GROUND—WATER QUALITY

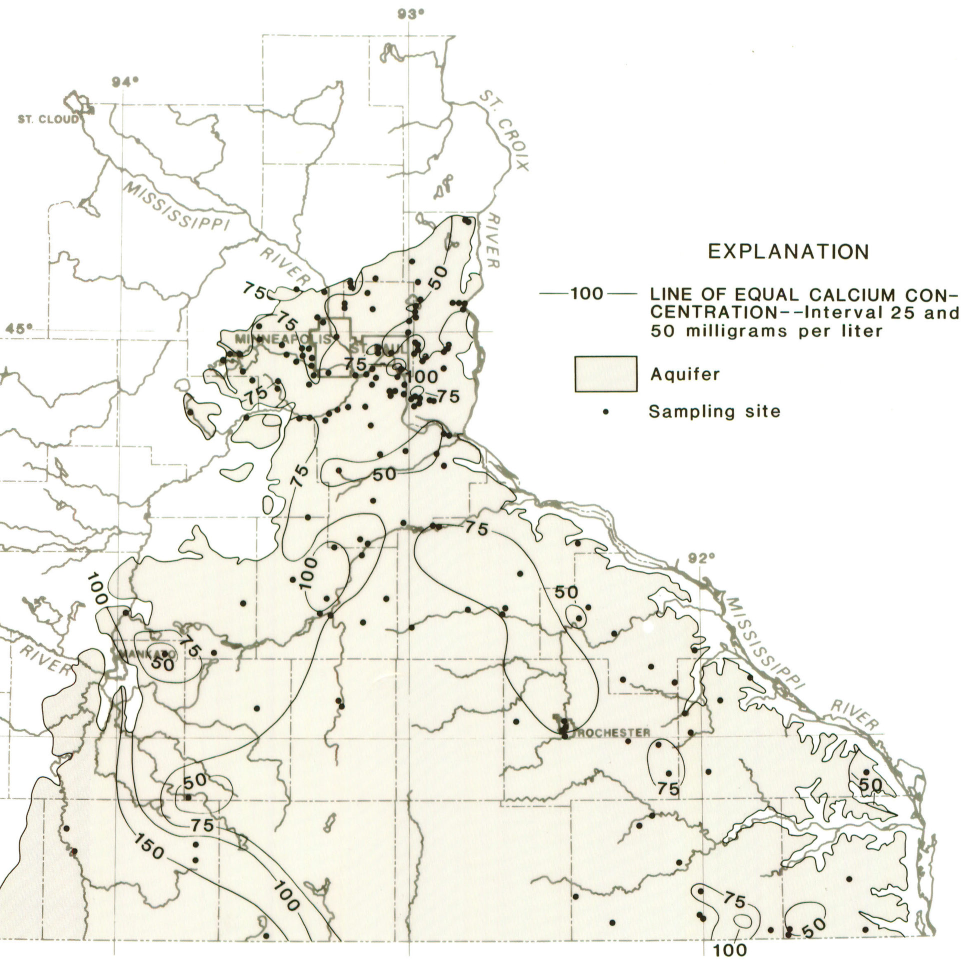

Figure 10.--Calcium concentration

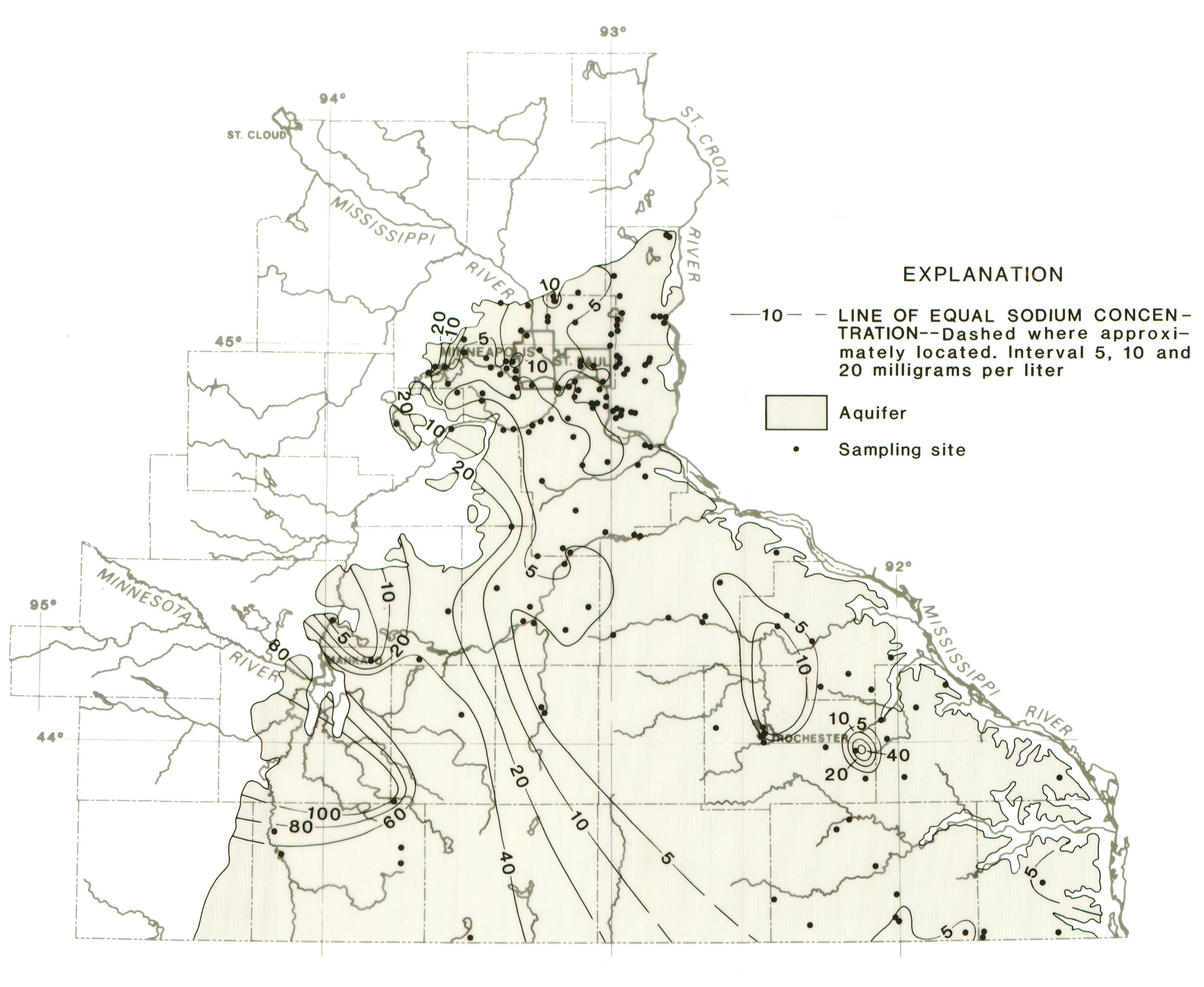

Figure 11.--Sodium concentration

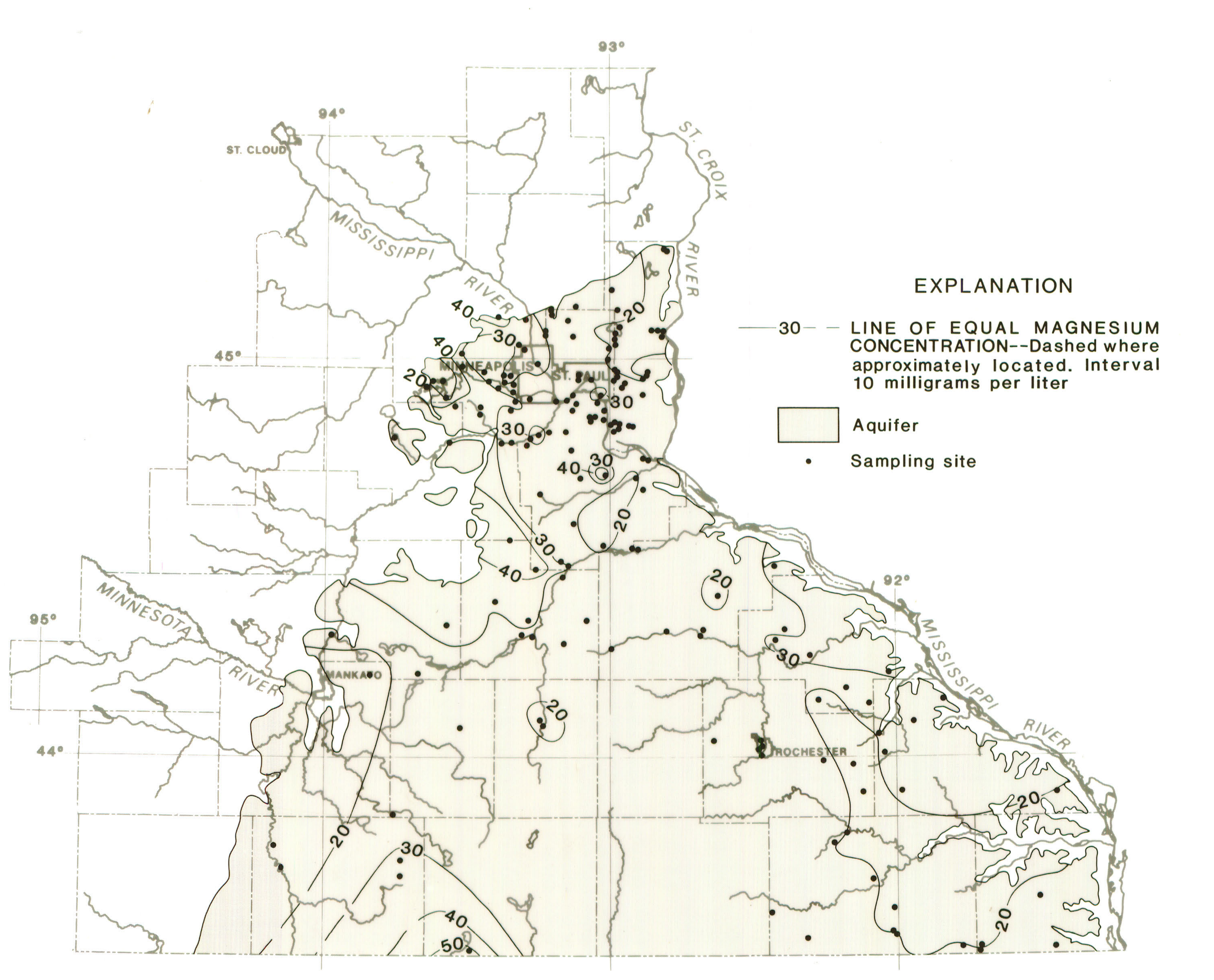

Figure 12.--Magnesium concentration

WATER QUALITY

The quality of water in the Prairie du Chien-Jordan aquifer is generally acceptable for most uses, except in some areas with local problems. Industrial wastes have contaminated the aquifer in a western suburb of the Twin Cities Metropolitan Area, and high concentrations of natural constituents limit municipal and industrial use in the southwest.

Table 2 provides the average, median, and range of selected constituents and properties of water from the aquifer. Values in this table were obtained from water-quality data stored in the U. S. Geological Survey Water Data Storage and Retrieval System (WATSTORE) or in the Storage and Retrieval System (STORET) maintained by the U. S. Environmental Protection Agency. Data from these bases were also used in the preparation of figures 9-15.

Table 2.--Summary of representative water-quality analyses for selected constituents and properties from the aquifer

[Values are in milligrams per liter except as indicated umho/cm, micromhos per centimeter; μgm/L, micrograms per liter]

Constituent or property	Recommended maximum for public supply[1]	Number of analyses	Concentrations Mean	Median	Minimum	Maximum
Specific conductance (umhos/cm at 25°C)	---	158	530	500	290	1200
pH	5.0-9.0	215	7.6	7.6	6.6	8.4
Temperature, water (°C)	---	162	10.5	10.0	6.0	20.0
Hardness as $CaCO_3$ (Mg,Ca)	---	227	280	270	150	660
Noncarbonate hardness	---	219	56	14	<1	510
Calcium, dissolved (Ca)	---	226	70	66	26	290
Magnesium, dissolved (Mg)	---	194	26	24	11	51
Sodium, dissolved (Na)	---	227	8.7	4.2	1.4	110
Percent sodium	---	194	5	3	<1	56
Potassium, dissolved (K)	---	203	2	2	.3	14
Bicarbonate (HCO_3)	---	182	319	316	191	550
Carbonate (CO_3)	---	88	<1	<1	<1	13
Sulfate, dissolved (SO_4)	250	227	28	50	14	480
Chloride, dissolved (Cl)	250	227	3.6	1.5	<1	35
Fluoride, dissolved (F)	---	217	.2	.2	.1	.5
Silica, dissolved (SiO_2)	---	192	16	16	8.1	29
Dissolved solids (residue on evaporation at 180°C)	500	187	311	285	165	1100
Nitrate, dissolved as N	10	93	2.34	.43	<.01	29
Boron, dissolved as B, μg/L	---	164	20	<10	<10	300
Iron, dissolved as Fe, μg/L	300	5	6509	820	20	1400
Manganese, total as Mn, μg/L	50	172	170	30	<1	420

[1] U.S. Environmental Protection Agency, 1975, p. 59566-59587; 1977, p. 17143-17147.

Dissolved Solids

Dissolved-solids concentration, a measure of the dissolved substances in water, is a common indicator of suitability for various uses. Water with less than 500 mg/L dissolved solids is generally satisfactory for domestic and industrial uses.

Dissolved-solids concentrations in the Prairie du Chien-Jordan aquifer range from 300 to 1,000 mg/L and generally fall short of 500 mg/L. The highest values are in the southwestern part, where leakage from overlying Cretaceous deposits is highly mineralized.

Water Types and Major Ions

Ground water is commonly classified on the basis of relative concentrations, in milliequivalents of major cations and anions. Water from the Prairie du Chien-Jordan aquifer is predominantly of the calcium magnesium bicarbonate type, as shown by the water-type patterns in figure 9. This type of water is common in recharge areas and in the upper part of the ground-water system throughout Minnesota (Winter, 1974).

Areal changes in concentration of major ions in the aquifer are similar (figs. 10-15). Calcium and sulfate, and to a lesser degree sodium and magnesium, increase in concentration toward the southwestern part of the study area. Bicarbonate concentration increases away from the southwestern corner of the study area where the dominant anion is sulfate. Leakage from overlying Cretaceous deposits are the source of much of the sulfate in the southwest. Chloride concentrations are generally low throughout the central part of the study area but are high in local areas to the east and north.

Water-Quality Problems

The most notable water-quality problem in the aquifer is the presence of toxic organic compounds in water from wells in the Prairie du Chien-Jordan aquifer owned by a municipality in the Twin Cities Metropolitan Area (Hult and Schoenberg, 1984). The source of these compounds is probably a coal-tar distillation and wood-preserving plant that operated for about 55 years until 1972. The contaminants appear to have entered the aquifer mainly through multiaquifer wells on and near the plant site.

Elsewhere in the aquifer, hardness and high iron concentrations limit suitability for municipal and industrial use in parts of extreme southeast Minnesota (Anderson and others, 1974b; Broussard and others, 1975). Excessive sulfate concentrations in the southwest are probably due to leakage of highly mineralized water from the overlying Cretaceous deposits.

Confining beds of bedrock and drift overlie and protect most of the Prairie du Chien-Jordan aquifer from surface pollutants. However, the aquifer subcrops beneath thin drift to the east along the Mississippi River valley, where pollution from the land surface is a potential problem. Other conditions that create the potential for contamination are faults, buried valleys filled with permeable deposits that intersect the aquifer, and fractures in the overlying confining layers. Contaminants can also enter the aquifer through multiaquifer wells and deteriorated or improperly grouted well casings.

CONVERSION FACTORS

Multiply inch-pound unit	By	To obtain SI (metric) unit
foot (ft)	0.3048	meter (m)
gallon (gal)	3.785	liter (L)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
square mile (mi^2)	2.590	square kilometer (km^2)
micromho per centimeter (μmho/cm at 25°C)	1.000	microsiemens per centimeter (us/cm at 25°C)

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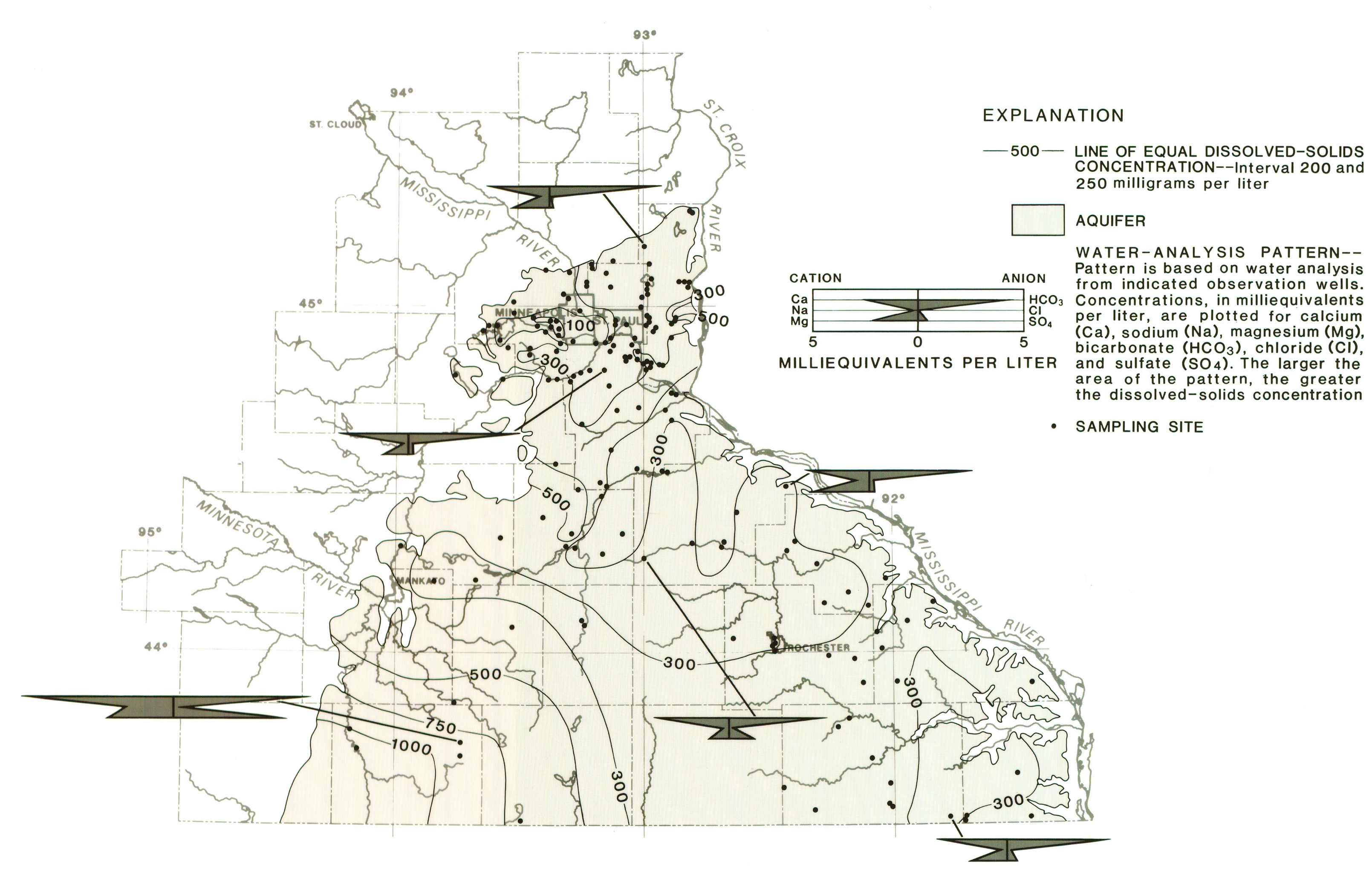

Figure 9.--Dissolved-solids concentration and water-type patterns

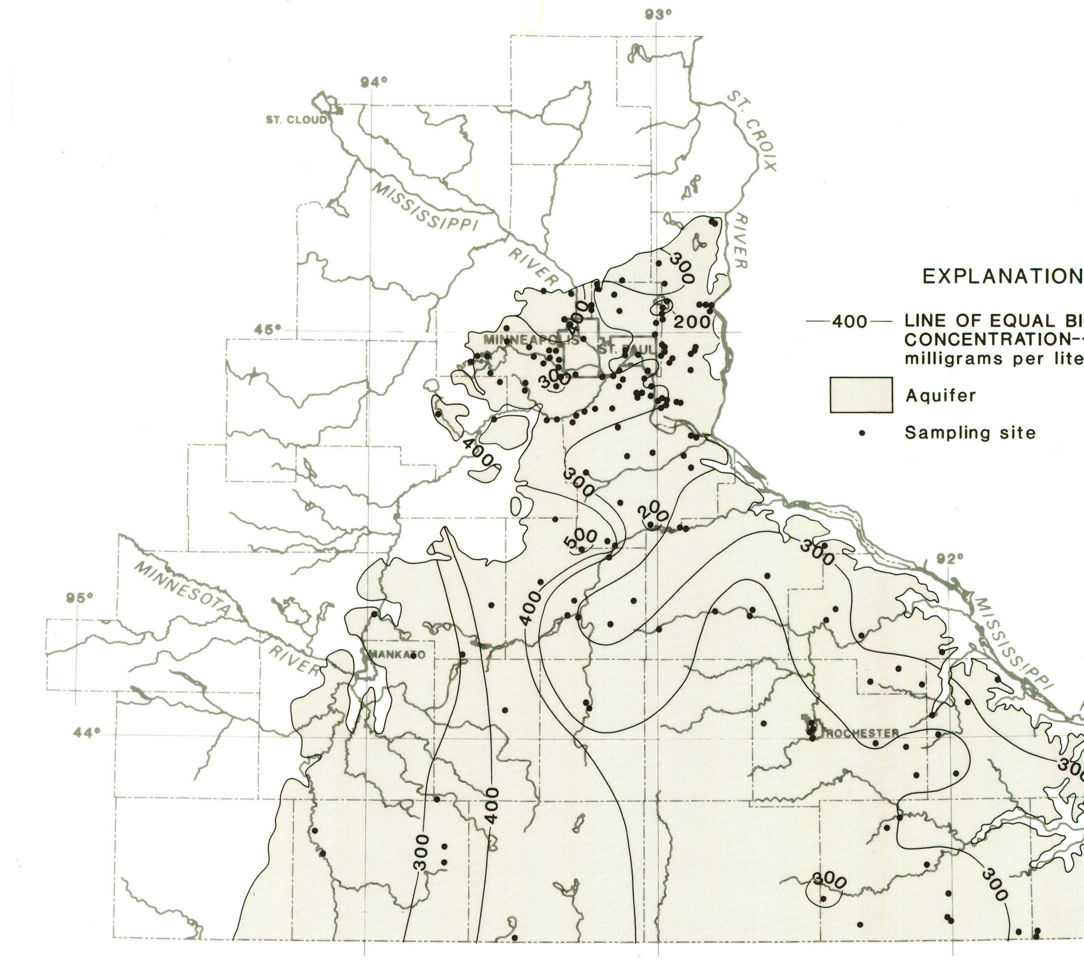

Figure 13.--Bicarbonate concentration

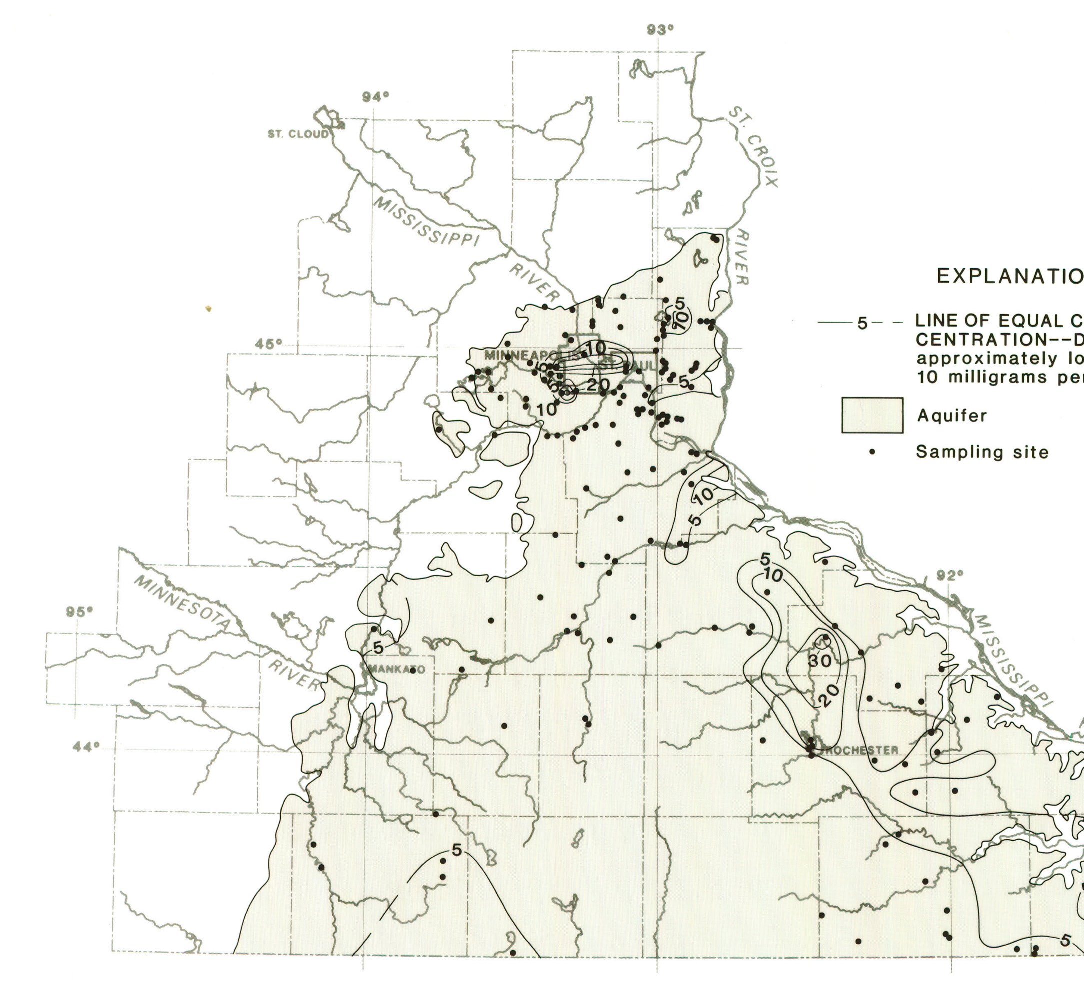

Figure 14.--Chloride concentration

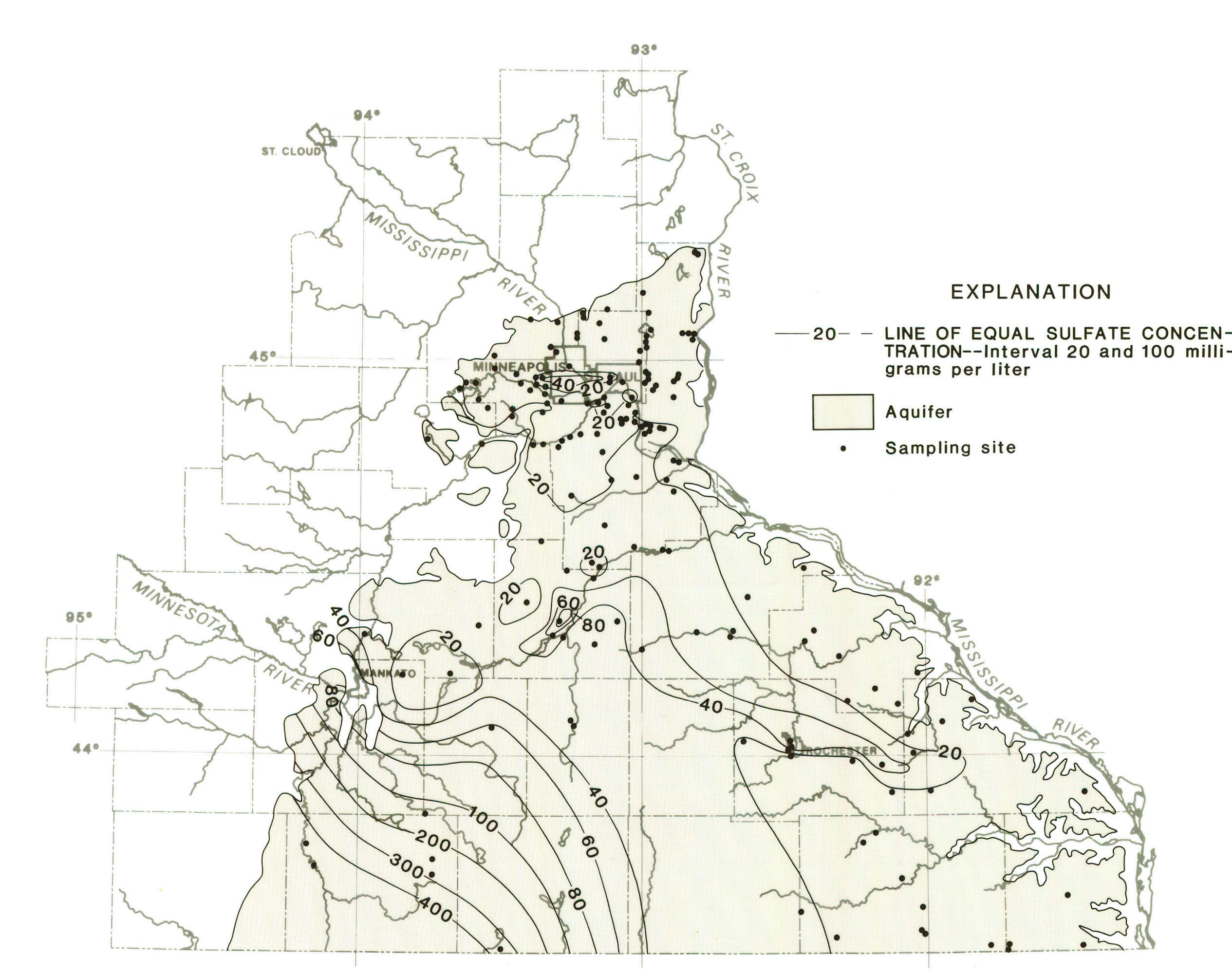

Figure 15.--Sulfate concentration

HYDROGEOLOGIC AND WATER—QUALITY CHARACTERISTICS OF THE PRAIRIE DU CHIEN—JORDAN AQUIFER, SOUTHEAST MINNESOTA

BY
J. F. RUHL, R. J. WOLF AND D. G. ADOLPHSON, 1983

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

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