01.

LOCATION.--Lat 44°25'43", long 93°11'37", in SW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.11, T.111 N., R.20 W., Hydrologic Unit 07040002, Highway 218 at Dundas.

Owner: Rollie Green.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled commercial artesian well, diameter 4 in. (0.10 m), depth 158 ft (48.2 m), cased to 101 ft (30.8 m).

DATUM.--Altitude of land-surface datum is 950 ft (290 m). Measuring point: Top of casing, 2.00 ft (0.61 m) above land-surface datum.

PERIOD OF RECORD.--October 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 21.72 ft (6.62 m) below land-surface datum, May 14, 1986; lowest, 27.24 ft (8.30 m) below land-surface datum, Jan. 12, 1982.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 01	25.13	Jan. 24	25.12	Apr. 05	24.28	May 17	24.20	Aug. 02	25.07	Sep. 22	25.35

442751093240701. Local number, 112N21W31CBB01.

LOCATION.--Lat 44°27'51", long 93°24'07", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.31, T.112 N., R.21 W., Hydrologic Unit 07040002, 1.0 mi (1.6 km) south of Highway 19.

Owner: Trondhjem Church.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 276 ft (84.1 m), cased to 232 ft (70.7 m).

DATUM.--Altitude of land-surface datum is 1,130 ft (344 m). Measuring point: Top of casing, 1.10 ft (0.34 m) above land-surface datum.

PERIOD OF RECORD.--June 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 136.06 ft (41.47 m) below land-surface datum, Sept. 21, 1987; lowest, 141.8 ft (43.22 m) below land-surface datum, Oct. 30, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	139.46	Jan. 24	139.58	Mar. 22	139.74	May 17	139.68	Aug. 15	140.16	Sep. 22	140.11

## GROUND-WATER LEVELS

## SCOTT COUNTY

443732093460301. Local number, 113N24W06BCB01.

LOCATION.--Lat 44°37'32", long 93°46'03", in NW¼SW¼NW¼ sec.6, T.113 N., R.24 W., Hydrologic Unit 07020012, in Belle Plaine.

Owner: Creative Tool and Engineering. Formerly Belle Plaine Coop Creamery.

AQUIFER.--Buried sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 12 in. (0.30 m), depth 272 ft (82.9 m), screen information not available.

DATUM.--Altitude of land-surface datum is 840 ft (256 m). Measuring point: Top of well cap, 2.30 ft (0.70 m) above land-surface datum.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 116.77 ft (35.59 m) below land-surface datum, July 11, 1983; lowest, 143.96 ft (43.87 m) below land-surface datum, July 9, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 02	121.32	Mar. 02	121.33	Mar. 21	121.04	Jun. 14	120.70	Aug. 03	121.00	Sep. 27	121.59

443352093423001. Local number, 113N24W28DAA01.

LOCATION.--Lat 44°33'52", long 93°42'30", in NE¼NE¼SE¼ sec.28, T.113 N., R.24 W., Hydrologic Unit 07020012, at Michelle Wildlife Area.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in. (0.15 m), depth 450 ft (137 m), cased to 219 ft (66.8 m).

DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Top of well seal, 2.30 ft (0.70 m) above land-surface datum.

PERIOD OF RECORD.--August 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 131.70 ft (40.14 m) below land-surface datum, May 2, 1984; lowest, 137.07 ft (41.78 m) below land-surface datum, Aug. 15, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	133.00	Jan. 24	132.99	Mar. 27	132.86	May 23	134.87	Aug. 15	137.07	Sep. 22	136.49

443352093423002. Local number, 113N24W28DAA02.

LOCATION.--Lat 44°33'52", long 93°42'30", in NE¼NE¼SE¼ sec.28, T.113 N., R.24 W., Hydrologic Unit 07020012, at Michelle Wildlife Area.

Owner: U.S. Geological Survey.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 2 in. (0.05 m), depth 655 ft (200 m), screened 650 to 655 ft (198 to 200 m).

DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Top of casing, 3.00 ft (0.91 m) above land-surface datum.

PERIOD OF RECORD.--August 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 221.1 ft (67.39 m) below land-surface datum, May 3, 1983; lowest, 225.79 ft (68.82 m) below land-surface datum, Sept. 13, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	224.73	Jan. 24	224.59	Mar. 27	222.74

## GROUND-WATER LEVELS

## SCOTT COUNTY--Continued

443715093480801. Local number, 113N25W02CAC01.

LOCATION.--Lat 44°37'15", long 93°48'08", in SW¼NE¼SW¼ sec.2, T.113 N., R.25 W., Hydrologic Unit 07020012, 0.75 mi (1.21 km) west of Belle Plaine at Shep's Gravel Pit.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.04 m), depth 323 ft (98.4 m), cased to 193 ft (58.8 m).

DATUM.--Altitude of land-surface datum is 750 ft (229 m). Measuring point: Top of casing, 0.25 ft (0.08 m) above land-surface datum.

PERIOD OF RECORD.--October 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 5.59 ft (1.70 m) below land-surface datum, May 7, 1986; lowest, 10.86 ft (3.31 m) below land-surface datum, Sept. 27, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL								
Dec. 02	10.49	Apr. 06	9.65	Jun. 14	9.87	Aug. 03	10.28	Sep. 27	10.86

444025093220801. Local number, 114N21W20BAA01.

LOCATION.--Lat 44°40'25", long 93°22'08", in NE¼NE¼NW¼ sec.20, T.114 N., R.21 W., Hydrologic Unit 07020012, 0.5 mi (0.8 km) east of Credit River.

Owner: Credit River Town Hall.

AQUIFER.--Buried sand of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 98 ft (29.9 m), screened 93 to 98 ft (28.4 to 29.9 m).

DATUM.--Altitude of land-surface datum is 946 ft (288 m). Measuring point: Top of casing, 1.10 ft (0.34 m) above land-surface datum.

PERIOD OF RECORD.--September 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 34.00 ft (10.36 m) below land-surface datum, Feb. 3, 1987; lowest, 40.72 ft (12.41 m) below land-surface datum, July 16, 1981.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	37.84	Jan. 24	38.08	Mar. 24	37.68	May 17	38.26	Aug. 15	40.29	Sep. 22	39.27

443752093254401. Local number, 114N22W35DCC01.

LOCATION.--Lat 44°37'52", long 93°25'44", in SW¼SW¼SE¼ sec.35, T.114 N., R.22 W., Hydrologic Unit 07020012, southwest of Credit River.

Owner: St. Catherine's Church.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 235 ft (71.6 m), cased to 194 ft (59.1 m).

DATUM.--Altitude of land-surface datum is 1,015 ft (309 m). Measuring point: Top of casing, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--September 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 83.27 ft (25.38 m) below land-surface datum, Dec. 4, 1986; lowest, 90.30 ft (27.52 m) below land-surface datum, Sept. 6, 1979.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 05	86.01	Jan. 24	86.59	Mar. 24	87.05	May 17	86.87	Aug. 15	87.55	Sep. 22	87.32

## GROUND-WATER LEVELS

## SCOTT COUNTY--Continued

444633093212901. Local number, 115N21W09CCC01.

LOCATION.--Lat 44°46'33", long 93°21'29", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.9, T.115 N., R.21 W., Hydrologic Unit 07020012, at Savage waste treatment plant.

Owner: City of Savage, well 2.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age and Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled public-supply artesian well, depth 846 ft (258 m), 16 in (0.41 m) casing 0 ft to 280 ft (85.3 m), 10 in (0.25 m) casing 250 ft to 660 ft (85.3 m to 201 m).

DATUM.--Land-surface datum is 730 ft (222.5 m). Measuring point: Edge of vent pipe 0.75 ft (0.23 m) above land-surface datum.

PERIOD OF RECORD.--February 1971 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 18.98 ft (5.79 m) below land-surface datum, Aug. 9, 1979; lowest, 80.65 ft (24.58 m) below land-surface datum, July 12, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Dec. 02	72.35	Jan. 20	68.31	Mar. 14	68.05

444427093353901. Local number, 115N23W28BDD01.

LOCATION.--Lat 44°44'27", long 93°43'53", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.28, T.115 N., R.23 W., Hydrologic Unit 07020012, Merriam Junction.

Owner: Chicago and Northwestern Transportation Company.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 16 in. (0.40 m), depth 140 ft (42.7 m), cased to 75 ft (22.9 m).

DATUM.--Altitude of land-surface datum is 758 ft (231 m). Measuring point: Top of casing, 0.90 ft (0.27 m) above land-surface datum.

PERIOD OF RECORD.--November 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 25.75 ft (7.84 m) below land-surface datum, Mar. 8, 1985; lowest, 42.84 ft (13.06 m) below land-surface datum, Jan. 20, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 03	41.69	Jan. 20	42.84	Mar. 14	42.26	May 18	42.11	Aug. 14	42.25	Sep. 27	42.36

444427093353902. Local number, 115N23W28BDD02.

LOCATION.--Lat 44°44'27", long 93°35'39", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec.28, T.115 N., R.23 W., Hydrologic Unit 07020012, Merriam Junction.

Owner: Chicago and Northwestern Transportation Company.

AQUIFER.--Ironton-Galesville Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 355 ft (108 m), screened 350 to 355 ft (107 to 108 m).

DATUM.--Altitude of land-surface datum is 758 ft (231 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--November 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 20.52 ft (6.25 m) below land-surface datum, Mar. 21, 1986; lowest, 43.99 ft (13.14 m) below land-surface datum, July 14, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	31.52	Dec. 01	25.84	Feb. 01	26.63	Apr. 01	26.97	Jun. 01	33.54	Aug. 01	36.84
05	32.04	05	25.21	05	24.77	05	29.00	05	32.70	05	38.26
10	30.08	10	25.26	10	24.30	10	27.62	10	36.40	10	39.11
15	29.70	15	25.05	15	25.69	15	30.85	15	36.92	15	36.46
20	31.60	20	24.63	20	24.18	20	31.65	20	37.66	20	34.63
25	30.58	25	24.57	25	25.19	25	31.54	25	34.51	25	37.08
31	29.34	31	24.19	28	24.34	30	27.65	30	35.97	31	36.37
Nov. 01	30.24	Jan. 01	24.10	Mar. 01	24.36	May 01	29.00	Jul. 01	35.42	Sep. 01	36.57
05	28.73	05	23.93	05	24.25	05	28.52	05	33.97	05	33.87
10	30.82	10	24.01	10	29.46	10	30.16	10	36.84		
15	29.17	15	23.92	15	26.88	15	30.09	15	38.47		
20	26.77	20	24.19	20	27.72	20	34.22	20	36.41		
25	25.65	25	24.65	25	26.92	25	33.68	25	37.54		
30	25.91	31	26.65	31	28.38	31	32.46	31	35.44		

GROUND-WATER LEVELS

SCOTT COUNTY--Continued

444427093353903. Local number, 115N23W28BDD03.

LOCATION.--Lat 44°44'27", long 93°35'39", in SE¼SE¼NW¼ sec.28, T.115 N., R.23 W., Hydrologic Unit 07020012, Merriam Junction.

Owner: Chicago and Northwestern Transportation Company.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 525 ft (160 m), screened 520 to 525 ft (158 to 160 m).

DATUM.--Altitude of land-surface datum is 758 ft (231 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--November 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 33.85 ft (10.31 m) below land-surface datum, Mar. 8, 1985; lowest, 55.12 ft (16.80 m) below land-surface datum, Aug. 1, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 01	49.80	Dec. 01	46.04	Feb. 01	44.58	Apr. 01	44.44	Jun. 01	45.35	Aug. 01	53.44
05	49.72	05	45.92	05	44.65	05	44.40	05	45.40	05	53.38
10	49.08	10	45.98	10	44.48	10	44.62	10	46.53	10	53.42
15	44.12	15	45.89	15	44.86	15	44.50	15	47.20	15	53.67
20	48.73	20	45.20	20	44.51	20	44.51	20	47.30	20	53.57
25	48.12	25	45.07	25	44.43	25	44.70	25	48.30	25	53.62
31	47.80	31	44.44	28	44.43	30	45.10	30	48.81	31	53.37
Nov. 01	47.65	Jan. 01	44.36	Mar. 01	44.48	May 01	45.10	Jul. 01	48.80	Sep. 01	53.26
05	47.10	05	44.04	05	44.63	05	44.65	05	49.08	05	52.63
10	47.23	10	44.28	10	44.33	10	44.57	10	50.13	10	52.04
15	46.75	15	44.24	15	44.28	15	44.67	15	51.28	15	51.70
20	46.71	20	44.43	20	44.69	20	45.39	20	52.37	20	52.08
25	46.14	25	44.27	25	44.58	25	45.20	25	52.45	25	52.34
30	46.01	31	44.16	31	44.45	31	45.34	31	53.35	30	52.17

SHERBURNE COUNTY

452938093432701. Local number, 035N27W29DBB02.

LOCATION.--Lat 45°29'38", long 93°43'27", in NW¼NW¼SE¼ sec.29, T.35 N., R.27 W., Hydrologic Unit 07010203, 3.2 mi (5.2 km) north of Orrrock in Sherburne National Wildlife Refuge.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2½ in. (0.05 m), depth 15 ft (4.6 m), screened 13 to 15 ft (4.0 to 4.6 m).

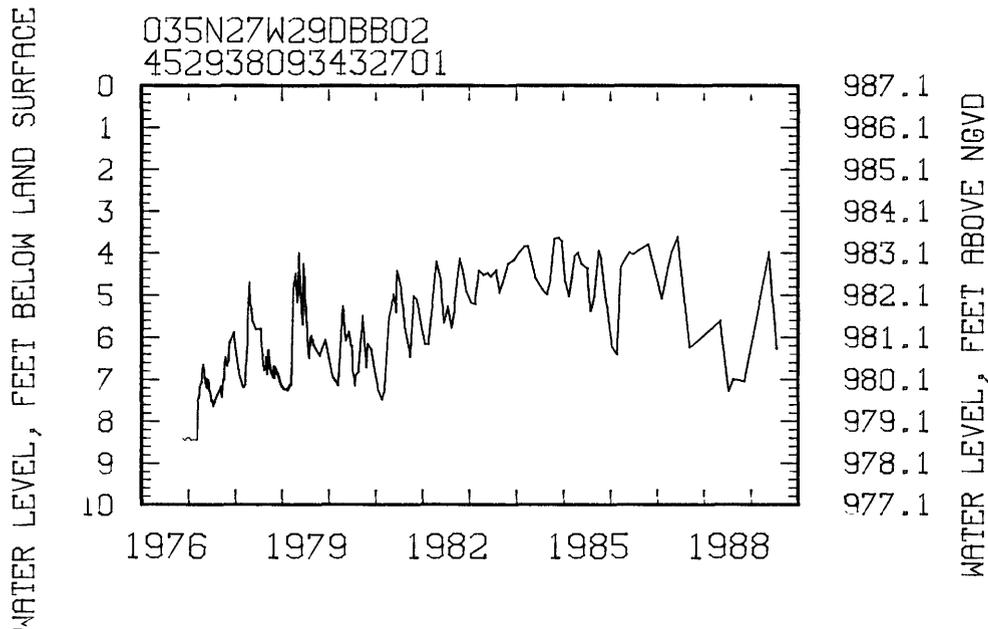
DATUM.--Land-surface datum is 987.1 ft (300.9 m) National Geodetic Datum of 1929. Measuring point: Top of casing, 1.70 ft (0.52 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 3.60 ft (1.09 m) below land-surface datum, June 9, 1987; lowest, 8.48 ft (2.58 m) below land-surface datum, Nov. 30, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 09	7.06	May 22	3.97	Jul. 21	6.28



GROUND-WATER LEVELS

STEELE COUNTY

435742093164001. Local number, 106N20W30BAD01.  
 LOCATION.--Lat 43°57'42", long 93°16'40", in SE¼NE¼NW¼ sec.30, T.106 N., R.20 W., Hydrologic Unit 07040002, at Hope.

Owner: Hope Elevator.  
 AQUIFER.--Galena Formation of Middle Ordovician Age.  
 WELL CHARACTERISTICS.--Drilled commerial artesian well, diameter 5 in. (0.13 m), depth 215 ft (65.5 m), cased to 108 ft (32.9 m).  
 DATUM.--Altitude of land-surface datum is 1,198 ft (365 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.  
 PERIOD OF RECORD.--November 1981 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.90 ft (9.11 m) below land-surface datum, May 10, 1984; lowest, 34.48 ft (10.50 m) below land-surface datum, July 10, 1985.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Dec. 01	33.50	Mar. 01	33.48	Apr. 05	32.32	Jun. 15	32.55	Aug. 02	33.37	Sep. 28	33.23

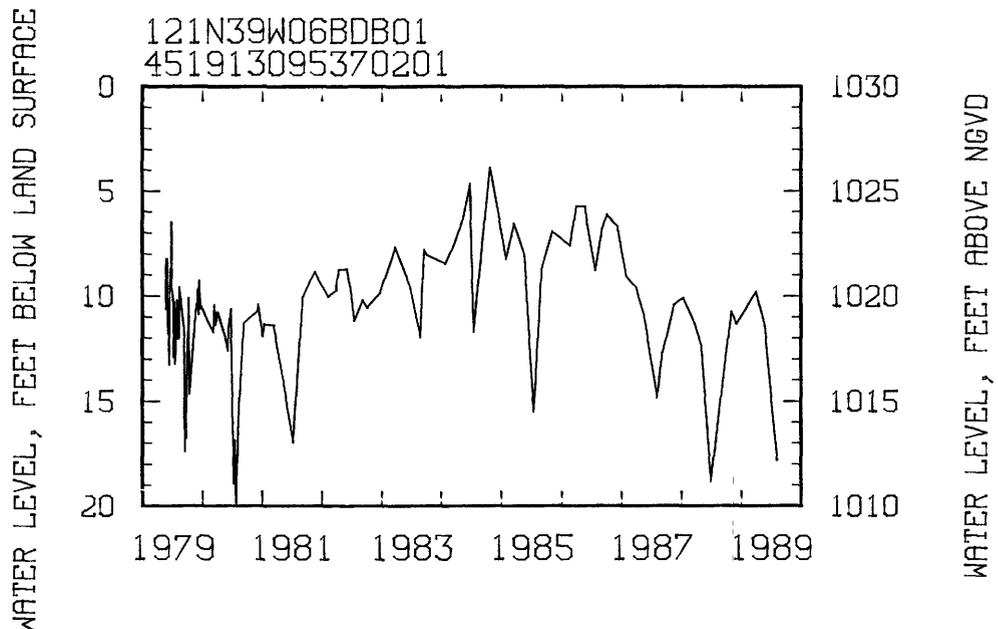
SWIFT COUNTY

451913095370201. Local number, 121N39W06BDB01.  
 LOCATION.--Lat 45°19'13", long 95°37'02", in NW¼SE¼NW¼ sec.6, T.121 N., R.39 W., Hydrologic Unit 07020005, in Ambush Park.

Owner: City of Benson.  
 AQUIFER.--Buried sand of Pleistocene Age.  
 WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 3 in. (0.08 m), depth 143 ft (43.6 m), screened 123 to 143 ft (37.5 to 43.6 m).  
 DATUM.--Altitude of land-surface datum is 1,030 ft (314 m). Measuring point: Top of casing 3.00 ft (0.91 m) above land-surface datum.  
 REMARKS.--Water level affected by pumping.  
 PERIOD OF RECORD.--May 1979 to current year.  
 EXTREMES FOR PERIOD OF RECORD.--Highest water level, 3.85 ft (1.17 m) below land-surface datum, Oct. 25, 1984; lowest, 19.90 ft (6.07 m) below land-surface datum, July 24, 1980.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL						
Nov. 02	10.75	Dec. 02	11.36	Feb. 13	10.38	Mar. 31	9.80	May 25	11.44	Aug. 08	17.82



GROUND-WATER LEVELS

WABASHA COUNTY

442708092155401. Local number, 111N12W04BBD01.

LOCATION.--Lat 44°27'08", long 92°15'54", in SE¼NW¼ sec.04, T.111 N., R.12 W., Hydrologic Unit 07040001, at Lake City.

Owner: City of Lake City, well 3.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 16 in. (0.41 m), depth 430 ft (131 m), cased to 258 ft (78.6 m).

DATUM.--Altitude of land-surface datum is 685 ft (209 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

REMARKS.--Measured weekly by David Finley.

PERIOD OF RECORD.--August 1974 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 3.63 ft (1.11 m) below land-surface datum, May 5, 1975; lowest, 11.50 ft (3.51 m) below land-surface datum, Jan. 31, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 03	11.18	Dec. 05	11.12	Feb. 06	10.88	Apr. 03	10.06	Jun. 05	9.28	Aug. 07	11.29
10	11.19	12	10.77	13	10.58	10	8.20	12	10.21	21	11.18
17	11.05	19	10.67	20	10.84	16	8.32	19	10.44	28	11.09
24	11.08	26	10.79	27	10.94	24	8.43	24	10.76	Sep. 05	10.93
31	10.92	Jan. 03	11.03	Mar. 06	11.18	May 01	9.26	Jul. 03	10.54	11	11.06
Nov. 14	11.09	09	11.17	13	10.67	08	9.13	10	10.87	18	11.18
21	10.98	17	10.99	20	11.04	15	9.34	17	11.08	25	11.07
28	11.06	23	10.98	27	10.19	22	9.98	24	11.08		
		30	10.89			30	9.51	31	11.06		

WADENA COUNTY

462415095003001. Local number, 134N34W19ADD01.

LOCATION.--Lat 46°24'21", long 95°00'36", in SE¼SE¼ sec.19, T.134 N., R.34 W., Hydrologic Unit 07010107, 0.05 mi (0.08 km) north of Verndale.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in. (0.05 m), depth 37 ft (11.3 m), screened 34 to 37 ft (10.4 to 11.3 m).

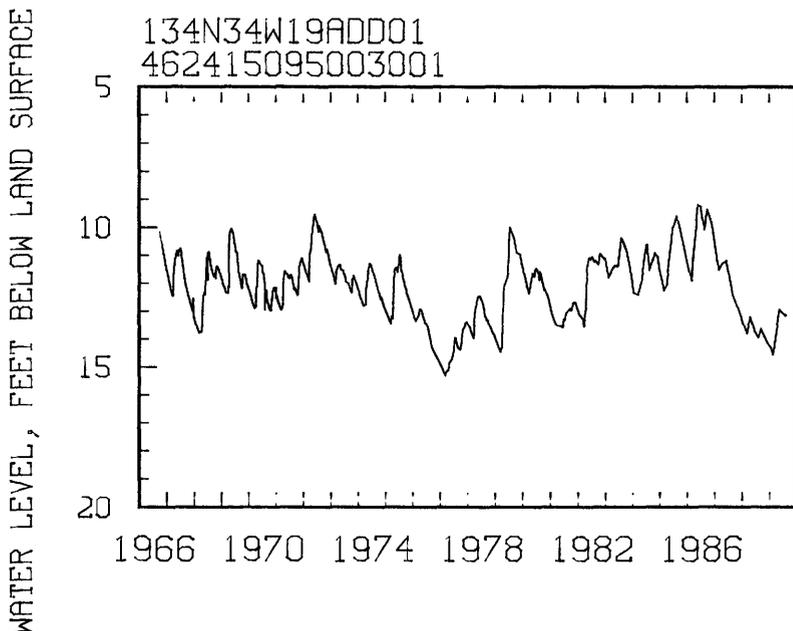
DATUM.--Altitude of land-surface datum is 1,342 ft (409 m). Measuring point: Top of casing, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--September 1966 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 9.18 ft (2.79 m) below land-surface datum, May 23, 1986; lowest, 15.33 ft (4.41 m) below land-surface datum, Mar. 10-11, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL	DAY	WATER LEVEL
Oct. 19	13.90	Jan. 14	14.31	Feb. 15	14.57	May 12	12.93	Aug. 02	13.16
Nov. 30	14.14					31	13.00		



## GROUND WATER LEVELS

## WASHINGTON COUNTY

445125092464001. Local number, 027N20W02BCC01.

LOCATION.--Lat 44°51'25", long 92°46'40", in SW¼SW¼NW¼ sec.2, T.27 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park by Afton Alps.

Owner: U.S. Geological Survey.

AQUIFER.--St. Lawrence Formation and Franconian Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 6 in. (0.15 m), depth 285 ft (86.9 m), cased to 105 ft (32.0 m).

DATUM.--Altitude of land-surface datum is 695 ft (212 m). Measuring point: Center of pressure guage, 3.80 ft (1.16 m) above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 33.94 ft (10.38 m) above land-surface datum, May 2, 1980; lowest, 19.67 ft (5.991 m) above land-surface datum, Jan.8, 1985.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 02	+28.41	May 25	+30.71	Jul. 31	+29.56	Sep. 21	+29.33

445125092464002. Local number, 027N20W02BCC02.

LOCATION.--Lat 44°51'25", long 92°46'40", in SW¼SW¼NW¼ sec.2, T.27 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park by Afton Alps.

Owner: U.S. Geological Survey.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 4 in. (0.10 m), depth 385 ft (117 m), cased to 365 ft (111 m).

DATUM.--Altitude of land-surface datum is 695 ft (212 m). Measuring point: Center of pressure guage, 3.80 ft (1.16 m) above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 42.35 ft (12.91 m) above land-surface datum, May 2, 1980; lowest, 23.81 ft (7.25 m) above land-surface datum, Jan. 8, 1985.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 02	+34.39	May 25	+36.46	Jul. 31	+34.74	Sep. 21	+34.62

445125092464003. Local number, 027N20W02BCC03.

LOCATION.--Lat 44°51'25", long 92°46'40", in SW¼SW¼NW¼ sec.2, T.27 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park by Afton Alps.

Owner: U.S. Geological Survey.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled observation artesian well, diameter 1½ in. (0.04 m), depth 535 ft (163 m), screened 530 to 535 ft (162 to 163 m).

DATUM.--Altitude of land-surface datum is 695 ft (212 m). Measuring point: Center of pressure guage, 3.40 ft (1.04 m) above land-surface datum.

PERIOD OF RECORD.--March 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 22.05 ft (6.72 m) above land-surface datum, May 2, 1980; lowest, 4.70 ft (1.43 m) above land-surface datum, Sept. 21, 1989.

## WATER LEVEL, IN FEET ABOVE LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 02	+7.54	May 25	+7.54	Jul. 31	+7.66	Sep. 21	+4.70

GROUND WATER LEVELS

WASHINGTON COUNTY--Continued

444751092563101. Local number, 027N21W28BCC01.

LOCATION.--Lat 44°47'51", 92°56'31", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$  sec.28, T.27 N., R.21 W., Hydrologic Unit 07010206, 0.1 mi (0.2 km) east of Ideal Avenue South.

Owner: Eugene Smallidge.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation water-table well, diameter 16 in. (0.41 m), depth 345 ft (105 m), cased to 60 ft (18.3 m).

DATUM.--Altitude of land-surface datum is 807 ft (246 m). Measuring point: Hole in pump base, 2.10 ft (0.64 m) above land-surface datum.

PERIOD OF RECORD.--August 1977, January 1978, December 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 60.32 ft (18.38 m) below land-surface datum, Oct. 28, 1986; lowest, 81.87 ft (24.95 m) below land-surface datum, Aug. 3, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 01	75.89	Jan. 24	75.97	Mar. 31	74.26	May 10	75.29	Aug. 15	76.87	Sep. 20	73.22

445536092462401. Local number, 028N20W11CAA01.

LOCATION.--Lat 44°55'36", long 92°46'24", in NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.11, T.28 N., R.20 W., Hydrologic Unit 07030005, at Lake St. Croix Beach.

Owner: Lower St. Croix Valley Fire Department.

AQUIFER.--Franconian Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled domestic water-table well, diameter 4 in. (0.10 m), depth 94 ft (28.6 m), cased to 78 ft (23.8 m).

DATUM.--Altitude of land-surface datum is 720 ft (220 m). Measuring point: Top of electrical housing, 1.70 ft (0.52 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.27 ft (9.53 m) below land-surface datum, May 1, 1986; lowest, 38.65 ft (11.78 m) below land-surface datum, Mar. 3, 1982, Sept. 16, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	38.53	Jan. 17	38.54	Mar. 13	38.63	May 15	36.28	Jul. 31	37.90	Sep. 21	38.21

445220092465901. Local number, 028N20W34ADA01.

LOCATION.--Lat 44°52'20", long 92°46'59", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.34, T.28 N., R.20 W., Hydrologic Unit 07030005, in Afton State Park.

Owner: State of Minnesota.

AQUIFER.--Franconia Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 4 in. (0.10 m), depth 306 ft (93.2 m), cased to 276 ft (84.1 m).

DATUM.--Altitude of land-surface datum is 970 ft (296 m). Measuring point: Top of casing, 0.90 ft (0.27 m) above land-surface datum.

PERIOD OF RECORD.--August 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 240.43 ft (73.28 m) below land-surface datum, June 27, 1984; lowest, 245.59 ft (74.85 m) below land-surface datum, July 30, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
May 15	242.78	Jul. 31	243.64	Sep. 21	243.44

## GROUND WATER LEVELS

## WASHINGTON COUNTY--Continued

450134092583101. Local number, 029N21W06CAD01.

LOCATION.--Lat 45°01'34", long 92°58'31", in SE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$  sec.6, T.29 N., R.21 W., Hydrologic Unit 07010206, at 6488 North Highway 36 Boulevard.

Owner: Twenty Nine Pines Trailer Park.

AQUIFER.--St. Peter Sandstone of Middle Ordovician Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in. (0.15 m), depth 210 ft (64.0 m), cased to 141 ft (43.0 m).

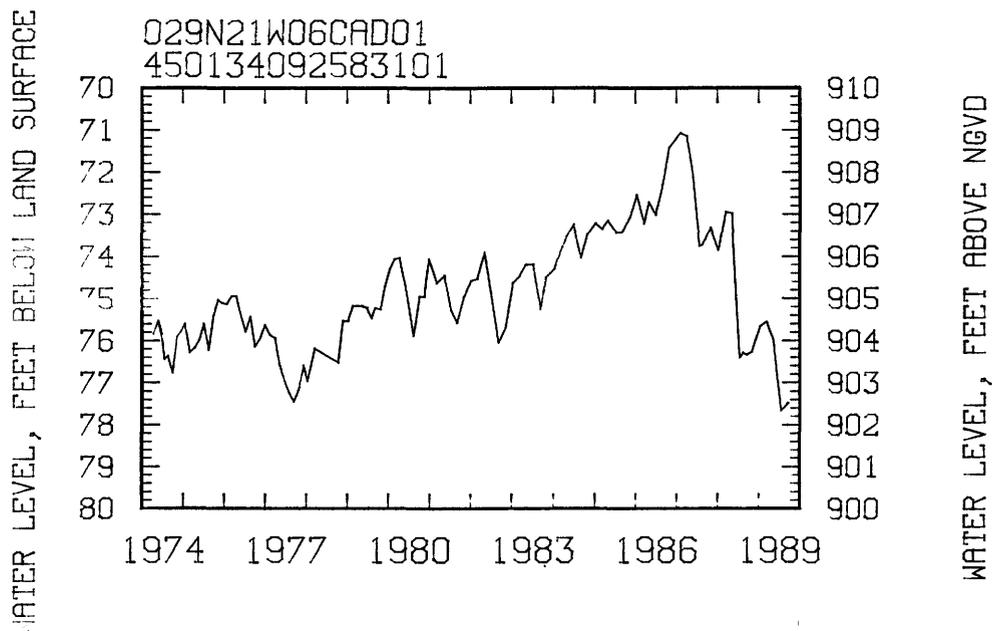
DATUM.--Altitude of land-surface datum is 980 ft (299 m). Measuring point: Hole in pump base, 2.20 ft (0.67 m) above land-surface datum.

PERIOD OF RECORD.--April 1974 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 71.07 ft (21.66 m) below land-surface datum, Feb. 6, 1987; lowest, 77.68 ft (23.68 m) below land-surface datum, July 24, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	76.27	Jan. 17	75.66	Mar. 13	75.55	May 15	76.02	Jul. 24	77.68	Sep. 18	77.50



450027092552101. Local number, 029N21W10CCC01.

LOCATION.--Lat 45°00'27", long 95°55'21", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.10, T.29 N., R.21 W., Hydrologic Unit 07010206, Lake Jane Road, 0.7 mi (1.1 km) north of Highway 212.

Owner: City of Lake Elmo.

AQUIFER.--Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 6 in. (0.15 m), depth 348 ft (106 m), cased to 280 ft (85.3 m).

DATUM.--Altitude of land-surface datum is 935 ft (285 m). Measuring point: Top of well cap, 1.20 ft (0.37 m) above land-surface datum.

PERIOD OF RECORD.--September 1977, February 1978, February 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 31.92 ft (9.72 m) below land-surface datum, Oct. 28, 1986; lowest, 45.65 ft (13.91 m) below land-surface datum, Sept. 28, 1977.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 31	40.17	Jan. 17	40.95	Mar. 13	41.42	May 15	41.96	Jul. 24	42.67	Sep. 18	42.74

## GROUND WATER LEVELS

## WASHINGTON COUNTY--Continued

450858092575001. Local number, 031N21W28ABD01.

LOCATION.--Lat 45°08'58", long 92°57'50", in SE¼NW¼NE¼ sec.28, T.31 N., R.21 W., Hydrologic Unit 07010206, County Road 8A, 1.65 mi (2.6 km) east of Highway 61.

Owner: White Bear Gun Club.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age.

WELL CHARACTERISTICS.--Drilled domestic artesian well, diameter 4 in. (0.10 m), depth 142 ft (43.3 m), cased to 94 ft (28.6 m).

DATUM.--Altitude of land-surface datum is 939 ft (28.6 m). Measuring point: Top of well cap, 1.30 ft (0.40 m) above land-surface datum.

PERIOD OF RECORD.--September 1977, February 1978, February 1980 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 7.57 ft (2.30 m) below land-surface datum, Oct. 28, 1986; lowest, 13.70 ft (4.18 m) below land-surface datum, Aug. 16, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 15	12.68	Jan. 26	12.88	Apr. 04	12.54	May 22	12.45	Aug. 16	13.70	Sep. 21	13.68

451355092532601. Local number, 032N20W30BCD01.

LOCATION.--Lat 45°13'55", long 92°53'26", in SE¼SW¼NW¼ sec.30, T.32 N., R.20 W., Hydrologic Unit 07030005, 0.25 mi (0.4 km) north of 192nd Street.

Owner: Arno Birr.

AQUIFER.--Prairie du Chien Group of Early Ordovician Age and Jordan Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 260 ft (79.2 m), cased to 141 ft (43.0 m).

DATUM.--Altitude of land-surface datum is 990 ft (302 m). Measuring point: Vent pipe, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--March 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 51.56 ft (15.72 m) below land-surface datum, Oct. 28, 1986; lowest, 58.53 ft (17.84 m) below land-surface datum, Sept. 15, 1988.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Nov. 15	56.88	Jan. 26	56.58	Apr. 04	56.56	Sep. 21	56.85

## WATONWAN COUNTY

440037094372601. Local number, 106N32W01DDB01.

LOCATION.--Lat 44°00'37", long 94°37'26", in NW¼SE¼SE¼ sec.1, T.106 N., R.32 W., Hydrologic Unit 07020010, north of St. James.

Owner: U.S. Geological Survey.

AQUIFER.--Surficial outwash sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Bored observation water-table well, diameter 2 in. (0.05 m), depth 22 ft (6.7 m), screened 19 to 22 ft (5.8 to 6.7 m).

DATUM.--Altitude of land-surface datum is 1,056.2 ft (321.9 m) National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 4.80 ft (1.46 m) above land-surface datum.

PERIOD OF RECORD.--November 1965 to current year.

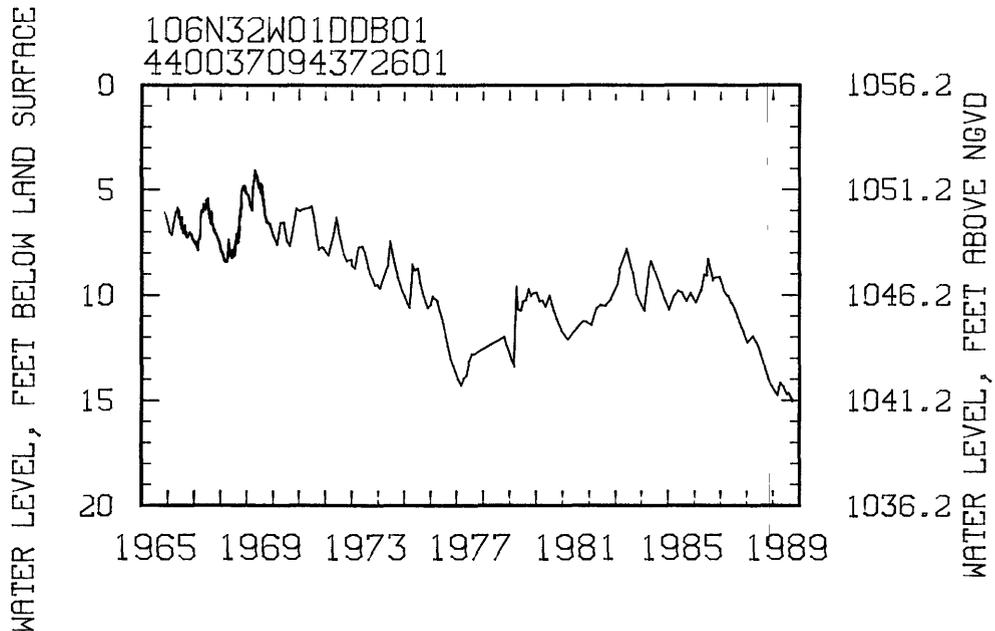
EXTREMES FOR PERIOD OF RECORD.--Highest water level, 4.11 ft (1.25 m) below land-surface datum, Apr. 27, 1969; lowest, 15.10 ft (4.60 m) below land-surface datum, Sept. 27, 1989.

## WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Oct. 24	14.02	Jan. 31	14.66	Apr. 06	14.20	Jul. 11	14.78
Dec. 02	14.34	Mar. 02	14.82	May 24	14.40	Aug. 03	14.67
	16 14.39		23 14.42	Jun. 14	14.59	Sep. 05	15.00
						27	15.10

## GROUND WATER LEVELS

WATONWAN COUNTY--Continued



440409094304901. Local number, 107N31W14DAC01.

LOCATION.--Lat 44°04'09", long 94°30'49", in SW¼SE¼ sec.14, T.107 N., R.31 W., Hydrologic Unit 07020010, 2.75 mi (4.4 km) east of LaSalle.

Owner: William Lassas.

AQUIFER.--Sandstone of Cretaceous Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 12 in. (0.30 m), depth 150 ft (45.7 m), screened 100 to 135 ft (30.5 to 41.2 m).

DATUM.--Altitude of land-surface datum is 1,008 ft (307 m). Measuring point: Vent pipe, 1.80 ft (0.55 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 10.44 ft (3.18 m) below land-surface datum, May 9, 1983; lowest, 16.29 ft (4.97 m) below land-surface datum, July 12, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Dec. 02	14.78	Mar. 02	14.66	Apr. 06	14.04	Sep. 27	15.73

440133094312501. Local number, 107N31W35CAC01.

LOCATION.--Lat 44°01'33", long 94°31'25", in SW¼NE¼SW¼ sec.35, T.107 N., R.31 W., Hydrologic Unit 07020010, northeast of St. James.

Owner: Al Guyer.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled irrigation artesian well, diameter 10 in. (0.25 m), depth 350 ft (107 m), screened 310 to 350 ft (94.5 to 107 m).

DATUM.--Altitude of land-surface datum is 1,055 ft (322 m). Measuring point: Vent pipe, 1.00 ft (0.30 m) above land-surface datum.

PERIOD OF RECORD.--September 1981 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 29.83 ft (9.09 m) below land-surface datum, May 9, 1983; lowest, 41.64 ft (12.69 m) below land-surface datum, July 12, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL						
Dec. 02	35.17	Mar. 02	35.22	Apr. 06	34.88	Sep. 27	36.68

GROUND-WATER LEVELS

WINONA COUNTY

435746092034202. Local number, 106N10W19DDA02.

LOCATION.--Lat 43°57'46", long 92°03'42", in NE¼SE¼SE¼ sec. 19, T.106N., R.10W., Hydrologic Unit 07040003, at St. Charles.

Owner: City of St. Charles, Well 5.

AQUIFER.--Ironton-Galesville Sandstones of Late Cambrian Age.

WELL CHARACTERISTICS.--Drilled public supply artesian well, diameter 12 in. (0.30 m), depth 702 ft (214 m), cased to 645 ft (197 m).

DATUM.--Altitude of land-surface datum is 1,160 ft (354 m); Measuring point: Edge of vent pipe, 1.00 ft (0.30 m) above land-surface datum.

REMARKS.--Water level affected by pumping.

PERIOD OF RECORD.--May 1984 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 218.80 ft (66.69 m) below land-surface datum, Aug. 26, 1987; lowest, 266.75 ft (81.30 m) below land-surface datum, July 20, 1985.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Oct. 14	267.10	Dec. 03	234.90	Feb. 03	233.72	Apr. 03	229.32	Jun. 06	237.18	Aug. 02	240.40
21	266.22	10	233.30	10	232.19	10	229.90	12	229.82	15	230.08
28	269.10	16	231.32	17	232.80	17	232.38	19	232.50	22	229.14
Nov. 04	267.80	23	230.70	24	231.50	24	235.54	26	230.30	29	229.90
12	238.60	30	232.05	Mar. 03	233.60	May 01	230.90	Jul. 05	233.70	Sep. 05	231.54
19	241.82	Jan. 13	235.32	13	232.10	08	235.30	10	230.52	11	230.40
26	237.60	20	233.82	20	232.30	22	234.90	17	230.30	18	233.32
		27	234.23	27	229.60	30	235.70	25	233.90	25	232.12

WRIGHT COUNTY

450403093544501. Local number, 119N26W35DDA01.

LOCATION.--Lat 45°04'03", long 93°54'45", in NE¼SE¼SE¼ sec.35, T.119 N., R.26 W., Hydrologic Unit 07010204, at Montrose.

Owner: City of Montrose, well 1.

AQUIFER.--Mount Simon Sandstone of Late Cambrian Age and Hinckley Sandstone of Late Precambrian Age.

WELL CHARACTERISTICS.--Drilled unused artesian well, diameter 10 in. (0.25 m), depth 693 ft (211 m), cased to 526 ft (160 m).

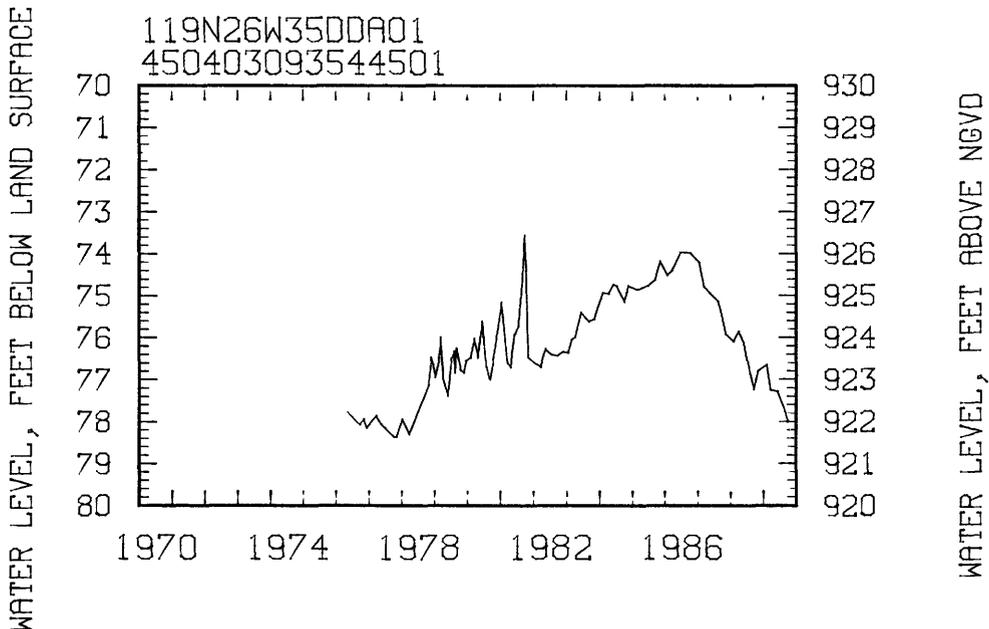
DATUM.--Altitude of land-surface datum is 1,000 ft (305 m). Measuring point: Edge of breather pipe, 1.50 ft (0.46 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 73.54 ft (22.41 m) below land-surface datum, Sept. 28, 1981; lowest, 78.38 ft (23.89 m) below land-surface datum, Nov. 3, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL										
Nov. 03	76.79	Jan. 31	76.64	Mar. 16	77.26	Jun. 01	77.30	Aug. 24	77.76	Sep. 26	78.01



GROUND-WATER LEVELS

YELLOW MEDICINE COUNTY

444219096165501. Local number, 114N45W04DCD01.

LOCATION.--Lat 44°42'19", long 96°16'55", in SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec.4, T.114 N., R.45 W., Hydrologic Unit 07020003, at Canby City Park.

Owner: City of Canby, well 6.

AQUIFER.--Surficial sand and gravel of Pleistocene Age.

WELL CHARACTERISTICS.--Drilled unused water-table well, diameter 12 in. (0.30 m), depth 62 ft (18.9 m), screened 44 to 68 ft (13.4 to 20.7 m).

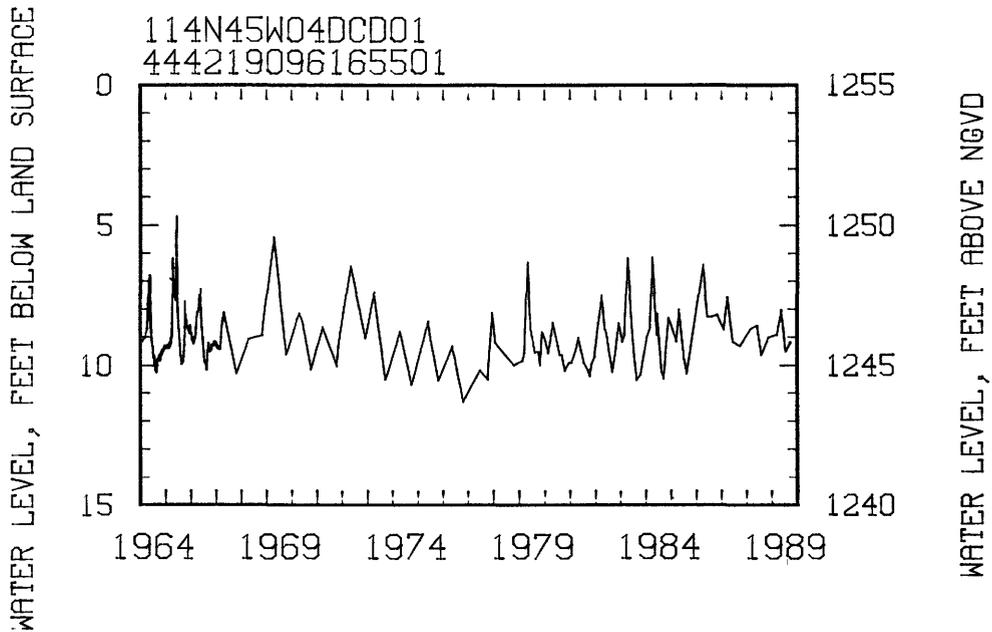
DATUM.--Altitude of land-surface datum is 1,255 ft (382 m). Measuring point: Top of casing, 2.90 ft (0.88 m) above land-surface datum.

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

EXTREMES FOR PERIOD OF RECORD.--Highest water level, 4.67 ft (1.42 m) below land-surface datum, June 5, 1965; lowest, 11.32 ft (3.45 m) below land-surface datum, Oct. 7, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
Nov. 03	9.00	Jan. 04	8.93	Mar. 06	8.89	May 11	8.00	Jul. 13	9.52	Sep. 14	9.17



QUALITY OF GROUND WATER  
WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
ANOKA COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)		
450403093163801	030.24.22DCB01 MWW14	112OTSH	03-28-89	0930	24.00	52.00	833	1010		
450403093163802	030.24.22DCB02 MWW15	112OTSH	03-27-89	1630	25.00	26.00	833	626		
450403093164901	030N24W22CDA01 MWW1 AT ANO	112OTSH	03-28-89	1130	14.72	54.00	816	590		
450403093164902	030N24W22CDA02 MWW2	112OTSH	03-28-89	1030	12.00	17.50	816	901		
450439093164015	30N24W22ABB15	364STPR	03-22-89	1600	3.00	65.00	808	433		
450439093164016	30N24W22ABB16	112SPDF	03-22-89	1630	3.30	50.00	809	554		
450439093164017	30N24W22ABB17	112PLSC	03-22-89	1700	5.00	11.00	808	1150		
450442093162410	30N24W22ABA10	364STPR	03-27-89	1000	31.76	99.00	843	514		
450442093162411	30N24W22ABA11	364STPR	03-27-89	1130	36.15	67.00	843	892		
450442093162412	30N24W22ABA12	112SPDF	03-27-89	1145	31.04	50.00	844	837		
450442093162832	30N24W22ABB32	364STPR	03-30-89	1320	19.50	55.00	803	570		
450442093163522	30N24W22ABB22	364STPR	03-23-89	1400	29.38	91.00	837	455		
450442093163523	30N24W22ABB23	112SPDF	03-23-89	1415	29.10	50.00	837	431		
450442093163531	30N24W22ABB31	112SPDF	03-24-89	0900	27.43	38.50	837	549		
450442093163806	30N24W22ABB06	364STPR	03-22-89	1010	2.60	76.00	808	572		
450442093163813	30N24W22ABB13	364STPR	03-22-89	1100	--	32.00	809	595		
450442093163814	30N24W22ABB14	111ALVM	03-20-89	1600	4.93	8.00	808	540		
450442093164004	30N24W22BAA04	364STPR	03-20-89	1100	3.50	64.00	810	555		
450442093164005	30N24W22BAA05	112SPDF	03-21-89	1300	7.50	26.00	810	590		
450442093164018	30N24W22BAA18	112PLSC	03-21-89	1300	8.33	11.00	810	899		
450442093164019	30N24W22BAA19	364STPR	03-21-89	1430	4.58	45.00	811	551		
450443093164001	30N24W22ABB01	364STPR	03-21-89	1520	4.80	59.00	811	581		
450443093164002	30N24W22ABB02	364STPR	03-22-89	0900	5.00	33.00	811	493		
450443093164003	30N24W22ABB03	112SPDF	03-22-89	1000	7.00	11.00	811	956		
STATION NUMBER	DATE	PH (STANDARD UNITS) (00400)	PH LAB (STANDARD UNITS) (00403)	TEMPERATURE WATER (DEG C) (00010)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKALINITY WAT WE TOT IT FIELD (MG/L AS CACO3) (00419)	ALKALINITY LAB (MG/L AS CACO3) (90410)
450403093163801	03-28-89	7.1	7.3	10.0	140	33	29	3.3	336	341
450403093163802	03-27-89	7.7	7.6	12.0	91	25	5.6	5.3	277	282
450403093164901	03-28-89	7.3	7.7	9.0	85	21	14	2.2	266	268
450403093164902	03-28-89	7.1	7.3	10.0	130	32	19	1.6	328	322
450439093164015	03-22-89	7.9	8.0	9.5	61	19	3.4	1.3	154	154
450439093164016	03-22-89	8.0	7.8	8.0	78	24	3.9	1.7	167	163
450439093164017	03-22-89	7.2	7.3	8.0	180	42	15	1.5	350	311
450442093162410	03-27-89	9.4	9.0	5.0	48	10	43	5.4	168	130
450442093162411	03-27-89	8.2	7.7	10.5	110	30	16	3.2	204	158
450442093162412	03-27-89	8.1	7.9	11.0	120	27	21	9.5	160	201
450442093162832	03-30-89	7.9	7.9	11.0	74	25	5.5	1.7	163	167
450442093163522	03-23-89	8.3	8.1	9.0	49	20	12	6.1	153	147
450442093163523	03-23-89	7.8	8.1	10.5	62	16	6.5	1.2	187	181
450442093163531	03-24-89	8.3	8.1	10.0	65	21	22	4.1	--	228
450442093163806	03-22-89	8.5	8.3	--	70	22	16	0.10	155	161
450442093163813	03-22-89	8.3	8.1	6.5	80	26	5.5	2.6	161	167
450442093163814	03-20-89	7.5	7.4	--	70	20	14	1.9	242	255
450442093164004	03-20-89	7.6	7.9	7.0	74	26	5.4	2.0	164	167
450442093164005	03-21-89	7.6	8.0	7.0	76	29	7.6	1.9	192	187
450442093164018	03-21-89	6.8	7.3	8.5	150	31	11	0.60	356	326
450442093164019	03-21-89	7.3	7.9	7.0	72	26	7.0	3.1	169	165
450443093164001	03-21-89	7.3	7.7	9.0	77	26	5.6	1.7	176	169
450443093164002	03-22-89	9.2	8.2	9.0	70	19	5.5	2.6	178	167
450443093164003	03-22-89	7.7	7.5	9.0	130	37	16	16	288	212

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 ANOKA COUNTY--Continued

STATION	NUMBER	DATE	SULFATE DIS- SOLVED (MG/L AS SO <sub>4</sub> ) (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 SIO <sub>2</sub> ) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	NITRO- GEN, NO <sub>2</sub> +NO <sub>3</sub> DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	BORON, DIS- SOLVED (UG/L AS B) (01020)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)
450403093163801	03-28-89	81	70	0.10	21	629	5.20	<0.010	100	9	100	
450403093163802	03-27-89	56	9.3	0.10	22	387	<0.100	<0.010	60	22	240	
450403093164901	03-28-89	46	9.5	0.10	18	351	0.220	<0.010	70	34	72	
450403093164902	03-28-89	58	67	0.10	19	545	1.40	<0.010	70	350	26	
450439093164015	03-22-89	71	4.1	0.10	19	271	<0.100	<0.010	20	8	170	
450439093164016	03-22-89	130	7.3	0.10	19	370	<0.100	0.050	20	230	310	
450439093164017	03-22-89	340	27	0.10	26	866	<0.100	0.040	40	16000	4800	
450442093162410	03-27-89	120	12	0.20	17	340	<0.100	0.030	20	110	41	
450442093162411	03-27-89	110	130	0.10	18	579	<0.100	<0.010	20	<3	460	
450442093162412	03-27-89	260	7.7	0.20	19	604	<0.100	<0.010	100	<3	320	
450442093162832	03-30-89	120	14	0.10	18	--	<0.100	0.030	20	140	230	
450442093163522	03-23-89	85	7.8	0.20	16	283	<0.100	<0.010	30	27	360	
450442093163523	03-23-89	45	5.8	0.10	16	250	<0.100	0.030	20	8	260	
450442093163531	03-24-89	40	16	0.30	14	329	2.20	<0.010	40	3	730	
450442093163806	03-22-89	99	30	0.10	17	359	<0.100	0.130	20	8	210	
450442093163813	03-22-89	120	21	0.10	18	384	<0.100	0.030	30	160	320	
450442093163814	03-20-89	25	11	0.10	18	319	<0.100	0.030	10	270	2400	
450442093164004	03-20-89	110	11	0.10	18	354	<0.100	0.030	20	19	370	
450442093164005	03-21-89	110	16	0.20	19	373	<0.100	0.030	20	110	550	
450442093164018	03-21-89	140	34	0.20	31	635	<0.100	0.100	20	16000	5300	
450442093164019	03-21-89	120	7.9	0.20	18	358	<0.100	0.030	30	51	380	
450443093164001	03-21-89	120	16	0.10	18	382	<0.100	0.030	20	8	230	
450443093164002	03-22-89	89	6.0	0.20	16	318	<0.100	0.110	30	22	470	
450443093164003	03-22-89	300	19	0.20	17	698	<0.100	<0.010	30	55	4100	

## QUALITY OF GROUND WATER

WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## BECKER COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEOLOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)
465356095083401	140.35.31 DAA USGS 14	112WDDF	05-15-89	1600	--	29.00	1452
465657095144801	140N36W016BBB01 23S	112WDDF	05-16-89	1100	43.42	49.00	--
465657095144802	140N36W16BBB02 23D	112WDDF	05-16-89	1200	--	199.00	--

STATION NUMBER	DATE	SPECIFIC CONDUCTANCE (US/CM) (00095)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)	PH (STANDARD UNITS) (00400)	PH LAB (STANDARD UNITS) (00403)	TEMPERATURE WATER (DEG C) (00010)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)
465356095083401	05-15-89	570	557	7.3	7.7	8.5	80	21	3.7
465657095144801	05-16-89	460	467	7.0	7.7	7.0	71	21	2.4
465657095144802	05-16-89	370	402	7.9	8.3	7.0	44	20	18

STATION NUMBER	DATE	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUORIDE, 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)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
465356095083401	05-15-89	1.0	13	14	0.10	14	330	5.70
465657095144801	05-16-89	0.70	10	0.50	0.10	15	233	0.560
465657095144802	05-16-89	3.8	3.0	2.5	0.10	11	--	<0.100

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 BELTRAMI COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE (US/CM) (00095)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)
472533094284500	146.30.34 BBB PENNINGTON W	112DSMO	07-11-89	1700	--	13.00	1312	--	222
		112DMDF	08-13-89	1730	--	13.00	1312	195	--
472537094261700	146N30W25CCCC E. SCHRA	112DSMO	03-22-89	1200	11.54	13.00	1317	404	399
		112DSMO	05-12-89	1500	10.39	13.00	1317	343	352
		112DSMO	07-11-89	1030	--	13.00	1317	--	251
472553094384500	146.31.29 CBB LAKE ANDRUS	112DSMO	07-11-89	0800	--	14.00	1313	--	490
472652094362400	146N31W21DAAAA ALLEN	112DSMO	07-10-89	1900	--	--	1332	--	379
472652094362401	146N31W21DAAAA	112DSMO	03-22-89	1400	20.08	--	1332	432	463
		112DSMO	05-12-89	1700	21.50	--	1332	404	400
472705094521800	146.33.21 ABC CO HWY GARA	112DMDF	08-02-89	1700	13.18	14.00	1355	3250	3470
472740094503400	146.33.15 ADD SCHMUNK PARK	112DMDF	08-01-89	1630	24.47	30.50	1365	464	489
472740094512700	146.33.15BACC NYMORE WATE	112DMDF	07-28-89	1100	9.06	12.50	1350	710	770
472757094531100	146.33.17 WOODLAND	112DMDF	08-02-89	1430	5.62	13.50	1345	785	795
472818094525200	146.33.9 CDC--PAUL BUNYON	112DMDF	07-28-89	1500	3.38	8.00	1342	1050	1060
472846094533700	146.33.8 ABB 15TH&NORTON	112DMDF	08-02-89	1330	16.34	21.00	1353	513	545
472907095084100	146.35.5ddc LUNDBERG	112DMDF	08-16-89	1000	--	20.00	1435	280	300
472919094540700	146.33.5 CAD CURLING CLUB	112DMDF	08-12-89	1030	--	30.00	1357	385	404
472925094525200	146.33.4 BDB DNR IN TOWN	112DMDF	08-02-89	1500	32.71	40.00	1375	590	768
472938094522800	146.33.4 ABB CAMERON PAR	112DMDF	07-27-89	1700	2.84	14.00	1345	890	895
472940094531100	146.33.5 AAD 26 AND PARK	112DMDF	08-02-89	1100	26.75	--	1378	578	604
472949094531500	146.33.5 29TH AND PARK	112DMDF	08-01-89	0930	--	14.00	1360	--	639
		112DMDF	08-04-89	0930	7.89	14.00	1360	605	--
473031094490100	147.33.36 BBB LANINIA RR	112DMDF	08-01-89	1800	28.30	38.00	1368	500	471
473049094524200	147.33.28 CDC OB WELL AT	112DMDF	08-12-89	1600	--	21.00	1350	440	433
473145094354700	147N31W22DCCC BIG LAKE	112DSMO	07-10-89	1500	--	--	1335	--	425
473236094505400	147.33.15 BCD DNR NORTH	112DMDF	08-03-89	1030	9.31	21.50	1355	450	512
473318094565300	147.34.13.BBB HWY 9 NORTH	112DMDF	08-15-89	1330	12.58	17.50	1390	610	552
473410095073000	147.35.4 DDC PINEWOOD W	112DMDF	08-03-89	1300	5.68	16.00	1400	480	515

STATION NUMBER	DATE	PH (STANDARD UNITS) (00400)	PH LAB (STANDARD UNITS) (00403)	TEMPERATURE WATER (DEG C) (00010)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKALINITY WAT WH TOT IT FIELD (MG/L AS CAC03) (00419)	ALKALINITY LAB (MG/L AS CAC03) (90410)	ALKALINITY WAT WH TOT FET FIELD (MG/L AS CAC03) (00410)
472533094284500	07-11-89	--	7.9	--	34	5.9	2.5	0.40	--	110	--
	08-13-89	7.9	--	11.0	--	--	--	--	--	--	--
472537094261700	03-22-89	7.4	7.6	11.0	67	11	1.3	0.90	209	217	--
	05-12-89	7.6	7.8	7.0	59	9.4	1.3	1.1	263	182	--
	07-11-89	--	7.7	--	41	6.5	1.0	0.90	--	132	--
472553094384500	07-11-89	--	7.6	--	66	18	4.8	1.9	--	252	--
472652094362400	07-10-89	--	7.9	--	56	12	3.6	2.8	--	192	--
472652094362401	03-22-89	7.5	7.7	11.0	65	16	7.3	2.0	201	215	--
	05-12-89	7.7	7.8	8.0	59	12	4.8	2.3	205	201	--
472705094521800	08-02-89	7.4	7.6	11.0	140	23	520	3.1	267	268	--
472740094503400	08-01-89	7.5	7.8	10.0	63	15	16	0.90	213	211	--
472740094512700	07-28-89	7.4	7.6	13.0	97	20	31	1.3	246	251	--
472757094531100	08-02-89	7.4	7.4	18.0	110	18	19	0.60	214	211	--
472818094525200	07-28-89	7.0	7.1	16.0	140	18	50	5.0	387	348	--
472846094533700	08-02-89	7.4	7.7	9.0	61	14	30	3.2	214	216	--
472907095084100	08-16-89	7.7	7.8	11.5	40	11	3.0	2.0	--	133	150
472919094540700	08-12-89	7.9	7.8	11.0	55	15	5.7	3.4	--	187	230
472925094525200	08-02-89	7.3	7.5	10.5	95	26	16	2.0	272	285	--
472938094522800	07-27-89	6.9	7.0	14.0	130	24	20	2.6	389	399	--
472940094531100	08-02-89	7.6	7.7	10.5	83	14	16	1.9	210	190	--
472949094531500	08-01-89	--	7.7	--	77	18	27	1.0	--	208	--
	08-04-89	7.5	--	9.0	--	--	--	--	200	--	--
473031094490100	08-01-89	7.5	7.6	9.5	76	12	6.1	1.8	205	204	--
473049094524200	08-12-89	7.6	7.8	12.0	63	18	4.4	1.5	--	238	238
473145094354700	07-10-89	--	7.7	--	62	16	2.9	1.5	--	226	--
473236094505400	08-03-89	7.3	7.6	7.5	77	19	2.7	1.0	304	267	--
473318094565300	08-15-89	7.5	7.7	10.5	86	20	2.6	0.60	--	278	280
473410095073000	08-03-89	6.8	6.8	10.0	79	21	3.0	0.90	292	282	--







QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 BLUE EARTH COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)
440230094101001	107N28W27DADA BIRR SPRING		08-23-89	0830	690	7.2	11.0
440558094072301	107N27W06CACB DAVIS HOLE S		08-23-89	1000	768	7.0	9.5

STATION NUMBER	DATE	OXYGEN, DIS-SOLVED (MG/L) (00300)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOSPHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
440230094101001	08-23-89	1.5	<0.010	7.70	0.010	0.30	<0.010	<0.010	1.3
440558094072301	08-23-89	0.5	<0.010	<0.100	0.890	1.0	<0.010	<0.010	1.6

QUALITY OF GROUND WATER  
WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
CASS COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE (US/CM) (00095)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)
471528094131800	144N28W27C FEDERAL DAM, M	112DSMO	07-19-89	1300	--	--	1300	--	521
471546094331700	144N31W25BBDC WELSH LAK	112DSMO	03-21-89	1100	7.92	17.00	1300	--	325
		112DSMO	05-12-89	1030	7.22	17.00	1300	228	211
		112DSMO	07-11-89	1400	--	17.00	1300	--	212
471907094074200	144N27W05CABA SIXMILE L	112DSMO	07-20-89	1100	--	--	1306	--	361
471927094244700	144N30W01ABABB KETCHUM	112DSMO	07-20-89	0900	--	--	1305	--	610
471942094132000	145N28W34CCACB BENA SO,	112DSMO	07-19-89	1200	--	--	1315	--	283
471945094345000	145N31W35CBDA S. PI	112DSMO	07-11-89	1500	--	--	1310	--	196
		112DSMO	08-13-89	1500	--	--	1310	180	--
471957094025000	145N27W36CBAAA RICE LAKE	112DSMO	07-20-89	1130	--	--	1315	--	368
472028094122400	145N28W27DDCAA BENA, MN	112DSMO	07-19-89	1000	--	--	1313	--	431
		112DSMO	08-15-89	1100	--	--	1313	400	--
472117094255000	145N30W24CDDC SUCKER LA	112DSMO	07-12-89	1630	--	--	1303	--	279
		112DSMO	08-14-89	1930	--	--	1303	--	--
472134094093000	145N27W19CBCAD BENA NE, M	112DSMO	07-19-89	1700	--	--	1318	--	227
		112DSMO	08-14-89	1745	3.41	--	1318	430	--
472200094394001	145N31W19BAAA SPIKE LK	112DSMO	03-21-89	1030	23.71	--	1344	394	391
		112DSMO	05-08-89	1500	23.34	--	1344	416	395
		112DSMO	07-11-89	1200	--	--	1344	--	401
		112DSMO	08-13-89	1600	--	--	1344	420	--
472201094320400	145N30W19BAAB PIKE BAY EAS	112DSMO	03-21-89	1200	22.03	30.00	1320	490	486
		112DSMO	05-12-89	1200	21.84	30.00	1320	506	468
		112DSMO	07-13-89	0800	--	30.00	1320	--	468
472240094361400	145.31.15 ACB CASS L RR	112DSMO	07-12-89	1800	--	23.00	1320	--	665
		112DMDF	08-13-89	1100	--	23.00	1320	720	654
		112DMDF	08-13-89	1630	17.66	23.00	1320	720	--
472250094395300	145.31.18 BAB CASS LAKE N	112DSMO	07-11-89	1030	--	21.00	1320	--	405
		112DMDF	08-13-89	1330	--	21.00	1320	390	387
472300094231800	145N29W08CDDC GRASS LK	112DSMO	07-12-89	1200	--	25.50	1325	--	441
		112DMDF	08-14-89	1900	--	25.50	1325	430	--
472318094185001	145N29W11DACCB	112DSMO	03-22-89	0930	6.25	--	1311	329	341
		112DSMO	05-12-89	1330	4.13	--	1311	246	226
		112DSMO	07-20-89	1000	--	--	1311	--	309
472335094214200	145N29W09ACACC	112DSMO	07-12-89	1500	--	--	1330	--	363
472355094061600	145N27W04DCCCC HIGHBA	112DSMO	07-19-89	1530	--	--	1318	--	176
472510094240700	146N29W31DBBB LYDICK	112DSMO	07-19-89	0900	--	--	1310	--	171
472520094220700	146N29W33BCDBB WINNIE	112DSMO	07-12-89	1330	--	--	1317	--	371
472533094032300	146N27W35AAAAA WINNIE	112DSMO	07-18-89	1700	--	--	1312	--	474
		112DSMO	08-14-89	1700	20.56	--	1312	405	--
472720095121800	146.36.24 BBB CHRISTOFFERS	112DMDF	08-16-89	1330	--	40.50	1462	530	498

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 CASS COUNTY--Continued

STATION NUMBER	DATE	PH (STAND- ARD UNITS) (00400)	PH LAB (STAND- ARD UNITS) (00403)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	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)
471528094131800	07-19-89	--	7.4	--	--	--	67	13	13	1.9
471546094331700	03-21-89	7.4	7.5	--	--	--	45	7.8	4.3	5.6
	05-12-89	7.3	7.6	6.0	--	--	34	3.9	2.0	1.3
	07-11-89	--	7.8	--	--	--	32	4.3	2.1	1.2
471907094074200	07-20-89	--	7.7	--	--	--	51	14	2.7	0.50
471927094244700	07-20-89	--	7.6	--	--	--	80	30	5.9	3.2
471942094132000	07-19-89	--	7.6	--	--	--	40	6.7	4.4	1.2
471945094345000	07-11-89	--	7.3	--	--	--	24	8.0	1.6	1.8
	08-13-89	6.8	--	13.0	--	--	--	--	--	--
471957094025000	07-20-89	--	7.0	--	--	--	52	7.3	13	3.8
472028094122400	07-19-89	--	7.9	--	--	--	55	12	15	0.70
	08-15-89	7.6	--	11.0	--	--	--	--	--	--
472117094255000	07-12-89	--	7.4	--	--	--	48	4.4	2.2	0.40
	08-14-89	--	--	--	--	--	--	--	--	--
472134094093000	07-19-89	--	7.1	--	--	--	36	4.1	2.1	1.3
	08-14-89	7.0	--	14.0	--	--	--	--	--	--
472200094394001	03-21-89	7.5	7.8	--	--	--	63	14	2.4	1.8
	05-08-89	7.7	7.8	7.0	--	--	62	14	1.8	1.5
	07-11-89	--	7.8	--	--	--	60	13	2.0	1.7
	08-13-89	7.5	--	8.5	--	--	--	--	--	--
472201094320400	03-21-89	7.6	7.6	8.0	--	--	74	16	3.9	1.4
	05-12-89	7.6	7.7	6.0	--	--	74	17	2.6	0.90
	07-13-89	--	7.8	--	--	--	70	16	3.1	1.3
472240094361400	07-12-89	--	7.2	--	--	--	110	16	3.1	1.2
	08-13-89	6.9	7.0	10.0	--	--	120	16	2.8	1.0
	08-13-89	6.9	--	10.0	760	2.0	--	--	--	--
472250094395300	07-11-89	--	7.7	--	--	--	60	14	2.1	0.90
	08-13-89	7.4	7.7	11.0	--	--	61	14	1.7	0.70
472300094231800	07-12-89	--	7.9	--	--	--	69	14	2.1	0.60
	08-14-89	--	--	10.5	--	--	--	--	--	--
472318094185001	03-22-89	7.8	7.7	11.0	--	--	52	12	3.2	0.80
	05-12-89	6.9	7.3	5.0	--	--	31	2.6	1.6	1.1
	07-20-89	--	7.5	--	--	--	51	6.4	2.6	1.1
472335094214200	07-12-89	--	8.3	--	--	--	56	12	3.1	0.70
472355094061600	07-19-89	--	8.5	--	--	--	21	5.3	6.3	2.1
472510094240700	07-19-89	--	8.3	--	--	--	24	6.1	1.3	0.60
472520094220700	07-12-89	--	8.2	--	--	--	49	15	3.3	1.1
472533094032300	07-18-89	--	7.9	--	--	--	54	23	7.5	1.1
	08-14-89	8.1	--	11.0	--	--	--	--	--	--
472720095121800	08-16-89	7.6	7.6	12.5	--	--	68	23	2.7	1.7

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 CASS COUNTY--Continued

STATION NUMBER	DATE	ALKA-LINITY WAT WH TOT IT FIELD (MG/L AS CACO3) (00419)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	ALKA-LINITY WAT WH TOT FET FIELD (MG/L AS CACO3) (00410)	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, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
471528094131800	07-19-89	--	187	--	6.0	40	0.10	11	--	0.460
471546094331700	03-21-89	150	160	--	13	0.90	0.10	18	--	<0.100
	05-12-89	104	104	--	5.0	0.40	0.10	16	--	<0.100
	07-11-89	--	103	--	5.0	0.50	0.10	16	--	<0.100
471907094074200	07-20-89	--	190	--	4.0	0.60	0.10	24	--	<0.100
471927094244700	07-20-89	--	343	--	3.0	0.50	0.10	22	--	<0.100
471942094132000	07-19-89	--	124	--	11	6.2	0.10	17	--	0.570
471945094345000	07-11-89	--	96	--	<1.0	0.80	0.10	14	--	<0.100
	08-13-89	--	--	--	--	--	--	--	--	--
471957094025000	07-20-89	--	148	--	6.0	19	0.10	13	--	<0.100
472028094122400	07-19-89	--	164	--	11	25	0.10	22	--	2.90
	08-15-89	--	--	--	--	--	--	--	--	--
472117094255000	07-12-89	--	145	--	<1.0	0.70	0.20	16	--	<0.100
	08-14-89	--	--	--	--	--	--	--	--	--
472134094093000	07-19-89	--	116	--	2.0	0.70	0.10	16	--	<0.100
	08-14-89	--	--	--	--	--	--	--	--	--
472200094394001	03-21-89	203	206	--	9.9	1.2	0.10	21	--	0.160
	05-08-89	217	206	--	8.0	0.70	0.10	21	--	0.170
	07-11-89	--	208	--	9.0	0.80	0.10	19	--	0.140
	08-13-89	--	--	--	--	--	--	--	--	--
472201094320400	03-21-89	241	250	--	28	3.0	0.10	21	--	<0.100
	05-12-89	243	243	--	15	0.80	0.10	22	--	<0.100
	07-13-89	--	239	--	17	1.0	0.10	20	--	<0.100
472240094361400	07-12-89	--	338	--	6.0	0.70	0.10	29	--	<0.100
	08-13-89	--	349	370	14	0.60	0.10	28	389	0.190
	08-13-89	--	--	370	--	--	--	--	--	--
472250094395300	07-11-89	--	212	--	4.0	0.80	0.10	19	--	1.00
	08-13-89	--	201	200	3.0	0.60	0.10	20	227	1.20
472300094231800	07-12-89	--	235	--	3.0	0.50	0.20	19	--	0.370
	08-14-89	--	--	--	--	--	--	--	--	--
472318094185001	03-22-89	178	183	--	6.5	0.70	0.10	16	--	<0.100
	05-12-89	109	110	--	4.0	0.40	0.10	15	--	0.260
	07-20-89	--	159	--	5.0	0.40	0.10	18	--	<0.100
472335094214200	07-12-89	--	184	--	9.0	0.50	0.10	18	--	<0.100
472355094061600	07-19-89	--	75	--	4.0	1.8	0.10	5.7	--	2.30
472510094240700	07-19-89	--	84	--	1.0	0.30	0.10	15	--	0.860
472520094220700	07-12-89	--	189	--	5.0	0.50	0.10	14	--	<0.100
472533094032300	07-18-89	--	190	--	6.0	27	0.10	20	--	2.30
	08-14-89	--	--	--	--	--	--	--	--	--
472720095121800	08-16-89	--	251	--	8.0	2.2	0.10	24	288	3.20

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 CASS COUNTY--Continued

STATION NUMBER	DATE	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 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)	BORON, DIS- SOLVED (UG/L AS B) (01020)
471528094131800	07-19-89	0.120	--	0.020	--	<0.010	--	--	--	<10
471546094331700	03-21-89	0.040	--	0.330	--	0.040	--	--	--	10
	05-12-89	0.020	--	0.100	--	0.020	--	--	--	10
	07-11-89	<0.010	--	0.010	--	0.020	--	--	--	<10
471907094074200	07-20-89	0.020	--	0.080	--	0.060	--	--	--	20
471927094244700	07-20-89	0.240	--	0.010	--	0.020	--	--	--	20
471942094132000	07-19-89	0.020	--	0.050	--	0.040	--	--	--	10
471945094345000	07-11-89	0.060	--	0.050	--	0.050	--	--	--	10
	08-13-89	--	--	--	--	--	--	1	--	--
471957094025000	07-20-89	0.020	--	0.020	--	0.030	--	--	--	30
472028094122400	07-19-89	<0.010	--	0.070	--	0.070	--	--	--	40
	08-15-89	--	--	--	--	--	--	1	--	--
472117094255000	07-12-89	0.050	--	0.020	--	0.010	--	--	--	20
	08-14-89	--	--	--	--	--	--	--	--	--
472134094093000	07-19-89	0.030	--	0.700	--	0.040	--	--	--	<10
	08-14-89	--	--	--	--	--	--	--	--	--
472200094394001	03-21-89	0.040	--	0.290	--	0.040	--	--	--	10
	05-08-89	0.030	--	0.170	--	0.050	--	--	--	20
	07-11-89	0.030	--	0.030	--	0.020	--	--	--	<10
	08-13-89	--	--	--	--	--	--	1	--	--
472201094320400	03-21-89	0.130	--	0.310	--	0.030	--	--	--	20
	05-12-89	0.020	--	0.040	--	0.030	--	--	--	30
	07-13-89	0.040	--	<0.010	--	<0.010	--	--	--	<10
472240094361400	07-12-89	0.140	--	<0.010	--	<0.010	--	--	--	70
	08-13-89	0.150	0.60	--	0.027	<0.001	<10	3	210	--
	08-13-89	--	--	--	--	--	--	4	--	--
472250094395300	07-11-89	0.030	--	0.020	--	0.020	--	--	--	30
	08-13-89	0.010	1.0	--	0.034	0.029	<10	<1	29	--
472300094231800	07-12-89	0.020	--	0.050	--	0.030	--	--	--	<10
	08-14-89	--	--	--	--	--	--	--	--	--
472318094185001	03-22-89	0.030	--	0.550	--	0.050	--	--	--	10
	05-12-89	0.030	--	0.430	--	<0.010	--	--	--	<10
	07-20-89	0.020	--	0.210	--	0.020	--	--	--	<10
472335094214200	07-12-89	0.020	--	0.010	--	0.020	--	--	--	<10
472355094061600	07-19-89	0.040	--	0.070	--	0.020	--	--	--	<10
472510094240700	07-19-89	0.010	--	0.090	--	0.040	--	--	--	20
472520094220700	07-12-89	0.050	--	<0.010	--	0.010	--	--	--	20
472533094032300	07-18-89	0.030	--	0.050	--	0.040	--	--	--	10
	08-14-89	--	--	--	--	--	--	<1	--	--
472720095121800	08-16-89	0.090	1.1	--	0.018	<0.001	--	<1	--	--

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 CASS COUNTY--Continued

STATION	NUMBER	DATE	CADMIUM, DIS- SOLVED (UG/L AS CD) (01025)	CHRO- MIUM, DIS- SOLVED (UG/L AS CR) (01030)	COPPER, DIS- SOLVED (UG/L AS CU) (01040)	IRON, DIS- SOLVED (UG/L AS FE) (01046)	LEAD, DIS- SOLVED (UG/L AS PB) (01049)	MANGA- NESE, DIS- SOLVED (UG/L AS MN) (01056)	MERCURY DIS- SOLVED (UG/L AS HG) (71890)	SELE- NIUM, DIS- SOLVED (UG/L AS SE) (01145)	ZINC, DIS- SOLVED (UG/L AS ZN) (01090)
471528094131800		07-19-89	--	--	--	8	--	160	--	--	--
471546094331700		03-21-89	--	--	--	32	--	96	--	--	--
		05-12-89	--	--	--	9	--	170	--	--	--
		07-11-89	--	--	--	33	--	170	--	--	--
471907094074200		07-20-89	--	--	--	10	--	50	--	--	--
471927094244700		07-20-89	--	--	--	1900	--	110	--	--	--
471942094132000		07-19-89	--	--	--	260	--	510	--	--	--
471945094345000		07-11-89	--	--	--	1800	--	220	--	--	--
		08-13-89	<1.0	1	2	--	1	--	<0.1	--	1200
471957094025000		07-20-89	--	--	--	890	--	550	--	--	--
472028094122400		07-19-89	--	--	--	12	--	<1	--	--	--
		08-15-89	<1.0	1	4	--	1	--	--	--	170
472117094255000		07-12-89	--	--	--	550	--	190	--	--	--
		08-14-89	--	--	--	--	--	--	--	--	--
472134094093000		07-19-89	--	--	--	490	--	340	--	--	--
		08-14-89	--	--	--	--	--	--	--	--	--
472200094394001		03-21-89	--	--	--	1000	--	100	--	--	--
		05-08-89	--	--	--	10	--	2	--	--	--
		07-11-89	--	--	--	15	--	45	--	--	--
		08-13-89	<1.0	<1	1	--	2	--	<0.1	--	710
472201094320400		03-21-89	--	--	--	76	--	40	--	--	--
		05-12-89	--	--	--	27	--	15	--	--	--
		07-13-89	--	--	--	62	--	50	--	--	--
472240094361400		07-12-89	--	--	--	20000	--	2800	--	--	--
		08-13-89	<1.0	<1	--	15000	<1	3100	<0.1	<1	--
		08-13-89	1.0	<1	4	--	2	--	<0.1	--	720
472250094395300		07-11-89	--	--	--	22	--	230	--	--	--
		08-13-89	<1.0	<1	--	<3	<1	17	<0.1	<1	--
472300094231800		07-12-89	--	--	--	6	--	20	--	--	--
		08-14-89	--	--	--	--	--	--	--	--	--
472318094185001		03-22-89	--	--	--	35	--	260	--	--	--
		05-12-89	--	--	--	81	--	180	--	--	--
		07-20-89	--	--	--	65	--	84	--	--	--
472335094214200		07-12-89	--	--	--	25	--	130	--	--	--
472355094061600		07-19-89	--	--	--	10	--	19	--	--	--
472510094240700		07-19-89	--	--	--	11	--	14	--	--	--
472520094220700		07-12-89	--	--	--	49	--	440	--	--	--
472533094032300		07-18-89	--	--	--	6	--	30	--	--	--
		08-14-89	<1.0	<1	6	--	1	--	--	--	1400
472720095121800		08-16-89	--	--	--	6	<10	--	--	--	--

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 CASS COUNTY--Continued

STATION NUMBER	DATE	CARBON, ORGANIC DIS- SOLVED (MG/L AS C) (00681)	CYANIDE TOTAL (MG/L AS CN) (00720)	PHENOLS TOTAL (UG/L) (32730)	DICAMBA (MED- IBEN) (BAN- VEL D) (UG/L) (82052)	PICLO- RAM (TOR- DON) (AMDON) TOTAL (UG/L) (39720)	SILVEX, TOTAL (UG/L) (39760)	2,4-D, TOTAL (UG/L) (39730)	2, 4-DP TOTAL (UG/L) (82183)	2,4,5-T TOTAL (UG/L) (39740)
471528094131800	07-19-89	2.0	--	--	--	--	--	--	--	--
471546094331700	03-21-89	2.6	--	--	--	--	--	--	--	--
	05-12-89	1.5	--	--	--	--	--	--	--	--
	07-11-89	1.8	--	--	--	--	--	--	--	--
471907094074200	07-20-89	2.0	--	--	--	--	--	--	--	--
471927094244700	07-20-89	1.7	--	--	--	--	--	--	--	--
471942094132000	07-19-89	2.7	--	--	--	--	--	--	--	--
471945094345000	07-11-89	11	--	--	--	--	--	--	--	--
	08-13-89	--	<0.010	--	--	--	--	--	--	--
471957094025000	07-20-89	3.6	--	--	--	--	--	--	--	--
472028094122400	07-19-89	1.0	--	--	--	--	--	--	--	--
	08-15-89	--	<0.010	--	--	--	--	--	--	--
472117094255000	07-12-89	10	--	--	--	--	--	--	--	--
	08-14-89	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
472134094093000	07-19-89	4.5	--	--	--	--	--	--	--	--
	08-14-89	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
472200094394001	03-21-89	2.4	--	--	--	--	--	--	--	--
	05-08-89	1.5	--	--	--	--	--	--	--	--
	07-11-89	1.7	--	--	--	--	--	--	--	--
	08-13-89	--	<0.010	--	--	--	--	--	--	--
472201094320400	03-21-89	3.4	--	--	--	--	--	--	--	--
	05-12-89	2.1	--	--	--	--	--	--	--	--
	07-13-89	3.0	--	--	--	--	--	--	--	--
472240094361400	07-12-89	3.5	--	--	--	--	--	--	--	--
	08-13-89	5.2	--	18	--	--	--	--	--	--
	08-13-89	--	<0.010	--	--	--	--	--	--	--
472250094395300	07-11-89	2.2	--	--	--	--	--	--	--	--
	08-13-89	1.7	--	4	--	--	--	--	--	--
472300094231800	07-12-89	1.8	--	--	--	--	--	--	--	--
	08-14-89	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
472318094185001	03-22-89	5.0	--	--	--	--	--	--	--	--
	05-12-89	5.6	--	--	--	--	--	--	--	--
	07-20-89	3.2	--	--	--	--	--	--	--	--
472335094214200	07-12-89	1.6	--	--	--	--	--	--	--	--
472355094061600	07-19-89	1.1	--	--	--	--	--	--	--	--
472510094240700	07-19-89	0.6	--	--	--	--	--	--	--	--
472520094220700	07-12-89	1.6	--	--	--	--	--	--	--	--
472533094032300	07-18-89	1.9	--	--	--	--	--	--	--	--
	08-14-89	--	<0.010	--	--	--	--	--	--	--
472720095121800	08-16-89	4.2	--	2	--	--	--	--	--	--









QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

CHIPPEWA COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)
445425095402301	117N40W27CCCA SEEPAGE FACE	08-15-89	2030	<0.010

STATION NUMBER	DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
445425095402301	08-15-89	2.40	0.020	0.70	0.070	0.050	2.3



QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 HUBBARD COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SPE-CIFIC CON-DUCT-ANCE LAB (US/CM) (90095)	PH (STAND-ARD UNITS) (00400)
465239095053301	139N35W10BAB01 29035	112WDDF	05-16-89	0900	--	1441	440	434	6.9
465249095071201	139N35W04DDD02 2M	112WDDF	05-15-89	1900	42.00	1424	430	436	6.8
465356095083201	140N35W32CBB01 14D	112WDDF	05-15-89	1730	145.00	1456	490	485	6.9
472347094461000	145.32.5 CDD CHRISTIANSON		08-16-89	0830	110.00	1370	520	528	7.5
472409094592200	145N34W03CBB COLEMANN		08-15-89	1600	76.00	1404	400	399	7.6

STATION NUMBER	DATE	PH LAB (STAND-ARD UNITS) (00403)	TEMPER-ATURE WATER (DEG C) (00010)	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)	ALKA-LINITY LAB (MG/L AS CACO3) (90410)	ALKA-LINITY WAT WH TOT FET FIELD (MG/L AS CACO3) (00410)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)
465239095053301	05-16-89	7.8	8.0	62	19	6.1	1.8	--	--	<1.0	0.40
465249095071201	05-15-89	7.8	8.0	66	18	2.6	1.2	--	--	25	8.0
465356095083201	05-15-89	7.6	8.5	70	22	3.7	1.0	--	--	10	10
472347094461000	08-16-89	7.7	9.0	79	21	2.8	1.6	289	306	5.0	0.50
472409094592200	08-15-89	7.8	14.5	61	16	2.1	1.0	209	210	8.0	0.60

STATION NUMBER	DATE	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, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC DIS-SOLVED (MG/L AS N) (00623)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	PHENOLS TOTAL (UG/L) (32730)
465239095053301	05-16-89	0.20	25	242	<0.100	--	--	--	--	--	--
465249095071201	05-15-89	0.10	11	252	0.840	--	--	--	--	--	--
465356095083201	05-15-89	0.10	19	267	<0.100	--	--	--	--	--	--
472347094461000	08-16-89	0.10	18	302	<0.100	0.050	<0.20	0.017	0.002	1.5	<1
472409094592200	08-15-89	0.10	18	246	0.310	<0.010	0.50	0.038	0.028	1.4	<1

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 ITASCA COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEO-LOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE (US/CM) (00095)	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)	PH (STANDARD UNITS) (00400)	
471923093550200	144N26W01BBDA	BALL CLUB	112DSMO	07-20-89	1200	1.71	1280	889	756	7.2
			112DSMO	08-14-89	1200	--	1280	970	--	7.2
472207093525000	145N25W18DDCA	EMERSON-DO	112DSMO	07-20-89	1400	3.35	1322	917	800	7.6
472207093525500	145N25W18DDCD	EMERSON	112DSMO	08-14-89	1330	3.74	1322	280	--	8.3
473226094032700	147N27W14DACC	CUTFOOT	112DSMO	07-18-89	1600	--	1340	--	170	--
473526094040500	148N27W35BAADD	MAX,MN	112DSMO	07-18-89	1400	--	1376	--	266	--

STATION NUMBER	DATE	PH LAB (STANDARD UNITS) (00403)	TEMPERATURE WATER (DEG C) (00010)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNESIUM DIS-SOLVED (MG/L AS MG) (00925)	SODIUM DIS-SOLVED (MG/L AS NA) (00930)	POTASSIUM DIS-SOLVED (MG/L AS K) (00935)	ALKALINITY LAB (MG/L AS CACO3) (90410)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLORIDE DIS-SOLVED (MG/L AS CL) (00940)
471923093550200	07-20-89	7.1	14.0	120	24	8.9	5.3	382	16	15
	08-14-89	--	14.0	--	--	--	--	--	--	--
472207093525000	07-20-89	7.5	10.5	84	24	45	1.0	256	9.0	94
472207093525500	08-14-89	--	18.0	--	--	--	--	--	--	--
473226094032700	07-18-89	7.3	--	20	5.1	3.8	0.90	76	9.0	1.0
473526094040500	07-18-89	8.2	--	36	12	1.8	0.50	134	3.0	1.0

STATION NUMBER	DATE	FLUORIDE DIS-SOLVED (MG/L AS F) (00950)	SILICA DIS-SOLVED (MG/L AS SIO2) (00955)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	PHOSPHORUS TOTAL (MG/L AS P) (00665)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BORON DIS-SOLVED (UG/L AS B) (01020)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)
471923093550200	07-20-89	0.20	38	<0.100	0.870	0.160	0.400	--	40	--
	08-14-89	--	--	--	--	--	--	<1	--	<1.0
472207093525000	07-20-89	0.10	21	0.160	0.030	0.030	<0.010	--	100	--
472207093525500	08-14-89	--	--	--	--	--	--	<1	--	<1.0
473226094032700	07-18-89	0.10	19	<0.100	0.070	0.180	0.030	--	<10	--
473526094040500	07-18-89	0.10	22	0.780	0.020	0.170	0.030	--	30	--

STATION NUMBER	DATE	CHROMIUM DIS-SOLVED (UG/L AS CR) (01030)	COPPER DIS-SOLVED (UG/L AS CU) (01040)	IRON DIS-SOLVED (UG/L AS FE) (01046)	LEAD DIS-SOLVED (UG/L AS PB) (01049)	MANGANESE DIS-SOLVED (UG/L AS MN) (01056)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	ZINC DIS-SOLVED (UG/L AS ZN) (01090)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CYANIDE TOTAL (MG/L AS CN) (00720)
471923093550200	07-20-89	--	--	8100	--	280	--	--	38	--
	08-14-89	3	1	--	1	--	--	41000	--	<0.010
472207093525000	07-20-89	--	--	160	--	790	--	--	4.9	--
472207093525500	08-14-89	2	3	--	3	--	<0.1	850	--	<0.010
473226094032700	07-18-89	--	--	1100	--	160	--	--	4.2	--
473526094040500	07-18-89	--	--	19	--	21	--	--	2.0	--

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 LAC QUI PARLE COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)
445630095462101	117N41W14CBAA SEEPAGE AT E	08-16-89	1000	1310	7.3	9.0
450026095514001	118N42W25AABA SEEPAGE AT B	08-16-89	1130	1740	7.1	9.0

STATION NUMBER	DATE	NITROGEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOSPHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
445630095462101	08-16-89	<0.010	<0.100	0.910	1.2	<0.010	<0.010	1.9
450026095514001	08-16-89	<0.010	<0.100	1.60	3.9	<0.010	<0.010	3.1

LE SUEUR COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)
441827093573301	110N26W28BDAA SEEPAGE FACE	08-29-89	1500	1190	7.1

STATION NUMBER	DATE	NITROGEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOSPHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
441827093573301	08-29-89	<0.010	0.930	0.040	0.30	0.020	0.010	1.5

NICOLLET COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD UNITS) (00400)	TEMPERATURE WATER (DEG C) (00010)
441206094114501	109N28W33DBAC SEEPAGE FACE	08-23-89	1200	941	7.4	15.0
441531094203001	109N29W8CADA COURTLAND BRI	08-23-89	1330	690	7.1	9.5

STATION NUMBER	DATE	OXYGEN, DIS-SOLVED (MG/L) (00300)	NITROGEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOSPHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
441206094114501	08-23-89	0.2	<0.010	<0.100	1.20	1.3	<0.010	<0.010	2.6
441531094203001	08-23-89	3.8	<0.010	7.40	0.020	0.40	0.010	0.010	0.8

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 POPE COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEOLOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE (US/CM) (00095)	
454239095104001	126N36W23BCA04	ROSHOLT 0U1	1120TSH	04-20-89	1100	6.79	13.00	1332	498
454240095103301	126N36W23BCA05	ROSHOLT 0U1	1120TSH	04-20-89	1000	5.57	14.00	1330	523
454240095104201	126N35W23BCB01	ROSHOLT 0U1	1120TSH	04-20-89	1200	8.25	16.00	1333	580
454242095103701	126N36W23WBCA01	ROSHOLT 0U	1120TSH	04-20-89	1530	10.57	12.00	1335	275
454242095103702	126N36W23BCA02	ROSHOLT 0L1	1120TSH	04-20-89	1630	10.63	31.00	1335	558
454242095103703	126N36W23BCA03	ROSHOLT 0M1	1120TSH	04-20-89	1600	10.67	23.00	1335	535
454243095103001	126N36W23BAC01	ROSHOLT-WES	1120TSH	04-20-89	1730	10.45	13.00	1335	550
454243095103002	126N36W23BAC18	ROSHOLT 0M1	1120TSH	04-20-89	1900	10.30	23.00	1335	560
454244095103701	126N36W23BBD01	ROSHOLT-0U9	1120TSH	04-21-89	0900	12.88	16.00	1337	519
454244095103702	126N36W23BBD11	ROSHOLT 0L0	1120TSH	04-20-89	1500	13.20	35.00	1338	545
454244095103703	126N36W23BBD12	ROSHOLT 0M0	1120TSH	04-20-89	1400	12.92	24.00	1338	525
454245095102601	126N36W23BAC08	ROSHOLT-WES	1120TSH	04-19-89	1400	10.66	12.00	1335	585
454245095102801	126N36W23BAC07	ROSHOLT-WES	1120TSH	04-19-89	1300	10.60	12.00	1335	560
454245095102802	126N36W23BAC17	ROSHOLT 4M0	1120TSH	04-19-89	1320	10.80	22.00	1335	545
454245095103001	126N36W23BAC06	ROSHOLT-WES	1120TSH	04-19-89	1100	11.03	12.00	1335	562
454245095103002	126N36W23BAC16	ROSHOLT 3M0	1120TSH	04-19-89	1120	10.95	22.00	1335	548
454245095103201	126N36W23BBD06	ROSHOLT-WES	1120TSH	04-19-89	1000	11.33	13.00	1336	549
454245095103202	126N36W23BBD10	ROSHOLT 2M0	1120TSH	04-19-89	1020	11.46	22.00	1336	505
454245095103501	126N36W23BBD05	ROSHOLT-WES	1120TSH	04-19-89	0900	12.04	13.00	1337	500
454247095102301	126N36W23BAC05	ROSHOLT-WES	1120TSH	04-18-89	1815	9.82	12.00	1334	555
454247095102302	126N36W23BAC15	ROSHOLT 6M0	1120TSH	04-21-89	1600	9.89	22.00	1334	550
454247095102501	126N36W23BAC04	ROSHOLT-WES	1120TSH	04-18-89	1715	9.69	12.00	1334	585
454247095102502	126N36W23BAC14	ROSHOLT 5M0	1120TSH	04-21-89	1500	9.87	22.00	1334	530
454247095102801	126N36W23BAC03	ROSHOLT-WESTP	1120TSH	04-18-89	1630	10.25	12.00	1335	555
454247095102802	126N36W23BAC12	ROSHOLT 4M0	1120TSH	04-21-89	1330	10.31	22.00	1335	540
454247095102803	126N36W23BAC13	ROSHOLT 4L0	1120TSH	04-21-89	1400	10.52	27.00	1335	540
454247095103001	126N36W23BAC02	ROSHOLT-WES	1120TSH	04-18-89	1915	10.48	13.00	1335	550
454247095103002	126N36W23BAC10	ROSHOLT 3L0	1120TSH	04-21-89	1230	10.46	29.00	1335	527
454247095103003	126N36W23BAC11	ROSHOLT 3M0	1120TSH	04-21-89	1200	10.47	22.00	1335	525
454247095103201	126N36W23BBD04	ROSHOLT-WES	1120TSH	04-18-89	1500	10.95	12.00	1335	340
454247095103202	126N36W23BBD07	ROSHOLT 2L	1120TSH	04-21-89	1030	11.08	30.00	1335	538
454247095103203	126N36W23BBD08	ROSHOLT 2M0	1120TSH	04-21-89	1000	11.07	22.00	1336	543
454247095103401	126N36W23BBD03	ROSHOLT-WES	1120TSH	04-18-89	1315	11.34	12.00	1336	540
454247095103402	126N36W23BBD09	ROSHOLT 1M0	1120TSH	04-18-89	1415	11.52	22.00	1336	540

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 POPE COUNTY--Continued

STATION NUMBER	DATE	TEMPER- ATURE WATER (DEG C) (00010)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	NITRO- GEN, AMMONIA DIS- SOLVED (MG/L AS N) (00608)	ALA- CHLOR TOTAL RECOVER (UG/L) (77825)	AME- TRYNE TOTAL (82184)	ATRA- ZINE, TOTAL (UG/L) (39630)	CYAN- AZINE TOTAL (UG/L) (81757)
454239095104001	04-20-89	7.0	--	--	11.0	0.020	--	--	--	--
454240095103301	04-20-89	7.0	--	--	5.30	0.030	--	--	--	--
454240095104201	04-20-89	7.0	--	--	9.60	0.040	--	--	--	--
454242095103701	04-20-89	5.5	3.5	5.2	1.50	0.020	<0.10	<0.10	<0.10	<0.10
454242095103702	04-20-89	9.0	--	--	<0.100	0.260	--	--	--	--
454242095103703	04-20-89	8.0	--	--	2.40	0.050	--	--	--	--
454243095103001	04-20-89	6.5	15	20	5.40	0.020	<0.10	<0.10	<0.10	<0.10
454243095103002	04-20-89	8.5	--	--	0.330	0.100	--	--	--	--
454244095103701	04-21-89	7.5	15	14	12.0	0.030	<0.10	<0.10	<0.10	<0.10
454244095103702	04-20-89	9.5	--	--	<0.100	0.210	--	--	--	--
454244095103703	04-20-89	9.0	--	--	7.20	0.030	--	--	--	--
454245095102601	04-19-89	7.5	16	14	14.0	0.020	<0.10	<0.10	<0.10	<0.10
454245095102801	04-19-89	7.0	16	18	9.10	0.020	<0.10	<0.10	<0.10	<0.10
454245095102802	04-19-89	8.0	--	--	0.820	0.040	--	--	--	--
454245095103001	04-19-89	6.5	16	15	7.10	0.010	<0.10	<0.10	<0.10	<0.10
454245095103002	04-19-89	8.0	--	--	<0.100	0.030	--	--	--	--
454245095103201	04-19-89	6.0	14	20	9.20	0.010	<0.10	<0.10	<0.10	<0.10
454245095103202	04-19-89	8.0	--	--	5.30	0.060	--	--	--	--
454245095103501	04-19-89	6.0	12	12	11.0	0.010	<0.10	<0.10	<0.10	<0.10
454247095102301	04-18-89	6.0	16	13	10.0	0.030	<0.10	<0.10	0.10	<0.10
454247095102302	04-21-89	8.5	--	--	<0.100	0.140	--	--	--	--
454247095102501	04-18-89	6.5	16	13	12.0	0.040	<0.10	<0.10	0.10	<0.10
454247095102502	04-21-89	9.0	--	--	<0.100	0.110	--	--	--	--
454247095102801	04-18-89	6.0	16	12	10.0	0.020	<0.10	<0.10	0.10	<0.10
454247095102802	04-21-89	8.5	--	--	<0.100	0.040	--	--	--	--
454247095102803	04-21-89	9.0	--	--	<0.100	0.140	--	--	--	--
454247095103001	04-18-89	6.0	20	12	7.90	0.010	<0.10	<0.10	0.10	<0.10
454247095103002	04-21-89	9.0	--	--	<0.100	0.180	--	--	--	--
454247095103003	04-21-89	9.0	--	--	0.280	0.030	--	--	--	--
454247095103201	04-18-89	6.0	4.2	8.2	0.830	0.020	<0.10	<0.10	0.20	<0.10
454247095103202	04-21-89	9.0	--	--	<0.100	0.190	--	--	--	--
454247095103203	04-21-89	8.0	--	--	4.10	0.030	--	--	--	--
454247095103401	04-18-89	6.0	15	11	13.0	0.020	<0.10	<0.10	0.10	<0.10
454247095103402	04-18-89	8.0	--	--	8.30	0.020	--	--	--	--



QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 RAMSEY COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEOLOGIC UNIT	DATE	TIME	DEPTH BELOW LAND SURFACE (WATER LEVEL) (FEET) (72019)	DEPTH OF WELL, TOTAL (FEET) (72008)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE (US/CM) (00095)
45022109305460	130N22W31DCBB. ST PAUL WATE	1120TSH	08-31-89	1355	15.32	17.30	888	1490
45024009305350	130N22W31ACDB. ST PAUL WATE	1120TSH	08-31-89	1245	9.40	--	885	685
45025209304520	130N22W32BAC. ST PAUL WATER	1120TSH	08-24-89	1250	9.04	19.80	894	463
45031109304070	130N22W29DDAC. ST PAUL WATE	1120TSH	08-24-89	1200	9.47	14.30	908	355
45031709304200	130N22W29DBDD. ST PAUL WATE	1120TSH	08-24-89	1050	7.20	10.90	901	753
45034209305560	1030N22W30BADC. ST. PAUL WA	1120TSH	08-24-89	1400	7.75	11.30	892	289
45035209303220	130N22W28BAAA. ST PAUL WATE	1120TSH	08-24-89	0900	10.98	14.50	915	2100
45035209305580	1030N22W30BABA. ST. PAUL WA	1120TSH	08-31-89	1120	8.97	15.00	897	318

STATION NUMBER	DATE	SPECIFIC CONDUCTANCE LAB (US/CM) (90095)	PH (STANDARD UNITS) (00400)	PH LAB (STANDARD UNITS) (00403)	TEMPERATURE WATER (DEG C) (00010)	OXYGEN, DIS-SOLVED (MG/L) (00300)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNESIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)
450221093054601	08-31-89	1520	6.2	6.6	12.0	<0.1	140	47	120	1.1
450240093053501	08-31-89	724	6.8	7.2	12.0	0.1	87	40	12	1.4
450252093045201	08-24-89	--	8.1	--	16.5	--	--	--	--	--
450311093040701	08-24-89	364	8.6	8.0	12.0	3.1	41	8.7	5.5	22
450317093042001	08-24-89	760	6.8	7.3	16.5	0.3	110	31	2.5	3.0
450342093055601	08-24-89	312	7.4	7.6	14.0	--	37	8.2	7.0	2.1
450352093032201	08-24-89	2130	7.2	7.2	12.5	4.3	60	10	370	2.3
450352093055801	08-31-89	327	7.2	7.5	11.5	0.4	40	8.3	16	1.3

STATION NUMBER	DATE	BICARBONATE WATER DIS IT FIELD (MG/L AS HCO3) (00453)	CARBONATE WATER DIS IT FIELD (MG/L AS CO3) (00452)	ALKALINITY LAB (MG/L AS CACO3) (90410)	ALKALINITY WATER DIS TOT IT FIELD (MG/L AS CACO3) (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	NITROGEN, DIS-SOLVED NO2+NO3 TOTAL (MG/L AS N) (00630)
450221093054601	08-31-89	756	0	598	620	17	160	0.20	64	<0.100
450240093053501	08-31-89	393	0	319	322	52	17	0.10	27	0.700
450252093045201	08-24-89	--	--	--	--	--	--	--	--	--
450311093040701	08-24-89	173	3	150	148	11	13	0.10	25	0.500
450317093042001	08-24-89	500	0	408	410	20	1.3	0.20	33	1.10
450342093055601	08-24-89	93	0	76	76	65	6.8	<0.10	19	0.200
450352093032201	08-24-89	328	0	273	269	29	480	0.10	14	3.00
450352093055801	08-31-89	173	0	148	142	6.0	8.3	0.10	20	0.800

STATION NUMBER	DATE	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITROGEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOSPHORUS TOTAL (MG/L AS P) (00665)	PHOSPHORUS, DIS-SOLVED (MG/L AS P) (00666)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	MANGANESE, DIS-SOLVED (UG/L AS MN) (01056)
450221093054601	08-31-89	<0.100	0.070	0.070	1.0	0.80	0.400	0.310	8300	7600
450240093053501	08-31-89	0.680	0.010	0.010	0.30	<0.20	0.100	0.030	270	1100
450252093045201	08-24-89	<0.100	--	<0.010	--	0.20	--	0.070	--	--
450311093040701	08-24-89	0.460	<0.010	<0.010	0.30	0.30	0.940	0.940	5	14
450317093042001	08-24-89	1.10	0.030	0.030	1.4	0.50	0.030	<0.010	2400	2000
450342093055601	08-24-89	0.180	<0.010	<0.010	<0.20	0.20	0.090	0.050	130	1400
450352093032201	08-24-89	3.00	0.020	0.030	0.80	0.70	0.050	0.050	20	140
450352093055801	08-31-89	0.790	<0.010	<0.010	<0.20	<0.20	0.050	0.050	9	390

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 REDWOOD COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)
443317095073401	113N36W36ABBC REDWOOD SPRI	08-17-89	1245	<0.010

STATION NUMBER	DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS-PHCRUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHCRUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
443317095073401	08-17-89	<0.100	0.240	0.50	<0.010	<0.010	1.5

RENVILLE COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)
442859094490301	112N33W20DAAD PETERSON SPR	08-23-89	1500	<0.010
443110094530001	112N34W12CBCA SEEPAGE @ FR	08-17-89	0915	<0.010
443631095094801	113N36W10ABDA SEEPAGE AT C	08-17-89	1700	<0.010
444413095251701	115N38W26DAAD SEEPAGE FACE	08-16-89	1730	<0.010

STATION NUMBER	DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA + ORGANIC DIS. (MG/L AS N) (00623)	PHOS-PHCRUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHCRUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)
442859094490301	08-23-89	0.520	0.040	0.40	<0.010	<0.010	1.9
443110094530001	08-17-89	<0.100	0.860	1.1	<0.010	<0.010	2.1
443631095094801	08-17-89	3.60	0.040	0.40	<0.010	<0.010	1.8
444413095251701	08-16-89	<0.100	0.780	1.2	0.780	0.760	7.1

QUALITY OF GROUND WATER  
 WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989  
 SCOTT COUNTY

STATION NUMBER	LOCAL IDENTIFIER	DATE	TIME	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD) (00400)	TEMPERATURE WATER (DEG C) (00010)
444132093383201	114N23W7CCBB SEEPAGE FACE	08-29-89	1130	700	901	6.9	10.0

STATION NUMBER	DATE	OXYGEN, DIS-SOLVED (MG/L) (00300)	NITROGEN, NITRITE DIS-SOLVED (MG/L) (00613)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L) (00608)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L) (00623)	PHOSPHORUS DIS-SOLVED (MG/L) (00666)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L) (00681)
444132093383201	08-29-89	0.8	<0.010	<0.100	0.050	0.30	0.010	<0.010	2.3

SIBLEY COUNTY

STATION NUMBER	LOCAL IDENTIFIER	GEOLOGIC UNIT	DATE	TIME	SPECIFIC CONDUCTANCE (US/CM) (00095)	PH (STANDARD) (00400)	TEMPERATURE WATER (DEG C) (00010)
443418093552201	113N26W26BABA SEEPAGE FACE		08-29-89	1255	1000	7.3	9.5

STATION NUMBER	DATE	OXYGEN, DIS-SOLVED (MG/L) (00300)	NITROGEN, NITRITE DIS-SOLVED (MG/L) (00613)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L) (00631)	NITROGEN, AMMONIA DIS-SOLVED (MG/L) (00608)	NITROGEN, AMMONIA + ORGANIC DIS. (MG/L) (00623)	PHOSPHORUS DIS-SOLVED (MG/L) (00666)	PHOSPHORUS ORTHO, DIS-SOLVED (MG/L) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L) (00681)
443418093552201	08-29-89	0.1	<0.010	<0.100	1.70	2.1	<0.010	<0.010	3.4

## CHEMICAL QUALITY OF PRECIPITATION

461458094295000 PRECIPITATION STATION AT CAMP RIFLEY, MN

## WATER-QUALITY RECORDS

LOCATION.--Lat 46°14'58", long 94°29'50", in NE¼ sec.18, T.132 N., R.30 W., Morrison County, Hydrologic Unit 07010104, approximately 500 ft southwest of the abandoned Gilgal Church and approximately 5 miles south of the town of Pillager.

PERIOD OF RECORD.--October 1983 to current year (weekly composite).

INSTRUMENTATION.--Samples are collected in a polyethylene bucket by an electrically operated wet/dry collector. A recording rain gage and a standard U.S. Weather Service bulk rain gage measure rainfall quantity.

REMARKS.--An observer collects only the wetfall bucket and services the rain gages every Tuesday around 0900 hours. The observer weighs the bucket and if there is enough wetfall, determines specific conductance and pH. The bucket with its remaining contents is then sent to the Illinois State Water Survey Laboratory for analysis.

## WATER QUALITY DATA, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## WEEKLY COMPOSITE

DATE	GREEN- WICH MEAN TIME	TOTAL	SPEC.	SPEC.	PH	PH	CALCIUM	MAG-
		PRECIP- ITATION FOR DEFINED PERIOD (IN) (00193)	CONduc- TANCE FIELD ATM DEP WET TOT (US/CM) (83154)	CONduc- TANCE LAB ATM DEP WET TOT (US/CM) (83158)	FIELD ATM DEP WET T (UNITS) (83106)	LAB ATM DEP WET T (UNITS) (83107)	ATM DEP WET DIS (MG/L) (82932)	NESIUM ATM DEP WET DIS (MG/L) (83002)
OCT 04-11	1200	0.0	--	--	--	7.01	--	--
OCT 11-18	1000	0.30	9.0	8.5	5.3	6.45	0.34	0.078
OCT 18-25	1300	0.32	8.2	7.2	5.2	6.04	0.21	0.020
OCT 25- NOV 01	1000	0.20	5.6	4.6	5.1	6.13	0.14	0.021
NOV 01-08	1430	0.10	5.0	3.7	5.2	5.67	0.10	0.022
NOV 08-15	1400	0.75	6.5	5.3	4.9	5.15	0.05	0.010
NOV 15-22	1100	1.40	--	--	--	--	--	--
NOV 22-29	1100	1.05	3.9	3.4	4.9	5.31	0.03	0.007
NOV 29- DEC 06	1600	0.0	--	--	--	--	--	--
DEC 06-13	1430	0.10	5.6	10.8	5.2	6.64	0.62	0.085
DEC 13-20	1400	--	6.3	7.9	5.1	6.48	0.17	0.034
DEC 20-27	1100	0.65	46.3	40.0	4.4	4.96	0.53	0.073
DEC 27 1988- JAN 03 1989	1330	0.15	5.8	6.7	5.1	6.27	0.23	0.035
JAN 03-10	1300	0.75	19.6	17.5	4.4	4.51	0.03	0.005
JAN 10-17	1700	0.05	19.0	14.7	4.3	4.98	0.45	0.042
JAN 17-24	1100	--	--	20.8	--	7.13	<0.12	<0.041
JAN 24-31	1100	--	--	15.8	--	4.92	0.35	0.040
JAN 31- FEB 07	1100	--	6.0	7.1	5.3	6.41	0.51	0.077
FEB 07-14	1100	--	9.1	8.2	5.1	5.86	0.12	0.023
FEB 14-21	1500	--	--	11.5	--	6.36	0.15	<0.028

## CHEMICAL QUALITY OF PRECIPITATION

461458094295000 PRECIPITATION STATION AT CAMP RIPLEY, MN.--Continued

CHEMICAL ANALYSIS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## WEEKLY COMPOSITE

DATE	GREEN WICH MEAN TIME	TOTAL	SPEC.	SPEC.	PH	PH	CALCIUM		MAG-	
		PRECIP- ITATION FOR DEFINED PERIOD (IN) (00193)	CONDC- TANCE FIELD ATM DEP WET TOT (US/CM) (83154)	CONDC- TANCE LAB ATM DEP WET TOT (US/CM) (83156)	FIELD ATM DEP WET T (UNITS) (83106)	LAB ATM DEP WET T (UNITS) (83107)	ATM DEP WET DIS (MG/L) (82932)	ATM DEP WET DIS (MG/L) (83002)	ATM DEP WET DIS (MG/L) (83002)	ATM DEP WET DIS (MG/L) (83002)
FEB										
21-28	1100	--	8.9	7.0	4.8	6.47	0.09	0.016		
FEB 28-										
MAR 07	1100	0.45	10.6	6.0	4.65	5.11	0.07	0.009		
MAR										
07-14	1100	0.25	4.4	3.6	5.2	5.76	0.11	0.016		
MAR										
14-21	1100	0.35	3.9	2.8	5.2	5.81	0.05	0.008		
MAR										
21-28	1500	0.45	14.5	15.6	5.2	6.56	0.38	0.061		
MAR 28-										
APR 04	1100	0.75	8.4	7.4	5.2	6.07	0.08	0.014		
APR										
04-11	1000	0.08	10.8	11.2	4.9	6.68	0.31	0.067		
APR										
11-18	1000	0.0	--	--	--	--	--	--		
APR										
18-25	1000	0.06	86.2	31.4	3.8	5.18	0.73	0.145		
APR 25-										
MAY 02	1500	1.00	10.7	6.7	4.6	5.37	0.18	0.023		
MAY										
02-09	1000	1.00	10.5	8.8	4.8	5.86	0.21	0.042		
MAY										
09-16	1000	0.07	70.9	15.0	3.9	6.43	0.65	0.132		
MAY										
16-23	1000	0.70	15.5	14.7	4.5	4.99	0.49	0.090		
MAY										
23-30	1000	2.50	8.7	9.3	4.9	5.92	0.40	0.056		
MAY 30-										
JUN 06	1500	0.0	--	123.1	--	6.87	<0.46	<0.153		
JUN										
06-13	1000	0.78	20.3	12.2	4.3	5.02	0.25	0.057		
JUN										
13-20	1000	0.20	12.8	6.3	4.5	5.63	0.13	0.020		
JUN										
20-27	1000	1.59	7.9	9.6	5.3	6.18	0.42	0.051		
JUN 27-										
JUL 04	1000	0.60	12.0	13.1	5.5	6.64	0.49	0.105		
JUL										
04-11	1130	0.04	--	17.1	--	5.30	0.53	0.071		
JUL										
11-18	1000	0.03	--	29.7	--	5.03	1.66	0.311		
JUL										
18-25	1000	0.02	--	53.6	--	7.21	4.21	0.563		
JUL 25-										
AUG 01	1500	0.63	10.1	12.6	5.5	6.59	0.92	0.151		
AUG										
01-08	1000	0.01	--	30.0	--	6.93	0.33	0.048		
AUG										
08-15	1330	1.19	9.5	10.3	5.45	6.52	0.61	0.123		
AUG										
15-22	1000	0.67	13.4	9.5	4.5	5.06	0.12	0.017		
AUG										
22-29	1000	1.55	8.2	7.8	4.6	5.04	0.06	0.008		
AUG 29-										
SEP 05	1000	3.18	7.1	8.1	4.7	5.14	0.16	0.022		
SEP										
05-12	1000	0.30	9.2	8.2	4.5	5.09	0.18	0.029		
SEP										
12-19	1300	0.0	--	1.6	--	6.09	<0.01	<0.003		
SEP										
19-26	1000	2.55	5.9	7.6	4.7	5.58	0.20	0.024		
SEP 26-										
OCT 03	1000	0.25	18.2	16.6	4.9	6.45	0.82	0.141		

## CHEMICAL QUALITY OF PRECIPITATION

461458094295000 PRECIPITATION STATION AT CAMP RIPLEY, MN.--Continued

CHEMICAL ANALYSIS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## WEEKLY COMPOSITE

DATE	SODIUM ATM DEP WET DIS (MG/L) (83138)	POTAS- SIUM ATM DEP WET DIS (MG/L) (83120)	SULFATE ATM DEP WET DIS AS SO <sub>4</sub> (MG/L) (83160)	CHLO- RIDE ATM DEP WET DIS (MG/L) (82944)	NI- TROGEN NITRATE ATM DEP WET DIS AS NO <sub>3</sub> (MG/L) (83071)	NI- TROGEN AMMON. ATM DEP WET DIS AS NH <sub>4</sub> (MG/L) (83047)	PHOS- PHORUS ORTHO ATM DEP WET DIS AS PO <sub>4</sub> (MG/L) (83111)
OCT							
04-11	--	--	--	--	--	--	--
OCT							
11-18	0.116	0.028	0.87	0.06	0.83	0.53	<0.02
OCT							
18-25	0.022	0.003	0.71	0.05	1.20	0.54	<0.02
OCT 25-							
NOV 01	0.071	0.019	0.50	0.06	0.45	0.23	0.03
NOV							
01-08	0.100	0.026	0.31	0.08	0.39	0.08	0.07
NOV							
08-15	0.016	0.004	0.38	0.05	0.77	0.15	<0.02
NOV							
15-22	--	--	--	--	--	--	--
NOV							
22-29	0.022	<0.003	0.27	<0.03	0.05	<0.02	<0.02
NOV 29-							
DEC 06	--	--	--	--	--	--	--
DEC							
06-13	0.105	0.135	0.65	0.21	0.87	0.47	0.16
DEC							
13-20	0.143	0.010	0.78	0.10	0.77	0.47	<0.02
DEC							
20-27	0.124	0.065	6.23	0.42	7.70	3.80	<0.02
DEC 27 1988-							
JAN 03 1989	0.234	0.021	0.30	0.20	0.94	0.25	<0.02
JAN							
03-10	0.017	0.008	0.82	0.05	2.42	0.20	<0.02
JAN							
10-17	0.105	0.026	0.49	0.41	3.79	0.31	<0.02
JAN							
17-24	0.290	<0.041	0.41	0.55	1.11	<0.28	<0.28
JAN							
24-31	0.177	0.010	0.88	0.23	3.92	0.40	<0.02
JAN 31-							
FEB 07	0.146	0.045	0.71	0.08	0.65	0.24	<0.02
FEB							
07-14	0.050	0.005	0.91	0.09	1.08	0.68	<0.02
FEB							
14-21	0.578	0.047	0.38	0.38	0.28	<0.19	<0.19
FEB							
21-28	0.304	0.011	0.30	0.09	1.35	0.26	<0.02
FEB 28-							
MAR 07	0.139	0.003	0.20	0.09	1.53	0.09	<0.02
MAR							
07-14	0.042	0.005	0.43	0.06	0.46	0.12	<0.02
MAR							
14-21	0.037	0.003	0.19	0.05	0.34	0.08	<0.02
MAR							
21-28	0.100	0.050	1.64	0.13	2.39	1.52	<0.02

## CHEMICAL QUALITY OF PRECIPITATION

461458094295000 PRECIPITATION STATION AT CAMP RIPLEY, MN.--Continued

CHEMICAL ANALYSIS, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989

## WEEKLY COMPOSITE

DATE	SODIUM	POTAS-	SULFATE	CHLO-	NI-	NI-	PHOS-
	ATM DEP WET DIS (MG/L) (83138)	SIUM ATM DEP WET DIS (MG/L) (83120)	ATM DEP WET DIS AS SO4 (MG/L) (83160)	RIDE ATM DEP WET DIS (MG/L) (82944)	NITRATE ATM DEP WET DIS AS NO3 (MG/L) (83071)	AMMON. ATM DEP WET DIS AS NH4 (MG/L) (83047)	ORTHO ATM DEP WET DIS AS PO4 (MG/L) (83111)
MAR 28-							
APR 04	0.050	0.010	0.96	0.04	1.02	0.71	<0.02
APR 04-11	0.141	0.076	1.29	0.11	1.04	0.60	<0.02
APR 11-18	--	--	--	--	--	--	--
APR 18-25	0.325	0.371	5.75	0.22	5.14	2.12	<0.02
APR 25-							
MAY 02	0.055	0.039	0.97	0.05	0.74	0.25	<0.02
MAY 02-09	0.037	0.022	1.25	0.06	1.37	0.78	<0.02
MAY 09-16	0.311	0.212	1.60	0.17	1.37	0.79	<0.02
MAY 16-23	0.039	0.055	2.23	0.09	1.82	0.51	<0.02
MAY 23-30	0.102	0.049	1.20	0.12	1.33	0.61	<0.02
MAY 30-							
JUN 06	0.561	<0.153	<1.53	<1.53	<1.53	1.53	<1.02
JUN 06-13	0.039	0.009	1.78	0.05	1.35	0.63	<0.02
JUN 13-20	0.131	0.005	0.59	0.10	1.00	0.10	0.02
JUN 20-27	0.067	0.048	1.15	0.10	1.57	0.73	<0.02
JUN 27-							
JUL 04	0.030	0.052	1.23	0.08	1.54	1.12	0.03
JUL 04-11	0.071	0.033	1.82	0.20	3.19	1.21	0.06
JUL 11-18	0.100	0.079	4.11	0.27	6.30	1.18	0.09
JUL 18-25	0.244	0.111	4.67	0.56	7.33	0.30	0.15
JUL 25-							
AUG 01	0.029	0.026	0.97	0.08	1.82	0.75	<0.02
AUG 01-08	0.133	<0.018	2.00	0.36	2.54	1.39	<0.12
AUG 08-15	0.027	0.037	0.77	0.09	1.36	0.84	<0.02
AUG 15-22	0.010	0.019	1.12	0.05	1.26	0.48	<0.02
AUG 22-29	0.008	0.005	0.99	<0.03	0.59	0.32	<0.02
AUG 29-							
SEP 05	0.025	0.015	0.98	0.07	0.92	0.43	<0.02
SEP 05-12	0.046	0.015	0.75	0.09	1.08	0.25	<0.02
SEP 12-19	0.013	0.031	<0.03	0.06	0.05	0.04	0.03
SEP 19-26	0.009	0.010	1.26	0.03	0.71	0.45	<0.02
SEP 26-							
OCT 03	0.058	0.084	2.47	0.12	2.22	1.08	<0.02



Hyde and pocupine at last camp on St. Louis River  
St. Louis River survey, 1910

INDEX

---

	Page		Page
Access to WATSTORE data.....	21	Cfs/day, definition of.....	22
Accuracy of the records.....	18	Champlin, Elm Creek near.....	80-82
Acre-foot, definition of.....	22	Chanarambie Creek near Edgerton.....	181
Adenosine triphosphate, definition of.....	22	Chemical oxygen demand, definition of.....	22
Aitkin, Mississippi River at.....	55	Chemical quality of precipitation.....	326-329
Akeley, Williams Lake near.....	46	Chippewa River near Milan.....	93
Aldrich, Leaf River near.....	175	Chlorophyll, definition of.....	22
Algae, definition of.....	22	Classification of records.....	19
Algal growth potential, definition of.....	22	Clearwater, Mississippi River at.....	176
Analysis of samples collected at water-		Clearwater River basin high-flow partial-	
quality miscellaneous sites.....	221-230	record stations in.....	176
at streamflow stations.....	231-237	low-flow partial-record stations in.....	163-164
at water-quality partial-record stations...	184-220	Clearwater River near South Haven.....	176
Anoka, Mississippi River near.....	83-57	Collection and computation of ground-water	
Appleton, Pomme de Terre River at.....	90-231	levels.....	20-21
Aquifer, definition of.....	22	ground-water quality.....	21
Arrangement of records.....	19	stage and water discharge.....	16-17
Artesian, definition of.....	22	Color unit, definition of.....	22
Artificial substrate, definition of.....	25	Concord, Milliken Creek near.....	179
Ashley Creek near Sauk Centre.....	70-71	Contents, definition of.....	22
Ash mass, definition of.....	22	Control, definition of.....	22
Austin, Cedar River near.....	159	Cooperation.....	1
		Cottage Grove, Mississippi River at Grey	
Bacteria, definition of.....	22	Cloud Island near.....	121-127
Bancroft, Bancroft Creek at.....	181	Cottonwood River near New Ulm.....	98,233
Bancroft Creek at Bancroft.....	181	near Springfield.....	178
Beaver Creek at Beaver Falls.....	177	tributary No. 2 near Sanborn.....	178
at Valley Springs, S.D.....	181	Courtland, Little Cottonwood River near.....	99
Beaver Falls, Beaver Creek at.....	177	Crooked Creek at Freeburg.....	180
Becida, Hennepin Creek near.....	174	Crooked Creek basin, high-flow partial-record	
Bed load, definition of.....	25	stations in.....	180
discharge, definition of.....	25	low-flow partial-record stations in.....	169
Bed material, definition of.....	22	Crooked Creek near Hinckley.....	179
Bemidji, Schoolcraft River near.....	40-41	Cross Lake, Pine River at Cross Lake Dam, at..	57
Bemidji, Mississippi River at.....	38-39	Pine River Reservoir at.....	56
Mississippi River near.....	42-43	Crow River at Rockford.....	77,231
Big Sioux River basin, high-flow partial-		North Fork, at Paynesville.....	176
record stations in.....	181	North Fork, near Kingston.....	176
Big Stone City, SD, Whetstone River near.....	86	South Fork, near Mayer.....	177
Big Stone Lake at Ortonville.....	87	Crow River basin, gaging-station records	
Biochemical oxygen demand, definition of.....	22	in.....	77
Biomass, definition of.....	22	high-flow partial-record stations in.....	176-177
Blue Earth River, East Branch, near Walters...	178	low-flow partial-record stations in.....	161-162
near Rapidan.....	101	Crow Wing River basin, gaging-station	
Blue-green algae, definition of.....	24	records in.....	59-65
Bottom material, definition of.....	22	high-flow partial-record stations in.....	174-175
Boy River near Remer.....	174	low-flow partial-record stations in.....	161-162
Brainerd, Gull Lake near.....	63	miscellaneous measurements in.....	183
Gull River at Gull Lake Dam near.....	64	Crow Wing River near Pillager.....	65
Mississippi River at.....	58	Cubic foot per second, definition of.....	22
Burns Valley Creek basin, low-flow partial-		Cubic feet per second per square mile,	
record stations in.....	167	definition of.....	22
Calumet, Swan River near.....	51	Dakota Creek basin, low-flow partial-	
Canby, Lazarus Creek tributary near.....	177	record stations in.....	167
Cannon River at Northfield.....	179	Data collection and computation,	
Cannon River basin, gaging-station records in.	149	ground-water levels.....	20-21
high-flow partial-record stations in.....	179	ground-water quality.....	21
low-flow partial-record stations in.....	167	stage and water discharge.....	16
Cannon River below Sabre Lake near Kilkenny...	179	Data presentation, ground-water levels.....	21
Cat River near Nimrod.....	174	ground-water quality.....	21
Cedar Creek basin, low-flow partial-record		stage and water discharge.....	17-18
stations in.....	167	surface-water quality.....	20
Cedar River near Austin.....	159	Deer River, Mississippi River at	
Cells/volume, definition of.....	22	Winnibigoshish Dam near.....	45
Ceylon, East Fork Des Moines River at.....	181	Winnibigoshish Lake near.....	44

## INDEX

	Page		Page
Definition of terms.....	22-26	Ground water, water quality data.....	297-325
Delft, Watonwan River near.....	178	Ground-water-level records, by county.....	242-296
Des Moines River at Jackson.....	160-237	Ground-water levels, records of.....	20,242-296
Des Moines River basin, gaging-station		in summary of hydrologic conditions.....	10
records in.....	160	Ground-water records, by county, quality.....	297-325
high-flow partial-record stations in.....	181	Gull Lake near Brainerd.....	63
low-flow partial-record stations in.....	170	Gull River at Gull Lake Dam, near Brainerd....	64
Diatoms, definition of.....	24	Hardness of water, definition of.....	23
Discharge at partial-record stations and		Harris, Goose Creek at.....	179
miscellaneous sites.....	161-183	Hastings, Mississippi River at Lock and	
high-flow partial-record stations.....	171-182	Dam 2 at.....	130-136
low-flow partial-record stations.....	161-170	Hawk Creek near Maynard.....	177
miscellaneous sites.....	183	Henderson, High Island Creek near.....	107,236
Discharge, definition of.....	23	Hennepin Creek near Becida.....	174
Discontinued gaging stations.....	30-33	High-flow partial-record stations.....	171-182
Dissolved, definition of.....	23	High Island Creek near Henderson.....	107,236
Dissolved solids concentration.....	23	Hill City, Smith Creek near.....	174
Diversity index, definition of.....	23	Hillman Creek near Pierz.....	175
Downstream order system and station number,		Hinckley, Crooked Creek near.....	179
definition of.....	16	Hoboken Creek at Sauk Centre.....	72-73
Drainage area, definition of.....	23	Houston, Root River near.....	180
Drainage basin, definition of.....	23	South Fork Root River near.....	180
Dry mass, definition of.....	22	Hydrographs showing comparison of water	
Dunnel, Fourmile Creek near.....	181	levels in 1989 to long-term levels in	
East Branch Blue Earth River near Walters....	178	different aquifers.....	11-15
East Fork Des Moines River near Celyon.....	181	Hydrologic bench-mark network, definition of..	10
Edgerton, Chanarambie Creek near.....	181	Hydrologic conditions, graphs or maps of...2,6-9,11-15	
Elba, North Fork Whitewater River near.....	152-154	Hydrologic unit, definition of.....	23
Elbow Lake, Pomme de Terre River near.....	177	Identifying estimated daily discharge.....	18
Elk River basin, high-flow partial-record		Introduction.....	1
stations in.....	176	Instantaneous discharge, definition of.....	23
Elm Creek basin, gaging-station records in....	80-82	Iowa River basin, gaging-station records in..	159
Elm Creek near Champlin.....	80-82	high-flow partial-record stations in.....	180-181
Empire, Vermillion River near.....	141-148	low-flow partial-record stations in.....	170
Explanation of the records.....	16-21	Jackson, Des Moines River at.....	160,237
Factors for converting Inch-Pound Units		Johnsburg, Little Cedar River near.....	180
to International System (SI)		Johnson Creek basin, high-flow partial-record	
Units.....	Inside back cover	stations in.....	175
Faribault, Straight River near.....	149,237	Johnson Creek near St. Augusta.....	175
Fecal coliform bacteria, definition of.....	22	tributary at Luxemburg.....	175
Fecal streptococcal bacteria, definition of...	22	Jordan, Minnesota River near.....	108-110
Federal Dam, Leech Lake at.....	47	Kanaranzi Creek tributary No. 2 near Wilmont..	181
Leech Lake River at.....	48	Kellogg, Zumbro River at.....	151
Foley, Stony Brook tributary near.....	176	Kettle River, Glaisby Brook near.....	179
Fort Ripley, Mississippi River near.....	66	Kettle River below Sandstone.....	137
Nokasippi River near.....	175	Kilkenny, Cannon River below Sabre Lake near..	179
Fourmile Creek near Dunnell.....	181	Kingston, North Fork Crow River near.....	176
Freeburg, Crooked Creek at.....	180	Knife River near Mora.....	138,237
Gage height, definition of.....	23	Laboratory measurements, surface-water quality	20
Gaging station, definition of.....	23	Lac qui Parle, Lac qui Parle River near.....	91
Gaging stations, discontinued.....	30-33	Minnesota River near.....	92,232
records.....	38-160	Lac qui Parle River near Lac qui Parle.....	91
Garden City, Watonwan River near.....	100,234	Lekes and Reservoirs:	
Garvin Brook near Minnesota City.....	155	Big Stone Lake at Ortonville.....	87
Garvin Brook basin, gaging-station		Gull Lake near Brainerd.....	63
records in.....	155	Leech Lake at Federal Dam.....	47
Gaylord, Middle Branch Rush River near.....	178	Mille Lacs Lake at Cove Bay near Onamia...	78
Glaisby Brook near Kettle River.....	179	Pokegama Lake near Grand Rapids.....	49
Goose Creek at Harris.....	179	Pine River Reservoir at Cross Lake.....	56
Grand Rapids, Mississippi River at.....	50	Sandy Lake at Libby.....	52
Pokegama Lake near.....	49	Williams Lake near Akeley.....	46
Granite Falls, Yellow Medicine River near....	95	Winnibigoshish Lake near Deer River.....	44
Graph showing comparison of dissolved solids		Lanesboro, Root River near.....	158
concentrations.....	8	Latitude-longitude system for wells and	
discharge at three long-term gaging		miscellaneous sites.....	16
stations.....	6-7	Lazarus Creek tributary near Canby.....	177
nitrate concentrations.....	9		
Green algae, definition of.....	24		

## INDEX

	Page		Page
Leaf River near Aldrich.....	175	near Lac qui Parle.....	92-232
Leech Lake at Federal Dam.....	47	Minnesota River basin, gaging-station	
Leech Lake River at Federal Dam.....	48	records in.....	86-110
Leech Lake River basin, gaging-station		high-flow partial-record stations in.....	177-179
records in.....	46-48	low-flow investigations in.....	165-166
high-flow partial-record stations in.....	174	Miscellaneous sites, discharge	
Le Sueur River near Rapidan.....	102,235	measurements at.....	183
Lester Prairie, Otter Creek near.....	176	Miscellaneous water-quality data collected	
Otter Creek tributary near.....	176	at streamflow stations.....	231-237
Libby, Mississippi River below Sandy		Mississippi River at Aitkin.....	55
River near.....	54	at Bemidji.....	38-39
Sandy Lake at.....	52	at Brainerd.....	58
Sandy River at Sandy Lake Dam at.....	53	at Clearwater.....	176
List of counties for which ground-water-		at Fifth Street at Newport.....	114-120
level records are published.....	viii-x	at Grand Rapids.....	50
for which ground-water-quality records		at Grey Cloud Island near Cottage Grove....	121-127
are published.....	x	at lock and dam 2, at Hastings.....	130-136
List of gaging stations, in downstream order,		at Nininger.....	128-129
for which records are published.....	vi-vii	at Prescott, WI.....	140
Little Cedar River near Johnsbury.....	180	at Pokegama Lake Dam near Grand Rapids....	183
Little Chippewa River near Starbuck.....	177	at St. Cloud.....	76
Little Cottonwood River near Courtland.....	99	at St. Paul.....	111-113
Little Sioux River basin, high-flow		at Winnibigoshish Dam, near Deer River....	45
partial-record stations in.....	182	at Winona.....	156-157
Little Sioux River near Spafford.....	182	below Sandy River near Libby.....	54
Long Creek near Potsdam.....	180	near Anoka.....	83-85
Long Prairie, Long Prairie River at.....	62	near Bemidji.....	42-43
Long Prairie River at Long Prairie.....	62	near Fort Ripley.....	66
Low-flow partial-record stations.....	161-170	near Royalton.....	67-69
Luverne, Rock River at.....	181	Montevideo, Minnesota River at.....	94
Luxemburg, Johnson Creek tributary at.....	175	Spring Creek near.....	177
Mankato, Minnesota River at.....	103-106	Mora, Knife River near.....	133,237
Map of Minnesota, ground-water observation		National Geodetic Vertical Datum of 1929	
wells.....	240-241	(NGVD), definition of.....	23
annual precipitation.....	2	National stream-quality accounting network	
high-flow partial record stations.....	172-173	(NASQAN), explanation of.....	10,23
lake and stream-gaging stations.....	34-35	National trends network (NTN), explanation of.	10,23
surface water-quality stations.....	36-37	Natural substrate, definition of.....	25
Maple River near Rapidan.....	178	Newport, Mississippi River at Fifth	
Marshall, Redwood River near.....	96	Street at.....	114-120
Mayer, South Fork Crow River near.....	177	New Prague, Sand Creek near.....	179
Maynard, Hawk Creek near.....	177	New Ulm, Cottonwood River near.....	98,233
Mean concentration, definition of.....	25	Nimrod, Cat River near.....	174
Mean discharge, definition of.....	23	Nininger, Mississippi River at.....	128-129
Methylene blue active substance,		Nokasippi River basin, high-flow partial-	
definition of.....	23	record stations in.....	175
Metamorphic stage, definition of.....	23	Nokasippi River near Fort Ripley.....	175
Micrograms per gram, definition of.....	23	North Fork Crow River at Paynesville.....	176
Micrograms per kilogram, definition of.....	23	near Kingston.....	176
Micrograms per liter, definition of.....	23	North Fork Whitewater River near Elba.....	152-154
Middle Branch Rush River near Gaylord.....	178	Northfield, Cannon River at.....	179
Middle Fork Whitewater River near State		Numbering system for wells and	
Park Group Camp near St. Charles.....	180	miscellaneous sites.....	16
Milan, Chippewa River near.....	93	Odessa, Yellow Bank River near.....	89
Mille Lacs Lake at Cove Bay near Onamia.....	78	Onamia, Mille Lacs Lake at Cove Bay near.....	78
Milligrams per liter, definition of.....	23	Onsite measurement and collection.....	19
Milligrams of carbon per area or volume per		Organic mass, definition of.....	22
unit time for periphyton, macrophytes,		Organism, definition of.....	23
and phytoplankton.....	24	count/area, definition of.....	23-24
Milligrams of oxygen per area or volume per		count/volume, definition of.....	24
unit time for periphyton, macrophytes,		Ormsby, South Fork Watonwan River near.....	178
and phytoplankton.....	24	Ortonville, Big Stone Lake at.....	87
Milliken Creek near Concord.....	179	Minnesota River at.....	88
Minneota, South Branch Yellow Medicine		Osage, Straight River at County Highway 125	
River at.....	166	near.....	59
Minnesota City, Garvin Brook near.....	155	Other records available.....	18
Minnesota River at Mankato.....	103-106	Otsego Creek basin, high-flow partial-record	
at Montevideo.....	94	stations in.....	176
at Ortonville.....	88	Otsego Creek near Otsego.....	176
near Jordan.....	108-110	Otsego, Otsego Creek near.....	176

## INDEX

	Page		Page
Otter Creek near Lester Prairie.....	176	Remer, Boy River near.....	174
tributary near Lester Prairie.....	176	Reservoirs (see lakes and reservoirs)	
Palisade, Willow River below.....	174	Return period, definition of.....	25
Parameter code numbers.....	24	Rochester, South Fork Zumbro River at.....	150
Park Rapids, Straight River at County Highway		Rock River at Luverne.....	181
115 near.....	60	Rockford, Crow River at.....	77,231
Straight River near.....	61	Rollingstone Creek basin, low-flow partial-	
Partial-record station, definition of.....	24	record stations in.....	167
discharge at.....	161-183	Root River at Rushford.....	180
Particle size, definition of.....	24	near Houston.....	180
Particle-size classification, definition of...	24	near Lanesboro.....	158
Paynesville, North Fork Crow River at.....	176	South Fork, near Houston.....	180
Percent composition, definition of.....	24	Root River basin, gaging station records in...	158
Periphyton, definition of.....	24	high-flow partial-record stations in.....	180
Pesticides, definition of.....	24	low-flow partial records in.....	168-169
Phytoplankton, definition of.....	24	Royalton, Mississippi River near.....	67-69
Piccocurie, definition of.....	24	Platte River above.....	175
Pierz, Hillman Creek near.....	175	Rum River basin, gaging-station records	
Pillager, Crow Wing River near.....	65	in.....	78-79
Sevenmile Creek near.....	175	low-flow partial-record stations in.....	165
Pine Creek basin, low-flow partial-record		Rum River near St. Francis.....	79,231
stations in.....	167	Runoff at streamflow stations (table 1).....	4-5
Pine River at Cross Lake Dam, at Cross Lake...	57	Runoff in inches, definition of.....	25
near Pine River.....	174	Rush Creek near Rushford.....	180
Pine River basin, gaging-station records		Rushford, Root River at.....	180
in.....	56-57	Rush Creek near.....	180
high-flow partial-record stations in.....	174	Rush River, Middle Branch near Gaylord.....	178
Pine River, Pine River near.....	174	St. Augusta, Johnson Creek near.....	175
Pine River Reservoir at Cross Lake.....	56	St. Charles, Middle Fork Whitewater River	
Plankton, definition of.....	24	near State Park Group Camp near.....	180
Platte River above Royalton.....	175	St. Cloud, Mississippi River at.....	76
Platte River basin, high-flow partial-		St. Croix Falls, WI, St. Croix River at.....	139
record stations in.....	175	St. Croix River at St. Croix Falls, WI.....	139
Pleasant Valley Creek basin, low-flow-partial-		St. Croix River basin, gaging-station	
record stations in.....	167	records in.....	137-139
Plum Creek basin, low-flow partial-record		high-flow partial-record stations in.....	179
stations in.....	163	St. Francis, Rum River near.....	79,231
Pokegama Lake near Grand Rapids.....	49	St. Michael, School Lake Creek tributary	
Polychlorinated biphenyls, definition of.....	24	near.....	177
Pomme de Terre River at Appleton.....	90,231	St. Paul, Mississippi River at.....	111-113
near Elbow Lake.....	177	Sanborn, Cottonwood tributary No. 2 near.....	178
Potsdam, Long Creek near.....	180	Sand Creek near New Prague.....	179
Prairie River basin, low-flow partial-record		Sandstone, Kettle River below.....	137
stations.....	161	Wolf Creek tributary near.....	179
Precipitation, chemical quality of.....	326-329	Sandy Lake at Libby.....	52
in summary of hydrologic conditions.....	1-3	Sandy River at Sandy Lake Dam, at Libby.....	53
Prescott, WI, Mississippi River at.....	140	Sandy River basin, gaging-station records in...	52-53
Primary productivity, definition of.....	24	Sauk Centre, Ashley Creek near.....	70-71
Publication on techniques of water-resources		Hoboken Creek at.....	72-73
investigations.....	27-28	Sauk River at.....	74-75
Quality of ground-water, by county.....	297-325	Sauk River at Sauk Centre.....	74-75
Radiochemical program, definition of.....	10,24	Sauk River basin, high-flow partial-record	
Rapidan, Blue Earth River near.....	101	stations in.....	175
Le Sueur River near.....	102,235	low-flow partial-record stations in.....	163
Maple River near.....	178	Sauk River tributary at Spring Hill.....	175
Records, accuracy of.....	18	Schoolcraft River near Bemidji.....	40-41
other available.....	18	School Lake Creek tributary near St. Michael..	177
Records of ground-water levels.....	20	Sediment, definition of.....	25
ground-water quality.....	21	collection of.....	19
stage and water discharge.....	16	Seven-day 10-year low flow, definition of....	25
surface-water quality.....	19	Sevenmile Creek near Pillager.....	175
Recoverable from bottom material, definition		Sleepy Eye, Spring Creek near.....	178
of.....	24	Spring Creek tributary near.....	178
Redwood Falls, Redwood River near.....	97,232	Smith Creek basin, high-flow partial-record	
Redwood River near Marshall.....	96	stations in.....	174
near Redwood Falls.....	97,232	Smith Creek near Hill City.....	174
Remark codes, surface-water quality.....	20	Sodium-adsorption ratio, definition of.....	25
		Solute, definition of.....	25
		South Branch Yellow Medicine River at Minnesota	166

## INDEX

	Page		Page
South Fork Crow River near Mayer.....	177	Upper Iowa River basin, low-flow partial-	
Root River near Houston.....	180	record stations in.....	170
Watonwan River near Ormsby.....	178		
Zumbro River at Rochester.....	150	Valley Springs, S.D., Beaver Creek near.....	181
South Haven, Clearwater River near.....	176	Vermillion River basin, gaging-station	
Spafford, Little Sioux River near.....	182	records in.....	141-148
Special networks and programs.....	10	Vermillion River near Empire.....	141-148
Specific conductance, definition of.....	25		
Spring Creek near Montevideo.....	177		
near Sleepy Eye.....	178		
tributary near Sleepy Eye.....	178	Walters, Blue Earth River East Branch near....	178
Springfield, Cottonwood River near.....	178	Watab River basin, low-flow partial-record	
Spring Hill, Sauk River tributary at.....	175	stations in.....	163
Stage-discharge relation, definition of.....	25	Water quality, in summary of hydrologic	
Starbuck, Little Chippewa River near.....	177	conditions.....	3-10
Station identification numbers.....	16	Water-quality records, analyses of samples	
Stony Brook tributary near Foley.....	176	collected at ground-water wells.....	297-325
Straight River at County Highway 125 near		collected at miscellaneous sites.....	221-230
Osage.....	59	collected at partial-record stations.....	184-220
at County Highway 115 near Park Rapids....	60	collected at streamflow stations.....	231-237
Straight River near Faribault.....	149,237	Water temperature, surface-water quality.....	19
near Park Rapids.....	61	Water year, definition of.....	26
Streamflow, definition of.....	25	Watonwan River, near Delft.....	178
in summary of hydrologic conditions.....	3	near Garden City.....	100,234
Substrate, definition of.....	25	South Fork near Ormsby.....	178
Summary of hydrologic conditions.....	1-10	Weighted average, definition of.....	26
ground-water levels.....	10	Wet mass.....	22
precipitation.....	1-3	Whetstone River near Big Stone City, SD.....	86
streamflow.....	3	Whitewater River basin, gaging-station	
water quality.....	3-10	records in.....	152-154
Surface area, definition of.....	25	high-flow partial-record stations in.....	180
Surficial bed material, definition of.....	25	Whitewater River, Middle Fork, near State	
Suspended, definition of.....	25	Park Group Camp near St. Charles.....	180
Suspended recoverable, definition of.....	25	North Fork, near Elba.....	152-154
Suspended sediment, definition of.....	25	Williams Lake near Akeley.....	46
Suspended-sediment concentration,		Willow River basin, high-flow partial-record	
definition of.....	25	stations in.....	174
Suspended-sediment discharge, definition of...	25	Willow River below Palisade.....	174
Suspended-sediment load, definition of.....	25	Wilmont, Kanaranzi Creek tributary No. 2 near.	181
Suspended total, definition of.....	25-26	Winnebago Creek basin, low-flow partial-record	
Swan River basin, gaging-station records in...	51	stations in.....	170
Swan River near Calumet.....	51	Winnibigoshish Lake near Deer River.....	44
		Winona, Mississippi River at.....	156-157
Table of runoff at streamflow stations.....	4-5	Wolf Creek tributary near Sandstone.....	179
Taxonomy, definition of.....	26	WDR, definition of.....	26
Thermograph, definition of.....	26	WRD, definition of.....	26
Time-weighted average, definition of.....	26	WSP, definition of.....	26
Tons per acre-foot, definition of.....	26		
Tons per day, definition of.....	26	Yellow Bank River near Odessa.....	89
Total, definition of.....	26	Yellow Medicine River near Granite Falls.....	95
bottom material, definition of.....	26	South Branch, at Minnesota.....	166
coliform bacteria, definition of.....	22		
load, definition of.....	26	Zooplankton, definition of.....	24
organism count, definition of.....	24	Zumbro River at Kellogg.....	151
recoverable, definition of.....	26	South Fork, at Rochester.....	150
sediment discharge, definition of.....	25	Zumbro River basin, gaging-station records	
sediment load, definition of.....	25	in.....	150-151
Tritium network, explanation of.....	10,26	high-flow partial-record stations in.....	179-180
Trout Creek basin, low-flow partial-record			
stations in.....	167		

## 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).

Multiply inch-pound units	By	To obtain SI units
<i>Length</i>		
inches (in)	$2.54 \times 10^1$	millimeters (mm)
	$2.54 \times 10^{-2}$	meters (m)
feet (ft)	$3.048 \times 10^{-1}$	meters (m)
miles (mi)	$1.609 \times 10^0$	kilometers (km)
<i>Area</i>		
acres	$4.047 \times 10^3$	square meters (m <sup>2</sup> )
	$4.047 \times 10^{-1}$	square hectometers (hm <sup>2</sup> )
	$4.047 \times 10^{-3}$	square kilometers (km <sup>2</sup> )
square miles (mi <sup>2</sup> )	$2.590 \times 10^0$	square kilometers (km <sup>2</sup> )
<i>Volume</i>		
gallons (gal)	$3.785 \times 10^0$	liters (L)
	$3.785 \times 10^0$	cubic decimeters (dm <sup>3</sup> )
	$3.785 \times 10^{-3}$	cubic meters (m <sup>3</sup> )
million gallons	$3.785 \times 10^3$	cubic meters (m <sup>3</sup> )
	$3.785 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
cubic feet (ft <sup>3</sup> )	$2.832 \times 10^1$	cubic decimeters (dm <sup>3</sup> )
	$2.832 \times 10^{-2}$	cubic meters (m <sup>3</sup> )
cfs-days	$2.447 \times 10^3$	cubic meters (m <sup>3</sup> )
	$2.447 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
acre-feet (acre-ft)	$1.233 \times 10^3$	cubic meters (m <sup>3</sup> )
	$1.233 \times 10^{-3}$	cubic hectometers (hm <sup>3</sup> )
	$1.233 \times 10^{-6}$	cubic kilometers (km <sup>3</sup> )
<i>Flow</i>		
cubic feet per second (ft <sup>3</sup> /s)	$2.832 \times 10^1$	liters per second (L/s)
	$2.832 \times 10^1$	cubic decimeters per second (dm <sup>3</sup> /s)
	$2.832 \times 10^{-2}$	cubic meters per second (m <sup>3</sup> /s)
gallons per minute (gal/min)	$6.309 \times 10^{-2}$	liters per second (L/s)
	$6.309 \times 10^{-2}$	cubic decimeters per second (dm <sup>3</sup> /s)
	$6.309 \times 10^{-5}$	cubic meters per second (m <sup>3</sup> /s)
million gallons per day	$4.381 \times 10^1$	cubic decimeters per second (dm <sup>3</sup> /s)
	$4.381 \times 10^{-2}$	cubic meters per second (m <sup>3</sup> /s)
<i>Mass</i>		
tons (short)	$9.072 \times 10^{-1}$	megagrams (Mg) or metric tons

POSTAGE AND FEES PAID  
U.S. DEPARTMENT OF THE INTERIOR  
INT 413

U.S. DEPARTMENT OF THE INTERIOR  
Geological Survey  
702 Post Office Building  
St. Paul, MN 55101



OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300  
SPECIAL 4TH CLASS BOOK RATE

