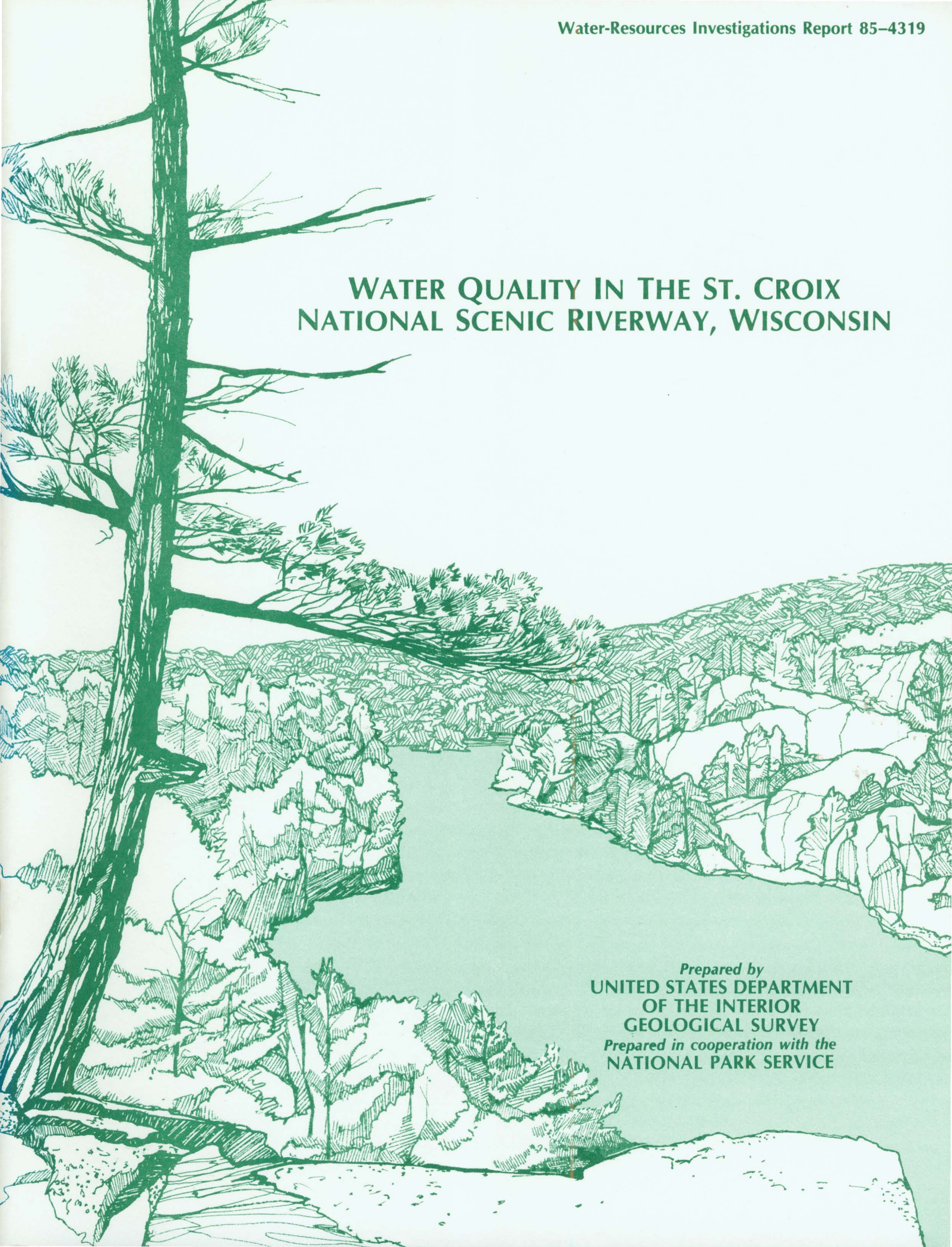
Water-Resources Investigations Report 85–4319

WATER QUALITY IN THE ST. CROIX NATIONAL SCENIC RIVERWAY, WISCONSIN



Prepared by
UNITED STATES DEPARTMENT
OF THE INTERIOR
GEOLOGICAL SURVEY
Prepared in cooperation with the
NATIONAL PARK SERVICE

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By David J. Graczyk

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Madison, Wisconsin
1986

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CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION TABLE

For the use of readers who prefer the International System of Units (SI), the conversion factors for the terms used in this report are listed below.

Multiply inch-pound unit	By	To obtain SI unit
inch (in.)	25.40	millimeter (mm)
square mile (mi^2)	2.590	square kilometer (km^2)
ton	0.9072	metric ton (t)
ton per square mile (ton/mi^2)	0.3503	tonnes per square kilometer ($tonnes/km^2$)
mile (mi)	1.609	kilometer (km)
cubic foot per second (ft^3/s)	2.832×10^2	cubic meter per second (m^3/s)
inch per hour (in/h)	25.40	millimeter per hour (mm/h)

WATER QUALITY IN THE ST. CROIX NATIONAL SCENIC RIVERWAY, WISCONSIN

By **David J. Graczyk**

ABSTRACT

The U.S. Geological Survey conducted a water-quality study of the St. Croix National Scenic Riverway. This report documents the water quality during the period 1975–83. The water quality is good for most uses and is a calcium bicarbonate type. Concentrations of most constituents analyzed were less than most sites in Wisconsin. Constituent loads and yields were also lower in the Scenic Riverway than in other Wisconsin streams. Water-quality samples were collected at 10 stations throughout the study area and were compared to analyses of samples from selected National Stream Quality Accounting Network stations (NASQAN) and the Hydrologic Bench-Mark Network (HBMN) station in Wisconsin.

The average suspended-sediment concentration for 9 of the 10 stations in this study was 7.7 milligrams per liter. This compared with an average suspended-sediment concentration of 11 milligrams per liter for two other stations in the scenic riverway and an average suspended-sediment concentration of 110 milligrams per liter for Wisconsin. Concentrations of major cations and anions were generally below concentrations at other stations in the State. The concentrations of major cations and anions at two of the stations were similar to concentrations at the HBMN station Popple River near Fence. Mean total phosphorus concentrations ranged from 0.02 to 0.08 milligram per liter at the study stations and from 0.03 to 0.16 milligram per liter at selected NASQAN stations. Concentrations of trace metals were below safe drinking water standards at all the study sites except for iron and manganese which exceeded drinking water standards at some of the study sites. Pesticides were sampled at the St. Croix River at St. Croix Falls and above and below cranberry bogs that drain into the Namekagon River. No pesticides were detected in the water/suspended-sediment mixture or bottom material.

Average annual loads of suspended sediment, total phosphorus, total nitrogen, and dissolved solids were calculated by a flow-duration curve method. Annual suspended-sediment loads ranged from 580 to 25,000 tons per year at the study stations. Annual suspended-sediment loads at the HBMN station and NASQAN stations ranged from 720 tons at the Popple River near Fence to 443,000 tons at the Chippewa River near Durand. Average annual total phosphorus loads ranged from 6,800 to 900,000 pounds at the study stations compared with 145,000 to 1,600,000 pounds at selected Wisconsin NASQAN stations.

Yields for suspended sediment, total phosphorus, total nitrogen, and dissolved solids at the study stations were consistently lower than at other stations in the State. Suspended-sediment yields ranged from 1.9 to 13.3 tons per square mile. The average suspended-sediment yield for Wisconsin is 80 tons per square mile. Total phosphorous and the other constituents exhibited the same trend.

INTRODUCTION

The St. Croix and the Namekagon Rivers became part of the National Wild and Scenic Riverway system in 1968. Together they form the St. Croix National Scenic Riverway which was one of the original eight rivers under the National Wild and Scenic Rivers Act. Approximately 250 mi of these rivers are now part of the scenic riverway, which is located in northwestern Wisconsin and eastern Minnesota (fig. 1).

The National Park Service administers the St. Croix National Scenic Riverway and is in charge of developing camping, canoe-launching, picnic, and information sites. The National Park Service requested the U.S. Geological Survey delineate floods at proposed sites for campgrounds and determine the water quality of the Riverway.

The flood plains were delineated at 28 sites on the Riverway. These data are available in previous administrative reports that can be found at the U.S. Geological Survey, Wisconsin District office. This report describes the water quality of the Riverway during the period 1975–83. A network of water-quality monitoring stations was established. This network will be used to determine the present water quality of the Riverway and to detect any major problems or changes.

Appreciation also is extended to Jack T. Freshwaters, Kenneth J. Hedmark, and Thomas J. Popowski who collected the water-quality samples and other field data.

PURPOSE AND SCOPE

The purposes of the study were to determine if any water-quality problems were present, to describe the present water quality of the scenic riverway, and to establish a data base for monitoring long-term trends. The study area

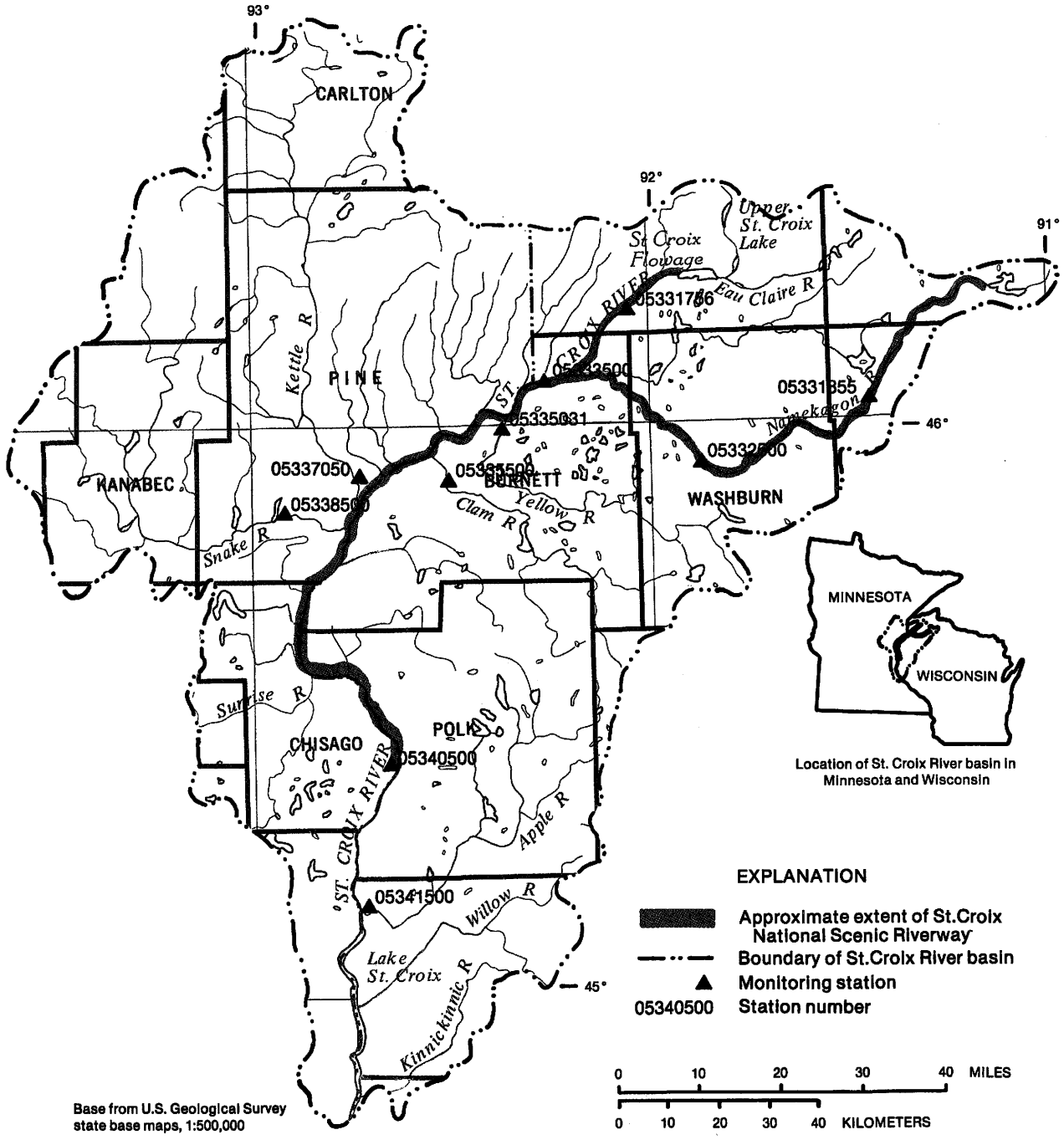

Figure 1. St. Croix National Scenic Riverway long-term water-quality-monitoring network.

includes most of the St. Croix River and its major tributaries (fig. 1). Water samples were collected at 10 stations in the Riverway and were analyzed for suspended sediment, chemical, and biological constituents. The stations are listed in table 1. One of these stations is the U.S. Geological Survey National Stream Quality Accounting Network (NASQAN) station at St. Croix Falls (05340500). The water-quality data collected in the Riverway were compared to selected NASQAN stations and the Hydrologic Bench-Mark Network (HBMN) station in Wisconsin (fig. 2).

Samples at nine of the stations were collected semi-annually; once in the spring high-flow period, and once in the late fall low-flow period. Samples were analyzed for the major inorganic constituents, nutrients, and suspended sediment. Water samples were collected annually at 6 of the 10 stations for analysis of trace metals. Samples at the NASQAN station St. Croix River at St. Croix Falls were collected monthly until the 1982 water year when samples were collected bimonthly. The 1983 water samples were collected quarterly.

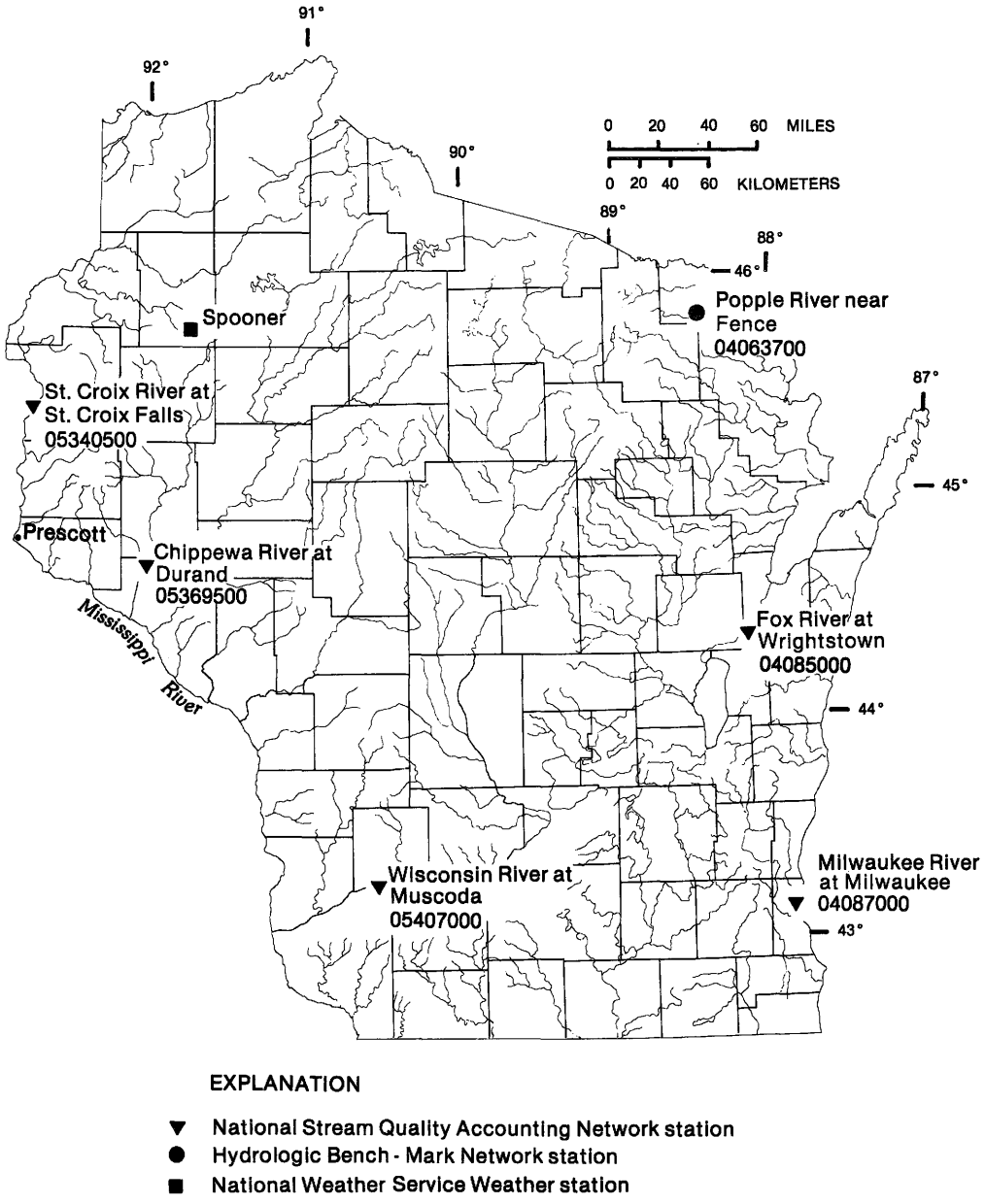

Figure 2. Location of selected National Stream Quality Accounting Network (NASQAN), Hydrologic Bench-Mark Network stations (HBMN), and a National Weather Service station in Wisconsin.

BASIN DESCRIPTION

The St. Croix River is in northwestern Wisconsin and eastern Minnesota (fig. 1). It flows southwest out of Upper St. Croix Lake near Solon Springs (fig. 1), at an altitude of 1,105 ft, to its confluence with the Mississippi River at Prescott (fig. 2), at an altitude of 675 ft (Young and Hindall, 1973). The drainage area of the St. Croix River at Prescott is 8,570 mi^2.

The St. Croix River flows through the Northern Highland, Central Plain, and Western Upland physiographic provinces in Wisconsin (Martin, 1932). Flat-topped and steep-sided hills with narrow stream valleys characterize the southern part of the basin. The rest of the basin is mostly outwash plains and knob and kettle end moraines. There are numerous lakes and swamps in the basin with more located east of the St. Croix River than to the west. A majority of these lakes and swamps is found in the northern two-thirds of the basin where drainage is generally poor. Above St. Croix Falls the river flows through pitted outwash and below St. Croix Falls through both ground and end moraines (Thwaites, 1956). The Riverway is underlain by Precambrian sandstone, lava flows, Cambrian sandstone, and dolomite (Bean, 1949). The thickness of the unconsolidated material under most of the basin ranges from 100 to 200 ft (Thwaites, 1956).

The soils of the basin are primarily silt and sandy loam (Hole, 1976). The permeability of these soils ranges from 0.05 to 10 in/h. Most of the basin has a soil permeability of 0.8 to 2.5 in/h (Young and Hindall, 1973).

The population of the counties that the St. Croix River flows through in Minnesota and Wisconsin is 384,900 (Wisconsin Department of Administration and U.S. Census Bureau, oral commun., 1984).

Land use in the basin is forest products management, agricultural, and recreational uses. The forested land is a mix of aspen, jack pine, and mixed northern hardwoods. The primary use of the forested land is pulp wood used for paper production and some saw-timber production. Agricultural use is mainly dairy farms and grain production. There is more agricultural land use in the southern portion of the basin than in the north because of a longer growing season and better soils.

The climate is continental and is characterized by long, snowy, and cold winters and relatively short summers. Average annual temperature at Spooner, National Weather Service weather station at Spooner, Wis., (fig. 2), is 42.0°F. The average monthly temperature ranges from 10.8°F in January to 71.4°F in July (Environmental Data Service, 1973). Normal annual total precipitation at Spooner is 28.91 in. for 1941–70 (Environmental Data Service, 1973). Maximum precipitation (4.45 in.) occurs in June and the minimum (0.66 in.) occurs both in January and February. Mean annual snowfall is about 45 in/yr in the St. Croix River basin.

Streamflow of the St. Croix River has been monitored at St. Croix Falls (05340500) since 1902. Average discharge for the 80 years of record is 4,206 ft^3/s. Average discharge and percent difference from the average discharge for water years (October 1 to September 30) 1976–83 are given in table 3. Discharge during the study period was above normal except for the 1976, 1977, 1980, and 1981 water years which were at or below normal because of below normal precipitation (table 2). Total precipitation and departure from normal for the 1976–83 water years are given in table 2. During the 1975–83 period the annual precipitation was 5.97 in. above normal and was characterized by wide fluctuations.

The annual minimum 7-day mean flows at the St. Croix River at St. Croix Falls with recurrence intervals of 2 ($Q_{7,2}$) and 10 years ($Q_{7,10}$) are 1,490 and 1,080 ft^3/s, respectively (Holmstrom, 1980). The minimum discharge recorded during the study period, 896 ft^3/s November 13, 1976.

The discharge of the 2-year recurrence interval flood (Q_2), that is the discharge that will be equaled or exceeded on an average every 2 years, is 22,200 ft^3/s at St. Croix Falls (Conger, 1981). The annual peak discharge at St. Croix Falls for the study period ranged from 13,400 ft^3/s in water year 1980 to 35,600 ft^3/s in the 1976 water year.

METHODS

Water samples and discharge measurements were collected and analyzed as described in Guy and Norman (1970), Skougstad and others (1979), Greeson and others (1977), and Rantz and others (1982). Water samples were collected twice a year at nine stations and monthly at the NASQAN site at St. Croix Falls until the 1982 water year when samples were collected bimonthly and quarterly starting in the 1983 water year. Samples were collected with depth-integrating samplers using equal-width increment methods. Samples were taken at high, medium, and low flows to characterize the range of discharge during the period 1975–83. The water-quality analyses and corresponding discharges are found in Appendix 1. A large volume of sample was collected and then split into subsamples for analysis by the National Water Quality Laboratory at Doraville, Ga. Temperature, pH, conductivity, and dissolved-oxygen concentrations were determined in the field.

WATER QUALITY

Statistics used to summarize the water-quality data collected at the 10 stations in the study area are: the number of measurements, the mean, the minimum, the maximum, and the standard deviation. The mean is a measure of central tendency and is the sum of the measurements divided by the number of measurements. The standard deviation characterizes the dispersion of the measurements about the mean. These statistics are presented in Appendix 2.

Some of the chemical constituent values required special treatment because some concentrations are reported as "less than" the analytical limit of detection. The following

approach was used where "less than" values appeared in the data. If a data value was given as less than 1.0 mg/L, a midpoint of the known range was chosen, 0.5 mg/L, and this value was used for calculation of the mean and standard deviation. To delete the "less than" value or use values of 0 or 1.0 mg/L would bias the data toward one end or the other end of the range.

WATER-QUALITY CLASSIFICATION OF STREAMS

A generalized water-quality classification of the St. Croix National Scenic Riverway showed that the water in the Riverway is a calcium bicarbonate type. The water quality was classified at a station in the Riverway if the station had three or more water-quality analyses. All cation and anion sums were equal or balanced to within 5 percent of each other. The cation or anion that made up 50 percent or more of the milliequivalents was considered the predominant ion.

The classification was done at six stations in the Riverway: the Namekagon River near Trego and near Hayward, Snake River near Pine City, Minn., Apple River near Sommerset, and the St. Croix River near Danbury and at St. Croix Falls. Calcium was the predominant cation and bicarbonate the predominant anion in the entire Riverway. The homogeneity of the surface-water type is controlled by ground water flowing through glacial drift containing fragments of dolomite.

Table 1. Water-quality monitoring stations in the St. Croix National Scenic Riverway

Station number	Station name	Drainage area (mi^2)	Semiannual samples	Annual samples
05331756	St. Croix River near Dairyland, Wis.	463	X	
05331855	Namekagon River near Hayward, Wis.	169	X	X
05332500	Namekagon River near Trego, Wis.	488	X	X
05333500	St. Croix River near Danbury, Wis.	1,580	X	X
05335031	Yellow River at Danbury, Wis.	374	X	
05335500	Clam River near Webster, Wis.	361	X	
05337050	Kettle River near Cloverdale, Minn.	1,050	X	
05338500	Snake River near Pine City, Minn.	558	X	X
05340500	St. Croix River at St. Croix Falls, Wis.	6,240	X	X
05341500	Apple River near Somerset, Wis.	579	X	X

Table 2. Total precipitation and departure from normal, Spooner, Wisconsin

Water year	Total precipitation (in)	Departure from normal[1] (in.)
1976	20.01	−8.90
1977	30.95	2.04
1978	36.60	7.69
1979	21.59	−7.32
1980	29.14	.23
1981	31.71	2.80
1982	28.33	−.58
1983	38.92	10.01

[1] Normal precipitation = 28.91 in.

Table 3. Average discharge and departure from average, St. Croix River at St. Croix Falls

Water year	Average discharge for water year (ft^3/s)	Percent difference from average for 80 years[1] 1902–82
1976	4,175	−1.0
1977	2,695	−36.0
1978	5,850	38.0
1979	5,337	27.0
1980	3,057	−27.0
1981	4,205	.00
1982	5,123	22.0
1983	6,569	56.0

[1] Average discharge = 4,206 ft^3/s.

DISSOLVED OXYGEN, SPECIFIC CONDUCTANCE, pH, AND TEMPERATURE

The mean dissolved-oxygen concentration measured at the 10 stations ranged from 9.4 mg/L at Clam River near Webster to 11.0 mg/L at both the St. Croix River near Danbury and the Namekagon River near Hayward stations. The maximum recorded dissolved-oxygen concentration was 16.0 mg/L at the Snake River near Pine City, Minn. The minimum recorded dissolved-oxygen concentration was 6.5 mg/L at the St. Croix River near Danbury. All of the measured dissolved-oxygen concentrations exceeded the level of 5 mg/L recommended by the U.S. Environmental Protection Agency to maintain fish populations (U.S. Environmental Protection Agency, 1976).

Specific conductance is a measure of the ability of a solution to transmit an electrical current. In water, specific conductance is a function of the amount of ionized material in solution. Specific conductance varies with the amount of material in solution and can be used as an estimate of inorganic water quality. The specific conductance of the St. Croix River increased downstream from a mean of 88 μS/cm at 25°C at St. Croix River near Dairyland to 180 μS/cm at 25°C at the St. Croix River at St. Croix Falls. The maximum recorded specific conductance was 400 μS/cm at 25°C at the Snake River near Pine City, Minn. The minimum recorded specific conductance was 55 μS/cm at 25°C at the St. Croix River near Dairyland.

pH is a measure of the hydrogen ion activity in water and is important in chemical and biological systems of water. Usually surface water's pH ranges from 6.5 to 8.5 (Hem, 1970). The mean pH observed ranged from 6.9 at both the St. Croix River near Dairyland and the Kettle River near Cloverdale to 7.8 at the Apple River near Somerset. The maximum recorded pH was 9.2 at the Snake River near Pine City, Minn. The minimum recorded pH was 6.0 at the St. Croix River near Dairyland.

Water temperature was measured when water-quality samples were obtained. The maximum observed water temperature was 29.5°C at the Snake River near Pine City, Minn. The minimum observed water temperature was 0°C at the Namekagon River near Hayward and Trego, the St. Croix River near Danbury and St. Croix Falls, the Snake River near Pine City, and the Apple River near Somerset.

SUSPENDED SEDIMENT

Suspended sediment is a concern because of harmful effects of erosion and deposition and high sediment loads reduce the aesthetics of a river. The source of sediments found in rivers are from erosion of soils and by scouring of stream channels. Sediment is transported as suspended sediment and bedload (Guy, 1970). Suspended sediment is the part that is suspended in the water column (from the water surface to approximately 0.3 ft above the streambed); bedload is the part that bounces along the bottom of the stream. Only the suspended portion of total sediment load was measured in this study.

Average suspended-sediment concentration for Wisconsin is 110 mg/L (Hindall, 1975). Hindall (1975) reported an average suspended-sediment concentration of 11 mg/L for two stations in the St. Croix National Scenic Riverway; this is similar to an average of 7.7 mg/L for nine stations measured in this study. Suspended-sediment concentrations were not determined at the Apple River near Somerset because the sampling site is downstream from a dam that traps most of the suspended sediment. The maximum observed sediment concentration was 54 mg/L at the St. Croix River at St. Croix Falls; the minimum concentration observed was 1 mg/L at several stations.

MAJOR INORGANIC CHEMICALS

The major inorganic chemicals are substances that generally dominate the total mass of dissolved material in water. These inorganic constituents include calcium, magnesium, fluoride, sodium, potassium, dissolved solids, silica, chloride, sulfate, hardness, bicarbonate, and carbonate. Only the following constituents will be discussed in detail: dissolved solids, chloride, and sulfate.

Dissolved-solids concentration is the amount of the dissolved materials in water and may be used as an indicator of inorganic water quality. Dissolved-solids concentrations of less than 500 mg/L are considered safe for drinking (Public Health Service, 1962). High concentrations of dissolved solids give water a bad taste and corrodes plumbing. The mean dissolved- solids concentration ranged from 84 mg/L at the St. Croix River near Danbury to 150 mg/L at the Apple River near Somerset. The maximum and minimum observed dissolved-solids concentrations were 196 mg/L at the Snake River near Pine City and 34 mg/L at the St. Croix River near Danbury.

Chloride also affects the taste of water and corrodes plumbing. Concentrations greater than 250 mg/L impart objectionable taste to water. The mean chloride concentration ranged from 1.2 mg/L at the St. Croix River near Dairyland to 4.4 mg/L at the Apple River near Somerset. The maximum observed chloride concentration was 7.8 mg/L at the St. Croix River near Danbury and the minimum observed was 0.10 mg/L at the Clam River near Webster. The chloride concentrations in the St. Croix Riverway are very low. Britton and others (1983) report that chloride concentrations at two-thirds of 345 NASQAN stations through the United States in 1976 had concentrations below 30 mg/L.

High concentrations of sulfates in drinking water have undesirable effects. Concentrations of greater than 250 mg/L may have laxative effects (U.S. Environmental Protection Agency, 1976). Mean sulfate concentrations observed ranged from 4.6 mg/L at the Namekagon River near Trego to 5.9 mg/L at the Snake River near Pine City. The maximum observed concentration was 13 mg/L and the minimum observed concentration was 0.1 mg/L both at the St. Croix

River at St. Croix Falls. Fifty-six percent of 345 NASQAN stations sampled in 1976 had a mean sulfate concentration of less than 50 mg/L (Britton and others, 1983).

Major cations and anions collected at the St. Croix River near Danbury and the St. Croix River at St. Croix Falls were compared to the HBMN station in Wisconsin. The Danbury and St. Croix Falls stations were chosen because of their location in the basin. That is, one near the headwaters (Danbury) and one at the lower end of the study area (St. Croix Falls). Mean concentrations for the major cations and anions for the HBMN station, the St. Croix River near Danbury, and the St. Croix River at St. Croix Falls are given in table 4. The HBMN station has a small drainage area and is close to its natural state because little development exists now or is planned (Cobb and Biesecker, 1971). The data for the Popple River near Fence indicates a river with good water quality for most uses. The St. Croix River at Danbury and at St. Croix Falls are similar to the HBMN station and indicate good water quality.

NUTRIENTS

Nutrients are essential for the growth of plants and animals and are usually found in waters at low concentrations. Excessive nutrient concentrations can eventually degrade the water quality. High nutrient concentrations accelerate plant growth. These plants eventually die and organic matter accumulates in the stream. As this organic matter decays organisms use oxygen to decompose the organic matter and thus reduce the available oxygen levels in the stream. The major nutrients considered are nitrogen and phosphorus. Samples were analyzed for total phosphorus and nitrogen species at all sampling stations (fig. 1). The maximum, minimum, and mean concentration, standard deviation, and number of samples analyzed are given in Appendix 2.

The sources of phosphorus are the breakdown of phosphate-bearing rock, precipitation and atmospheric deposition, human and animal wastes, detergents, fertilizer, and plant detritus. MacKenthum (1973) suggests that total phosphorus concentration for flowing streams be less than 0.1 mg/L to prevent the formation of biological nuisance growths. Mean total phosphorus concentrations ranged from 0.02 mg/L at the Namekagon River near Hayward to 0.08 mg/L at the Snake River near Pine City. Maximum and minimum observed total phosphorus concentrations were 0.39 mg/L at the Yellow River near Danbury to less than 0.01 mg/L at St. Croix River near Dairyland.

A comparison of phosphorus concentrations at the St. Croix study sites was made with NASQAN stations throughout the United States and selected NASQAN stations and HBMN stations in Wisconsin. Britton and others (1983) found that 25 percent of NASQAN stations sampled in 1976 had total phosphorus concentrations of less than 0.05 mg/L and about half the stations had concentrations of less than 0.1 mg/L. Fifty percent of the St. Croix National Scenic Riverway stations had mean total concentrations of less than 0.05 mg/L and all of the stations were less than 0.1 mg/L. Comparing the St. Croix National Scenic Riverway stations with selected NASQAN stations and the HBMN station in the State have similar results. All of the St. Croix National Scenic Riverway stations had mean total phosphorus concentrations less than the NASQAN stations in the State. The HBMN station, Popple River near Fence, had a lower mean phosphorus concentration than all of the St. Croix National Scenic Riverway stations. Mean total phosphorus concentrations for the NASQAN stations and HBMN station are given in table 5.

Organic nitrogen is found in several forms in flowing water. These forms are organic nitrogen, ammonia, nitrite, and nitrate. The sum of organic nitrogen, ammonia, and nitrite plus nitrate is equal to total nitrogen as N. The maximum, minimum, and mean concentrations for total nitrogen as N and the standard deviation, and number of samples can be found in Appendix 2.

There are no standards for total nitrogen as N but there are concentrations that should not be exceeded for ammonia, 0.02 mg/L, and nitrate nitrogen, 10 mg/L (U.S. Environmental Protection Agency, 1976). High concentrations adversely affect aquatic organisms and may enrich flowing waters. Major sources of nitrogen are municipal sewage, precipita-

Table 4. Mean concentrations of major cations and anions for the HBMN station, as compared to the St. Croix River at Danbury and at St. Croix Falls, 1974–81

[Concentrations in milligrams per liter]

	HBMN station	St. Croix National Scenic Riverway stations	
Constituent	Popple River near Fence	St. Croix River at Danbury	St. Croix River at St. Croix Falls
Calcium	18.4	15.3	21
Magnesium	9.4	4.3	6.7
Sodium	1.4	2.1	3.0
Potassium	.8	.7	1.1
Sulfate	7.7	4.9	5.7
Chloride	1.8	2.0	3.1

Table 5. Mean concentration of total phosphorus and total nitrogen for selected NASQAN stations and HBMN station in Wisconsin

[Concentrations in milligrams per liter]

Constituent	NASQAN stations				HBMN station
	Chippewa Rive. at Durand	Fox River at Wrightstown	Wisconsin River at Muscoda	Milwaukee River at Milwaukee	Popple River near Fence
Total phosphorus as P	0.11	0.14	0.09	0.16	0.03
Total nitrogen as N	1.2	1.5	1.3	2.2	----

tion and atmospheric deposition, industrial waste water, septic tanks, feedlot discharges, and fertilizers. The observed mean total nitrogen concentrations ranged from 0.42 mg/L at the Namekagon River near Hayward to 1.30 mg/L at the Snake River near Pine City, Minn. The maximum and minimum observed total nitrogen concentrations were 2.4 mg/L at the Kettle River near Cloverdale, Minn., to 0.16 mg/L at the Namekagon River near Hayward. The observed mean concentrations for the NASQAN stations and the HBMN station in Wisconsin are given in table 5. The observed mean total nitrogen concentrations at the St. Croix Scenic Riverway, except the Snake River near Pine City, Minn., were lower than mean total nitrogen concentrations at selected NASQAN stations in the State.

TRACE METALS

Trace metals are elements that normally occur at low concentrations in water. Even though they are found at low concentrations they may be toxic to plants and animals. Water samples for trace-metal analysis were collected at 6 of the 10 stations in the St. Croix National Scenic Riverway. The maximum, minimum, and mean concentrations, standard deviation, and the number of samples analyzed are given in table 6. The samples were analyzed for the following trace metals: arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, and zinc. Some of the analyses were reported as "less than" the analytical detection limit. The same treatment of the data for statistical purposes were used as reported earlier.

Mean concentrations of total recoverable iron at the Namekagon River near Trego, the St. Croix River near Danbury, the Snake River near Pine City, Minn., and the St. Croix River at St. Croix Falls exceeded recommended concentrations for drinking water and the range was 370 to 880 ug/L. The U.S. Environmental Protection Agency (1976) states that iron concentrations in water used for domestic water supplies should be less than 300 μg/L. Iron concentrations below 300 μg/L will not have objectionable taste and will not stain laundry or plumbing fixtures.

Water that is used for domestic water supplies should have concentrations of total recoverable manganese less than 50 μg/L (U.S. Environmental Protection Agency, 1976). Mean total recoverable manganese concentrations were exceeded at all of the stations sampled except at the St. Croix River near Danbury. High concentrations of manganese cause discoloration of water and objectionable taste. The range of mean total recoverable manganese was 70 μg/L at the Apple River near Somerset to 130 μg/L at the Snake River near Pine City. The concentrations of the other trace metals were less than recommended limits for drinking water.

BACTERIA

Numerous species of bacteria occur in water. Fecal coliform and fecal streptococci are used to indicate fecal contamination. These indicators show the presence of fecal contamination and the numbers of the indicators are proportional to disease-causing bacteria. The U.S. Environmental Protection Agency EPA (1976) states that based on a minimum of five samples taken over a 30-day period the log mean should not exceed 200 colonies per 100 mL nor should more than 10 percent of the total samples collected during a 30-day period exceed 400 colonies per 100 mL if the water is to be used for bathing or swimming. Maximum, minimum, and mean counts, standard deviation, and number of samples analyzed are given in Appendix 2. It is difficult to judge microbiological quality of water from the St. Croix National Scenic Riverway because of the infrequency of sample collection. Some of the maximum fecal counts exceed the EPA standards but the means were below the criteria for bathing waters.

PESTICIDES

Pesticides include all compounds used to control insects, weeds, and other pests. Pesticide residues can be extremely toxic and are detrimental to the environment. A water suspended-sediment mixture was analyzed for pesticide residue in 1976 at the St. Croix River at St. Croix Falls. The following pesticide residues were analyzed for:

Table 6. Maximum, minimum, mean, standard deviation, and number of samples of trace metals for the St. Croix National Scenic Riverway monitoring stations

[Chemical analyses in micrograms per liter]

		Total arsenic	Total recoverable cadmium	Total recoverable chromium	Total recoverable cobalt	Total recoverable copper	Total recoverable iron	Dissolved iron	Total recoverable lead	Total recoverable manganese	Dissolved manganese	Total recoverable mercury	Total selenium	Total recoverable zinc
05331855 Namekagon River near Hayward	Maximum	2	2	20	3	22	360	200	18	480	20	1.8	1	50
	Minimum	<1	<2	<20	<2	<1	50	50	<2	<10	<10	<.1	<1	<10
	Mean	1.0	1.0	11	1.0	5.0	240	118	6.0	80	9.0	.40	.60	18
	Standard deviation	.40	.60	5.0	1.0	7.0	90	40	5.0	150	7.0	.50	.20	14
	Number of samples	9	9	8	9	8	8	11	9	8	11	9	9	9
05332500 Namekagon River near Trego	Maximum	2	2	10	3	17	640	210	32	120	40	.5	--	40
	Minimum	<1	<1	<20	<1	<2	120	<10	<2	30	<10	<.1	<1	<10
	Mean	1.0	1.0	7.0	1.0	5.0	370	100	10	70	20	.30	--	20
	Standard deviation	.50	.70	2.0	.90	5.0	180	60	10	30	10	.10	--	10
	Number of samples	9	8	9	9	8	8	8	9	8	3	6	9	9
05333500 St. Croix River near Danbury	Maximum	2	3	20	2	24	810	450	24	100	20	1.0	--	20
	Minimum	<1	<1	<20	<2	<1	200	40	2	20	<10	<.1	<1	<10
	Mean	1.0	2.0	8.0	.90	7.0	400	210	9.0	40	10	.20	--	12
	Standard deviation	.40	.80	5.0	.70	9.0	200	140	8.0	20	7	.30	--	6
	Number of samples	9	9	9	9	7	7	11	7	7	9	9	9	9
05336500 Snake River near Pine City	Maximum	3	2	20	5	5	1,700	1,000	15	170	260	.50	--	40
	Minimum	<1	<1	<20	<1	<2	300	20	<1	80	<10	<.1	<1	<10
	Mean	1.0	.90	9.0	2.0	3.0	710	310	4.0	130	100	.10	--	20
	Standard deviation	.70	.50	6.0	2.0	2.0	440	280	4.0	30	80	.20	--	10
	Number of samples	9	9	9	8	8	8	11	9	8	11	9	9	9
05341500 Apple River near Somerset	Maximum	2	2	20	6	7	900	320	16	100	30	.2	--	70
	Minimum	<1	<1	<20	<2	<2	<10	<10	<2	<10	<10	<.1	<1	<10
	Mean	1.0	1.0	9.0	1.0	2.0	230	110	7.0	70	20	.06	--	20
	Standard deviation	.40	.50	5.0	2.0	2.0	240	100	6.0		10	.04	--	20
	Number of samples	10	10	10	10	9	9	12	9	9	12	10	9	10
05340500 St. Croix River at St. Croix Falls	Maximum	3	3	20	4	24	4,000	910	63	160	100	.6	1	380
	Minimum	<1	<1	<20	<2	<2	200	20	<2	20	<10	<.1	<1	<10
	Mean	1.0	1.0	9	1.0	4.0	880	350	10	80	30	.20	--	30
	Standard deviation	.50	.80	6.0	1.0	5.0	730	210	12	30	20	.20	--	70
	Number of samples	30	30	30	30	30	30	35	30	30	35	30	29	29

polychlorinated naphthalenes, aldrin, chlordane, DDD, DDE, DDT, diazinon, dieldrin, endrin, ethion, heptachlor, heptachlorepoxide, lindane, malathion, methyltrithion, parathion, toxaphene, and trithion. No pesticides were determined in this water-sediment sample. Pesticides may be adsorbed by or chemically bonded to silt, clay, and organic matter. There may be pesticides present in bottom material even though no pesticides were detected in the water suspended-sediment mixture. Bottom-material samples were not analyzed at the St. Croix River at St. Croix Falls station.

In 1981, the National Park Service requested that water samples be analyzed for pesticides above and below cranberry bogs that drain into the Namekagon River. Samples of the water suspended-sediment mixture and bottom material were collected and analyzed for the following pesticides: DDD, DDE, DDT, diazinon, dieldrin, endosulfan, endrin, ethion, heptachlor, heptachlorepoxide, lindane, malathion, methoxychlor, methylparathion, methyltrithion, mirex, parathion, perthane, toxaphene, trithion, 2, 4-D, 2, 4-DP, 2, 4, 5-T, silvex, polychlorinated napthalenes, aldrin, and chlordane. All of the pesticide concentrations were less than the detection limits.

LOADS AND YIELDS OF SELECTED WATER-QUALITY CHARACTERISTICS

While comparison of mean concentrations of the various water-quality characteristics provides an evaluation of the quality of the waters of the scenic riverway, additional assessment can be obtained by determining the annual load or yield of selected characteristics. Long-term estimated annual loads were determined for suspended sediment, total phosphorus, total nitrogen, and dissolved solids using a method described by Miller (1951). This technique uses a streamflow duration curve coupled with a constituent rating curve at each station. The streamflow duration curves were

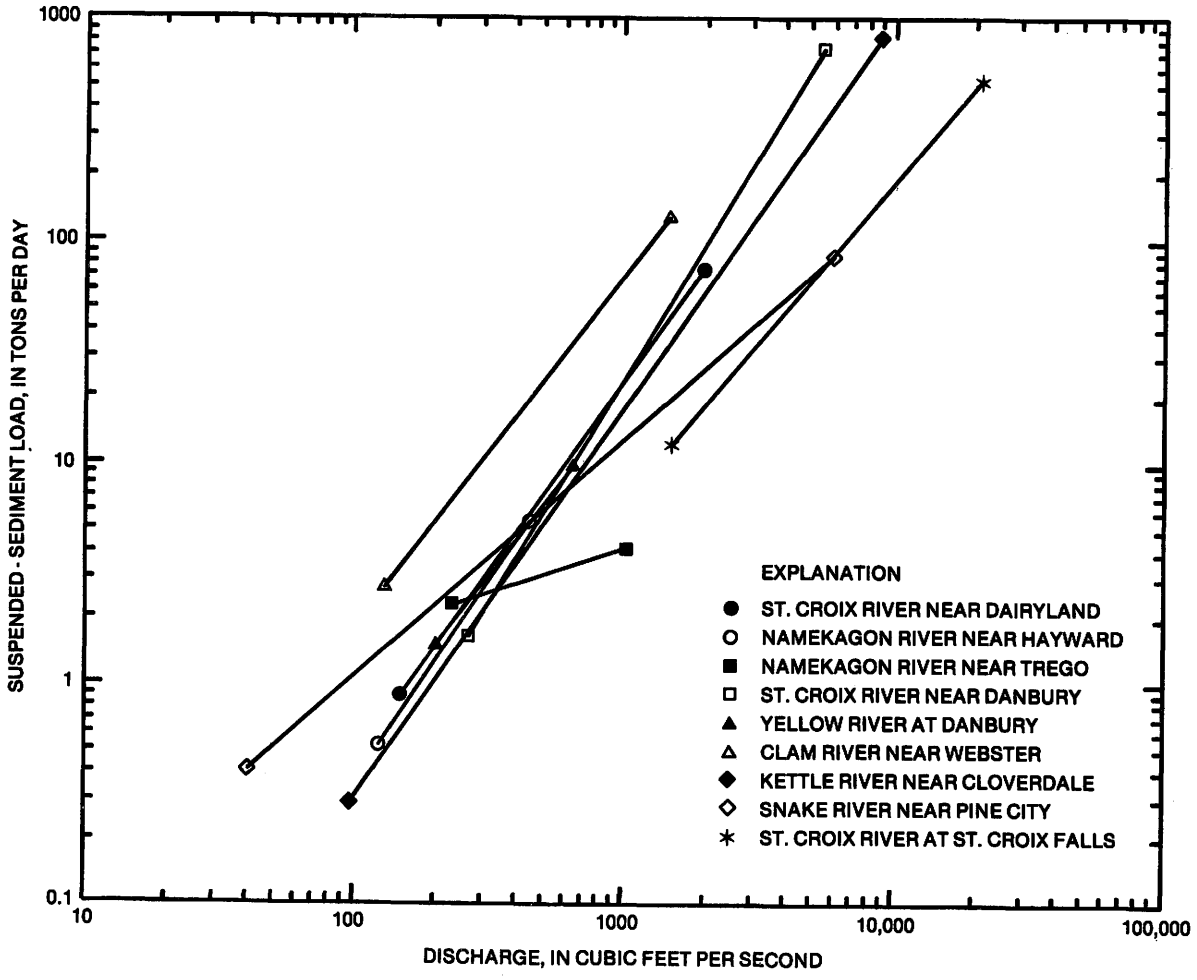

Figure 3. Relationship of suspended-sediment load to water discharge at monitoring stations in the St. Croix National Scenic Riverway.

obtained by transferring streamflow data from the St. Croix River at St. Croix Falls to the other nine stations by the relationship between the measured discharge at the miscellaneous sites and the daily discharge at the St. Croix River at St. Croix Falls station. The constituent-rating curves were developed based on regression analysis of load in tons or pounds versus instantaneous streamflow. The relationship between suspended sediment, total phosphorus, total nitrogen, and dissolved solids to water discharge for the St. Croix Scenic Riverway are shown in figures 3–6. The number of data points and correlation coefficients from the regression relationship developed for streamflow and water-quality loads are listed in table 7. The constituent-rating curves with correlation coefficients of less than 0.80 should be used with caution.

This method allows expansion of the more detailed streamflow and water-quality data collected at the NASQAN gaging station to provide estimates of annual loads and yields at sites where only minimal data were collected. Generally, considerably more data are required to calculate annual loads than is available at the 10 stations on the St. Croix River. This would consist of daily samples or frequent normal or base-flow samples with numerous sampling during runoff events to describe the entire range of discharges. Due to the limited data used to calculate the annual loads, the estimates could have a high degree of uncertainty.

SEDIMENT AND CHEMICAL LOADS

Suspended-sediment loads calculated for nine stations are given in table 8. Annual suspended-sediment loads ranged from 580 tons at the Namekagon River near Hayward to 25,000 tons at the St. Croix River at St. Croix Falls. Suspended-sediment load was not calculated at the Apple River near Somerset because the sampling site is downstream of a dam that traps most of the suspended sediment.

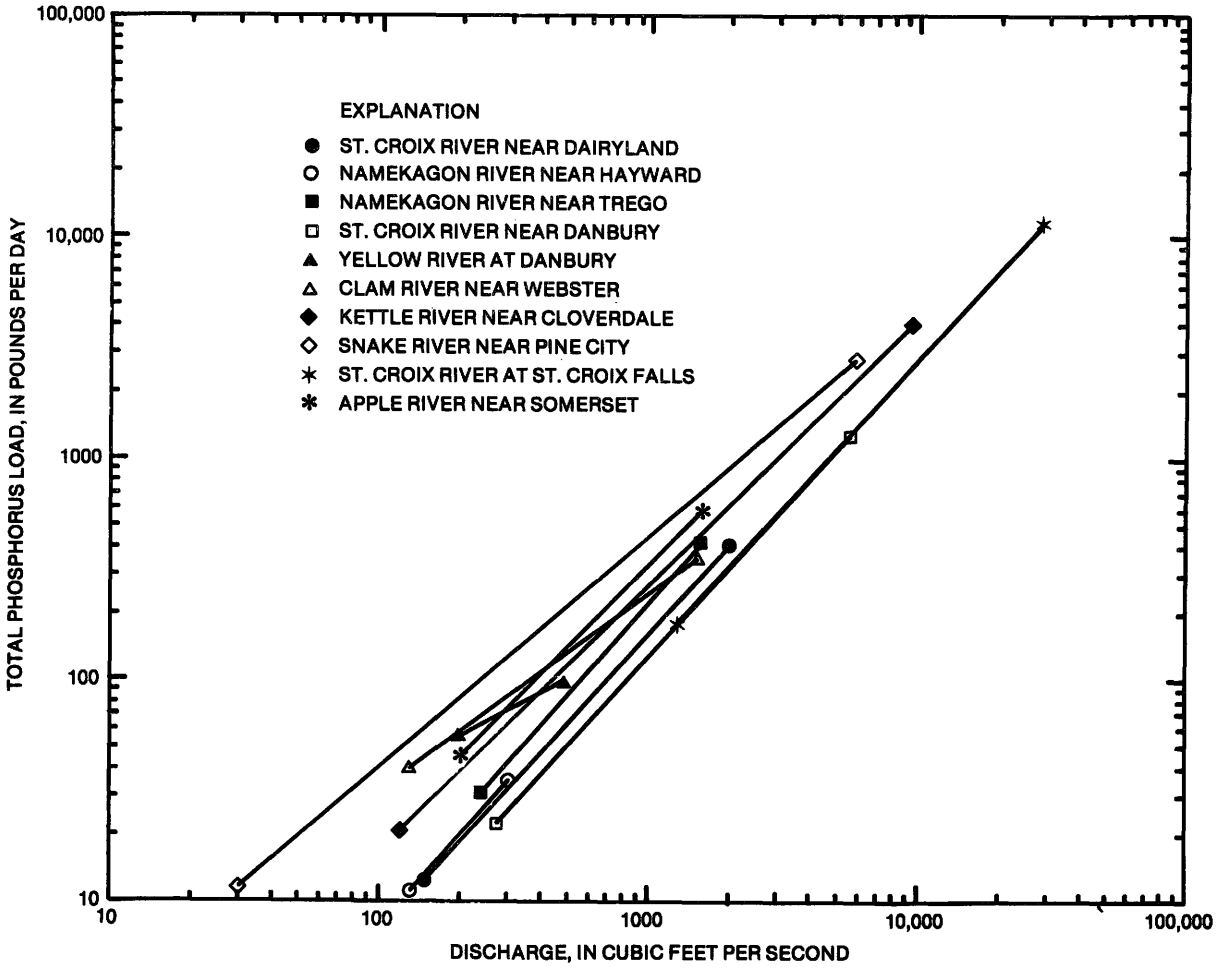

Figure 4. Relationship of total phosphorus load to water discharge at monitoring stations in the St. Croix National Scenic Riverway.

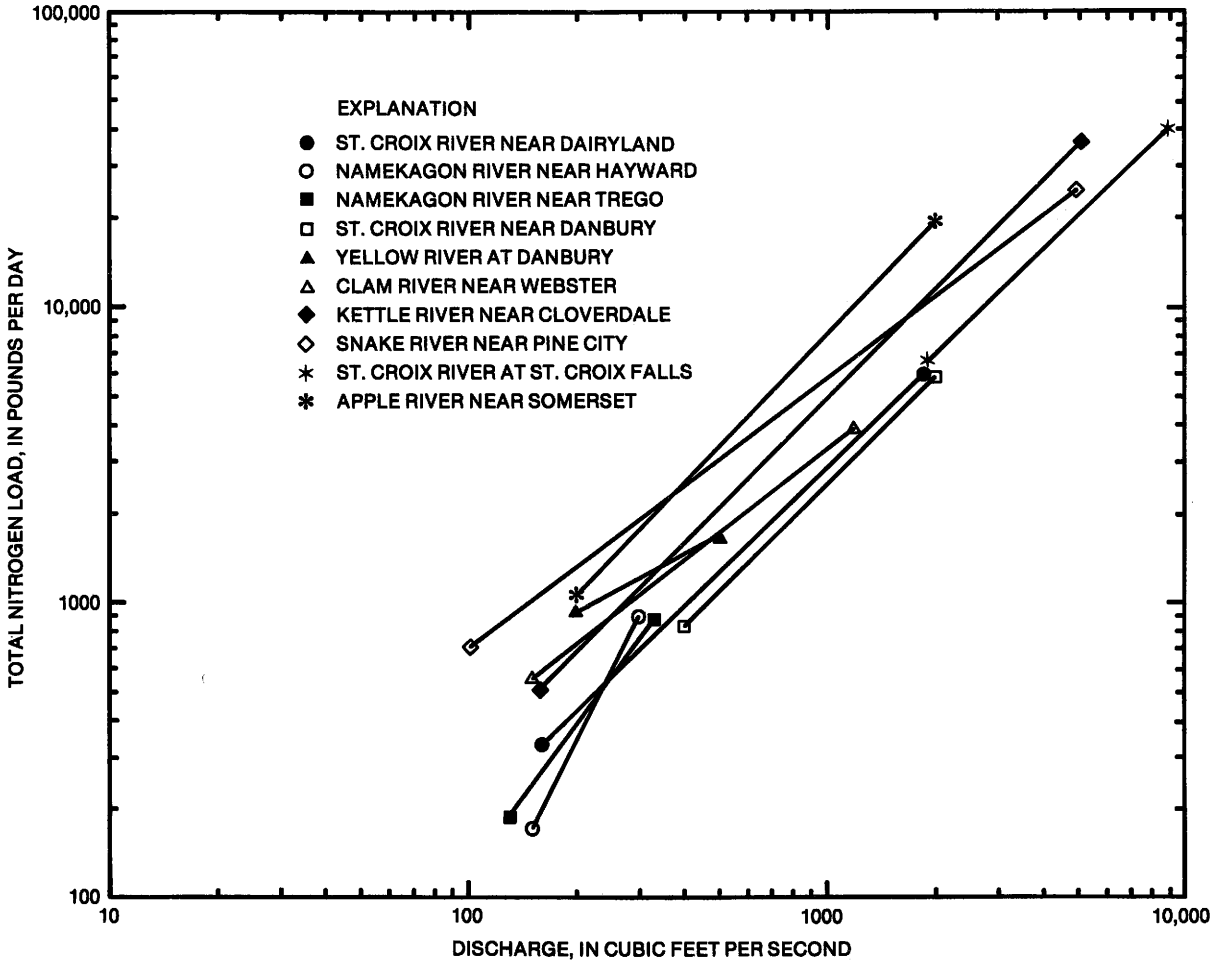

Figure 5. Relationship of total nitrogen to water discharge at monitoring stations in the St. Croix National Scenic Riverway.

Table 7. Correlation coefficients for regression equations for streamflow and water-quality loads for the St. Croix National Scenic Riverway stations

	Station	Suspended sediment		Total phosphorus		Total nitrogen		Dissolved solids	
		R 1/	n 2/	R	n	R	n	R	n
05331756	St. Croix River near Dairyland	0.91	15	0.94	15	0.97	13	---	--
05331855	Namekagon River near Hayward	.60	24	.59	24	.84	24	0.91	25
05332500	Namekagon River near Trego	.18	24	.82	25	.88	23	.97	25
05333500	St. Croix River near Danbury	.88	25	.87	25	.90	24	.95	25
05335031	Yellow River at Danbury	.66	16	.48	15	.53	15	---	--
05335500	Clam River near Webster	.92	15	.91	15	.82	15	---	--
05337050	Kettle River near Cloverdale	.97	13	.96	15	.96	14	---	--
05338500	Snake River near Pine City	.89	24	.96	25	.98	24	.99	25
05341500	Apple River near Somerset	---	--	.87	25	.88	25	.93	26
05340500	St. Croix River at St. Croix Falls	.72	83	.79	91	.94	85	.98	91

1/ R = correlation coefficient
2/ n = number of points

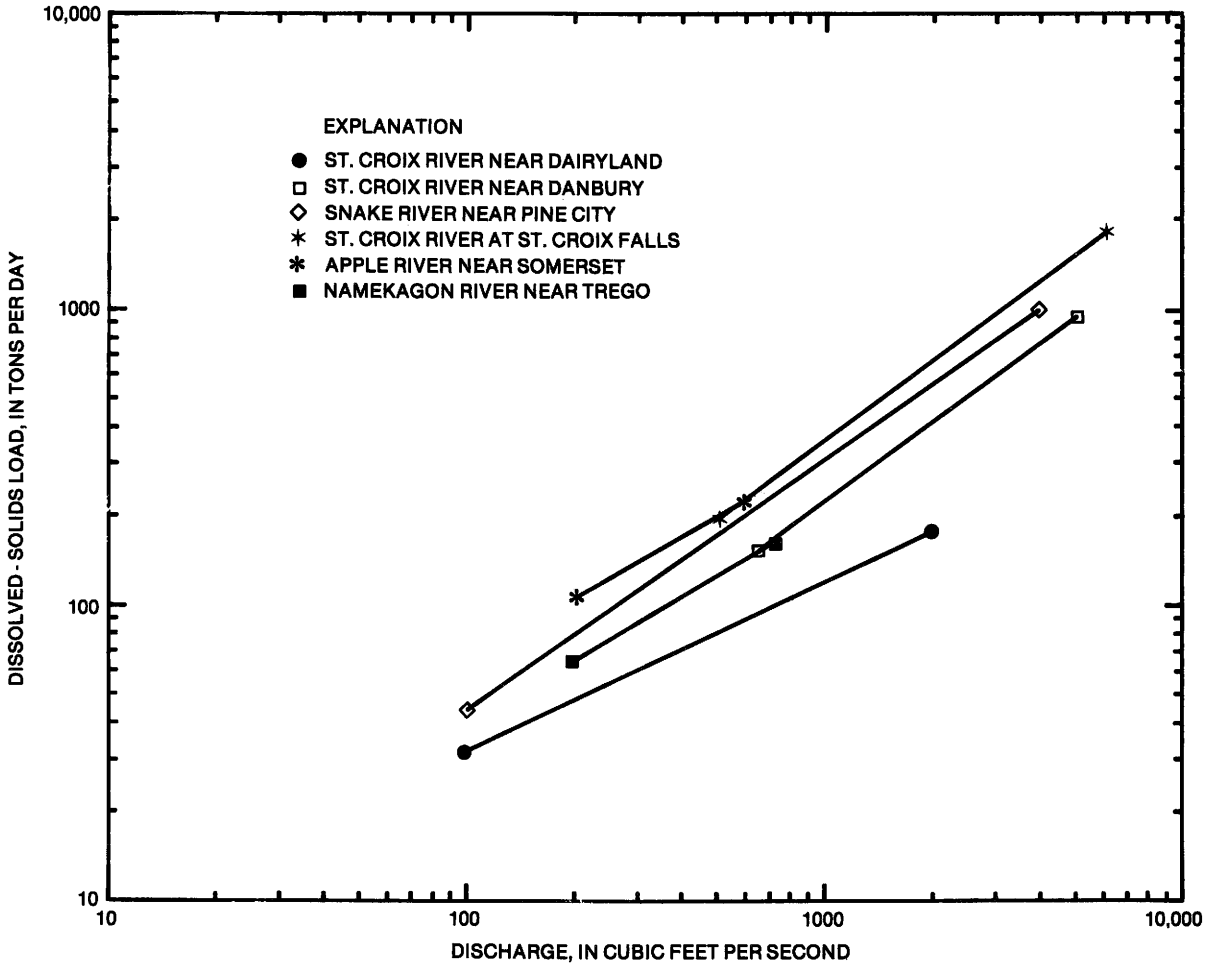

Figure 6. Relationship of dissolved solids to water discharge at monitoring stations in the St. Croix National Scenic Riverway.

Table 8. Average annual loads of suspended sediment, total phosphorus, total nitrogen, and dissolved solids at the St. Croix National Scenic Riverway stations, 1975–83

	Suspended-sediment load (ton)	Total phosphorus load (lb)	Total nitrogen load (lb)	Dissolved-solids load (ton)
St. Croix River near Dairyland	1,800	20,000	460,000	----
Namekagon River near Hayward	580	6,800	160,000	19,000
Namekagon River near Trego	1,000	29,000	540,000	37,000
St. Croix River near Danbury	11,000	99,000	1,200,000	83,000
Yellow River at Danbury	1,100	38,000	370,000	-----
Clam River near Webster	2,800	25,000	480,000	----
Kettle River near Cloverdale, Minn.	14,000	92,000	1,400,000	----
Snake River near Pine City, Minn.	1,800	66,000	1,000,000	33,000
Apple River near Somerset	----	48,000	1,000,000	61,000
St. Croix River at St. Croix Falls	25,000	900,000	7,600,000	457,000

The annual suspended-sediment loads at the selected NASQAN stations and the HBMN station ranged from 720 tons at the Popple River near Fence to 443,000 tons at the Chippewa River at Durand (Smith and Alexander, 1983) (table 9). The annual suspended-sediment load at the study stations were less than those at the NASQAN stations but greater than suspended-sediment load at the HBMN station.

Average annual total phosphorus loads calculated for the St. Croix National Scenic Riverway are given in table 8. Total phosphorus load ranged from 6,800 lb for the Namekagon River near Hayward to 900,000 lb for the St. Croix River at St. Croix Falls. Average annual total phosphorus load for the Popple River near Fence for 1974–81 was 6,900 lb (Smith and Alexander, 1983). Average annual phosphorus loads for selected NASQAN stations ranged from 145,000 lb for the Milwaukee River at Milwaukee to 1,600,000 lb for the Chippewa River at Durand (Smith and Alexander, 1983). Annual phosphorus loads are given in table 9 for selected NASQAN stations and the HBMN station. The total phosphorus loads for the study stations were below this range except for the St. Croix River at St. Croix Falls.

Average annual total nitrogen loads ranged from 160,000 lb at the Namekagon River near Hayward to 7,600,000 lb at the St. Croix River at St. Croix Falls (table 8). Annual total nitrogen loads at NASQAN stations ranged from 1,700,000 lb at the Milwaukee River at Milwaukee to 23,000,000 lb for the Wisconsin River at Muscoda. Total nitrogen loads at the St. Croix National Scenic Riverway stations were lower than for other stations around the State.

Average annual dissolved-solid loads were calculated at only 6 of the 10 stations in the St. Croix National Scenic Riverway. Dissolved-solids loads ranged from 19,000 tons at the Namekagon River near Hayward to 457,000 tons at the St. Croix River near St. Croix Falls (table 8). The average annual dissolved-solid loads for the NASQAN stations and HBMN station ranged from 8,900 tons at the Popple River near Fence to 966,000 lb at the Wisconsin River at Muscoda (table 9).

SEASONAL VARIABILITY OF LOADS

Bar graphs show the seasonal variability of water-quality loads over a period of time. Seasonal variability of the loads were only calculated at the St. Croix River at St. Croix Falls because sufficient data to calculate seasonal loads were available.

Bar graphs were prepared for four constituent loads: suspended sediment, phosphorus, nitrogen, and dissolved solids. The means were lowest in winter, December through February, and highest in spring, March through May (fig. 7). All the constituent loads follow the same pattern. During winter precipitation falls as snow and runoff is low (fig. 8). During the spring the runoff is from snowmelt and rainfall on frozen soil and runoff is high (fig. 8). Summer runoff is due to intense thunderstorms and runoff is also high during this period. Because runoff and loads are highly correlated, seasonal loads should follow the same pattern as runoff. This is the case with higher loads in spring and summer and lower loads in fall and winter.

SEDIMENT AND CHEMICAL YIELDS

Yields are obtained by dividing the annual loads by drainage area. The result is in tons or pounds per square mile. Comparisons of sediment and phosphorus yields from other Wisconsin streams were made.

The average annual sediment yield in Wisconsin is 80 ton/mi^2 (Hindall, 1975). Hindall (1975) reports that the regional sediment yield for the St. Croix River basin is about 10 ton/mi^2. The suspended-sediment yield for the St. Croix National Scenic Riverway stations ranged from 1.9 ton/mi^2 at the Snake River near Pine City, Minn., to 13.3 ton/mi^2 at the Kettle River near Cloverdale. Suspended-sediment yields are given in table 10.

Yields of total phosphorus, in pounds per square mile are shown in table 10. Yields ranged from 40 lb/mi^2 at the Namekagon River near Hayward to 144 lb/mi^2 at the St. Croix River at St. Croix Falls.

Table 9. Average annual loads of suspended sediment, total phosphorus, total nitrogen, and dissolved solids for NASQAN stations and HBMN station in Wisconsin, 1974–81

	Suspended-sediment load 1/ (ton)	Total phosphorus load 1/ (lb)	Total nitrogen load 2/ (lb)	Dissolved-solids load 1/ (ton)
Popple River near Fence	720	6,900	-----	8,900
Milwaukee River at Milwaukee	25,400	145,000	1,700,000	161,000
Chippewa River at Durand	443,000	1,600,000	17,000,000	523,000
Fox River at Wrightstown	101,000	1,000,000	11,000,000	805,000
Wisconsin River at Muscoda	326,000	1,500,000	23,000,000	966,000

1/ Smith and Alexander, 1983
2/ U.S. Geological Survey, 1975-82

A comparison of sediment and phosphorus yields from other Wisconsin streams are shown in figures 9 and 10, respectively. The yields from the St. Croix National Scenic Riverway stations are considerably lower than those of other stations in the State, especially as compared to data from small watersheds. These small basins are part of the nonpoint-source program. This program was used to assess nonpoint-source inputs and their effects on water quality (Field, written commun., 1981, 1984, 1985). The U.S. Geological Survey collected data at several basins in the State. The basins from the program with the highest yields are from the southwestern part of the State where there are steep slopes and large amounts of land in agriculture. Basically sandy soil, flat slopes, large amount of lakes and wetlands, and large forested areas account for the low yields in the St. Croix National Scenic Riverway.

Yields also were calculated for total nitrogen and dissolved solids (table 10). Yields of total nitrogen at the St.

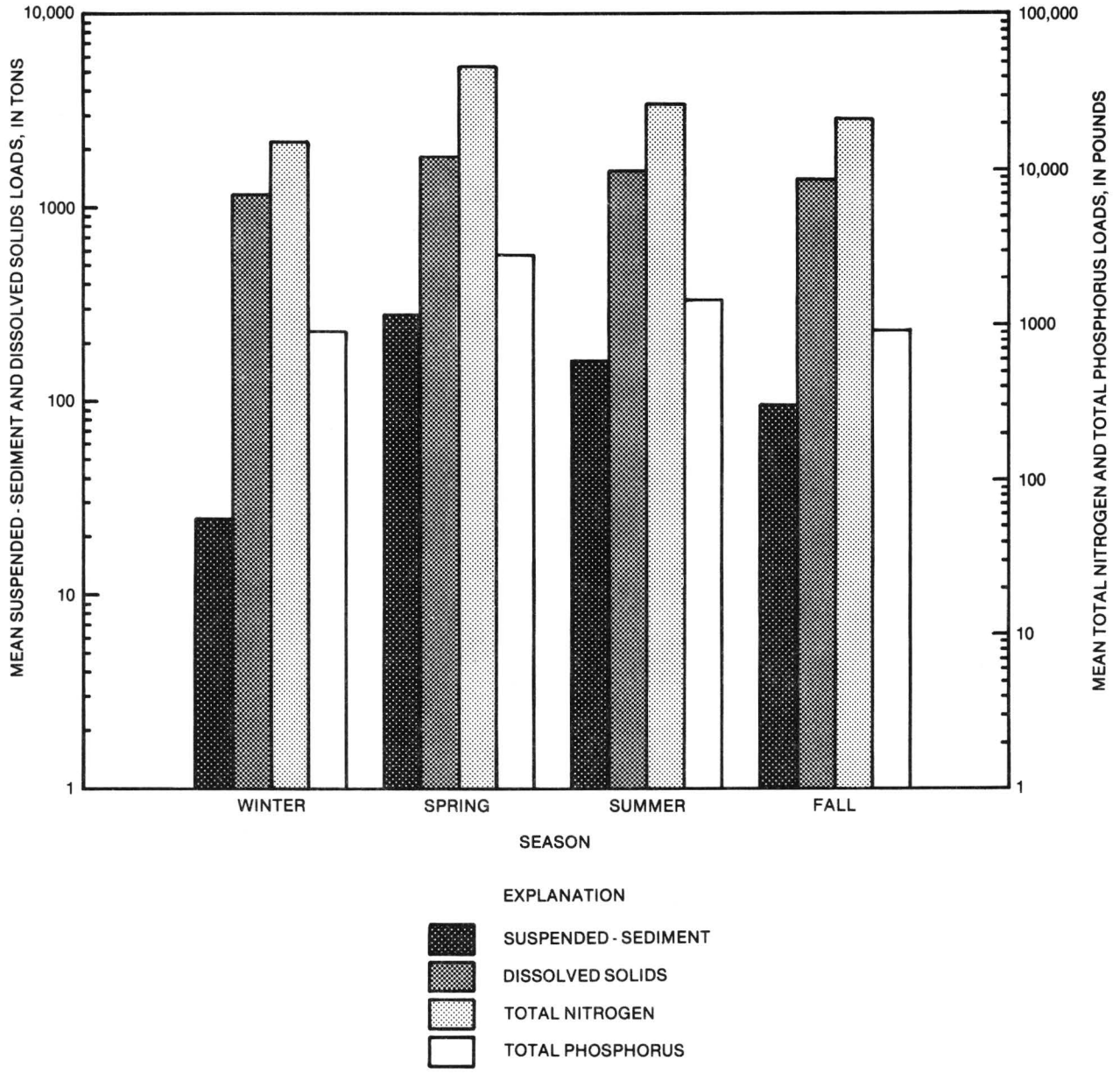

Figure 7. Seasonal relationship of suspended sediment, dissolved-solids, total nitrogen, and total phosphorus loads for the St. Croix River at St. Croix Falls.

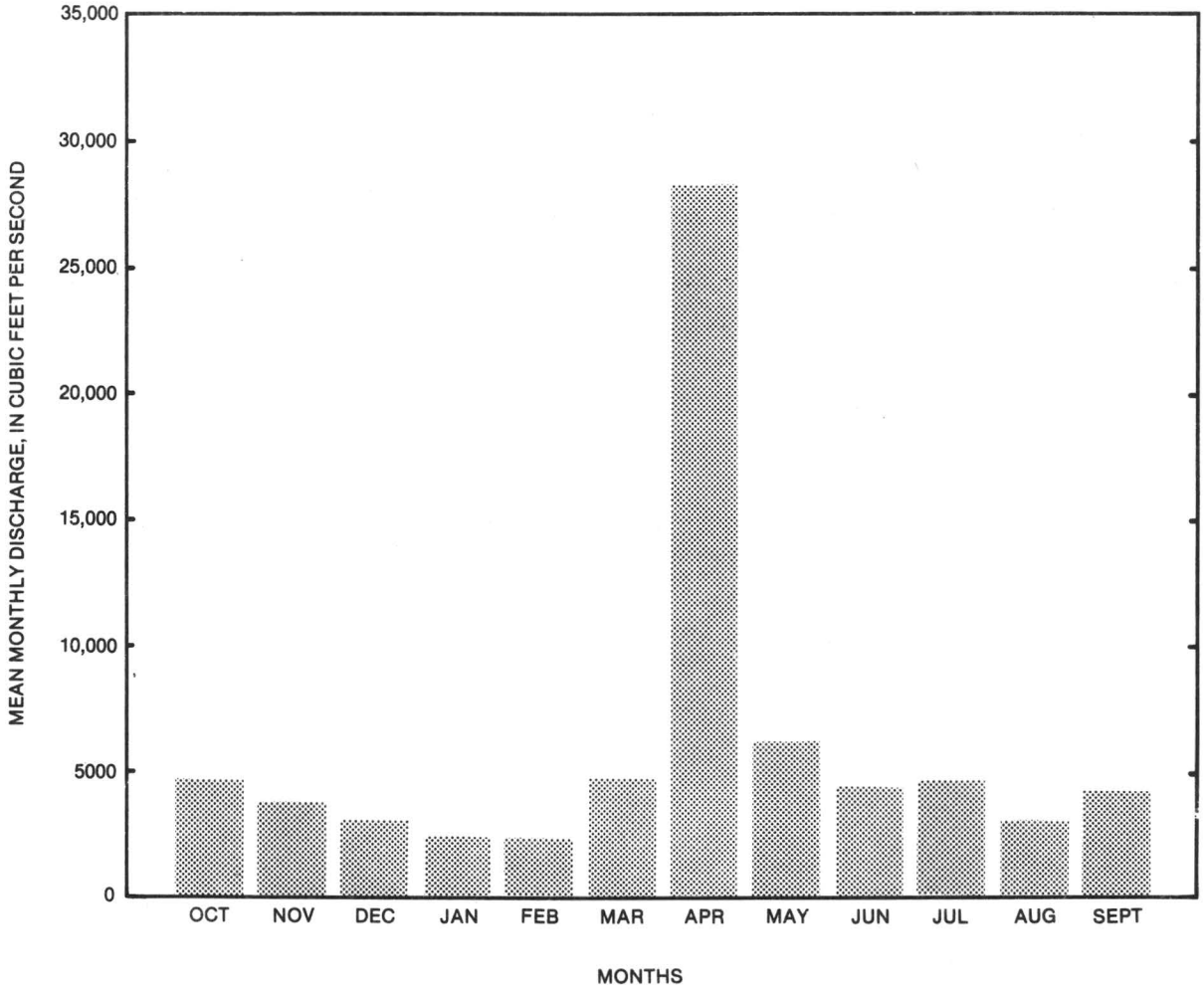

Figure 8. Mean monthly discharge for the St. Croix River at St. Croix Falls for the 1976–83 water years.

Table 10. Annual yields for suspended sediment, total phosphorus, total nitrogen, and dissolved solids at the St. Croix National Scenic Riverway monitoring stations

	Suspended-sediment yield (ton/mi^2)	Total phosphorus yield (lb/mi^2)	Total nitrogen yield (lb/mi^2)	Dissolved-solids yield (ton/mi^2)
St. Croix River near Dairyland	3.8	43	1,000	---
Namekagon River near Hayward	3.4	40	970	110
Namekagon River near Trego	2.1	59	1,100	76
St. Croix River near Danbury	6.9	62	760	52
Yellow River near Danbury	2.8	100	980	---
Clam River near Webster	7.8	69	1,330	---
Kettle River near Cloverdale, Minn.	13.3	88	1,330	---
Snake River near Pine City, Minn.	1.9	69	1,040	34
Apple River near Somerset	---	83	1,900	105
St. Croix River at St. Croix Falls	4.0	144	1,220	73

Croix National Scenic Riverway stations ranged from 760 lb/mi² at the St. Croix River near Danbury to 1,900 lb/mi² at the Apple River at Somerset.

Dissolved-solid yields at the St. Croix National Scenic Riverway ranged from 34 ton/mi² for the Snake River near Pine City to 110 ton/mi² at the Namekagon River near Hayward.

Total nitrogen and dissolved-solid yields at the study stations were compared to the selected NASQAN stations in the State. Yields for total nitrogen and dissolved solids for the NASQAN sites can be found in table 11. Nitrogen yields at the study stations were lower than other stations in the State. Total nitrogen yields for the NASQAN stations ranged from 1,820 lb/mi² at the Fox River at Wrightstown to 2,400 lb/mi² at the Milwaukee River at Milwaukee. The same trend of low yields at study stations for dissolved solids as compared to other stations in the State was found.

TREND ANALYSIS

Trend analysis is used to determine if the water quality is changing over time and if it is changing, is it getting better or worse. Trend analysis was done by Smith and Alexander (1983) at the NASQAN and HBMN stations throughout the country. As part of that study they analyzed the data for the St. Croix River at St. Croix Falls, which is included in this report. A trend is believed to exist if a seasonal Kendall test was significant at the 5 percent probability level. The hypothesis tested was that there was no trend during the time period 1974–81. The hypothesis was accepted (that is, a trend does not exist) if the calculated probability exceeded a significance level of 0.05 or 5 percent. The hypothesis was rejected (that is, a trend exists) if the probability was less than 0.05.

The trend analysis for selected loads can be found in table 12. The only load with a probability near the signifi-

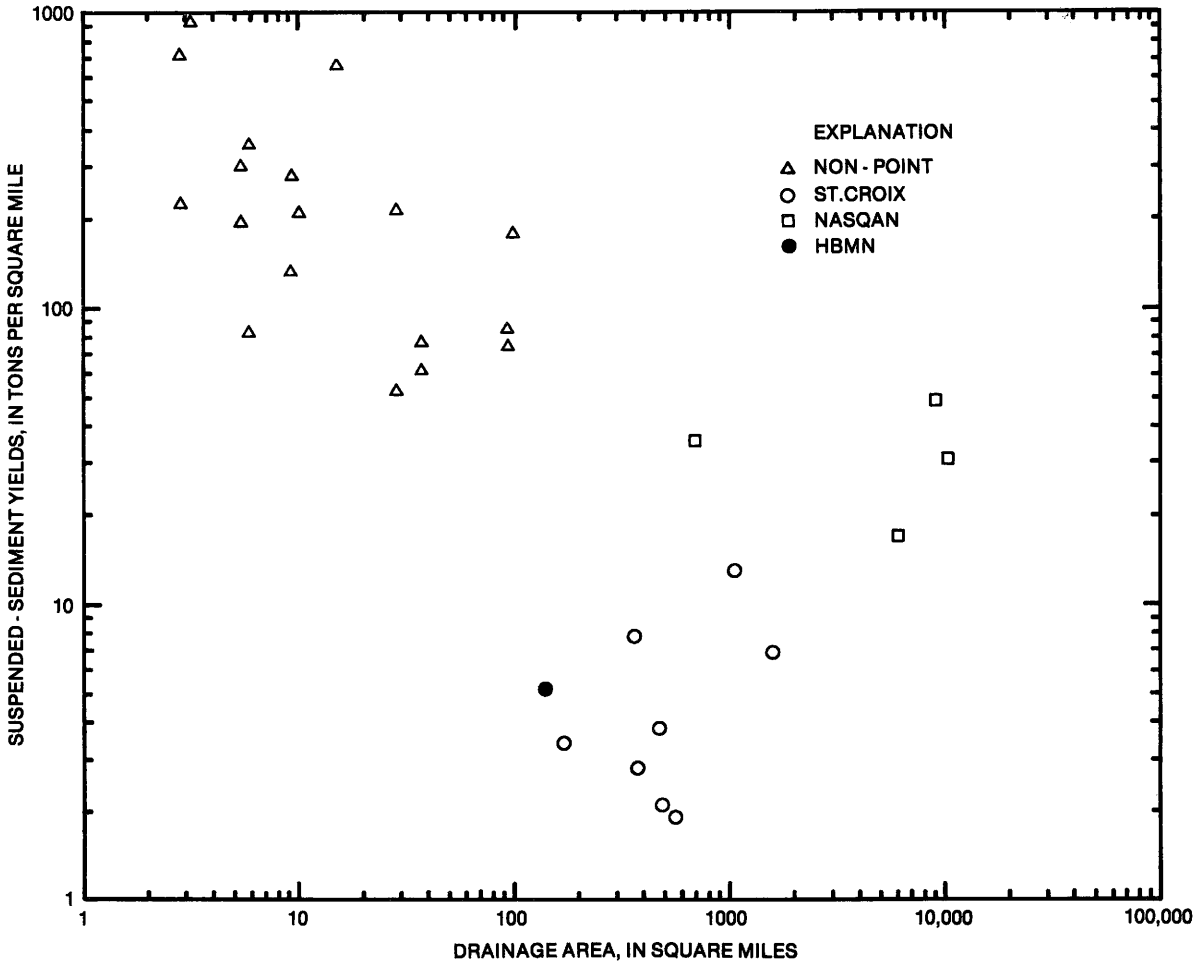

Figure 9. Relationship of suspended-sediment yields at the St. Croix National Scenic Riverway monitoring stations to other stations in Wisconsin.

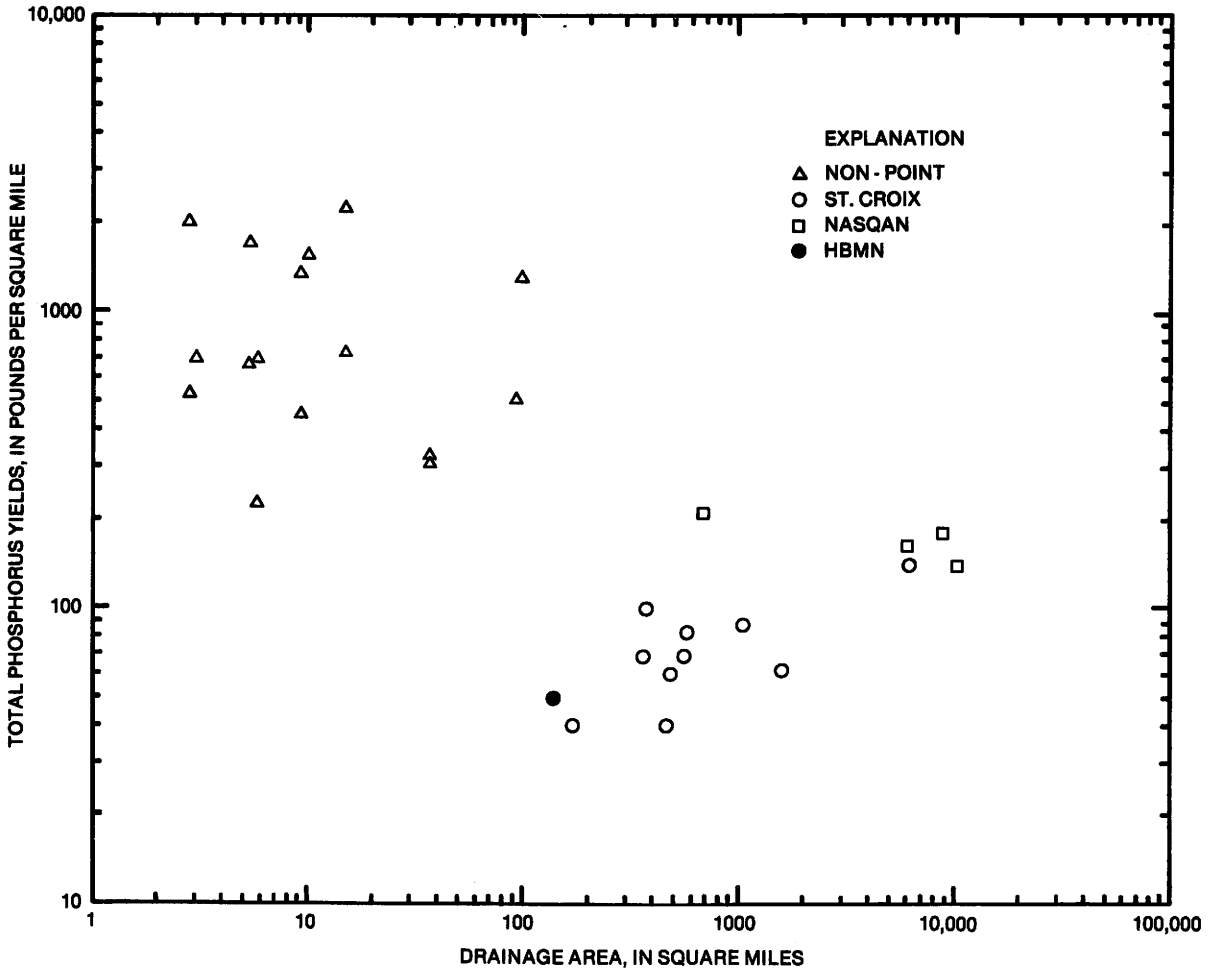

Figure 10. Relationship of total phosphorus yields at the St. Croix National Scenic Riverway stations to other stations in Wisconsin.

Table 11. Annual yields for suspended sediment, total phosphorus, total nitrogen, and dissolved solids at selected NASQAN stations and HBMN station in Wisconsin, 1974–81

[After Smith and Alexander, 1983]

	Suspended-sediment yield (ton/mi^2)	Total phosphorus yield (lb/mi^2)	Total nitrogen yield 1/ (lb/mi^2)	Dissolved-solids yield (ton/mi^2)
Popple River near Fence	5.2	50	---	64
Milwaukee River at Milwaukee	36	210	2,400	230
Chippewa River at Durand	49	180	1,900	58
Fox River at Wrightstown	17	165	1,820	130
Wisconsin River at Muscoda	31	140	2,210	93

1/ U.S. Geological Survey, 1975-82

cant probability was total ammonia as N. Smith and Alexander (1983) found that the total ammonia as N load was apparently increasing at a rate 26 percent per year. No other parameter probability was judged to be significant; therefore no trends were believed to exist.

SUMMARY AND CONCLUSIONS

The U.S. Geological Survey made a water-quality reconnaissance of the St. Croix Scenic Riverway from 1975 to 1983. The purposes of the study were: to determine if any water-quality problem was present, to determine the present water quality of the scenic riverway, and to establish a data base for monitoring long-term trends. Water-quality samples were collected at 10 different stations. The samples were analyzed for dissolved oxygen, specific conductance, pH, suspended sediment, major cations and anions, nutrients, trace metals, enteric bacteria, and pesticides.

Mean dissolved-oxygen concentrations ranged from 9.4 to 11.0 mg/L at the study stations. These values are well above minimum levels required to maintain fish population.

Mean suspended-sediment concentration ranged from 3.0 to 15.0 mg/L at the study sites. The maximum observed concentration of suspended sediment was 54 mg/L at the St. Croix River at St. Croix Falls with numerous concentrations of 1 mg/L observed at other stations in the basin. The range of suspended-sediment concentration at the St. Croix National Scenic Riverway is less than the average suspended-sediment concentration in Wisconsin rivers of 110 mg/L.

The major anions and cations concentrations at the study stations were below concentrations at other stations in the State. Concentrations of the major anions and cations at the St. Croix River near Danbury and St. Croix Falls are similar with concentrations at the Popple River near Fence, which is a station selected for long-term monitoring due to the minimal effect by man. Iron and manganese were the only trace metals that exceeded drinking water standards. No pesticides were detected in either the water-sediment mixture or bed-material samples along the Riverway.

Major nutrient concentrations were determined at all the stations. Mean concentrations of total phosphorus ranged from 0.02 to 0.08 mg/L. Mean concentrations of total nitrogen ranged from 0.42 to 1.30 mg/L. These concentrations were compared to selected National Stream Accounting Network (NASQAN) stations and Hydrologic Benchmark (HBMN) station in the State. The mean concentrations of phosphorus and nitrogen were lower at the St. Croix River National Scenic Riverway stations than at the NASQAN stations around the State.

Average annual loads and yields were calculated for suspended sediment, total phosphorus, total nitrogen, and dissolved solids using a flow-duration curve method. Annual suspended-sediment loads ranged from 580 to 25,000 tons and were lower than other stations in the State. Annual suspended-sediment yields ranged from 1.9 to 13.3 ton/mi^2 at the St. Croix National Scenic Riverway stations, which are well below the average suspended-sediment yield for Wisconsin, which is about 80 ton/mi^2. Total phosphorus loads and yields were also lower at the study stations than for other stations throughout the State. Annual total phosphorus yields ranged from 40 to 144 lb/mi^2 at the study stations. Annual total nitrogen and dissolved-solid loads and yields followed the same trend as total phosphorus and suspended sediment.

The water quality of the St. Croix National Scenic Riverway is generally good for most uses such as swimming and bathing. Trend analysis for selected parameter loads at the St. Croix River at St. Croix Falls show that the water quality is not significantly changed from 1974–81 except for an apparent increase in total ammonia as N.

Table 12. Trend analysis for St. Croix River at St. Croix Falls, 1974-81

	Loads[1]		
Constituents	**Mean load ton/yr**	**Probability P**	**Percent change per year of load**
Alkalinity as $CaCO_3$	300,000	1.00	0.00
Sulfate as SO_4	26,000	.69	−2.00
Chloride	13,000	.12	4.6
Silica	48,000	.89	−.6
Calcium	84,000	1.00	0.00
Magnesium	27,000	.56	−1.5
Sodium	12,000	.56	1.8
Potassium	52,000	.44	2.8
Dissolved solids	390,000	.96	−.1
Suspended sediment	39,000	.50	−6.9
Phosphorus, total as P	210	.89	1.8
Nitrate-nitrite, total as N	1,100	.82	−1.7
Ammonia, total as N	330	.08	26.1
Organic carbon, total as C	44,000	.46	−11.4

[1] Data from Smith and Alexander, 1983.

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Appendix 1. Summary of chemical analyses of water from the St. Croix National Scenic Riverway monitoring stations

[K,B = results based on count outside of the accepatable range (nonideal colony count)]

05331756—ST. CROIX RIVER NEAR DAIRYLAND, WIS.

05331756 -- ST. CROIX RIVER NEAR DAIRYLAND, WIS.

Location.--Lat 46°11'32", long 92°04'16", in NE1/4SE1/4 sec. 23, T. 43 N., R. 14 W., Douglas County, at bridge on County Trunk Highway T, 4.3 mi southeast of Dairyland.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)
OCT , 1975											
21...	1640	10.0	218	115	--	8.1	.7	46	56	.26	.23
APR , 1976											
04...	1530	4.0	1800	60	--	7.0	3.2	16	20	.67	.58
JUL											
22...	1030	24.0	232	100	8.4	8.0	.8	41	50	.43	.39
MAR , 1977											
17...	1330	1.0	340	135	12.3	--	--	50	61	.62	.27
AUG											
10...	1610	24.0	165	92	8.6	8.1	.6	39	48	.40	.38
APR , 1978											
05...	1500	3.0	714	85	12.1	8.0	.6	29	35	.47	.30
AUG											
22...	1415	25.0	198	90	8.8	8.2	.5	41	--	.33	.32
APR , 1979											
18...	1345	2.5	2040	55	12.2	6.8	4.3	14	--	.51	.42
AUG											
22...	1600	20.0	202	75	8.6	7.8	1.3	43	--	.30	.29
APR , 1980											
09...	1330	1.0	757	75	12.8	6.6	--	--	--	--	--
JUL											
08...	1400	26.0	148	103	8.8	7.4	3.7	43	--	.36	.33
APR , 1981											
01...	1330	3.0	857	65	12.4	6.0	41	--	--	.85	.64
AUG											
18...	1130	21.0	234	104	9.7	6.8	12	--	--	.67	.50
APR , 1982											
15...	1730	4.5	1510	56	12.0	7.1	3.1	--	--	.43	.29
AUG											
24...	1340	20.0	189	98	9.3	8.2	.6	--	--	--	.48
APR , 1983											
18...	1545	3.5	754	80	12.5	7.5	1.9	--	--	--	.24
AUG											
25...	0900	22.0	278	100	8.1	7.8	1.5	--	--	--	.38

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CHLORIDE, DISSOLVED (MG/L AS CL)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975										
21...	.030	.26	<.10	.040	.040	15	1.2	--	--	1
APR , 1976										
04...	<.010	.58	.09	.030	.020	13	.50	--	--	15
JUL										
22...	.010	.40	.03	.030	.030	--	.70	--	--	6
MAR , 1977										
17...	.070	.34	.28	.030	.030	5.3	1.7	<0	30	1
AUG										
10...	.010	.39	.01	.010	.010	5.5	.80	B20	340	11
APR , 1978										
05...	.050	.35	.12	.020	.010	8.0	1.6	22	72	10
AUG										
22...	<.010	.32	.01	.010	.010	8.1	1.4	21	K1300	2
APR , 1979										
18...	.020	.44	.07	.030	.010	9.0	1.1	K1	K15	10
AUG										
22...	<.010	.29	.01	.010	<.010	6.3	1.1	K200	470	3
APR , 1980										
09...	--	.50	--	.060	.020	8.7	1.0	K8	K20	6
JUL										
08...	.020	.35	.01	.020	.010	3.4	1.0	K12	110	3
APR , 1981										
01...	.130	.77	.08	.040	--	13	1.4	<1	K35	12
AUG										
18...	.070	.57	.10	.020	--	11	1.5	K16	K1500	1
APR , 1982										
15...	.040	.33	.10	.030	--	9.8	.90	K5	790	19
AUG										
24...	.020	.50	<.10	<.010	.010	3.8	1.1	83	K1400	3
APR , 1983										
18...	.060	.30	<.10	.010	.010	9.0	1.3	<2	38	1
AUG										
25...	.020	.40	<.10	.040	.020	10	1.4	25	1500	1

05331855 -- NAMEKAGON RIVER NEAR HAYWARD, WIS.

Location.--Lat 46°03'06", long 91°25'53", in NE1/4NE1/4 sec. 12, T. 41 N., R. 9 W., Sawyer County, at bridge over town road, 3.7 mi northeast of Hayward.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (μS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	NITROGEN, TOTAL (MG/L AS N)
OCT , 1975											
20...	1800	8.0	146	185	--	8.6	.3	78	79	8	.16
FEB , 1976											
04...	1430	.0	178	170	10.6	7.5	4.4	71	87	0	.47
APR											
01...	1015	3.5	446	100	12.0	7.2	--	--	--	--	--
06...	0910	6.5	440	105	11.0	7.0	7.6	39	48	0	.57
JUL											
20...	0900	21.0	179	160	8.1	7.9	1.7	68	83	0	.36
OCT											
04...	1330	13.0	127	185	9.8	8.2	.9	77	94	0	.19
JAN , 1977											
14...	1100	.0	131	215	8.9	--	--	77	94	--	.45
MAR											
15...	1400	5.0	219	140	12.4	--	--	48	58	--	.80
AUG											
08...	1500	24.0	164	160	10.0	8.4	.5	59	72	0	.47
OCT											
17...	1415	8.5	185	120	11.4	7.5	2.7	44	54	0	.44
FEB , 1978											
07...	1220	.0	171	150	9.8	7.6	3.2	66	81	0	.48
MAR											
30...	1240	9.0	176	145	12.6	8.6	.3	62	75	0	.33
AUG											
22...	1135	21.5	165	150	9.3	8.3	.6	67	--	--	.32
OCT											
17...	1230	7.0	185	160	12.2	8.2	.8	64	--	--	.24
FEB , 1979											
13...	1230	.5	169	185	9.0	7.3	6.8	70	--	--	.36
APR											
16...	1415	8.0	308	120	11.2	7.8	1.5	49	--	--	.45
AUG											
23...	0900	17.0	185	122	8.4	7.5	4.2	69	--	--	.38
FEB , 1980											
20...	1145	.5	170	163	11.5	6.9	17	70	--	--	.48
APR											
08...	1400	4.0	308	110	11.6	7.1	7.1	41	--	--	.57
JUL											
07...	1330	23.5	138	146	10.0	8.2	.9	76	--	--	.40
OCT											
14...	1300	6.0	164	146	12.0	7.9	1.8	--	--	--	.21

DATE	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
OCT 1975										
20...	.16	<.010	.16	<.10	.010	.020	3.4	23	5.8	2.3
FEB 1976										
04...	.19	.030	.22	.25	.030	.020	3.3	18	5.6	2.1
APR										
01...	--	--	--	--	--	--	--	--	--	--
06...	.38	.020	.40	.17	--	.180	12	12	3.6	1.7
JUL										
20...	.31	.020	.33	.03	.040	.030	--	19	5.3	2.1
OCT										
04...	.14	.010	.15	.04	.030	.020	2.6	22	6.4	2.1
JAN 1977										
14...	.19	.040	.23	.22	.020	.020	2.7	22	6.0	2.5
MAR										
15...	.29	.050	.34	.46	.030	.040	5.5	16	4.8	2.0
AUG										
08...	.45	.010	.46	.01	.030	.010	--	20	5.2	2.3
OCT										
17...	.35	.010	.36	.08	.020	<.010	--	15	4.2	2.0
FEB , 1978										
07...	.21	.010	.22	.26	.010	.010	2.1	22	5.6	2.4
MAR										
30...	.21	.010	.22	.11	.030	<.010	--	18	4.7	2.2
AUG										
22...	.28	<.010	.28	.04	.010	.010	--	20	5.7	2.4
OCT										
17...	.13	<.010	.13	.11	.010	<.010	--	19	5.5	2.2
FEB 1979										
13...	-.03	.130	.10	.26	.010	.010	--	20	5.4	2.2
APR										
16...	.25	.010	.26	.19	.020	--	--	15	4.1	2.0
AUG										
23...	.31	.020	.33	.05	.010	<.010	--	20	5.3	2.2
FEB , 1980										
20...	.28	.020	.30	.18	.020	.010	--	20	5.1	2.3
APR										
08...	.28	.060	.34	.23	.020	.010	--	13	3.6	1.8
JUL										
07...	.35	.040	.39	.01	.010	.010	--	20	5.5	2.3
OCT										
14...	.16	.010	.17	.04	.010	.020	--	17	5.3	2.4

05331855 -- NAMEKAGON RIVER NEAR HAYWARD, WIS.

Location.--Lat 46°03'06", long 91°25'53", in NE1/4NE1/4 sec. 12, T. 41 N., R. 9 W., Sawyer County, at bridge over town road, 3.7 mi northeast of Hayward.

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975										
20...	.70	1.8	5.3	.10	12	--	--	110	110	2
FEB , 1976										
04...	.70	1.9	3.9	<.10	15	--	--	97	90	11
APR										
01...	--	--	--	--	--	--	--	--	--	9
06...	.60	2.0	5.9	.10	9.8	--	--	64	59	--
JUL										
20...	.60	1.7	9.0	.10	13	--	--	93	92	8
OCT										
04...	.80	2.7	5.1	.10	13	B17	220	105	99	4
JAN , 1977										
14...	.70	3.1	4.5	.10	17	B3	B4	106	100	--
MAR										
15...	1.2	2.5	4.8	.10	10	B4	31	70	70	1
AUG										
08...	.80	2.0	4.3	<.10	13	B11	31	90	83	3
OCT										
17...	.70	2.1	4.3	<.10	12	K3	30	94	67	1
FEB , 1978										
07...	.80	2.2	5.7	.10	16	K9	33	97	95	1
MAR										
30...	.90	2.7	5.0	<.10	13	K0	150	102	84	1
AUG										
22...	.80	2.4	4.1	<.10	12	K12	35	96	88	4
OCT										
17...	.90	2.3	4.4	<.10	13	K4	62	94	86	1
FEB , 1979										
13...	.70	2.1	4.0	<.10	17	K2	K2	99	93	1
APR										
16...	.70	1.9	3.9	<.10	12	E7	<1	77	69	4
AUG										
23...	.60	1.9	4.4	<.10	12	44	530	86	88	2
FEB , 1980										
20...	.60	1.9	3.6	.10	15	K11	K10	87	91	2
APR										
08...	.80	1.9	4.7	.00	11	K14	32	82	61	4
JUL										
07...	.50	2.0	5.6	.10	13	K12	98	89	95	1
OCT										
14...	.70	2.4	3.5	.10	14	K5	22	94	84	1

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)
FEB , 1981										
24...	1215	2.0	186	152	12.9	7.3	6.1	.45	.12	.100
APR										
02...	0900	6.0	249	120	12.0	6.8	14	.57	.37	.050
AUG										
18...	0840	16.5	191	140	8.2	7.0	13	.49	.42	.040
APR , 1982										
07...	1330	5.0	261	132	12.5	7.7	2.1	.55	.35	.040
AUG										
24...	1135	16.5	134	161	9.2	8.3	.7	--	.39	.010
APR , 1983										
11...	1100	5.5	289	128	12.2	7.8	1.6	.30	.18	.020
AUG										
22...	1500	22.0	184	140	10.6	8.6	.3	--	.19	.010

DATE	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
FEB , 1981									
24...	.22	.23	.020	.010	2.5	17	3.2	2.1	.60
APR									
02...	.42	.15	.030	.010	6.5	15	3.9	1.7	.90
AUG									
18...	.46	.03	.020	<.010	4.0	19	5.3	2.2	.50
APR , 1982									
07...	.39	.16	.020	--	6.1	16	4.3	2.3	.70
AUG									
24...	.40	<.10	.020	<.010	2.0	20	5.6	2.3	.40
APR , 1983									
11...	.20	.10	.020	.030	6.8	16	4.4	2.3	.70
AUG									
22...	.20	<.10	.030	.030	4.9	20	5.5	2.6	.60

05331855 -- NAMEKAGON RIVER NEAR HAYWARD, WIS.

Location.--Lat 46°03'06", long 91°25'53", in NE1/4NE1/4 sec. 12, T. 41 N., R. 9 W., Sawyer County, at bridge over town road, 3.7 mi northeast of Hayward.

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
FEB , 1981									
24...	2.0	3.7	<.10	14	<1	K1	89	79	2
APR									
02...	2.0	4.6	<.10	11	K2	<1	77	67	2
AUG									
18...	2.1	3.7	<.10	12	26	640	86	87	2
APR , 1982									
07...	1.8	5.1	<.10	13	K2	120	78	76	2
AUG									
24...	1.8	4.0	<.10	13	45	210	127	91	3
APR , 1983									
11...	2.1	10	<.10	12	<2	220	94	80	1
AUG									
22...	2.1	7.6	<.10	14	52	340	111	94	3

05332500—NAMEKAGON RIVER NEAR TREGO, WIS.

05332500 -- NAMEKAGON RIVER NEAR TREGO, WIS.

Location.--Lat 45°56'53", in NW1/4SW1/4 sec. 17, T. 40 N., R. 12 W., Washburn County, at Northern States Power Company powerplant, 4.4 mi northwest of Trego.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (μS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	NITROGEN, TOTAL (MG/L AS N)
OCT , 1975										
20...	1515	11.5	396	170	--	7.3	7.9	81	99	.22
FEB , 1976										
05...	1030	.0	400	--	8.9	7.6	3.8	77	94	.56
APR										
01...	1315	2.0	1500	95	13.1	7.1	5.6	36	44	.88
JUL										
19...	1600	24.5	299	160	8.3	8.1	1.2	75	92	--
OCT										
04...	1200	13.5	252	195	10.2	8.2	1.0	81	99	.27
JAN , 1977										
14...	1510	.0	240	240	8.3	--	--	86	110	.51
MAR										
15...	1130	1.5	567	155	11.4	--	--	58	71	.78
AUG										
08...	1230	21.0	358	175	7.0	7.5	4.1	66	81	.43
OCT										
17...	1220	8.5	629	125	10.2	7.6	2.1	43	53	.87
FEB , 1978										
07...	1000	.0	320	170	9.1	7.2	9.4	77	94	.67
MAR										
30...	1100	2.5	437	170	12.0	8.0	1.3	69	84	.37
AUG										
22...	0950	22.5	403	145	6.7	7.7	2.4	61	--	.60
OCT										
17...	1030	8.0	444	170	10.1	7.7	2.5	66	--	.42
FEB , 1979										
13...	1020	.5	320	215	9.2	7.2	9.3	76	--	.48
APR										
16...	1230	4.0	1010	115	11.9	7.5	2.4	40	--	.57
AUG										
23...	1120	19.0	353	132	8.2	7.6	4.0	82	--	.27
FEB , 1980										
20...	1000	1.0	300	182	9.5	6.9	20	80	--	.53
APR										
08...	1220	4.5	617	140	10.6	7.2	6.7	56	--	.62
JUL										
07...	1130	23.0	249	156	7.6	7.2	10	78	--	.40
OCT										
14...	0945	9.0	378	153	10.0	7.1	12	--	--	.30
FEB , 1981										
24...	1020	1.0	378	165	11.6	6.8	18	--	--	.62

05332500 --- NAMEKAGON RIVER NEAR TREGO, WIS.

Location.--Lat 45°56'53", in NW1/4SW1/4 sec. 17, T. 40 N., R. 12 W., Washburn County, at Northern States Power Company powerplant, 4.4 mi northwest of Trego.

DATE	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
OCT , 1975										
20...	.22	<.010	.22	<.10	.020	.010	---	23	6.7	2.9
FEB , 1976										
05...	.15	.060	.21	.35	.050	.040	3.5	18	6.0	2.7
APR										
01...	.56	.020	.58	.30	.050	.020	10	11	3.1	1.5
JUL										
19...	---	---	---	---	.040	.030	---	21	6.4	2.5
OCT										
04...	.22	.030	.25	.02	.030	.020	3.4	24	7.2	2.7
JAN , 1977										
14...	.10	.080	.18	.33	.030	.020	4.4	25	7.0	3.0
MAR										
15...	.24	.100	.34	.44	.030	.090	4.9	18	5.6	2.3
AUG										
08...	.38	.030	.41	.02	.040	.020	---	21	5.8	2.8
OCT										
17...	.73	.020	.75	.12	.030	.010	---	15	4.3	2.2
FEB , 1978										
07...	.26	.050	.31	.36	.010	.010	2.7	24	6.5	3.0
MAR										
30...	.08	.060	.14	.23	.020	.010	---	19	5.5	2.7
AUG										
22...	.44	.050	.49	.11	.030	.020	---	20	5.6	2.7
OCT										
17...	.24	.010	.25	.17	.020	.010	---	20	5.9	2.6
FEB , 1979										
13...	.08	.050	.13	.35	.020	.010	---	23	6.3	2.6
APR										
16...	.31	.050	.36	.21	.030	---	---	13	4.0	2.1
AUG										
23...	.22	.030	.25	.02	.020	<.010	---	21	5.8	2.7
FEB , 1980										
20...	.21	.060	.27	.26	.020	.020	---	22	5.9	2.9
APR										
08...	.31	.060	.37	.25	.030	.010	---	16	4.7	2.4
JUL										
07...	.33	.060	.39	.01	.020	.010	---	21	5.8	2.6
OCT										
14...	.22	.020	.24	.06	.050	.010	---	18	5.9	2.9
FEB , 1981										
24...	.14	.120	.26	.36	.040	.020	2.6	19	3.0	2.7

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975										
20...	.90	2.4	4.8	.20	13	---	---	107	100	0
FEB , 1976										
05...	.70	2.5	3.7	.10	17	---	---	108	97	0
APR										
01...	.60	1.5	5.2	.10	10	---	---	74	55	---
JUL										
19...	.50	.20	3.3	.10	13	---	---	103	92	7
OCT										
04...	.90	3.2	4.5	.10	13	<0	B6	115	100	3
JAN , 1977										
14...	.80	3.6	3.7	.10	19	B10	B13	114	110	29
MAR										
15...	1.2	2.9	4.0	.10	11	23	450	91	80	0
AUG										
08...	.80	2.6	4.9	<.10	13	B3	66	100	91	3
OCT										
17...	.80	2.5	5.5	<.10	13	K18	34	101	70	2
FEB , 1978										
07...	2.3	2.7	5.6	.10	18	K15	22	107	110	1
MAR										
30...	.70	1.5	4.4	.10	14	K2	26	97	89	1
AUG										
22...	.80	2.8	5.0	.10	13	K9	98	111	87	4
OCT										
17...	.90	2.5	4.7	.10	14	K9	38	105	90	2
FEB , 1979										
13...	.80	2.5	4.0	.10	18	K19	K17	109	100	1
APR										
16...	.90	2.2	3.9	<.10	11	K25	K15	80	61	2
AUG										
23...	.60	2.7	3.0	.10	13	K5	260	90	98	4
FEB , 1980										
20...	.70	2.4	3.4	.10	18	K15	K12	102	100	2
APR										
08...	.90	2.1	4.7	.10	13	K3	K9	101	77	2
JUL										
07...	.60	2.4	3.8	.10	13	K2	K390	96	96	4
OCT										
14...	.80	2.9	3.0	.10	15	K4	K15	105	89	1
FEB , 1981										
24...	.80	2.8	3.7	<.10	15	K6	K7	98	85	4

05332500 -- NAMEKAGON RIVER NEAR TREGO, WIS.

Location.--Lat 45°56'53", in NW1/4SW1/4 sec. 17, T. 40 N., R. 12 W., Washburn County, at Northern States Power Company powerplant, 4.4 mi northwest of Trego.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)
APR , 1981										
02...	1100	5.0	617	134	11.4	6.9	15	.58	.34	.070
AUG										
17...	1200	22.0	503	139	8.7	7.0	15	.58	.46	.060
APR , 1982										
07...	1000	1.5	665	128	12.2	7.6	2.4	1.4	.64	.140
AUG										
24...	0945	20.5	283	160	7.3	8.0	1.6	--	.27	.030
APR , 1983										
11...	1240	5.0	660	133	12.7	7.8	2.0	.40	--	<.010
AUG										
22...	1210	22.0	477	152	7.0	7.7	2.9	---	.41	.090

DATE	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
APR , 1981									
02...	.41	.17	.030	<.010	5.4	16	4.6	2.1	1.0
AUG									
17...	.52	.06	.040	.020	8.9	19	5.5	2.6	.60
APR , 1982									
07...	.78	.65	.100	--	6.6	14	4.1	2.3	.60
AUG									
24...	.30	<.10	.030	.020	2.3	21	6.2	2.8	.50
APR , 1983									
11...	.30	.10	.020	<.010	8.0	16	4.6	2.5	.70
AUG									
22...	.50	<.10	.040	.720	7.7	21	6.0	2.9	.60

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
APR , 1981									
02...	2.3	3.1	<.10	11	K1	K7	83	73	4
AUG									
17...	2.8	4.0	<.10	14	K6	250	109	89	5
APR , 1982									
07...	2.0	5.0	<.10	12	K2	88	74	70	5
AUG									
24...	2.4	4.0	.20	13	K2	330	132	97	5
APR , 1983									
11...	2.9	10	<.10	12	K12	58	95	84	1
AUG									
22...	2.5	9.2	<.10	15	K5	890	121	100	4

05333500 --- ST. CROIX RIVER NEAR DANBURY, WIS.

Location.--Lat 46°04'28", long 92°14'50" in SW1/4 sec. 23, T. 48 N., R. 15 W., Burnett County, on State Highway 35, 10 mi northeast of Danbury.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	NITROGEN, TOTAL (MG/L AS N)
OCT , 1975										
23...	1500	9.0	950	140	---	8.0	1.3	66	81	.27
FEB , 1976										
04...	1030	.0	860	100	10.6	7.2	8.0	66	80	.48
APR										
05...	1500	5.5	5500	60	10.7	7.4	1.6	21	26	.76
JUL										
22...	1245	26.0	860	125	9.6	8.5	.4	60	73	.35
OCT										
06...	1415	11.0	634	175	11.3	8.2	.8	67	82	.21
JAN , 1977										
03...	1300	.0	658	95	---	7.6	3.7	75	92	.45
MAR										
17...	1530	.5	268	145	12.0	---	---	54	66	.98
AUG										
11...	1330	23.5	770	125	11.0	8.4	.4	56	68	.53
OCT										
20...	0915	6.5	2350	95	10.5	7.5	2.3	38	46	.67
FEB , 1978										
09...	1000	.0	898	135	9.6	7.4	4.7	61	74	.46
APR										
05...	1630	4.5	2340	145	12.4	8.1	.7	46	56	.24
AUG										
24...	1600	21.0	4830	100	6.5	7.5	1.8	29	---	1.2
OCT										
18...	1450	10.0	1180	130	11.8	8.0	1.2	61	---	.46
FEB , 1979										
16...	1045	.0	948	170	8.6	7.1	9.7	63	---	.24
APR										
18...	1545	5.0	4960	60	11.2	6.8	7.4	24	---	.61
AUG										
22...	1420	20.0	802	100	8.7	7.9	1.6	59	---	.27
FEB , 1980										
20...	1515	.0	973	153	9.4	6.7	23	63	---	.46
APR										
09...	1620	1.0	2300	82	12.7	7.0	8.9	47	---	.65
JUL										
08...	1545	26.0	607	124	9.9	7.8	2.0	65	---	.30
OCT										
15...	1645	10.0	902	122	11.6	7.1	9.8	---	---	1.0
FEB , 1981										
25...	1200	.0	1000	134	11.8	6.7	14	---	---	.47

DATE	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
OCT , 1975										
23...	.26	.010	.27	<.10	.030	.010	4.4	18	5.2	2.6
FEB , 1976										
04...	.19	.050	.24	.24	.030	.030	5.7	17	5.3	2.3
APR										
05...	.56	.020	.58	.18	.040	.030	10	7.1	2.3	1.3
JUL										
22...	.30	.030	.33	.02	.040	.020	39	18	5.0	2.0
OCT										
06...	.18	.020	.20	.01	.040	.020	---	18	5.2	2.2
JAN , 1977										
03...	.23	.050	.28	.17	.020	.030	4.7	22	6.3	2.2
MAR										
17...	.50	.090	.59	.39	.040	.020	6.7	16	4.2	2.1
AUG										
11...	.52	.010	.53	<.10	.030	.010	5.6	15	5.3	2.4
OCT										
20...	.60	.010	.61	.06	.020	.010	---	13	3.4	1.8
FEB , 1978										
09...	.19	.040	.23	.23	.010	<.010	2.4	20	5.2	2.5
APR										
05...	.05	.030	.08	.16	.020	.010	---	14	3.8	2.0
AUG										
24...	1.1	.050	1.1	.08	.050	.020	---	11	3.5	1.4
OCT										
18...	.42	<.010	.42	.04	.020	.010	---	16	4.6	2.2
FEB , 1979										
16...	.00	.050	<.10	.24	.010	<.010	---	20	5.2	2.6
APR										
18...	.48	.020	.50	.11	.030	---	---	8.3	2.4	1.4
AUG										
22...	.23	.030	.26	.01	.010	<.010	---	16	4.4	2.2
FEB , 1980										
20...	.25	.040	.29	.17	.020	.010	---	19	4.8	2.4
APR										
09...	.40	.050	.45	.20	.040	.020	---	13	3.7	2.0
JUL										
08...	.26	.030	.29	.01	.010	.000	---	17	4.6	2.3
OCT										
15...	.97	.000	.97	.04	.020	.020	---	16	4.6	2.4
FEB , 1981										
25...	.19	.090	.28	.19	.030	<.010	5.9	15	1.7	2.2

05333500 ST. CROIX RIVER NEAR DANBURY, WIS.

Location.--Lat 46°04'28", long 92°14'50" in SW1/4 sec. 23, T. 48 N., R. 15 W., Burnett County, on State Highway 35, 10 mi northeast of Danbury.

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975										
23...	.70	1.8	3.3	.30	9.7	--	--	95	81	3
FEB , 1976										
04...	.60	1.8	3.8	.10	16	--	--	100	87	2
APR										
05...	.50	1.4	7.0	.10	8.9	--	--	58	42	50
JUL										
22...	.40	1.3	2.6	.10	11	--	--	85	76	11
OCT										
06...	.70	2.6	1.5	.10	11	B5	48	93	82	0
JAN , 1977										
03...	.80	7.8	8.6	.10	12	B3	B3	105	110	2
MAR										
17...	1.0	2.2	4.9	.10	11	B2	68	87	74	12
AUG										
11...	.40	2.0	4.7	.10	11	20	140	91	74	10
OCT										
20...	.70	1.7	5.7	<.10	11	K12	60	81	60	15
FEB , 1978										
09...	.80	2.4	5.9	<.10	16	K3	40	94	89	1
APR										
05...	.80	2.2	4.8	<.10	11	K4	32	80	67	14
AUG										
24...	.70	1.5	6.1	<.10	9.3	600	700	98	51	25
OCT										
18...	.90	1.7	4.1	.10	12	K5	72	94	78	4
FEB , 1979										
16...	.90	2.2	4.9	.10	17	K3	K10	95	91	5
APR										
18...	.70	1.4	4.4	<.10	9.1	K3	K12	61	42	19
AUG										
22...	.40	1.6	2.9	.10	11	K64	320	34	74	1
FEB , 1980										
20...	.60	1.8	3.3	.10	16	K12	K12	82	86	8
APR										
09...	.80	1.7	5.0	.10	12	K3	K14	82	66	14
JUL										
08...	.50	1.7	3.6	.10	9.9	K21	53	78	79	1
OCT										
15...	.70	2.2	4.7	.10	12	K4	46	91	77	1
FEB , 1981										
25...	1.0	2.0	4.0	<.10	13	K5	26	88	62	4

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)
APR , 1981										
01...	1200	3.5	2700	75	12.2	6.1	49	.88	.72	.080
AUG										
18...	1330	21.0	1060	110	11.3	7.2	6.9	.58	.43	.070
APR , 1982										
17...	1200	6.0	3900	78	11.9	6.9	7.4	.53	.35	.040
AUG										
24...	1510	21.5	774	126	10.8	8.4	.5	--	.48	.020
APR , 1983										
18...	1410	3.5	2990	92	11.8	7.6	1.8	--	.25	.050
AUG										
24...	1500	22.5	1160	120	9.7	8.3	.6	--	.24	.060

DATE	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
APR , 1981									
01...	.80	.08	.060	.020	10	11	3.5	1.9	1.3
AUG									
18...	.50	.08	.020	.020	10	18	5.1	2.7	.50
APR , 1982									
17...	.39	.14	.040	--	9.0	9.3	2.9	1.8	.60
AUG									
24...	.50	<.10	.010	.010	3.3	17	4.8	2.3	.30
APR , 1983									
18...	.30	<.10	.020	<.010	9.3	11	3.3	2.3	.60
AUG									
24...	.30	<.10	.040	.040	8.5	17	4.7	2.4	.40

05333500 -- ST. CROIX RIVER NEAR DANBURY, WIS.

Location.--Lat 46°04'28", long 92°14'50" in SW1/4 sec. 23, T. 48 N., R. 15 W., Burnett County, on State Highway 35, 10 mi northeast of Danbury.

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
APR , 1981									
01...	2.0	4.3	<.10	9.1	K5	42	74	54	27
AUG									
18...	2.3	5.3	<.10	14	K12	770	92	81	6
APR , 1982									
17...	1.3	4.0	<.10	9.8	K7	230	62	47	31
AUG									
24...	1.6	3.0	.10	11	K12	320	110	77	3
APR , 1983									
18...	1.3	10	<.10	10	<2	77	72	61	14
AUG									
24...	1.8	10	.10	13	K11	690	95	85	2

05335031—YELLOW RIVER AT DANBURY, WIS.

05335031 -- YELLOW RIVER AT DANBURY, WIS.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	NITROGEN, TOTAL (MG/L AS N)
OCT , 1975											
23...	1130	10.0	266	170	--	8.1	1.3	84	100	0	.56
APR , 1976											
05...	0915	3.5	689	145	11.0	7.4	5.8	75	92	0	.69
JUL											
22...	0915	25.0	301	160	7.8	8.4	.6	75	92	0	.96
MAR , 1977											
16...	0845	1.5	529	215	11.0	--	--	90	110	--	.76
AUG											
11...	1130	22.5	218	150	8.2	8.4	.5	60	73	0	1.9
APR , 1978											
06...	1000	4.5	447	215	12.2	8.1	1.3	82	100	0	.62
AUG											
25...	0830	21.5	467	170	6.9	8.3	.7	72	--	--	1.1
APR , 1979											
18...	1640	7.0	426	150	12.3	7.9	1.6	66	--	--	.61
AUG											
22...	1130	20.5	304	136	7.7	8.1	1.1	72	--	--	.71
APR , 1980											
10...	1000	2.0	326	202	12.4	7.5	5.1	83	--	--	.64
JUL											
09...	1130	--	249	178	--	8.1	1.3	76	--	--	.85
APR , 1981											
01...	1000	6.0	304	170	12.8	7.3	6.3	--	--	--	--
MAY											
12...	1030	13.0	308	149	10.8	7.2	--	--	--	--	.41
AUG											
18...	1500	23.0	289	145	8.3	8.0	1.4	--	--	--	.56
APR , 1982											
17...	0950	5.0	476	139	11.9	7.9	1.8	--	--	--	.39
AUG											
25...	0745	19.0	199	144	12.0	7.9	1.7	--	--	--	.80
APR , 1983											
13...	1540	3.0	496	156	12.3	7.8	2.1	--	--	--	.50
AUG											
24...	1115	23.5	331	125	7.8	8.0	1.4	--	--	--	.80

05335031 -- YELLOW RIVER AT DANBURY, WIS.

Location.--Lat 46°00'44", long 92°21'27", in NW1/4NW1/4 sec. 27, T. 41 N., R. 16 W., Burnett County, on State Highway 35, 0.7 mi northeast of Danbury.

DATE	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CHLORIDE, DISSOLVED (MG/L AS CL)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975											
23...	.50	.030	.53	.03	.390	.040	3.0	2.2	--	--	2
APR , 1976											
05...	.38	.020	.40	.29	.040	.030	13	2.3	--	--	4
JUL											
22...	.82	.110	.93	.03	.080	.030	--	1.4	--	--	5
MAR , 1977											
18...	.27	.050	.32	.44	.040	.030	5.8	2.0	<0	58	8
AUG											
11...	1.7	.110	1.8	.13	.070	.080	6.0	2.5	B13	620	7
APR , 1978											
06...	.30	.030	.33	.29	.020	<.010	7.3	1.4	K14	460	6
AUG											
25...	1.1	.010	1.1	.04	.080	.030	9.0	1.5	K26	K2400	8
APR , 1979											
18...	.39	.030	.42	.19	.030	.010	5.7	2.7	K1	310	2
AUG											
22...	.67	.010	.68	.03	.060	.010	7.2	2.2	130	1100	7
APR , 1980											
10...	.22	.070	.29	.35	.050	.010	3.1	2.5	K2	40	1
JUL											
09...	.75	.080	.83	.02	.060	.010	4.5	2.2	150	K3500	3
APR , 1981											
01...	--	--	--	--	.030	--	--	2.7	K2	K8	2
MAY											
12...	.36	.030	.39	.02	.030	--	4.1	--	--	--	4
AUG											
18...	.40	.060	.46	.10	.040	--	6.2	2.2	K15	K2200	2
APR , 1982											
17...	.11	.030	.14	.25	.030	--	3.8	2.4	<1	700	7
AUG											
25...	.64	.060	.70	.10	.040	.030	6.0	1.8	K16	K1300	3
APR , 1983											
13...	.28	.020	.30	.20	.030	<.010	5.3	2.4	K3	510	1
AUG											
24...	.55	.050	.60	.20	.070	.030	7.2	2.1	24	K1900	6

05335500—CLAM RIVER NEAR WEBSTER, WIS.

05335500 -- CLAM RIVER NEAR WEBSTER, WIS.

Location.--Lat 45°52'50", long 92°29'15", in SW1/4NW1/4 sec. 9, T. 39 N., R. 15 W., Burnett County, 6.0 mi west of Webster.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	NITROGEN, TOTAL (MG/L AS N)
OCT , 1975											
23...	0930	11.0	186	220	--	7.8	3.4	112	140	0	.32
APR , 1976											
05...	1200	4.5	1550	65	--	7.4	2.0	25	31	0	1.0
JUL											
22...	1510	25.5	128	170	9.4	9.1	.1	90	110	0	1.3
MAR , 1977											
19...	0840	2.5	311	205	11.2	--	--	82	100	--	.90
AUG											
11...	0900	18.5	128	190	7.4	8.4	.7	90	110	0	2.0
APR , 1978											
06...	1220	4.5	471	160	10.8	8.0	1.4	71	87	0	.74
AUG											
25...	1100	21.5	436	175	7.2	7.8	2.5	83	--	--	.94
APR , 1979											
19...	0800	6.5	770	110	10.7	7.6	1.8	38	--	--	.51
AUG											
22...	0920	19.5	142	122	7.7	8.0	1.9	97	--	--	1.1
APR , 1980											
10...	1200	2.0	362	153	12.3	7.4	5.0	65	--	--	.46
JUL											
09...	0900	21.0	139	178	7.2	8.1	1.6	93	--	--	1.5
APR , 1981											
01...	0750	4.5	409	144	11.4	6.9	15	--	--	--	.69
AUG											
18...	1715	22.0	246	178	8.1	7.3	8.9	--	--	--	.55
APR , 1982											
16...	0820	5.5	650	115	11.1	7.5	3.1	--	--	--	.68
AUG											
25...	0945	16.5	168	185	8.2	8.2	1.2	--	--	--	--
APR , 1983											
18...	1200	4.0	656	130	12.0	7.7	2.2	--	--	--	--
AUG											
24...	0825	21.0	192	185	7.0	8.0	1.9	--	--	--	.80

05335500 -- CLAM RIVER NEAR WEBSTER, WIS.

Location.--Lat 45°52'50", long 92°29'15", in SW1/4NW1/4 sec. 9, T. 39 N., R. 15 W., Burnett County, 6.0 mi west of Webster.

DATE	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CHLORIDE, DISSOLVED (MG/L AS CL)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975											
23...	.26	.010	.27	.05	.030	.010	3.6	1.5	--	--	5
APR , 1976											
05...	.71	.040	.75	.28	.060	.080	10	1.7	--	--	27
JUL											
22...	1.0	.270	1.3	.04	.080	.030	23	.50	--	--	11
MAR , 1977											
19...	.40	.130	.53	.37	.060	.040	6.5	2.0	B5	470	9
AUG											
11...	1.6	.340	1.9	.10	.070	.010	5.3	1.5	B21	220	11
APR , 1978											
06...	.40	.050	.45	.29	.050	.020	8.5	.10	K10	160	31
AUG											
25...	.80	.060	.86	.08	.060	.020	7.1	1.1	77	310	43
APR , 1979											
19...	.44	.020	.46	.05	.040	.020	10	2.0	K8	K10	18
AUG											
22...	.94	.060	1.0	.13	.060	<.010	7.1	1.6	130	470	11
APR , 1980											
10...	.14	.070	.21	.25	.060	.030	5.5	2.0	K4	K19	9
JUL											
09...	1.2	.220	1.4	.06	.090	.010	13	1.6	40	1300	3
APR , 1981											
01...	.56	.020	.58	.11	.040	--	5.6	2.4	K4	K20	17
AUG											
18...	.37	.060	.43	.12	.040	--	6.9	1.7	K14	K760	12
APR , 1982											
16...	.50	.030	.53	.15	.040	--	7.3	1.6	K2	160	15
AUG											
25...	--	<.010	.60	<.10	.040	.020	5.2	1.3	44	>1000	9
APR , 1983											
18...	.44	.060	.50	<.10	.040	.010	7.2	1.8	K11	K290	21
AUG											
24...	.54	.060	.60	.20	.070	<.010	8.5	1.7	40	1900	11

05337050—KETTLE RIVER NEAR CLOVERDALE, WIS.

05337050 -- KETTLE RIVER NEAR CLOVERDALE, MINN.

Location.--Lat 45°54'13", long 92°43'47", in SW1/4SW1/4 sec. 33, T. 40 N., R. 19 W., Pine County, 8.0 mi south of Cloverdale.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (μS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)
OCT , 1975											
22...	1530	10.0	134	185	--	7.4	7.2	94	110	.26	.25
APR , 1976											
04...	1100	4.0	7230	70	--	7.0	3.0	16	19	1.0	.82
JUL											
23...	1215	26.5	233	185	8.3	8.2	.9	77	94	.31	.30
MAR , 1977											
18...	1230	.5	E180	170	12.1	--	--	41	50	2.4	1.0
AUG											
11...	1645	24.5	157	175	9.4	8.1	1.1	74	90	.83	.82
APR , 1978											
06...	1620	3.5	3830	90	12.0	7.6	1.2	25	30	1.1	.70
AUG											
29...	1430	19.5	1830	100	8.5	7.5	2.2	36	--	1.5	1.4
APR , 1979											
19...	1150	4.0	9180	70	11.6	6.8	5.5	18	--	.91	.67
AUG											
21...	1400	21.5	146	158	9.5	8.3	.7	71	--	.38	.37
APR , 1980											
10...	1500	2.0	2000	93	12.8	6.8	11	33	--	.91	.50
JUL											
09...	1350	26.5	118	184	9.0	7.5	5.1	83	--	.38	.34
MAR , 1981											
31...	1620	3.0	1890	114	12.5	6.1	45	--	--	2.0	1.6
AUG											
19...	0910	19.0	250	154	9.1	6.9	35	--	--	1.1	.81
APR , 1982											
16...	1630	4.5	8780	66	11.9	6.9	5.2	--	--	1.9	1.7
AUG											
25...	1240	20.5	214	167	9.7	8.5	.5	--	--	--	--
APR , 1983											
13...	1140	3.0	4160	77	12.3	7.3	2.8	--	--	.70	.54
AUG											
23...	1740	25.0	319	150	8.5	8.3	.7	--	--	.70	.42

05337050 -- KETTLE RIVER NEAR CLOVERDALE, MINN.

Location.--Lat 45°54'13", long 92°43'47", in SW1/4SW1/4 sec. 33, T. 40 N., R. 19 W., Pine County, 8.0 mi south of Cloverdale.

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CHLORIDE, DISSOLVED (MG/L AS CL)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975										
22...	.010	.26	<.10	.020	.020	6.4	5.8	--	--	0
APR , 1976										
04...	.010	.83	.20	.060	.060	18	1.3	--	--	--
JUL										
23...	<.010	.30	.01	.030	.030	13	4.7	--	--	3
MAR , 1977										
18...	.380	1.4	.98	.090	.040	16	5.7	100	B2500	--
AUG										
11...	.010	.83	<.10	.110	.020	5.7	5.3	B9	170	0
APR , 1978										
06...	.160	.86	.25	.090	.030	7.9	2.0	420	>2000	30
AUG										
29...	.030	1.4	.08	.050	.030	17	1.8	95	110	20
APR , 1979										
19...	.070	.74	.17	.060	.020	12	4.6	K40	93	27
AUG										
21...	.010	.38	<.10	.010	.010	13	5.9	K15	280	2
APR , 1980										
10...	.160	.66	.25	.050	.030	12	2.5	K11	63	2
JUL										
09...	.030	.37	.01	.030	.000	7.1	6.2	23	730	2
MAR , 1981										
31...	.250	1.8	.21	.100	--	20	5.9	120	1700	19
AUG										
19...	.090	.90	.23	.040	--	23	4.7	K16	K1900	1
APR , 1982										
16...	.080	1.8	.14	.080	--	11	1.7	100	1400	46
AUG										
25...	<.010	.10	<.10	.030	.030	9.4	4.2	K10	370	3
APR , 1983										
13...	.060	.60	.10	.040	.030	13	2.3	50	260	4
AUG										
23...	.080	.50	.20	.120	.040	16	4.4	K16	K1500	3

05338500—SNAKE RIVER NEAR PINE CITY, MINN.

05338500 -- SNAKE RIVER NEAR PINE CITY, MINN.

Location.--Lat 45°50'30", long 92°56'00", in SE1/4NW1/4 sec. 26, T. 39 N., R. 21 W., Pine County, 1.5 mi northeast of Pine County.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)	NITROGEN, TOTAL (MG/L AS N)
OCT , 1975											
22...	1215	12.0	92	250	--	8.6	.6	131	140	10	.77
FEB , 1976											
03...	1430	1.0	120	340	11.0	7.2	18	151	180	0	1.5
APR											
03...	0900	4.5	5910	90	10.8	7.1	4.9	32	39	0	1.2
JUL											
23...	1515	28.5	63	190	8.8	9.0	.2	91	110	0	1.9
OCT											
07...	0900	9.5	40	280	8.6	8.5	.7	115	140	0	1.5
JAN , 1977											
11...	1400	.0	30	400	16.0	--	--	159	190	--	.91
MAR											
18...	1445	2.0	624	260	9.6	--	--	110	130	--	2.1
AUG											
12...	0930	21.5	67	225	8.6	8.0	1.9	98	120	0	1.7
OCT											
20...	1200	9.0	1190	190	9.4	7.6	3.4	69	84	0	1.9
FEB , 1978											
09...	1200	.5	185	275	8.8	7.3	11	110	140	0	1.4
APR											
06...	1820	4.0	2600	125	9.6	7.5	2.5	40	49	0	1.0
AUG											
29...	1130	22.5	611	200	7.4	7.9	2.3	93	--	--	1.6
OCT											
18...	1700	11.0	175	200	10.4	8.1	1.4	89	--	--	1.4
FEB , 1979											
16...	1400	1.0	114	360	9.7	7.4	12	150	--	--	1.0
APR											
19...	1615	7.0	3670	120	8.7	7.1	4.8	31	--	--	.90
AUG											
21...	1115	22.0	145	184	8.0	8.3	.8	86	--	--	1.6
FEB , 1980											
21...	0945	1.0	109	317	10.6	6.9	33	140	--	--	1.1
APR											
11...	0715	2.0	1900	160	11.9	6.8	13	43	--	--	1.0
JUL											
09...	1610	29.5	97	196	7.9	8.4	.8	99	--	--	1.2
OCT											
16...	0750	9.0	84	218	9.6	7.4	7.4	--	--	--	.89
FEB , 1981											
21...	1450	--	--	--	--	--	--	--	--	--	--

05338500 -- SNAKE RIVER NEAR PINE CITY, MINN.

Location.--Lat 45°50'30", long 92°56'00", in SE1/4NW1/4 sec. 26, T. 39 N., R. 21 W., Pine County, 1.5 mi northeast of Pine County.

DATE	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
OCT , 1975										
22...	.76	.010	.77	<.10	.070	.020	13	32	11	4.6
FEB , 1976										
03...	.66	.440	1.1	.42	.260	.220	12	33	13	9.4
APR										
03...	.68	.070	.95	.25	.090	.110	15	10	3.6	1.6
JUL										
23...	1.5	.290	1.8	.07	.120	.050	48	27	9.0	3.5
OCT										
07...	1.3	.200	1.5	.01	.090	.020	18	30	12	4.4
JAN , 1977										
11...	.52	.250	.77	.14	.030	.020	14	40	16	6.2
MAR										
18...	.95	.350	1.3	.79	.100	.060	12	26	11	4.9
AUG										
12...	1.6	.060	1.7	.04	.090	.040	6.4	27	10	4.7
OCT										
20...	1.6	.190	1.8	.09	.070	.050	--	19	7.1	5.9
FEB , 1978										
09...	.71	.260	.97	.43	.070	.020	--	33	12	5.2
APR										
06...	.66	.150	.81	.23	.080	.040	--	11	4.1	1.8
AUG										
29...	1.4	.020	1.4	.18	.140	.070	--	26	9.1	3.5
OCT										
16...	1.1	.100	1.2	.21	.080	.050	--	24	8.5	3.1
FEB , 1979										
16...	.25	.260	.51	.52	.030	.010	--	39	14	5.3
APR										
19...	.68	.070	.75	.15	.070	--	--	10	3.9	1.8
AUG										
21...	1.5	.150	1.6	.03	.080	.020	--	25	8.1	3.1
FEB , 1980										
21...	.61	.210	.82	.30	.050	.030	--	37	12	5.0
APR										
11...	.59	.160	.75	.25	.080	.010	--	13	4.8	2.3
JUL										
09...	1.1	.090	1.2	.03	.060	.010	--	26	9.8	4.6
OCT										
16...	.77	.040	.81	.08	.050	.020	--	26	9.5	4.0
FEB , 1981										
21...	--	--	--	--	--	--	--	--	--	--

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1975										
22...	1.7	4.2	4.7	.30	2.3	--	--	178	150	14
FEB , 1976										
03...	1.9	6.9	6.0	.20	17	--	--	194	180	0
APR										
03...	1.6	1.7	6.7	.10	8.1	--	--	77	53	21
JUL										
23...	1.3	1.2	5.4	.10	7.3	--	--	140	110	9
OCT										
07...	1.5	5.8	5.1	.10	.5	B7	56	158	130	8
JAN , 1977										
11...	1.8	6.8	5.0	.10	4.5	B0	78	193	180	--
MAR										
18...	3.2	6.3	9.2	.10	8.3	98	B2700	154	140	4
AUG										
12...	1.9	4.4	7.5	.10	11	B14	B3500	163	130	10
OCT										
20...	2.1	4.8	9.6	.10	8.9	E12	83	143	99	5
FEB , 1978										
09...	2.2	5.1	11	.10	16	K14	85	182	150	2
APR										
06...	2.3	2.2	4.8	<.10	4.8	K19	E940	79	56	7
AUG										
29...	1.8	3.6	6.3	.10	9.1	K89	1500	161	120	13
OCT										
16...	2.1	3.8	5.4	.10	7.9	K5	K2500	153	110	5
FEB , 1979										
16...	1.8	4.9	5.7	.10	15	40	27	196	180	4
APR										
19...	2.6	2.5	5.4	<.10	6.4	K10	K56	83	51	4
AUG										
21...	1.3	3.1	3.6	.10	8.1	43	4500	133	110	4
FEB , 1980										
21...	1.5	4.8	4.1	.20	14	K18	K16	176	160	2
APR										
11...	2.5	2.8	5.5	.10	7.3	K21	120	100	64	1
JUL										
09...	1.8	3.5	2.3	.10	2.3	200	4600	133	110	1
OCT										
16...	1.6	3.7	3.7	.10	2.8	K5	K10	146	110	3
FEB , 1981										
21...	--	--	--	--	--	--	--	--	--	2

05338500 -- SNAKE RIVER NEAR PINE CITY, MINN.

Location.--Lat 45°50'30", long 92°56'00", in SE1/4NW1/4 sec. 26, T. 39 N., R. 21 W., Pine County, 1.5 mi northeast of Pine County.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)
FEB , 1981										
25...	1450	2.0	304	310	9.6	7.0	27	1.5	.73	.270
MAR										
31...	1235	5.0	672	218	13.2	7.5	6.8	.96	.86	.060
AUG										
19...	1230	25.0	191	168	7.6	7.5	4.7	1.8	1.6	.080
APR , 1982										
16...	1130	6.5	2670	108	10.4	7.3	4.1	.89	.55	.110
AUG										
25...	1530	26.5	117	189	9.7	9.2	.1	--	--	<.010
APR , 1983										
12...	1515	4.5	2410	110	11.1	7.3	4.5	--	.68	.020
AUG										
23...	1315	26.0	197	190	7.9	8.2	1.1	--	1.2	.060

DATE	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	PHOSPHORUS, DISSOLVED (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
FEB , 1981									
25...	1.0	.47	.120	.040	11	34	12	5.4	3.5
MAR									
31...	.92	.04	.090	.030	8.4	27	9.6	4.2	2.5
AUG									
19...	1.7	.07	.080	.040	25	24	8.3	3.9	1.6
APR , 1982									
16...	.66	.23	.060	--	11	11	4.6	2.5	2.2
AUG									
25...	1.5	<.10	.110	.060	20	25	8.7	3.7	1.1
APR , 1983									
12...	.70	<.10	.050	.020	14	12	4.2	2.4	1.5
AUG									
23...	1.3	<.10	.050	1.00	17	25	8.8	3.6	1.3

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
FEB , 1981									
25...	6.9	5.3	.10	11	48	K1100	188	160	2
MAR									
31...	5.1	4.1	.10	4.9	K5	37	139	120	3
AUG									
19...	3.4	4.5	.10	8.8	36	K5000	145	100	4
APR , 1982									
16...	2.4	5.0	<.10	8.0	K20	280	82	60	6
AUG									
25...	3.3	3.0	.30	6.9	42	>5000	154	110	6
APR , 1983									
12...	2.5	10	<.10	7.9	K9	160	86	68	4
AUG									
23...	3.3	10	<.10	9.5	K13	K5100	155	120	8

05341500 -- APPLE RIVER NEAR SOMERSET, WIS.

Location.--Lat 45°09'30", long 92°43'00", in NE1/4SE1/4 sec. 21, T. 31 N., R. 19 W., St. Croix County, 3.1 mi northwest of Somerset.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)
OCT , 1975									
22...	0900	9.5	280	260	--	8.5	.8	140	150
FEB , 1976									
03...	1100	1.0	440	290	12.1	8.0	2.5	128	160
APR									
03...	1400	6.0	1640	130	11.9	7.6	2.4	49	60
JUL									
06...	1330	23.0	334	240	7.8	8.3	1.2	121	150
OCT									
07...	1415	10.5	465	315	9.7	8.4	1.0	134	160
JAN , 1977									
10...	1520	.0	208	340	8.4	--	--	151	180
MAR									
19...	1415	3.0	654	260	11.8	--	--	110	130
JUN									
06...	0700	20.0	4900	170	8.6	7.9	--	--	--
AUG									
03...	1030	21.5	465	295	8.4	8.0	2.4	120	150
OCT									
21...	1200	12.0	650	220	10.0	7.8	3.3	110	130
FEB , 1978									
02...	1300	.0	465	280	12.7	7.6	3.3	67	82
MAR									
31...	1040	6.5	650	225	11.4	8.1	1.4	90	110
AUG									
25...	1500	22.0	655	240	7.3	8.0	2.1	110	--
OCT									
19...	1050	9.0	294	265	11.0	8.4	.9	120	--
FEB , 1979									
20...	1300	.0	280	335	11.6	7.9	3.2	130	--
APR									
11...	1045	4.5	654	205	11.3	7.9	2.0	82	--
AUG									
20...	1300	19.5	276	232	8.3	8.0	2.3	120	--
FEB , 1980									
21...	1400	.0	280	300	12.2	7.5	8.0	130	--
APR									
11...	1145	4.5	654	202	11.8	7.5	5.3	90	--
JUL									
10...	1200	24.0	455	244	7.3	7.5	8.0	120	--
OCT									
16...	1440	8.0	470	240	10.5	7.8	3.5	--	--

DATE	CARBONATE FET-FLD (MG/L AS CO3)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
OCT , 1975									
22...	10	.75	.39	.36	.040	3.6	33	13	4.0
FEB , 1976									
03...	0	1.4	.41	.98	.070	4.7	30	13	3.7
APR									
03...	0	1.5	.83	.70	.080	11	14	4.9	1.7
JUL									
06...	0	1.1	.60	.48	.090	5.5	31	13	3.5
OCT									
07...	0	.78	.30	.48	.070	3.5	33	14	3.4
JAN , 1977									
10...	--	1.4	.36	1.0	.040	6.5	38	15	4.1
MAR									
19...	--	1.6	.76	.84	.070	6.2	28	10	3.4
JUN									
06...	--	--	--	--	--	--	--	--	--
AUG									
03...	0	1.3	.73	.57	.040	--	32	13	3.6
OCT									
21...	0	.96	.55	.41	.040	--	28	11	3.5
FEB , 1978									
02...	0	.58	.39	.19	.010	5.8	20	6.0	3.9
MAR									
31...	0	1.9	1.1	.80	.120	--	24	8.9	3.2
AUG									
25...	--	1.3	.77	.49	.070	--	32	11	3.2
OCT									
19...	--	1.0	.41	.60	.070	--	31	12	3.4
FEB , 1979									
20...	--	1.4	.43	1.0	.040	--	33	13	4.0
APR									
11...	--	1.2	.50	.68	.050	--	23	8.5	3.1
AUG									
20...	--	1.0	.41	.63	.060	--	30	9.9	2.4
FEB , 1980									
21...	--	1.4	.37	1.0	.040	--	35	12	3.9
APR									
11...	--	1.0	.33	.70	.060	--	23	8.4	3.1
JUL									
10...	--	.92	.39	.53	.060	--	30	12	3.6
OCT									
16...	--	1.0	.39	.65	.040	--	28	11	3.2

Location.--Lat 45°09'30", long 92°43'00", in NE1/4SE1/4 sec. 21, T. 31 N., R. 19 W., St. Croix County, 3.1 mi northwest of Somerset.

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)
OCT , 1975									
22...	1.2	4.2	4.1	.50	12	--	--	172	170
FEB , 1976									
03...	1.3	4.8	4.1	.10	18	--	--	169	150
APR									
03...	1.8	2.5	5.1	.10	8.8	--	--	85	69
JUL									
06...	.80	3.7	5.5	.10	14	--	--	151	140
OCT									
07...	1.2	4.4	5.7	.10	14	20	27	172	160
JAN , 1977									
10...	1.2	5.6	4.4	.10	22	180	220	183	180
MAR									
19...	2.0	4.7	5.1	.10	16	B11	700	147	130
JUN									
06...	--	--	--	.10	--	--	--	--	--
AUG									
03...	1.1	4.1	4.6	<.10	16	B42	--	160	150
OCT									
21...	1.4	3.4	4.5	.10	13	46	190	138	130
FEB , 1978									
02...	.90	2.4	7.0	.10	15	K0	32	107	96
MAR									
31...	3.3	4.9	5.8	.10	14	K2	460	152	120
AUG									
25...	1.3	3.0	3.9	.10	14	140	220	171	130
OCT									
19...	1.6	4.2	4.4	.10	15	K25	68	159	140
FEB , 1979									
20...	1.2	4.6	4.4	.10	19	K8	E50	170	160
APR									
11...	2.0	4.8	7.1	.10	13	170	110	128	110
AUG									
20...	.90	4.4	5.1	.10	13	180	220	153	140
FEB , 1980									
21...	1.1	5.3	3.0	.20	17	220	130	157	160
APR									
11...	2.4	4.7	5.1	.10	12	48	45	132	110
JUL									
10...	1.0	4.4	2.9	.10	14	90	100	145	140
OCT									
16...	1.4	4.6	3.7	.10	13	29	K16	150	130

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	OXYGEN, DISSOLVED (MG/L)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	NITROGEN, TOTAL (MG/L AS N)
FEB , 1981								
26...	1245	2.0	545	270	12.2	7.4	9.5	1.2
MAR								
31...	1022	9.0	654	230	11.3	7.5	6.4	1.4
AUG								
21...	1045	20.0	520	250	8.1	7.4	8.6	1.2
APR , 1982								
06...	1045	1.0	1100	180	13.9	7.8	2.5	.78
AUG								
26...	1030	19.0	455	258	8.5	8.4	1.1	.81
APR , 1983								
08...	1210	5.0	715	210	11.7	7.9	2.2	.80
AUG								
23...	1030	21.5	655	245	7.6	8.0	2.3	1.0

DATE	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)
FEB , 1981									
26...	.40	.83	.060	6.3	27	9.5	3.5	3.1	6.6
MAR									
31...	.83	.56	.060	6.2	28	11	3.3	2.1	5.2
AUG									
21...	.61	.56	.050	1.4	31	12	4.1	1.0	4.5
APR , 1982									
06...	.47	.31	.050	5.7	18	6.8	2.7	2.2	4.2
AUG									
26...	.20	.61	.040	3.8	31	13	3.6	.70	4.7
APR , 1983									
08...	.40	.40	.040	5.5	23	8.4	3.2	1.6	4.4
AUG									
23...	.50	.50	.090	6.1	31	12	3.6	1.1	4.6

05341500 -- APPLE RIVER NEAR SOMERSET, WIS.

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	SEDI-MENT, SUS-PENDED (MG/L)
FEB , 1981								
26...	4.7	<.10	14	36	310	159	130	--
MAR								
31...	4.3	<.10	12	K7	K8	157	130	--
AUG								
21...	6.2	.10	14	K74	230	152	140	--
APR , 1982								
06...	6.7	.10	11	K6	100	96	95	--
AUG								
26...	4.0	.20	16	64	82	166	150	2
APR , 1983								
08...	8.0	<.10	12	K5	150	145	120	--
AUG								
23...	7.0	.10	18	59	630	171	150	--

05340500—ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	TIME	TEMPER-ATURE (DEG C)	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (µS)	PH (STAND-ARD UNITS)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2)	ALKA-LINITY FIELD (MG/L AS CACO3)	BICAR-BONATE FET-FLD (MG/L AS HCO3)	CAR-BONATE FET-FLD (MG/L AS CO3)
OCT , 1974									
02...	1450	9.5	1940	200	8.0	1.7	85	100	0
NOV									
11...	1100	7.0	5400	175	7.4	5.8	75	91	0
DEC									
03...	0945	2.0	1760	215	7.0	16	80	98	0
JAN , 1975									
13...	1100	.0	2450	215	7.4	7.1	93	110	0
FEB									
18...	1230	.5	3680	210	7.1	15	94	120	0
MAR									
11...	1400	.5	4400	215	7.2	12	94	120	0
APR									
09...	1350	.5	5370	205	7.4	6.6	86	110	0
MAY									
06...	0930	10.5	20900	85	--	--	37	45	0
JUN									
25...	1045	22.5	9210	135	7.7	2.3	60	73	0
JUL									
22...	1045	24.5	5930	230	7.8	2.6	84	100	0
AUG									
26...	1045	22.0	1900	195	7.8	2.5	82	100	0
SEP									
16...	1000	14.0	1900	195	7.9	2.2	89	110	0
OCT									
14...	1415	13.0	1900	190	8.0	1.7	86	100	0
NOV									
10...	1300	7.5	6100	210	7.9	2.3	93	110	0
DEC									
16...	0945	.0	5700	210	7.4	6.6	85	100	0
JAN , 1976									
14...	1100	.0	6950	160	7.7	3.7	96	120	0
FEB									
19...	1200	1.5	4490	230	7.5	5.5	90	110	0
MAR									
09...	1200	2.0	5120	200	7.6	4.2	87	110	0
APR									
14...	0900	11.0	12600	100	7.4	2.8	36	44	0
MAY									
04...	1230	10.0	6130	145	7.7	2.5	65	79	0
JUN									
09...	1300	25.5	2420	180	8.2	1.1	86	110	0

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	NITROGEN, TOTAL (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
OCT , 1974									
02...	.89	.33	.56	.020	8.9	23	7.5	3.0	.90
NOV									
11...	.56	.36	.20	.030	--	22	6.1	3.0	1.1
DEC									
03...	.82	.52	.30	.020	--	22	7.0	3.0	.90
JAN , 1975									
13...	.69	.27	.42	.020	3.9	26	8.9	3.5	1.0
FEB									
18...	.74	.35	.39	.030	--	26	8.2	3.3	.90
MAR									
11...	.66	.26	.40	.030	--	27	8.2	3.4	.90
APR									
09...	.79	.40	.39	.030	6.1	23	7.6	3.4	1.0
MAY									
06...	.90	.79	.11	.050	--	14	3.7	1.7	1.5
JUN									
25...	1.5	1.4	.11	.060	--	17	5.4	2.2	1.1
JUL									
22...	1.0	.86	.16	.080	13	23	7.3	2.9	1.3
AUG									
26...	.83	.61	.22	.050	--	24	7.3	2.9	1.2
SEP									
16...	.52	.43	.09	.040	--	24	7.9	3.3	1.1
OCT									
14...	.44	.34	.10	.020	6.4	26	8.4	3.3	1.1
NOV									
10...	.42	.32	.10	.040	--	24	8.0	3.0	1.0
DEC									
16...	.87	.54	.33	.040	--	21	7.5	3.3	.90
JAN , 1976									
14...	.84	.46	.38	.050	9.0	25	6.7	3.7	1.1
FEB									
19...	.87	.40	.47	.070	--	25	7.9	3.4	1.0
MAR									
09...	.94	.52	.42	.070	--	23	7.8	3.3	1.1
APR									
14...	.87	.68	.19	.050	16	9.2	3.6	1.6	1.0
MAY									
04...	.75	.60	.15	.050	--	17	6.7	2.3	.90
JUN									
09...	.47	.43	.04	.040	--	25	7.6	3.1	1.0

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.45 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1974									
02...	4.4	5.1	.30	12	11	B2	136	110	--
NOV									
11...	2.2	6.4	.10	12	B2	18	98	98	2
DEC									
03...	2.9	5.9	.10	13	4	16	100	100	15
JAN , 1975									
13...	3.6	5.4	.10	16	B15	26	127	120	2
FEB									
18...	2.5	4.9	.10	17	B9	260	119	120	2
MAR									
11...	2.1	4.9	.10	17	B52	340	117	120	4
APR									
09...	3.1	5.1	.30	16	B7	B4	127	110	4
MAY									
06...	2.5	5.9	2.4	6.9	22	88	78	61	11
JUN									
25...	2.3	5.0	.30	9.1	49	72	130	78	10
JUL									
22...	2.6	5.1	.20	13	22	92	127	110	35
AUG									
26...	3.1	5.1	.20	13	48	120	109	110	12
SEP									
16...	2.8	5.0	.20	13	67	51	105	110	3
OCT									
14...	2.9	4.9	.20	12	B6	B8	122	110	0
NOV									
10...	2.6	5.0	.20	10	26	38	115	110	--
DEC									
16...	3.4	7.6	.20	15	B8	B11	130	110	--
JAN , 1976									
14...	3.9	7.0	.20	16	B3	B13	134	120	0
FEB									
19...	3.3	7.0	.20	16	77	97	138	120	2
MAR									
09...	4.3	7.9	.20	16	B8	B11	134	120	0
APR									
14...	2.6	7.2	.10	8.0	B13	100	79	55	11
MAY									
04...	2.1	5.2	.10	9.1	B4	B4	96	82	9
JUN									
09...	2.2	2.7	.10	8.3	B10	B20	113	100	4

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)	CARBONATE FET-FLD (MG/L AS CO3)
JUL , 1976									
06...	1115	24.5	1860	165	8.3	.7	77	94	0
AUG									
02...	1230	24.5	1560	180	7.1	13	85	100	0
SEP									
09...	1200	20.0	1330	190	--	--	89	110	--
OCT									
07...	1130	8.0	1580	235	8.2	1.1	90	110	0
NOV									
15...	1215	1.0	2400	240	7.8	3.0	99	120	0
DEC									
02...	1130	.0	1640	250	8.0	2.1	110	130	0
JAN , 1977									
11...	0900	.0	1470	290	--	--	102	120	--
FEB									
03...	1100	.5	3660	65	7.4	8.1	105	130	0
MAR									
19...	1145	1.0	5830	200	--	--	67	82	--
APR									
12...	1130	14.0	4280	175	--	--	71	87	--
MAY									
09...	1330	18.0	5210	190	7.0	15	77	94	0
JUN									
14...	1200	22.0	1660	175	7.0	13	69	84	0
JUL									
08...	1130	26.5	6100	160	7.1	9.5	62	75	0
AUG									
03...	1300	21.5	3110	205	7.9	1.8	75	92	0
SEP									
12...	1220	18.0	7270	135	7.3	6.0	62	75	0
OCT									
21...	1000	12.5	8100	125	7.5	3.4	55	67	0
NOV									
15...	1110	2.5	7100	165	7.6	3.0	61	74	0
DEC									
12...	1200	.5	1700	205	7.3	7.4	76	93	0
JAN , 1978									
17...	1240	1.5	3030	260	7.3	8.0	82	100	0
FEB									
02...	1030	.0	4490	205	7.3	8.8	90	110	0
MAR									
16...	1200	1.0	4130	225	7.7	3.5	90	110	0

DATE	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)
JUL , 1976									
06...	.76	.75	.01	.060	10	21	6.6	3.1	.80
AUG									
02...	.56	.55	.01	.050	--	22	7.9	2.9	.80
SEP									
09...	.44	.43	.01	.040	--	24	8.0	3.1	.70
OCT									
07...	.25	.18	.07	.040	6.8	23	8.0	3.0	.90
NOV									
15...	.40	.25	.15	.030	--	27	9.1	3.4	.90
DEC									
02...	.45	.23	.22	.030	--	29	10	4.0	1.0
JAN , 1977									
11...	.72	.33	.39	.020	8.5	27	8.0	2.2	.40
FEB									
03...	.77	.35	.42	.030	--	30	9.3	3.5	.90
MAR									
19...	1.5	.83	.71	.060	8.9	20	6.6	3.1	2.1
APR									
12...	.85	.60	.25	.030	--	21	6.5	2.9	1.4
MAY									
09...	.67	.55	.12	.040	--	21	7.9	3.5	1.3
JUN									
14...	.91	.81	.10	.040	--	21	7.0	3.2	1.0
JUL									
08...	.96	.82	.14	.050	8.5	18	6.1	3.0	1.2
AUG									
03...	.71	.56	.15	.040	1.7	23	7.2	3.3	1.1
SEP									
12...	1.3	1.2	.12	.060	--	18	5.8	2.4	1.3
OCT									
21...	--	--	.13	.040	--	17	5.6	2.6	1.1
NOV									
15...	--	--	.19	.040	11	19	5.9	2.5	1.0
DEC									
12...	--	--	.28	.020	16	23	7.2	3.1	1.2
JAN , 1978									
17...	--	--	.40	.020	--	26	8.0	3.6	1.1
FEB									
02...	.92	.50	.42	.030	6.8	25	8.4	3.8	1.1
MAR									
16...	.86	.40	.46	.030	1.1	25	7.9	4.1	1.3

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	COLIFORM, FECAL, 0.45 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, (COLS. PER 100 ML)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
JUL , 1976									
06...	2.6	4.6	.10	9.2	30	480	112	94	4
AUG									
02...	2.6	3.2	.10	12	B16	330	112	100	7
SEP									
09...	5.1	6.4	.10	11	B27	110	108	110	4
OCT									
07...	3.3	3.8	.10	10	--	--	122	110	5
NOV									
15...	3.9	5.8	.10	13	--	--	127	120	--
DEC									
02...	2.4	3.6	.10	14	--	--	139	130	--
JAN , 1977									
11...	3.4	3.7	.10	14	--	--	125	120	--
FEB									
03...	4.4	4.6	.10	17	--	--	130	130	0
MAR									
19...	3.9	7.3	.10	11	--	--	112	95	2
APR									
12...	2.7	10	.10	8.4	--	--	120	96	4
MAY									
09...	3.7	11	.10	6.8	--	--	119	100	4
JUN									
14...	2.9	8.8	.10	9.9	--	--	104	95	42
JUL									
08...	2.7	6.1	<.10	11	--	--	105	85	11
AUG									
03...	3.0	3.9	<.10	13	--	--	110	100	4
SEP									
12...	2.6	7.4	.10	11	--	--	119	85	5
OCT									
21...	3.1	7.2	.10	11	--	--	100	81	6
NOV									
15...	2.9	5.8	.10	11	--	--	100	85	4
DEC									
12...	3.6	8.9	<.10	4.8	--	--	119	98	12
JAN , 1978									
17...	3.5	8.1	.10	16	--	--	121	120	2
FEB									
02...	3.4	8.3	.10	17	--	--	133	120	2
MAR									
16...	4.4	7.8	.10	17	--	--	119	120	1

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (µS)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	BICARBONATE FET-FLD (MG/L AS HCO3)
MAR , 1978								
31...	1230	.5	9690	165	7.9	1.5	61	74
MAY								
04...	1145	15.0	5600	145	--	--	56	68
JUN								
08...	1120	19.0	6030	160	--	--	56	68
JUL								
14...	1200	21.0	14600	125	7.4	3.9	50	--
AUG								
07...	1300	23.5	5150	165	8.0	1.5	76	--
SEP								
18...	1425	16.0	7120	150	7.6	3.0	62	--
OCT								
19...	0845	8.0	3140	185	8.0	1.5	80	--
NOV								
14...	1030	3.0	4250	200	8.1	1.2	79	--
DEC								
14...	1300	1.0	2250	230	7.5	5.6	91	--
JAN , 1979								
22...	1045	.0	5240	230	7.3	9.3	96	--
FEB								
20...	1110	.0	4160	250	7.4	7.3	95	--
MAR								
26...	1410	.0	6890	200	7.1	11	73	--
APR								
20...	1300	7.0	28500	80	7.3	2.7	28	--
MAY								
08...	1030	10.5	8680	120	7.3	4.6	47	--
JUN								
07...	1400	20.5	6160	135	7.8	1.8	60	--
JUL								
03...	1300	24.0	6330	148	7.8	2.0	65	--
AUG								
06...	1330	25.0	1820	175	8.0	1.4	75	--
SEP								
13...	1140	15.5	4700	144	8.0	1.6	81	--
OCT								
10...	1145	9.5	3240	192	7.1	13	84	--
NOV								
29...	1100	1.0	6130	195	7.4	5.8	75	--
DEC								
19...	1510	1.0	1600	215	6.9	22	92	--

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	CARBONATE FET-FLD (MG/L AS CO3)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)
MAR , 1978									
31...	0	1.1	.79	.35	.100	--	17	5.2	2.6
MAY									
04...	--	.70	.66	.04	.030	5.7	17	5.4	2.6
JUN									
08...	--	1.0	.87	.13	.040	5.9	16	5.2	2.7
JUL									
14...	--	1.5	1.4	.14	.100	--	16	5.0	2.1
AUG									
07...	--	1.2	1.1	.13	.070	13	21	6.8	2.7
SEP									
18...	--	1.4	1.2	.18	.070	18	20	6.0	2.7
OCT									
19...	--	.65	.52	.13	.040	--	22	7.1	2.9
NOV									
14...	--	.32	.23	.09	.010	5.9	22	6.9	3.3
DEC									
14...	--	.69	.37	.32	.010	5.5	25	8.2	3.6
JAN , 1979									
22...	--	.71	.32	.39	.020	--	29	9.2	3.5
FEB									
20...	--	.82	.35	.47	.020	4.5	25	8.2	3.6
MAR									
26...	--	1.4	.70	.67	.070	6.2	22	7.1	3.6
APR									
20...	--	.94	.79	.15	.090	--	8.5	2.8	1.5
MAY									
08...	--	.82	.68	.14	.040	13	14	4.6	2.2
JUN									
07...	--	.60	.54	.06	.020	12	18	5.6	2.6
JUL									
03...	--	.98	.93	.05	.050	--	20	6.2	2.7
AUG									
06...	--	.67	.62	.05	.040	12	22	6.9	2.9
SEP									
13...	--	.61	.50	.11	.030	6.2	23	7.3	3.3
OCT									
10...	--	.89	.81	.08	.020	--	24	7.3	3.1
NOV									
29...	--	.71	.60	.11	.030	--	26	8.2	3.8
DEC									
19...	--	.82	.48	.34	.020	5.9	26	8.1	3.8

DATE	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
MAR , 1978								
31...	2.3	3.3	5.7	<.10	10	100	83	9
MAY								
04...	1.4	4.3	8.2	<.10	5.0	96	77	7
JUN								
08...	.80	2.8	6.5	.10	8.1	103	76	54
JUL								
14...	1.4	2.6	6.0	<.10	9.6	118	74	8
AUG								
07...	1.0	2.7	5.6	.10	12	125	97	1
SEP								
18...	1.6	2.9	5.7	.10	11	131	87	32
OCT								
19...	1.1	2.8	4.6	.10	11	119	100	2
NOV								
14...	1.1	2.8	3.8	<.10	10	104	97	3
DEC								
14...	1.1	3.0	5.1	.10	14	131	110	1
JAN , 1979								
22...	1.1	3.3	5.5	.10	17	137	130	1
FEB								
20...	1.0	3.2	4.9	.10	17	129	120	1
MAR								
26...	2.1	4.4	6.6	.10	14	123	100	8
APR								
20...	1.7	2.0	5.3	<.10	7.1	66	46	34
MAY								
08...	1.2	2.7	4.4	.10	7.2	94	65	11
JUN								
07...	1.0	2.5	4.2	.10	6.3	97	76	7
JUL								
03...	.90	2.5	3.6	.10	7.8	111	83	6
AUG								
06...	.80	2.7	3.6	.10	11	125	95	3
SEP								
13...	.80	2.7	4.0	.10	12	123	100	3
OCT								
10...	.90	3.7	3.9	.10	12	115	110	--
NOV								
29...	.90	3.6	13	.00	13	130	110	6
DEC								
19...	1.0	3.3	5.3	.10	15	133	120	2

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (μS)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	ALKALINITY FIELD (MG/L AS CACO3)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC TOTAL (MG/L AS C)
JAN , 1980												
08...	1300	.0	1560	223	7.2	11	93	.93	.43	.50	.020	4.7
FEB												
04...	1140	.0	3770	220	7.0	9.1	49	1.5	.66	.87	.160	--
MAR												
20...	0945	.0	4190	212	7.0	18	94	.78	.33	.45	.050	4.4
APR												
11...	0945	2.5	9790	118	7.2	5.9	48	.95	.65	.30	.060	9.0
MAY												
12...	1230	13.5	1720	183	7.1	11	74	.58	.47	.11	.040	--
JUN												
09...	1330	19.0	5400	166	7.4	5.9	77	.79	.72	.07	.060	9.2
JUL												
10...	0930	25.5	1310	175	7.9	2.0	83	.48	.48	.00	.040	5.3
AUG												
13...	1415	23.0	3060	165	7.3	7.9	81	.79	.75	.04	.060	--
SEP												
08...	1320	20.5	6250	140	6.9	14	58	.67	.54	.13	.030	19
OCT												
16...	1130	7.5	4860	172	7.3	12	--	--	--	.02	.010	--
NOV												
03...	1215	5.0	2200	180	7.3	7.1	--	.72	.61	.11	.020	--
DEC												
04...	1300	.5	909	210	7.3	8.3	--	.66	.43	.23	.060	7.2
JAN , 1981												
12...	1120	.0	2330	242	7.0	20	--	.60	.26	.34	.020	5.2
FEB												
26...	1040	.0	4350	210	7.0	16	--	1.0	.55	.46	.030	--
MAR												
16...	1230	1.5	4370	185	7.1	13	--	.72	.40	.32	.040	4.8
APR												
09...	1220	8.0	7380	132	6.9	12	--	1.8	1.6	.23	.050	14
MAY												
04...	1315	13.0	11500	106	6.6	19	--	.96	.81	.15	.050	-
JUN												
11...	1200	20.0	5540	154	7.4	5.6	--	.84	.73	.11	.040	17
JUL												
07...	1120	27.0	5540	126	7.0	13	--	1.4	1.3	.12	.060	18
AUG												
04...	1320	23.0	5240	154	7.5	4.7	--	.88	.78	.10	.150	--
SEP												
16...	1145	18.5	3330	166	6.4	59	--	.59	.49	.10	.030	9.7

DATE	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
JAN , 1980											
08...	27	8.3	3.9	1.2	3.3	6.2	.10	16	130	120	4
FEB											
04...	14	6.1	3.1	3.9	5.7	12	.10	12	96	87	2
MAR											
20...	25	7.8	3.8	1.1	3.3	3.7	.10	17	133	120	2
APR											
11...	13	4.2	2.0	1.7	2.4	5.6	.10	8.9	97	67	12
MAY											
12...	21	6.8	3.3	1.0	2.9	4.1	.10	8.5	111	92	4
JUN											
09...	20	6.8	3.3	.90	2.9	4.3	.10	8.3	122	93	12
JUL											
10...	23	7.9	3.7	.90	2.7	2.3	.10	10	105	100	6
AUG											
13...	21	7.3	3.1	1.0	2.6	3.7	.10	14	127	100	2
SEP											
08...	20	6.1	2.7	1.2	2.5	5.3	.10	13	117	86	13
OCT											
16...	40	1.8	4.0	.30	5.9	.1	.10	5.7	120	120	1
NOV											
03...	19	6.6	3.2	.90	3.2	3.4	.00	11	113	91	1
DEC											
04...	24	8.0	3.5	.90	3.4	5.7	.10	14	131	110	8
JAN , 1981											
12...	28	8.9	4.0	1.0	3.4	6.1	.10	18	146	130	8
FEB											
26...	22	5.6	3.4	2.1	4.6	5.3	<.10	14	127	110	2
MAR											
16...	21	6.5	3.1	1.6	3.6	2.7	<.10	14	116	99	2
APR											
09...	16	5.4	2.5	2.1	3.3	6.1	<.10	8.6	83	74	4
MAY											
04...	13	4.2	2.7	1.4	2.5	5.7	<.10	5.7	77	60	19
JUN											
11...	21	6.8	3.1	1.0	2.7	3.8	<.10	7.2	120	89	12
JUL											
07...	19	5.4	2.6	1.2	2.8	3.4	<.10	10	117	80	11
AUG											
04...	21	6.4	2.8	.80	2.9	5.5	.10	12	130	96	6
SEP											
16...	24	7.5	2.9	.80	3.1	5.1	<.10	10	130	100	5

05340500 -- ST. CROIX RIVER AT ST. CROIX FALLS, WIS.

Location.--Lat 45°24'25", long 92°38'49", in SW1/4NW1/4 sec. 30, T. 34 N., R. 18 W., Polk County, in St. Croix Falls.

DATE	TIME	TEMPERATURE (DEG C)	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (μS)	PH (STANDARD UNITS)	CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)
OCT , 1981										
13...	1140	11.0	5630	145	7.1	11	.60	.030	--	--
DEC										
07...	1305	.5	3140	194	7.5	5.1	.13	.030	23	7.2
FEB , 1982										
01...	1130	.0	4980	210	7.2	11	.52	.160	24	7.7
APR										
06...	1250	.0	18100	128	7.5	3.2	.99	.080	13	4.3
JUN										
01...	1250	20.0	6280	130	7.9	1.6	.90	.040	17	5.4
AUG										
18...	0920	23.0	1760	165	8.1	1.2	.50	.030	22	7.0
NOV										
02...	1030	7.5	6350	137	7.6	2.9	.60	.050	16	5.4
APR , 1983										
12...	1150	5.0	13900	105	7.6	2.2	.40	.040	11	3.8
MAY										
24...	1100	14.0	6320	146	7.9	1.6	.60	.010	18	5.8
JUL										
06...	0745	19.5	18600	93	7.2	5.3	1.0	.060	13	4.1

DATE	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	SEDIMENT, SUSPENDED (MG/L)
OCT , 1981									
13...	--	--	3.4	3.4	<.10	--	99	--	5
DEC									
07...	3.3	.90	3.3	5.4	<.10	12	121	110	3
FEB , 1982									
01...	3.3	1.1	3.9	6.5	.10	15	127	120	20
APR									
06...	2.2	2.3	2.5	5.4	<.10	9.2	79	67	11
JUN									
01...	2.5	.80	2.4	5.0	<.10	7.4	104	79	17
AUG									
18...	3.1	<.10	2.6	4.0	.10	11	129	99	3
NOV									
02...	2.5	.30	3.3	5.0	<.10	11	102	81	5
APR , 1983									
12...	2.3	1.1	2.4	10	<.10	9.2	80	66	4
MAY									
24...	2.8	.90	3.0	4.0	<.10	7.6	125	82	5
JUL									
06...	2.0	1.0	2.4	11	.10	7.6	91	68	24

Appendix 2. Maximum, minimum, mean, standard deviation, and number of samples for selected constituents for the St. Croix National Scenic Riverway monitoring stations

[Specific conductance in microsiemens per centimeter at 25 degrees Celsius; chemical analyses in milligrams per liter; pH in standard units]

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05331756 St. Croix River near Dairyland	Maximum	135	8.2	12.8	---	---	---	---	50	---	1.7
	Minimum	55	6.0	8.1	---	---	---	---	14	---	.5
	Mean	88	6.9	10.4	---	---	---	---	36	---	1.2
	Standard deviation	22	---	1.9	---	---	---	---	12	---	.33
	Number of samples	17	16	15	---	---	---	---	10	---	17

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
---	---	---	0.85	0.06	15	19	200	1,500
---	---	---	.26	<.01	3.4	1	<1	30
---	---	---	.48	.03	8.7	7	35	510
---	---	---	.17	.01	3.3	5	56	560
---	---	---	13	17	16	16	13	12

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05331855 Namekagon River near Hayward	Maximum	215	8.6	12.9	23	6.4	2.6	1.2	78	10.0	3.1
	Minimum	100	6.8	8.1	12	3.2	1.7	.4	39	3.5	1.7
	Mean	147	7.4	11	18	5.0	2.2	.71	63	5.0	2.1
	Standard deviation	27	---	1.5	2.8	.82	.22	.16	13	1.6	.33
	Number of samples	28	26	27	27	27	27	27	19	27	27

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
.1	17	127	.80	.04	12	11	45	640
<.1	9.8	64	.16	.01	2.0	1	<1	<1
.01	13	92	.42	.02	4.6	3	11	120
.02	1.8	13	.14	.01	2.7	3	13	170
27	27	27	25	26	14	24	20	21

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05332500 Namekagon River near Trego	Maximum	240	8.2	13	25	7.2	3.0	2.3	86	10.0	3.6
	Minimum	95	6.8	7.0	11	3.0	1.5	.50	36	3.0	.2
	Mean	157	7.3	9.7	19	5.5	2.6	.81	68	4.6	2.4
	Standard deviation	31	---	1.9	3.5	1.1	.33	.34	15	1.6	.63
	Number of samples	26	25	26	27	27	27	27	19	27	27

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
.20	19	132	1.4	.10	10.0	29	25	390
<.10	10	74	.22	.01	2.3	1	<1	6
.11	13.8	101	.56	.03	5.4	3.9	9	100
.03	2.3	13	.25	.02	2.6	5.5	7	140
27	27	27	24	27	13	24	20	21

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05333500 St. Croix River near Danbury	Maximum	228	8.5	12.7	22	6.3	2.7	1.3	75	10.0	7.8
	Minimum	60	6.1	6.5	7.1	1.7	1.3	.3	21	1.5	1.3
	Mean	127	7.1	11	15	4.3	2.1	.68	54	4.9	2.0
	Standard deviation	37	---	1.4	3.7	1.1	.36	.23	16	2.0	1.2
	Number of samples	46	26	25	27	27	27	27	19	27	27

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
.10	17	110	1.2	.06	39	31	600	770
<.10	8.9	34	.21	.01	2.4	1	2	3
.10	12	84	.54	.03	9.0	11	38	150
.04	2.6	16	.26	.01	8.7	12	130	210
27	27	27	24	27	15	23	21	21

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05335031 Yellow River at Danbury	Maximum	215	8.4	12.8	---	---	---	---	90	---	2.7
	Minimum	125	7.2	6.9	---	---	---	---	60	---	1.4
	Mean	162	7.6	10	---	---	---	---	76	---	2.1
	Standard deviation	26	---	2.1	---	---	---	---	8.6	---	.41
	Number of samples	18	17	16	---	---	---	---	11	---	17

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
---	---	---	1.9	.39	13	8	150	3,500
---	---	---	.39	.02	3.0	1	<1	8
---	---	---	.76	.07	6.1	4.4	37	1,100
---	---	---	.35	.08	2.4	2.3	52	1,100
---	---	---	17	18	16	16	12	12

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05335000 Clam River near Webster	Maximum	220	9.1	12.3	---	---	---	---	112	---	2.4
	Minimum	65	6.9	7.0	---	---	---	---	25	---	.10
	Mean	158	7.6	9.4	---	---	---	---	77	---	1.5
	Standard deviation	39	---	2.0	---	---	---	---	26	---	.56
	Number of samples	17	16	15	---	---	---	---	11	---	17

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
---	---	---	2.0	.09	23	43	130	1,300
---	---	---	.32	.03	3.6	3	2	19
---	---	---	.90	.05	8.3	15	30	350
---	---	---	.44	.02	4.4	10	37	370
---	---	---	15	17	17	15	12	11

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05337050 Kettle River near Cloverdale	Maximum	185	8.5	12.8	---	---	---	---	94	---	6.2
	Minimum	66	6.1	8.3	---	---	---	---	16	---	1.3
	Mean	130	6.9	10.5	---	---	---	---	52	---	4.1
	Standard deviation	46	---	1.7	---	---	---	---	28	---	1.7
	Number of samples	17	16	15	---	---	---	---	11	---	17

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
---	---	---	2.4	.12	23	46	420	2,500
---	---	---	.26	.01	5.7	1	9	63
---	---	---	1.0	.06	13	12	80	850
---	---	---	.64	.03	4.9	14	110	830
---	---	---	16	17	17	13	12	11

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05338500 Snake River near Pine City	Maximum	400	9.2	16.0	40	16	9.4	3.5	159	11	6.9
	Minimum	90	6.8	7.4	10	3.6	1.6	1.1	31	2.3	1.2
	Mean	220	7.4	9.8	25	9.1	4.1	1.9	97	5.9	4.0
	Standard deviation	80	---	1.9	8.9	3.3	1.6	.57	40	2.3	1.6
	Number of samples	27	25	26	27	27	27	27	19	27	27

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
.30	17.0	196	2.1	.26	48	21	200	5,000
<.10	.50	77	.77	.03	6.4	1	1	10
.12	8.1	140	1.3	.08	16	5.8	36	1,400
.06	4.0	37	.39	.04	9.9	4.7	45	1,800
27	27	27	24	27	15	24	21	19

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05341500 Apple River near Somerset	Maximum	340	8.5	13.9	38	15	4.1	3.3	151	8.0	6.6
	Minimum	130	7.4	7.3	14	4.9	1.7	.7	49	2.9	2.4
	Mean	248	7.8	10	28	11	3.4	1.5	110	5.1	4.4
	Standard deviation	48	---	1.9	5.4	2.5	.53	.66	26	1.3	.87
	Number of samples	28	26	27	27	27	27	27	19	27	27

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
.50	22	183	1.9	.12	11	220	700
<.1	8.8	85	.58	.01	1.4	1	8
.12	14.4	150	1.1	.06	5.4	67	170
.08	2.7	23	.31	.02	2.1	68	170
28	27	27	27	27	15	21	20

		Specific conductance	pH	Dissolved oxygen	Calcium	Magnesium	Sodium	Potassium	Alkalinity as $CaCO_3$	Sulfate	Chloride
05340500 St. Croix River at St. Croix Falls	Maximum	295	8.3	14	40	10	4.1	3.9	110	13	5.9
	Minimum	65	6.4	6.6	8.5	1.8	1.5	<.1	28	.1	2.0
	Mean	180	7.3	9.7	21	6.7	3.0	1.1	76	5.7	3.2
	Standard deviation	44	---	1.8	5.0	1.5	.56	.51	17	2.2	.74
	Number of samples	91	76	68	81	81	81	81	60	82	82

Fluoride	Silica	Dissolved solids residue at 180°C	Total nitrogen as N	Total phosphorus as P	Total organic carbon as C	Suspended sediment	Fecal coliform colonies/100 mL	Fecal streptococci colonies/100 mL
2.4	18	146	1.8	.16	19	54	420	2,000
<.10	4.8	66	.25	.01	1.1	1	<1	1
.14	11.4	115	.83	.05	9.0	7.5	39	240
.24	3.3	16	.30	.03	4.6	9.3	63	440
82	82	82	67	82	39	72	68	70

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