Hydrogeologic and Water-Quality Data Used to Characterize the Management Systems Evaluation Area Near Princeton, Minnesota, 1991

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Contents

Illustrations

Tables

Conversion Factors and Abbreviations

Multiply	By	To obtain
centimeter (cm)	0.3937	inch
hectare (ha)	2.471	acre
meter (m)	3.281	foot
kilometer (km)	.6214	mile
square kilometer (km^2)	.3861	square mile
degrees Celsius (°C)	1.8(°C)+32	degrees Fahrenheit

Sea level: In this report sea level refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Abstract

The Minnesota Management Systems Evaluation Area project is part of a multi-scale, inter-agency initiative to evaluate the effects of agricultural management systems on water quality in the midwest corn belt. The research area is located in the Anoka Sand Plain about 5 kilometers southwest of Princeton, Minnesota. The ground-water-quality monitoring network within and immediately surrounding the research area consists of 29 observation wells and 22 multiport wells. Thirteen observation wells are also located outside the research area. The primary objectives of research by the U.S. Geological Survey at the Princeton Management Systems Evaluation Area are to: (1) determine the relation of the spatial and temporal distribution of agricultural chemicals in ground water to recharge, topography, and subsurface heterogeneities; and (2) determine the effects of the modified and prevailing farming systems on ground-water quality. This report presents geologic logs and water-quality data used to characterize the Princeton Management Systems Evaluation Area.

Introduction

The Management Systems Evaluation Area (MSEA) program is part of a multi-scale, inter-agency initiative to evaluate the effects of agricultural systems on water quality in the midwest corn belt. Five primary MSEAs (fig. 1) were selected to represent a variety of hydrogeologic settings and the geographic diversity of prevailing farming practices in the region.

The Minnesota MSEA has a primary research area near Princeton, Minnesota in the Anoka Sand Plain, an area of glacial outwash covering about 4,400 km^2, and satellite areas located near Oakes, North Dakota; Brookings, South Dakota; and Arena, Wisconsin (fig. 2) (Delin and others, 1992; Anderson and others, 1991). Each of these locations are in sand-plain areas considered typical of the northern corn-belt region. The interagency research objective of the Minnesota MSEA is to evaluate the effects of a modified farming system on ground-water quality in sand-plain areas with slightly different climatic conditions. The modified farming system uses irrigated ridge-tillage in a corn/soybean rotation. Nitrogen fertilizer and the herbicides atrazine, alachlor, and metribuzin are applied. Although the modified farming system is evaluated at satellite areas in North Dakota, South Dakota, and Wisconsin (fig. 2), research was concentrated at the area near Princeton, Minnesota. The remainder of this report discusses information pertinent only to the Princeton MSEA.

Research at the Princeton MSEA is being conducted primarily by the Minnesota District of the U.S. Geological Survey (USGS) in cooperation with the University of Minnesota Department of Soil Science, and the U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS). Other agencies conducting research at the Princeton MSEA include the USGS Geologic Division, Minnesota Pollution Control Agency (MPCA), the USDA Soil Conservation Service, the University of Minnesota Department of Agricultural Engineering, the University of Minnesota Department of Geology and Geophysics, and the U.S. Environmental Protection Agency. The MPCA assisted with financial support, project planning, collection of water samples, and the interpretation of water-quality data.

The primary objectives of research by the USGS at the Princeton MSEA are to: (1) determine the relation of the spatial and temporal distribution of agricultural chemicals in ground water to recharge, topography, and subsurface heterogeneities; and (2) determine the effects of the modified and prevailing farming systems on ground-water quality. This report presents geologic logs and water-quality data used to characterize the Princeton MSEA.

Location and Description of Study Area

The 8.3 km^2 study area is located about 5 km southwest of Princeton, Minnesota and about 80 km northwest of Minneapolis and St. Paul (fig. 2). The 65-ha research area is located about in the middle of the study area (fig. 3) and adjacent to a wetland (fig. 4). Topography is undulating in the research area with a maximum change in elevation of about 3 m over a horizontal distance of about 40 m. The area is drained primarily by Battle Brook, a tributary of the St. Francis River that flows into the Mississippi River. Five cropped areas (fig. 3) were established in 1991 to evaluate the effects of selected farming systems on ground-water quality. The 1.8- to 2.7-ha cropped areas were oriented parallel to the predominant ground-water flow direction based on water-level data collected during October 1990 through March 1991. This orientation was preferred to minimize the mixing of leachates reaching the water table from the different farming systems being evaluated.

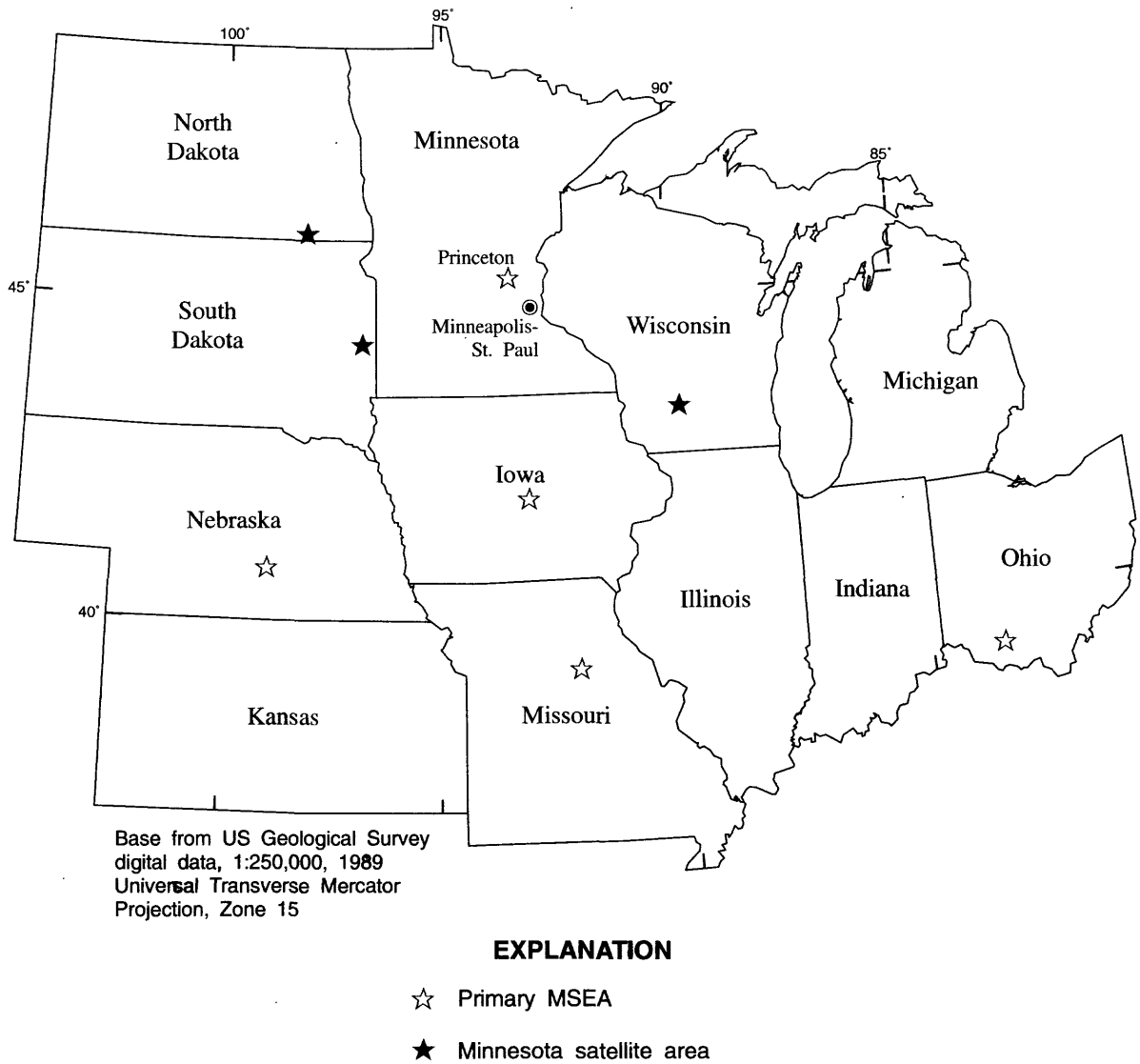

Figure 1.--Location of Management Systems Evaluation Areas (MSEAs) in the midwest.

The ground-water monitoring network within and immediately surrounding the research area consists of 29 observation wells and 22 multiport wells (MPORTs) (fig. 4). Thirteen observation wells are also located near the research area (fig. 3). The observation wells within the research area are constructed of 5.1-cm inside-diameter (i.d.) galvanized-steel or polyvinyl-chloride (PVC) casing with 15- or 60-cm long stainless-steel screens. The observation wells located outside the research area are constructed of 5.1-cm i.d. galvanized-steel casing with 60- or 150-cm long stainless-steel screens. All but four of the observation wells are screened in the upper meter of the saturated zone, with the remaining four wells installed 7 to 14 m below the water table. The observation wells were installed through the annulus of 10.2-cm i.d. hollow-stem augers. The augers were then removed and the natural formation below the water table was allowed to collapse around the casing. Above the water table, a mixture of bentonite and native material was used to backfill the annulus to prevent the vertical movement of water and agricultural chemicals down the borehole.

Each MPORT consists of six 0.6-cm i.d. stainless-steel tubes housed in a 5.1-cm i.d. PVC casing; each tube has a 3-cm long screened interval (port) which is external to the PVC casing. The sampling ports were installed at 50-cm intervals with the uppermost port 50 cm above the water table at the time of installation, to

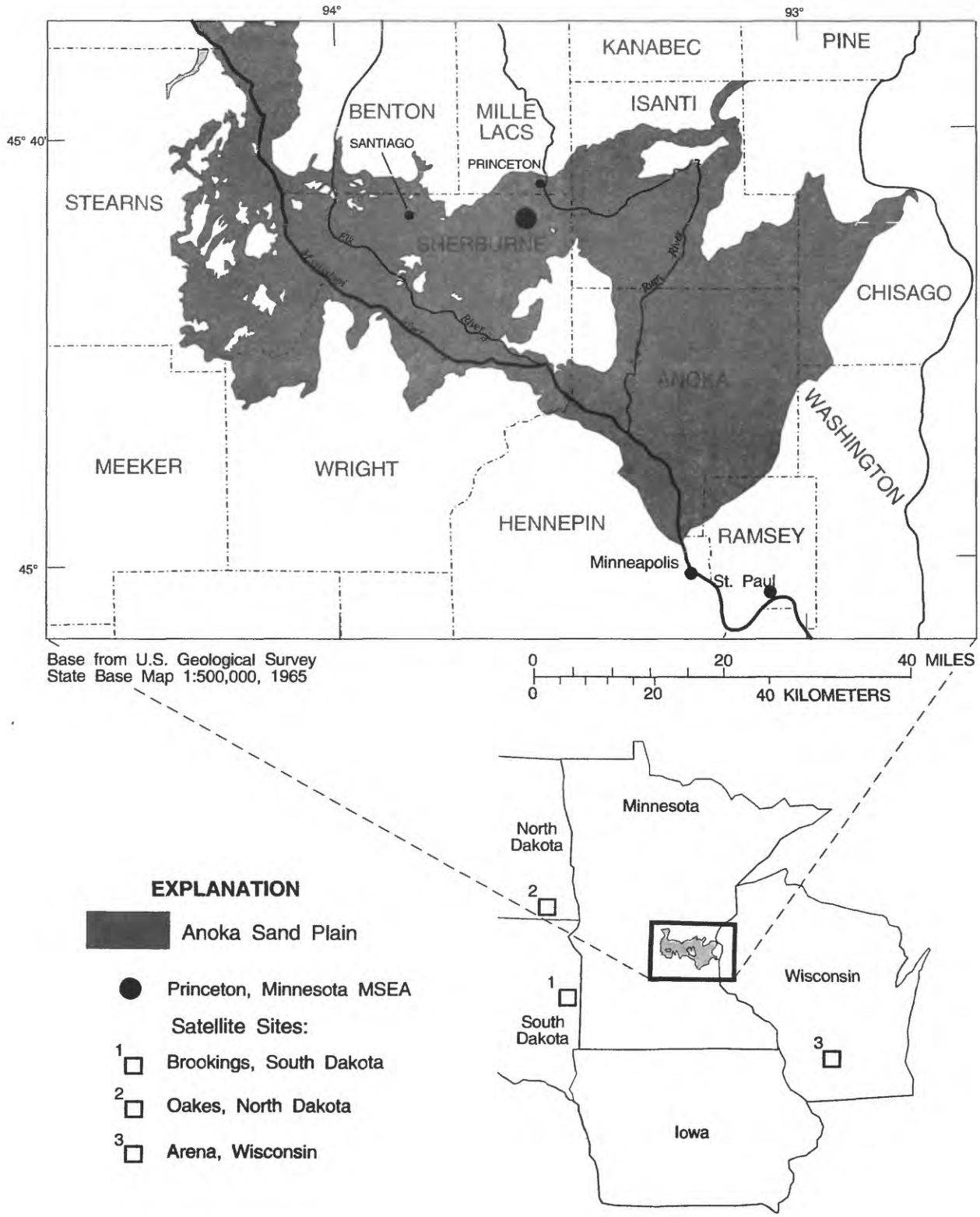

Figure 2.--Location of the Princeton, Minnesota Management Systems Evaluation Area (MSEA) in the Anoka Sand Plain.

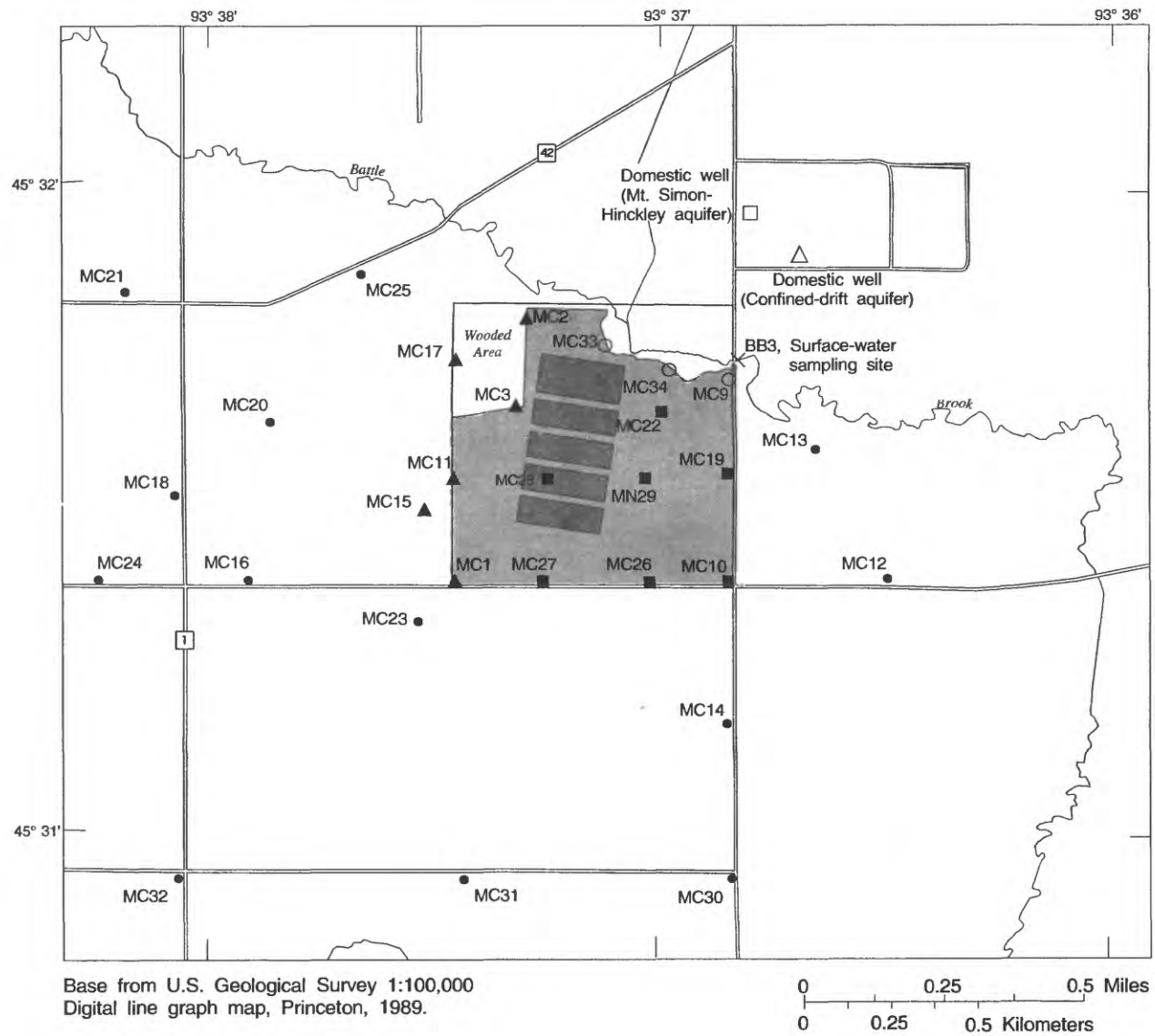

Figure 3.--Study area at the Princeton, Minnesota Management Systems Evaluation Area.

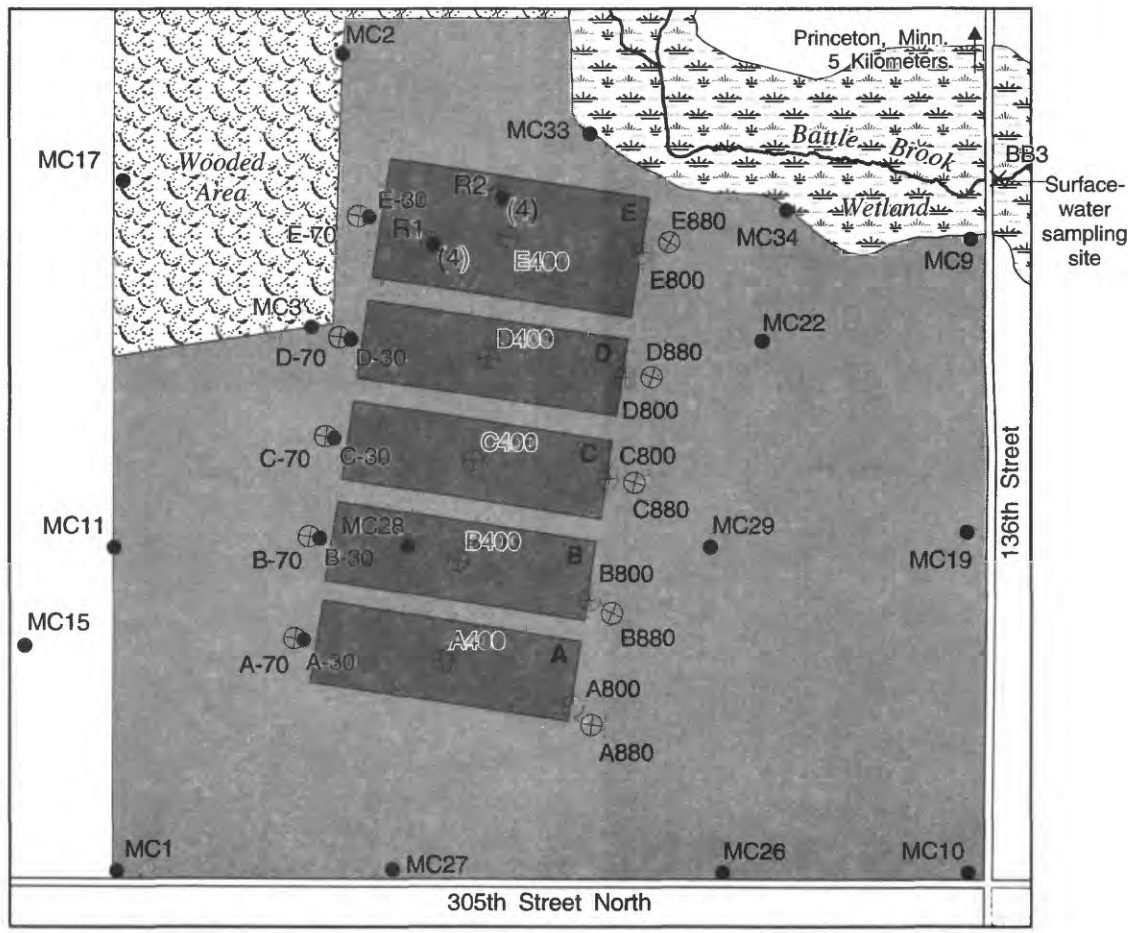

Figure 4.--Layout of the research area at the Princeton, Minnesota, Management Systems Evaluation Area.

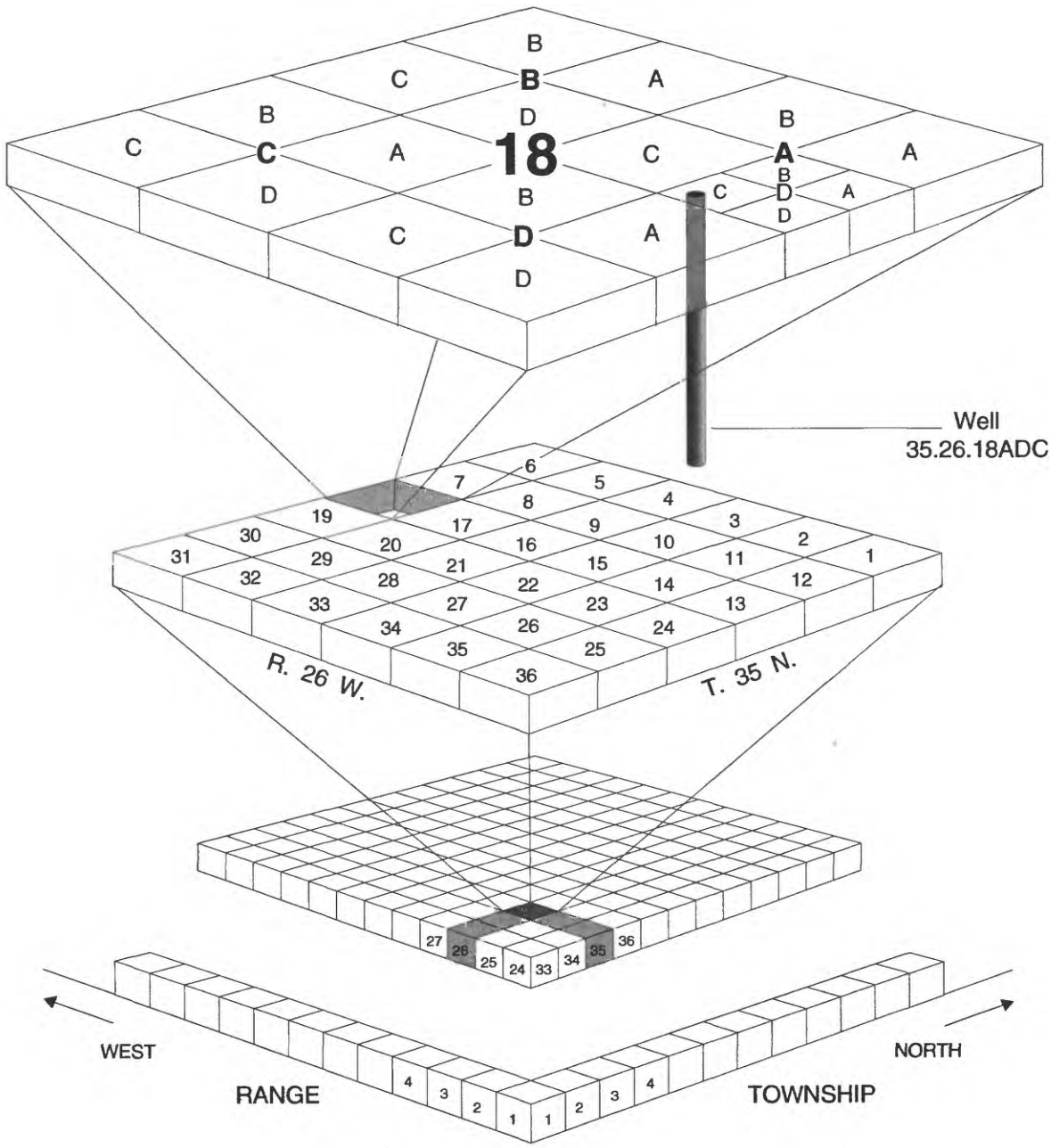

Figure 5.--Test hole and well-numbering system.

allow sample collection if the water table rose. The MPORTs were installed through the annulus of 10.2-cm i.d. hollow-stem augers. The augers were then removed and the natural formation was allowed to collapse around the MPORT. Above the uppermost port, a mixture of bentonite and native material was used to backfill the annulus. The MPORTs were used to collect water samples to evaluate ground-water quality and to measure water levels monthly to supplement observation-well data.

Test Hole and Well-Numbering System

The system of numbering wells and test holes in this report is based on the U.S. Bureau of Land Management's system of land subdivision (township, range, and section). The system of numbering data-collection points is shown in figure 5. In this system, the first number of a location number indicates the township; the second, the range; and the third, the section in which the point is located. Upper-case letters after the section number indicate the location within the section; the first letter denotes the 160-acre tract; the second, the 40-acre tract; the third, the 10-acre tract; and so forth. Letters A, B, C, and D are assigned in a counterclockwise direction, beginning in the northeast corner of each tract. For example, the number 35.26.18ADC indicates a test hole or observation well in the southwest 1/4 of the southeast 1/4 of the northeast 1/4 of section 18, township 35 north, range 26 west (fig. 5).

Description of Tables

This report contains three tables following the list of references. Table 1 contains geologic logs for each of the observation wells and MPORTs in the study area. Tables 2 and 3 contain baseline water-quality information for the MSEA; table 2 contains results of inorganic analyses and table 3 contains results of herbicide analyses. Results for the surficial aquifer were determined by collecting ground-water samples from 29 observation wells screened at the water table (fig. 3). The samples were collected during April 1991, before application of agricultural chemicals on the MSEA cropped areas. The wells were placed in one of four groups based on land use and geographic setting as follows: (1) seven wells affected by previous land use in the research area (field wells); (2) six wells immediately upgradient (west) of the research area (upgradient wells); (3) three wells near the wetland adjacent to Battle Brook, along the north edge of the research area (wetland wells); and (4) thirteen wells within the study area outside the research area (off-site wells) (fig. 3). Results are also included for a sample collected from Battle Brook at the northeast corner of the research area (site BB3), and from two domestic wells located northeast of the research area. One domestic well was completed in the confined-drift aquifer and the other in the Mt. Simon-Hinckley aquifer (fig. 3).

Acknowledgments

The authors acknowledge Robert H. Dowdy (U.S. Department of Agriculture, Agricultural Research Service), co-principal investigator with G.N. Delin and J.L. Anderson for the MSEA study in Minnesota. The authors are also grateful to C.P. Regan, Joe Magner, and other personnel at the Minnesota Pollution Control Agency and to Lifeng Guo, a graduate student at the University of Minnesota, Department of Geology and Geophysics. The authors are grateful to the U.S. Department of Agriculture, Soil Conservation Service for conducting a detailed soil survey of the research area and to the land owner (Berlinson and Associates) for leasing the land to the University of Minnesota.

References

Anderson, J. L., Dowdy, R. H., and Delin, G. N., 1991, Ground water impacts from irrigated ridge-tillage: *in* Ritter, W.F., ed., Proceedings of the American Society of Civil Engineers, 1991 National Conference on Irrigation and Drainage Engineering, Honolulu, Hawaii, July 23-26, 1991, p. 604-610.

Delin, G.N., Landon, M.K., Anderson, J.L., and Dowdy, R.H., 1992, Hydrologic research at the Princeton, Minnesota Management Systems Evaluation Area: U.S. Geological Survey Open-File Report 92-107, 2 p.

Table 1.--Geologic logs of test holes

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC1 **Location: 35.26.18ACCCCC** **Land Surface Altitude: 297.3 meters**		
Sand, medium, with loamy bands, dark brown	0-0.9	0.9
Sand, medium, with fewer bands, light brown	.9-1.2	.3
Silt, gray	1.2-1.3	.1
Sand, medium, becoming coarser with depth, brown	1.3-2.0	.7
Sand, medium to coarse, dark brown	2.0-2.6	.6
Sand, coarse gravel, brown	2.6-3.0	.4
Gravel, fine to coarse, brown	3.0-3.7	.7
Sand, mixed with gravel, brown	3.7-9.1	5.4
Till, gray	9.1-9.4	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.4 meters Screen: Stainless steel 10 slot, 2.4-3.0 meters Height of casing above land surface: 0.6 meters Static water level: 3.2 meters below top of casing (08/19/91)		
Test Hole Number: MC2 **Location: 35.26.18ABABCD** **Land Surface Altitude: 297.2 meters**		
Topsoil, loamy, black	0-.2	.2
Sand, fine to medium, dark brown	.2-.5	.3
Sand, fine to medium, brown	.5-.7	.2
Sand, fine to medium, light brown	.7-1.8	1.1
Sand, medium, light brown	1.8-2.0	.2
Sand, medium to coarse, brown	2.0-6.1	4.1
Sand, medium to coarse, silty, gray	6.1-7.0	.9
Till, red to gray	7.0-8.5	1.5
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.4 meters Screen: Stainless steel 10 slot, 2.4-3.0 meters Height of casing above land surface: 0.6 meters Static water level: 3.3 meters below top of casing (08/19/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC3 **Location: 35.26.18ABCDBD** **Land Surface Altitude: 297.8 meters**		
Topsoil, loamy, dark brown	0-0.6	0.6
Sand, fine to medium, brown	.6-1.5	.9
Sand, silty, with some clay, (perched water), dark brown	1.5-1.9	.4
Sand, medium, light brown	1.9-2.8	.9
Silt, sandy, brown	2.8-2.9	.1
Sand, fine to medium, brown	2.9-9.1	6.2
Sand, medium to coarse, grayish brown	9.1-10.7	1.6
Sand, fine to medium, gray	10.7-14.9	4.2
Till, reddish brown	14.9-15.2	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-3.0 meters Screen: Stainless steel 10 slot, 3.0-3.7 meters Height of casing above land surface: 1.2 meters Static water level: 4.3 meters below top of casing (08/20/91)		
Test Hole Number: MC9 **Location: 35.26.18AADAAD** **Land Surface Altitude: 294.8 meters**		
Sand, fine to medium, loamy, dark brown	0-.6	.6
Sand, fine to medium, some silt, dark brown	.6-1.2	.6
Sand, fine to medium, silty, dark brown	1.2-2.4	1.2
Sand, fine to medium, clean, gray	2.4-2.7	.3
Peat, with some sand, fine to medium, black	2.7-4.6	1.9
Sand, coarse to very coarse, and gravel, finer with depth, gray to black	4.6-7.6	3.0
Sand, medium to coarse, silty, grading to till, red	7.6-9.8	2.2
Till, clayish, red	9.8-10.0	.2
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-3.0 meters Screen: Stainless steel 10 slot, 3.0-3.7 meters Height of casing above land surface: 1.2 meters Static water level: 2.1 meters below top of casing (08/19/91)		
Test Hole Number: MC10 **Location: 35.26.18ADDDDD** **Land Surface Altitude: 296.7 meters**		
Sand, fine to medium, loamy, dark brown	0-1.2	1.2
Sand, fine to medium, minor silt, saturated, dark brown to brown, lighter with depth	1.2-5.8	4.6
Sand, medium to very coarse, with fine gravel, some cobbles, brown	5.8-6.4	.6
Till, red	6.4-7.0	.6
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.9 meters Screen: Stainless steel 10 slot, 2.9-3.5 meters Height of casing above land surface: 1.4 meters Static water level: 4.0 meters below top of casing (08/12/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC11 **Location: 35.26.18ACBBCB** **Land Surface Altitude: 297.4 meters**		
Topsoil, loamy, black	0-0.9	0.9
Sand, medium, brown	.9-2.7	1.8
Sand, coarse to medium, cobbles, brown	2.7-3.4	.7
Sand, coarse to medium, light brown to brown	3.4-4.3	.9
Sand, coarse, with some cobbles, dark brown	4.9-7.0	2.1
Sand, coarse, silty, brown	7.0-7.6	.6
Sand, medium, brown	7.6-10.7	3.1
Till, reddish brown	10.7-11.3	.6
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.7 meters Screen: Stainless steel 10 slot, 2.7-3.4 meters Height of casing above land surface: 1.5 meters Static water level: 4.1 meters below top of casing (08/20/91)		
Test Hole Number: MC12 **Location: 35.26.17BDCCCD** **Land Surface Altitude: 297.9 meters**		
Sand, fine to medium, well sorted, loamy, light brown	0-.6	.6
Sand, fine to medium, well sorted, brown to light brown	.6-2.1	1.5
Sand, fine to medium, well sorted, light brown to tan	2.1-5.2	3.1
Sand, coarse to medium, with gravel and pebbles, light brown to brown	5.2-8.2	3.0
Sand, with gravel and pebbles, red to brown	8.2-15.8	7.6
Till, clayey, with pebbles, brown	15.8-16.2	.4
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-5.0 meters Screen: Stainless steel 10 slot, 5.0-6.5 meters Height of casing above land surface: 1.4 meters Static water level: 6.2 meters below top of casing (08/30/91)		
Test Hole Number: MC13 **Location: 35.26.17BCABBA** **Land Surface Altitude: 298.5 meters**		
Sand, fine to medium, loamy, dark brown	0-2.1	2.1
Sand, medium to fine, light brown to brown	2.1-5.2	3.1
Sand, coarse, with gravel and pebbles, light brown to gray	5.2-8.2	3.0
Sand and gravel interbedded, dark brown to gray	8.2-11.3	3.1
Till, clayey, brown	11.3-11.6	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.9 meters Screen: Stainless steel 10 slot, 4.9-6.5 meters Height of casing above land surface: 1.5 meters Static water level: 6.2 meters below top of casing (08/13/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC14 **Location: 35.26.18DADDDD** **Land Surface Altitude: 298.8 meters**		
Sand, fine to medium, loamy, light brown to brown	0-3.7	3.7
Sand, medium to fine, light brown to tan	3.7-5.2	1.5
Sand, medium to coarse, with pebbles, light brown to tan	5.2-8.2	3.0
Sand, coarse, with medium to coarse gravel, light brown to tan	8.2-12.8	4.6
Till, clayey, red to brown	12.8-13.1	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-5.2 meters Screen: Stainless steel 10 slot, 5.2-6.7 meters Height of casing above land surface: 1.2 meters Static water level: 6.8 meters below top of casing (08/30/91)		
Test Hole Number: MC15 **Location: 35.26.18BDDABD** **Land Surface Altitude: 299.1 meters**		
Sand, fine to medium, loamy, dark to light brown	0-3.7	3.7
Sand, coarse to medium, with gravel and pebbles, light brown to brown	3.7-8.2	4.5
Sand, medium to coarse, silty, reddish brown	8.2-11.9	3.7
Till, clayey, red brown	11.9-12.8	.9
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.5 meters Screen: Stainless steel 10 slot, 4.5-5.1 meters Height of casing above land surface: 0.9 meters Static water level: 5.2 meters below top of casing (08/21/91)		
Test Hole Number: MC16 **Location: 35.26.18BCCDDD** **Land Surface Altitude: 299.2 meters**		
Sand, fine to medium, loamy, black to brown	0-3.0	3.0
Sand, coarse to medium, brown to gray	3.0-5.2	2.2
Sand, coarse, with gravel and pebbles, brown to gray	5.2-8.2	3.0
Sand, medium to coarse, gray	8.2-9.8	1.6
Sand, medium to coarse, with gravel and pebbles, red to brown	9.8-12.2	2.4
Till, clayey, brown	12.2-12.3	.1
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.4 meters Screen: Stainless steel 10 slot, 4.4-5.0 meters Height of casing above land surface: 0.9 meters Static water level: 5.1 meters below top of casing (08/30/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC17 **Location: 35.26.18ABBCCB** **Land Surface Altitude: 297.9 meters**		
Sand, fine to medium, with clay and silt, loamy, black	0-0.6	0.6
Sand, fine to medium, with silt, light brown to brown	.6-2.1	1.5
Sand, medium to coarse, orange-brown	2.1-3.7	1.6
Sand, coarse to medium, with fine gravel, brown to gray	3.7-6.7	3.0
Sand, with gravel, silty, reddish brown	6.7-13.1	6.4
Till, clayey, red brown	13.1-13.2	.1
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-3.2 meters Screen: Stainless steel 10 slot, 3.2-3.8 meters Height of casing above land surface: 1.1 meters Static water level: 4.1 meters below top of casing (08/13/91)		
Test Hole Number: MC18 **Location: 35.27.13ADADAD** **Land Surface Altitude: 296.2 meters**		
Sand, medium to fine, silty, loamy, dark to light brown	0-2.1	2.1
Sand, coarse to medium, with gravel, gray to brown	2.1-6.7	4.6
Sand, medium to fine, silty, gray to brown	6.7-9.8	3.1
Sand, fine to medium, silty, red to brown	9.8-15.5	5.7
Till, clayey, red to brown	15.5-16.2	.7
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-0.5 meters Screen: Stainless steel 10 slot, 0.5-2.0 meters Height of casing above land surface: 0.6 meters Static water level: 1.6 meters below top of casing (08/30/91)		
Test Hole Number: MC19 **Location: 35.26.18ADAAAC** **Land Surface Altitude: 298.0 meters**		
Sand, fine to medium, loamy, dark to light brown	0-.6	.6
Sand, fine to medium, gray to brown	.6-1.9	1.3
Sand, fine to medium, silty, gray to brown	1.9-2.1	.2
Sand, fine to medium, gray to brown	2.1-2.2	.1
Sand, silty, gray to brown	2.2-2.3	.1
Sand, fine to medium, brownish gray	2.3-3.7	1.4
Sand, medium to coarse, brownish gray	3.7-7.3	3.6
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.1 meters Screen: Stainless steel 10 slot, 4.1-4.7 meters Height of casing above land surface: 1.2 meters Static water level: 5.1 meters below top of casing (08/16/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC20 **Location: 35.26.18BBDCBD** **Land Surface Altitude: 297.8 meters**		
Sand, fine to medium, loamy, light orange to brown	0-2.1	2.1
Sand, medium to coarse, light orange to brown	2.1-3.7	1.6
Sand, medium to coarse, with gravel, dark gray	3.7-5.2	1.5
Sand, medium to fine, with silt and pebbles, red to brown	5.2-11.3	6.1
Till, clayey, red to brown	11.3-11.9	.6
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.3 meters Screen: Stainless steel 10 slot, 2.3-3.8 meters Height of casing above land surface: 0.9 meters Static water level: 3.5 meters below top of casing (08/30/91)		
Test Hole Number: MC21 **Location: 35.27.12DDDCCD** **Land Surface Altitude: 297.8 meters**		
Sand, fine to medium, loamy, dark brown	0-2.1	2.1
Sand, medium, brown	2.1-11.6	9.5
Till, clayey, red to brown	11.6-12.5	.9
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-1.7 meters Screen: Stainless steel 10 slot, 1.7-3.2 meters Height of casing above land surface: 0.4 meters Static water level: 2.7 meters below top of casing (08/30/91)		
Test Hole Number: MC22 **Location: 35.26.18AACDAC** **Land Surface Altitude: 298.6 meters**		
Sand, fine to medium, loamy, brown	0-.8	.8
Sand, fine to medium, light brown to tan	.8-2.4	1.6
Sand, medium to coarse, with gravel and pebbles, light brown to tan	2.4-4.3	1.9
Sand, medium to coarse, with gravel, light gray	4.5-5.9	1.4
Sand, medium to coarse, light gray to brown	5.9-7.1	1.2
Sand, coarse, and gravel, light brown to gray	7.1-7.6	.5
Sand, fine to very fine, with some coarse sand, light brown	7.6-7.8	.2
Sand, very fine, silty, light brown	7.8-7.9	.1
(Core not recovered)	7.9-8.2	.3
Sand, fine to coarse, with gravel, red brown	8.2-12.5	4.3
Till, clayey with pebbles, red brown	12.5-13.4	.9
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.5 meters Screen: Stainless steel 10 slot, 4.5-5.1 meters Height of casing above land surface: 0.8 meters Static water level: 5.1 meters below top of casing (08/15/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC23 **Location: 35.26.18CAABDC** **Land Surface Altitude: 299.7 meters**		
Sand, fine to medium, loamy, dark brown to black	0-0.6	0.6
Sand, fine to medium, dark brown to tan	.6-5.2	4.6
Sand, coarse to medium, with gravel, light brown to gray	5.2-9.8	4.6
Sand, medium to fine, light brown to gray	9.8-10.4	.6
Sand, fine, with pebbles, silty, red to brown	10.4-12.5	2.1
Till, clayey, red to brown	12.5-14.9	2.4
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.9 meters Screen: Stainless steel 10 slot, 4.9-6.4 meters Height of casing above land surface: 0.5 meters Static water level: 5.6 meters below top of casing (08/30/91)		
Test Hole Number: MC24 **Location: 35.27.13ADCDDC** **Land Surface Altitude: 298.5 meters**		
Sand, fine to medium, brown to light brown	0-3.7	3.7
Sand, medium to coarse, with gravel, light brown to gray	3.7-6.7	3.0
Sand, fine to coarse, with some gravel, light brown to gray	6.7-7.0	.3
Silty sand to sandy silt, with gravel, red to brown	7.0-12.8	5.8
Till, clayey	12.8-13.1	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-3.0 meters Screen: Stainless steel 10 slot, 3.0-4.6 meters Height of casing above land surface: 1.2 meters Static water level: 4.6 meters below top of casing (08/30/91)		
Test Hole Number: MC25 **Location: 35.26.07CDCDBB** **Land Surface Altitude: 297.4 meters**		
Sand, fine to medium, loamy, dark gray to brown	0-3.0	3.0
Sand, medium to coarse, with gravel, gray to brown	3.0-4.0	1.0
Sand, fine to medium, silty, gray to brown	4.0-4.3	.3
Sand, medium, gray to brown	4.3-5.2	.9
Sand, fine to medium, with gravel and pebbles, gray to brown	5.2-12.5	7.3
Sandy silt, with pebbles, red to brown	12.5-13.1	.6
Till, clayey, with pebbles, red to brown	13.1-13.4	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.3 meters Screen: Stainless steel 10 slot, 2.3-3.8 meters Height of casing above land surface: 0.7 meters Static water level: 3.1 meters below top of casing (08/30/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC26 **Location: 35.26.18ADCDCD** **Land Surface Altitude: 298.4 meters**		
Sand, fine to medium, loamy, dark brown	0-0.8	0.8
Sand, fine to medium, dark brown	.8-1.7	.9
Sand, fine to medium, silty, brown	1.7-2.0	.3
Sand, fine to medium, brown	2.0-2.5	.5
Sand, fine to medium, silty, brown	2.5-2.7	.2
Sand, fine to medium, brown	2.7-5.8	3.1
Sand, medium to very coarse, with gravel, fine to medium, brown	5.8-7.6	1.8
Gravel, fine to coarse, clean, brown	7.6-10.7	3.1
Till, reddish brown	10.7-11.0	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.4 meters Screen: Stainless steel 10 slot, 4.4-5.0 meters Height of casing above land surface: 0.7 meters Static water level: 4.9 meters below top of casing (08/19/91)		
Test Hole Number: MC27 **Location: 35.26.18ACDCDD** **Land Surface Altitude: 296.2 meters**		
Sand, medium, loamy, black	0-.6	.6
Sand, medium, with fine gravel, brown	.6-1.5	.9
Sand, fine to medium, silty, with cobbles	1.6-2.1	.5
Sand, medium, with gravel, fine, brown	2.1-3.7	1.6
Sand, coarse, with gravel, fine, brown	3.7-5.2	1.5
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-2.1 meters Screen: Stainless steel 10 slot, 2.1-2.7 meters Height of casing above land surface: 1.2 meters Static water level: 2.9 meters below top of casing (08/19/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC28 **Location: 35.26.18ACABDC** **Land Surface Altitude: 298.4 meters**		
Sand, fine to medium, loamy, black to dark brown	0-0.8	0.8
Sand, medium, light brown to brown	.8-2.3	1.5
Sand, medium to coarse, dark brown to brown	2.3-3.3	1.0
Sand, coarse to very coarse, dark brown	3.3-6.0	2.7
Sand, medium, gray to brown	6.0-6.5	.5
Sand, medium, silty, dark brown to brown	6.5-6.8	.3
Sand, medium, gray to brown	6.8-7.3	.5
Sand, coarse, with gravel, gray	7.3-7.6	.3
Sand, medium to coarse, gray to brown	7.6-7.9	.3
Sand, fine to medium, brown to dark brown	7.9-8.0	.1
(Core not recovered)	8.0-8.2	.2
Sand, coarse to medium, with gravel, gray to brown	8.2-9.4	1.2
Sand, coarse to medium, silty, with gravel, gray	9.4-12.5	3.1
Till, clayey, with pebbles, red to brown	12.5-12.8	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.2 meters Screen: Stainless steel 10 slot, 4.2-4.8 meters Height of casing above land surface: 0.1 meters Static water level: 3.9 meters below top of casing (08/16/91)		
Test Hole Number: MC29 **Location: 35.26.18ADBACA** **Land Surface Altitude: 297.9 meters**		
Sand, fine, loamy, dark brown to brown	0-.3	.3
sand, fine to coarse, light brown to tan	.3-1.4	1.1
Sand, medium to fine, light brown to tan	1.4-2.4	1.0
(Core not recovered)	2.4-2.7	.3
Sand, very fine, light brown	2.7-2.8	.1
Sand, fine to medium, light brown to tan	2.8-3.0	.2
Sand, medium to coarse, light brown to gray	3.0-3.3	.3
Sand, fine to coarse, silty, light brown to gray	3.3-3.5	.2
Sand, coarse with gravel, light brown to gray	3.5-4.0	.5
Sand, fine to very fine, light brown to tan	4.0-4.1	.1
(Core not recovered)	4.1-4.3	.2
Sand, fine to medium, light brown to gray	4.3-4.5	.2
Sand, coarse to medium, light brown to gray	4.5-5.5	1.0
(Core not recovered)	5.5-5.8	.3
Sand, medium, gray to brown	5.8-6.7	.9
Sand, medium, with gravel and pebbles, red to brown	6.7-12.8	6.1
Till, clayey, red brown	12.8-12.9	.1
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.1 meters Screen: Stainless steel 10 slot, 4.1-4.7 meters Height of casing above land surface: 0.7 meters Static water level: 4.3 meters below top of casing (08/15/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC30 **Location: 35.26.19AAAAAA** **Land Surface Altitude: 298.6 meters**		
Sand, medium to fine, loamy, brown	0-0.6	0.6
Sand, medium to fine, brown	.6-5.2	4.6
Sand, coarse, coarse gravel,	5.2-12.8	7.6
Sand, coarse, coarse to fine gravel	12.8-18.9	6.1
Sand, fine, interbedded with clay	18.9-19.5	.6
Till, red	19.5-19.8	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-5.1 meters Screen: Stainless steel 10 slot, 5.1-6.0 meters Height of casing above land surface: 0.7 meters Static water level: 6.5 meters below top of casing (08/30/91)		
Test Hole Number: MC31 **Location: 35.26.19ABBBBB** **Land Surface Altitude: 299.2 meters**		
Sand, medium to fine, loamy, black	0-.6	.6
Sand, medium to fine, brown	.6-3.7	3.1
Sand, coarse to medium, brown	3.7-6.7	3.0
Sand, coarse	6.7-9.1	2.4
Sand, medium to fine, light brown	9.1-10.0	.9
Till, red	10.0-10.4	.4
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.5 meters Screen: Stainless steel 10 slot, 4.5-5.5 meters Height of casing above land surface: 0.9 meters Static water level: 6.4 meters below top of casing (08/30/91)		
Test Hole Number: MC32 **Location: 35.27.24AAAAAA** **Land Surface Altitude: 299.3 meters**		
Sand, fine, loamy, black	0-.3	.3
Sand, medium to fine, light brown	.3-4.9	4.6
Sand, medium to fine with cobbles	4.9-6.4	1.5
Sand, coarse to medium, brown	6.4-9.1	2.7
Sand, coarse to medium, reddish	9.1-13.7	4.6
Sand, coarse, reddish	13.7-14.0	.3
Till, gray	14.0-14.3	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-4.3 meters Screen: Stainless steel 10 slot, 4.3-5.3 meters Height of casing above land surface: 1.1 meters Static water level: 5.3 meters below top of casing (08/30/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: MC33 **Location: 35.26.18AABCDA** **Land Surface Altitude: 296.1 meters**		
Sand, fine, loamy, dark brown	0-0.3	0.3
Sand, fine, black	.3-1.8	1.5
Sand, fine, dark brown to black	1.8-3.0	1.2
Cobbles	3.0-3.4	.4
Sand, coarse, with fine gravel, black	3.0-7.6	4.6
Sand, coarse, with fine gravel, brown	7.6-14.0	6.4
Sand, medium to fine, silty	14.0-14.6	.6
Sand, medium gravel, coarse clay interbedded	14.6-15.5	.9
Till, red	15.5-16.2	.7
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-1.8 meters Screen: Stainless steel 10 slot, 1.8-2.7 meters Height of casing above land surface: 0.2 meters Static water level: 2.0 meters below top of casing (8/16/91)		
Test Hole Number: MC34 **Location: 35.26.18AAACCD** **Land Surface Altitude: 295.1 meters**		
Sand, medium to fine, loamy, dark brown	0-.6	.6
Sand, medium to fine, black	.6-5.2	4.6
Sand, coarse gray	5.2-6.7	1.5
Sand, silty, reddish	6.7-8.2	1.5
Sand, coarse, with lenses of sandy silt and clay	8.2-11.0	2.8
Till, with lenses of fine sand	11.0-11.3	.3
Observation Well Information Casing: 5.1-cm diameter galvanized steel, 0-1.2 meters Screen: Stainless steel 10 slot, 1.2-2.1 meters Height of casing above land surface: 0.5 meters Static water level: 1.5 meters below top of casing (8/16/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: A30 **Location: 35.26.18ACBD** **Land Surface Altitude: 298.8 meters**		
Sand, fine to medium, loamy, dark brown	0-0.1	0.1
Sand, loamy, brown	.1-.5	.4
Sand, medium to fine, brown to tan	.5-1.3	.8
Sand, medium to fine, brown	1.3-1.5	.2
Sand, medium, silty, brown	1.5-2.0	.5
Sand, medium, brown	2.0-3.0	1.0
Sand, medium, brown	3.0-3.4	.4
Sand, medium to coarse, brown	3.4-3.9	.5
Sand, very coarse, with pebbles, brown	3.9-7.9	4.0
Sand, very coarse, brown	7.9-10.0	2.1
Gravel, dark brown	10.0-13.1	3.1
Clay and sand interbedded, red	13.1-14.6	1.5
Till, red	14.6-14.7	.1
Observation Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.7 meters Screen: Stainless steel 10 slot, 4.7-4.9 meters Height of casing above land surface: 0.6 meters Static water level: 4.8 meters below top of casing (8/14/91)		
Test Hole Number: A70 **Location: 35.26.18ACBD** **Land Surface Altitude: 298.9 meters**		
Sand, medium, loamy, dark brown	0-1.5	1.5
Sand, medium, brown	1.5-3.0	1.5
Sand, medium to coarse, brown	3.0-4.6	1.6
Sand, coarse to very coarse, dark brown	4.6-6.1	1.5
Sand, coarse to very coarse, dark brown	6.1-7.3	1.2
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.4 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 4.5 and 5.4 meters Height of casing above land surface: 0.2 meters Static water level: 4.5 meters below top of casing (1/14/92)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: A400 **Location: 35.26.18ACDBAA** **Land Surface Altitude: 297.9 meters**		
Sand, fine to medium, loamy, dark brown	0-0.5	0.5
Sand, fine to medium, dark brown to light brown	.5-1.2	.7
(Core not recovered)	1.2-1.5	.3
Sand, medium to coarse, brown	1.5-1.9	.4
Sand, coarse to very coarse, with gravel, brown	1.9-2.5	.6
Sand, coarse to medium, brown	2.5-2.7	.2
(Core not recovered)	2.7-3.0	.3
Sand, fine, with gravel and pebbles, brown	3.0-3.2	.2
Sand, fine, with very-coarse gravel, pebbles, and cobbles, brown	3.2-3.4	.2
Sand, coarse to very coarse, brown to dark brown	3.4-6.7	3.3
Sand, coarse, silty, lenses of fine silt, red to reddish-brown	6.7-10.7	4.0
Till, hard, red	10.7-11.3	.6
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.5 and 6.1 meters Height of casing above land surface: 0.4 meters Static water level: 3.4 meters below top of casing (05/03/91)		
Test Hole Number: A800 **Location: 35.26.18ACDA** **Land Surface Altitude: 297.1 meters**		
Sand, fine, loamy, dark brown	0-.4	.4
Sand, fine, brown	.4-.6	.2
Sand, fine, light brown	.6-.7	.1
Sand, medium, light brown	.7-1.8	1.1
Sand, coarse, brown	1.8-3.7	1.9
Sand, coarse, gray	3.7-5.2	1.5
Sand, fine to coarse, gray	5.2-8.2	3.0
Sand, fine, silty, reddish	8.2-11.0	2.8
Till, red	11.0-11.6	.6
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.7 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.1 and 5.7 meters Height of casing above land surface: 0.7 meters Static water level: 3.7 meters below top of casing (8/14/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: A880 **Location: 35.26.18ACDA** **Land Surface Altitude: 296.9 meters**		
Sand, fine to medium, loamy, dark brown	0-0.6	0.6
Sand, medium, brown	.6-1.5	.9
Sand, medium to coarse	1.5-3.0	1.5
Sand, very coarse	3.0-4.6	1.6
Sand, medium to coarse	4.6-5.8	1.2
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.5 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 2.3 and 5.5 meters Height of casing above land surface: 0.3 meters Static water level: 1.9 meters below top of casing (1/15/92)		
Test Hole Number: B30 **Location: 35.26.18ACBA** **Land Surface Altitude: 298.2 meters**		
Sand, fine to medium, loamy, dark brown	0-.3	.3
Sand, fine to medium, brown	.3-1.5	1.2
Sand, medium, brown	1.5-3.3	1.8
Sand, coarse, brown	3.3-3.9	.6
Sand, very coarse, with pebbles, brown	3.9-4.4	.5
Sand, very coarse, with pebbles, dark brown	4.4-6.1	1.7
Sand, brown	6.1-11.3	5.2
Till, red	11.3-11.4	.1
Observation Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.2 meters Screen: Stainless steel 10 slot, 4.1-4.2 meters Height of casing above land surface: 0.6 meters Static water level: 3.4 meters below top of casing (5/15/91)		
Test Hole Number: B70 **Location: 35.26.18ACBA** **Land Surface Altitude: 298.3 meters**		
Sand, medium, loamy, brown	.3-1.5	1.2
Sand, coarse, brown	1.5-3.0	1.5
Sand, coarse to very coarse	3.0-3.6	.6
Sand, very coarse	3.6-4.1	.5
Silt	4.1-4.2	.1
Sand, coarse to very coarse	4.6-5.8	1.2
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.6 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.6 and 4.6 meters Height of casing above land surface: 0.7 meters Static water level: 3.9 meters below top of casing (1/16/92)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: B400 **Location: 35.26.18ACAACC** **Land Surface Altitude: 297.7 meters**		
Sand, fine to medium, loamy, dark brown	0-0.5	0.5
Sand, fine to medium, brown	.5-1.7	1.2
Sand, medium to coarse, brown	1.7-1.8	.1
Sand, coarse, brown	1.8-2.1	.3
Sand, medium to coarse, brown	2.1-2.3	.2
Sand, medium, brown	2.3-3.2	.9
Sand, coarse to very coarse, with some lenses of medium sand, brown	3.2-4.6	1.4
Sand, medium, brown	4.6-4.8	.2
Sand, medium to coarse, brown	4.8-5.4	.6
Sand, medium, with gravel and cobbles, brown	5.4-5.6	.2
Sand, very coarse, with gravel, gray	5.6-8.2	2.6
Sand, very coarse, with gravel and silt, gray	8.2-9.8	1.6
Sand, coarse, silty	9.8-12.2	2.4
Till, red to brown	12.2-12.8	.6
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.0 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.5 and 6.0 meters Height of casing above land surface: 0.5 meters Static water level: 3.7 meters below top of casing (4/29/91)		
Test Hole Number: B800 **Location: 35.26.18ACAD** **Land Surface Altitude: 297.8 meters**		
Sand, fine, loamy, dark brown	0-.5	.5
Sand, fine, brown	.5-.7	.2
Sand, fine, tan to light brown	.7-.9	.2
Sand, medium to fine, light brown	.9-1.1	.2
Sand, fine to medium, light brown	1.1-1.3	.2
Sand, medium to fine, light brown	1.3-1.5	.2
Sand, medium, light brown	1.5-1.8	.3
Sand, medium to coarse, light brown	1.8-2.4	.6
Sand, medium, light brown	2.4-2.7	.3
Sand, medium to fine, gray to light brown	3.0-3.5	.5
Sand, coarse, with gravel, gray to light brown	3.5-3.8	.3
Sand, coarse to very coarse, gray to brown	3.8-6.7	2.9
Sand, medium to fine, silty, reddish	6.7-11.3	4.6
Till, clayey, red	11.3-11.9	.6
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.4 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.9 and 6.4 meters Height of casing above land surface: 0.5 meters Static water level: 3.2 meters below top of casing (8/1/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: B880 **Location: 35.26.18ACAD** **Land Surface Altitude: 298.1 meters**		
Sand, medium, loamy, dark brown	0-0.2	0.2
Sand, medium, light brown	.2-.9	.7
Sand, medium	3.0-3.3	.3
Sand, coarse	3.3-4.1	.8
Sand, fine	4.1-4.2	.1
Sand, coarse	4.2-4.3	.1
Sand to fine gravel	4.6-6.1	1.5
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.2 and 4.1 meters Height of casing above land surface: 0.4 meters Static water level: 3.7 meters below top of casing (1/16/92)		
Test Hole Number: C30 **Location: 35.26.18ABCD** **Land Surface Altitude: 298.2 meters**		
Sand, fine to medium, loamy, dark brown	0-.6	.6
Sand, fine to medium, brown to light brown	.6-1.2	.6
Sand, medium to fine, brown	1.2-1.7	.5
Sand, medium to coarse, brown	1.7-2.1	.4
Sand, medium to fine, brown	2.1-2.7	.6
Sand, medium, brown	2.7-3.0	.3
Sand, medium to coarse, brown	3.0-3.3	.3
Sand, medium to very coarse, brown	3.3-4.1	.8
Sand, coarse, brown	4.1-12.8	8.7
Sand, very coarse	12.8-14.3	1.5
Clay, red	14.3-14.9	.6
Till, red	14.9-15.0	.1
Observation Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.0 meters Screen: Stainless steel 10 slot, 3.8-4.0 meters Height of casing above land surface: 0.6 meters Static water level: 3.4 meters below top of casing (5/14/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: C70 **Location: 35.26.18ABCD** **Land Surface Altitude: 298.2 meters**		
Sand, fine, loamy, dark brown	0-0.3	0.3
Sand, fine to medium, brown	1.5-2.6	1.1
Sand, medium, brown	3.0-4.2	1.2
Sand, fine to medium, brown	4.6-5.5	.9
Sand, coarse to medium, light gray	5.5-5.7	.2
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.7 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 4.8 and 5.7 meters Height of casing above land surface: 0.6 meters Static water level: 4.2 meters below top of casing (1/29/92)		
Test Hole Number: C400 **Location: 35.26.18ACAABB** **Land Surface Altitude: 298.2 meters**		
Sand, fine to medium, loamy, dark brown	0-.5	.5
Sand, fine to medium, brown	.5-.8	.3
Sand, fine to medium, light brown	.8-1.8	.7
Sand, medium, light brown	1.8-2.6	.8
Sand, fine to medium, silty, light brown	2.6-2.8	.2
Sand, fine to medium, light brown	3.0-3.2	.2
Sand, medium to fine, light brown	3.2-3.4	.2
Sand, medium, light brown	3.4-4.3	.9
Sand, medium to coarse, light brown to gray	4.6-5.9	1.3
Sand, very coarse to coarse, brown	5.9-6.7	.8
Sand, medium to coarse, brown	6.7-8.2	1.5
Sand, very coarse, with gravel, reddish brown	8.2-9.8	1.6
Sand, fine, silty, reddish brown	9.8-12.5	2.7
Till, red	12.5-13.4	.9
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.5 and 6.1 meters Height of casing above land surface: 0.3 meters Static water level: 0.5 meters below top of casing (5/1/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: C800 **Location: 35.26.18ACAA** **Land Surface Altitude: 297.9 meters**		
Sand, fine, loamy, dark brown	0-0.5	0.5
Sand, fine, brown	.5-.8	.3
Sand, fine, light brown	.8-1.2	.4
Sand, fine to medium, light brown	1.2-1.5	.3
Sand, medium, brown	1.5-2.7	1.2
Sand, medium to coarse, brown	2.7-3.0	.3
Sand, coarse to very coarse, brown	3.0-4.6	1.6
Sand, coarse to very coarse, tan to gray	4.6-4.8	.2
Sand, medium to coarse, brown	4.8-5.9	1.1
Sand, coarse, brown	5.9-6.7	.8.
Sand, coarse, silty	6.7-8.2	1.5
Sand, medium, silty	8.2-9.8	1.6
Sand, fine to medium, silty, pebbles, reddish	9.8-12.8	3.0
Till, red	12.8-12.9	.1
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.7 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.2 and 5.7 meters Height of casing above land surface: 0.5 meters Static water level: 3.6 meters below top of casing (5/12/91)		
Test Hole Number: C880 **Location: 35.26.18ACAA** **Land Surface Altitude: 298.1 meters**		
Sand, medium, loamy, dark brown	0-1.5	1.5
Sand, medium, light brown	1.5-3.0	1.5
Sand, coarse, dark brown	4.6-6.1	1.5
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.6 and 6.1 meters Height of casing above land surface: 0.4 meters Static water level: 4.1 meters below top of casing (3/3/92)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: D30 **Location: 35.26.18ABCC** **Land Surface Altitude: 297.8 meters**		
Sand, fine to medium, loamy, dark brown	0-0.7	0.7
Sand, fine to medium, brown	.7-1.5	.8
Sand, medium, silty, brown	1.5-3.0	1.5
Sand, medium to coarse, brown	3.0-3.4	.4
Sand, fine, brown	3.4-4.6	1.2
Sand, coarse	4.6-12.2	7.6
Sand, coarse, silty, red to brown	12.2-16.5	4.3
Till, red to brown	16.5-16.6	.1
Observation Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.1 meters Screen: Stainless steel 10 slot, 3.9-4.1 meters Height of casing above land surface: 0.5 meters Static water level: 3.1 meters below top of casing (5/13/91)		
Test Hole Number: D70 **Location: 35.26.18ABCC** **Land Surface Altitude: 297.6 meters**		
Sand, medium, loamy, dark brown	0-1.5	1.5
Sand, medium to coarse, red	1.5-3.0	1.5
Sand, very coarse, red	3.0-5.5	2.5
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.3 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 2.8 and 5.3 meters Height of casing above land surface: 0.4 meters Static water level: 4.2 meters below top of casing (3/3/92)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: D400 **Location: 35.26.18ABDDBB** **Land Surface Altitude: 298.1 meters**		
Sand, fine to medium, loamy, dark brown	0-0.6	0.6
Sand, fine to medium, brown	.6-.9	.3
Sand, fine to medium, light brown	.9-1.2	.3
Sand, medium to coarse, light brown	1.5-2.7	1.2
Sand, coarse to medium, with gravel, light brown	3.0-3.4	.4
Sand, coarse, with medium gravel, light brown to gray	3.4-4.1	.7
Sand, medium to fine, with some coarse sand, light brown	4.1-4.2	.1
Sand, medium with coarse sand, light brown	4.6-5.9	1.3
Sand, coarse, brown to gray	5.9-8.2	2.3
Sand, medium to coarse, brown to gray	8.2-9.8	1.6
Sand, medium to coarse, with some gravel, silty, brown to gray	9.8-12.8	3.0
Till, red	12.8-13.1	.3
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.6 and 6.1 meters Height of casing above land surface: 0.5 meters Static water level: 3.5 meters below top of casing (5/2/91)		
Test Hole Number: D800 **Location: 35.26.18AACCAB** **Land Surface Altitude: 296.7 meters**		
Sand, fine to medium, loamy, dark brown	0-.8	.8
Sand, medium to fine, brown	.8-1.5	.7
Sand, medium, brown	1.5-1.9	.4
Sand, medium to coarse, brown	1.9-2.4	.5
Sand, coarse, brown	2.4-3.0	.6
Sand, coarse to very coarse, brown	3.0-6.7	3.7
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.0 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.5 and 6.0 meters Height of casing above land surface: 0.73 meters Static water level: 4.2 meters below top of casing (5/7/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: D880 **Location: 35.26.18AACC** **Land Surface Altitude: 297.4 meters**		
Sand, medium, loamy, dark brown	0.6-1.5	0.9
Sand, medium to coarse	1.5-3.0	1.5
Sand, medium, to fine gravel, reddish brown	3.0-6.1	3.1
Sand, very coarse	6.1-7.6	1.5
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-6.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.6 and 6.1 meters Height of casing above land surface: 0.6 meters Static water level: 2.2 meters below top of casing (1/15/92)		
Test Hole Number: E30 **Location: 35.26.18ABACCC** **Land Surface Altitude: 297.8 meters**		
Sand, fine to medium, loamy, dark brown	0-.3	.3
Sand, medium to fine, brown	.3-1.0	.7
Sand, fine to medium, brown	1.0-1.2	.2
Sand, medium, brown	1.5-2.7	1.2
Sand, very coarse, brown	3.0-3.3	.3
Sand, coarse to very coarse, brown	3.3-3.7	.4
Sand, medium to very coarse, brown	3.7-3.9	.2
Sand, coarse to medium, brown	3.9-4.4	.5
Observation Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.4 meters Screen: Stainless steel 10 slot, 4.3-4.4 meters Height of casing above land surface: ? meters Static water level: 3.7 meters below top of casing (8/30/91)		
Test Hole Number: E70 **Location: 35.26.18ABAC** **Land Surface Altitude: 298.0 meters**		
Sand, fine, loamy, light tan	1.5-2.3	.8
Sand, very fine, brown	2.3-2.4	.1
Sand, medium, light tan	2.4-2.6	.2
Sand, medium, light brown	3.0-5.6	1.7
Sand, coarse, gray to brown	5.6-5.8	.2
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.0 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.0 and 4.0 meters Height of casing above land surface: 0.6 meters Static water level: 3.9 meters below top of casing (1/29/92)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: E400 **Location: 35.26.18AAC** **Land Surface Altitude: 298.2 meters**		
Sand, fine to medium, loamy, dark brown	0-0.7	0.7
Sand, medium, brown	.7-1.2	.5
Sand, fine, brown	1.5-2.0	.5
Sand, medium, brown	2.0-3.0	1.0
Sand, fine, brown	3.0-3.3	.3
Sand, fine to medium, brown	3.3-4.0	.7
Sand, medium to coarse, brown	4.0-4.1	.1
Sand, coarse, brown	4.6-4.7	.1
Sand, coarse, to fine gravel, brown	4.7-4.8	.1
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.1 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 1.9 and 4.1 meters Height of casing above land surface: 0.5 meters Static water level: 4.5 meters below top of casing (3/6/92)		
Test Hole Number: E800 **Location: 35.26.18AACBAC** **Land Surface Altitude: 296.0 meters**		
Sand, fine, loamy, dark brown	0-.4	.4
Sand, fine to medium, brown	.4-.7	.3
Sand, fine to medium, light brown	.7-1.2	.5
(Core not recovered)	1.2-1.5	.3
Sand, fine to medium, light brown	1.5-1.7	.2
Sand, fine, brown	1.7-2.0	.3
Sand, very fine, brown	2.0-3.0	1.0
Sand, medium to coarse, with fine gravel, brown	3.0-4.4	1.4
Sand, coarse, with fine gravel, gray to brown	4.4-7.6	3.2
Sand, coarse to medium, with fine gravel, gray	7.6-12.2	4.6
Sand, with some fine gravel, silty, poorly sorted, red to brown to gray	12.2-16.8	4.6
Till, with clay, reddish brown	16.8-16.9	.1
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.6 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.0 and 5.6 meters Height of casing above land surface: 0.8 meters Static water level: 2.1 meters below top of casing (5/10/91)		

Table 1.--Geologic logs of test holes--Continued

Geologic log	Depth (meters)	Thickness (meters)
Test Hole Number: E880 Location: 35.26.18AACB Land Surface Altitude: 296.5 meters		
Sand, medium, loamy, dark brown	0-0.6	0.6
Sand, medium, brown	.6-1.5	.9
Sand, medium, reddish brown	1.5-3.0	1.5
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-3.7 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 5.1 and 3.7 meters Height of casing above land surface: 1.0 meters Static water level: 2.4 meters below top of casing (1/15/92)		
Test Hole Number: R1 Location: 35.26.1ABBBAD Land Surface Altitude: 296.4 meters		
Sand, fine to medium, loamy, dark brown	0-.8	.8
Sand, medium to fine, dark brown to brown	.8-1.4	.6
(Core not recovered)	1.4-1.5	.1
Sand, medium to coarse, brown	1.5-2.2	.7
Sand, medium to very coarse, brown	2.2-2.5	.3
(Core not recovered)	2.5-3.0	.5
Sand, medium to coarse, light brown	3.0-3.4	.4
Sand, medium to coarse, brown	3.4-3.5	.1
Sand, coarse to very coarse, brown	3.5-3.7	.2
Sand, very coarse, brown	3.7-4.9	1.2
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-4.7 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 2.2 and 4.7 meters Height of casing above land surface: 1.2 meters Static water level: 3.5 meters below top of casing (5/6/91)		
Test Hole Number: R2 Location: 35.26.18ABADDC Land Surface Altitude: 297.7 meters		
Sand, fine to medium, loamy, dark brown	0-.4	.4
Sand, fine to medium, brown	.4-.9	.5
Sand, fine to medium, light brown	.9-1.8	.9
Sand, fine to medium, brown	1.8-2.1	.3
Sand, medium to coarse, brown	2.1-2.4	.3
Sand, coarse to very coarse, brown	2.4-3.1	.7
Sand, medium to fine, brown	3.1-3.4	.3
Sand, coarse to very coarse, brown	3.4-4.0	.6
Sand, medium to coarse, gray	4.0-6.1	2.1
Multiport Well Information Casing: 5.1-cm diameter schedule 80 polyvinylchloride: 0-5.8 meters Screen: Six 0.6 cm diameter, 2.5 cm long, multiport screens at 0.5 meter spacings between, 3.7 and 5.8 meters Height of casing above land surface: 1.0 meters Static water level: 4.4 meters below top of casing (5/7/91)		

Table 2.--Results of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; <, less than detection limit; NA, not applicable]

Well number or identifier	Depth of bottom of screen below water table, in meters	Specific conductance (µS/cm at 25°C)	pH (standard units)	Temperature, water (°C)	Dissolved oxygen (mg/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)
				Field Wells				
MC10	0.2	175	7.6	6.7	7.8	26	4.4	2.4
MC19	.5	475	7.4	8.4	8.1	59	21	2.9
MC22	.5	213	7.7	10.3	10.5	39	13	3.1
MC26	.5	376	7.5	8.8	9.7	42	17	3.5
MC27	.6	179	5.9	5.4	5.9	3.4	.8	.4
MC28	.6	490	7.1	8.0	8.2	41	8.4	1.5
MC29	.8	407	7.4	7.8	6.8	54	17	2.9
Mean	.5	331	7.2	7.9	8.1	38	12	2.4
Median	.5	376	7.4	8.0	8.0	41	13	2.9
25th Percentile	.5	179	7.1	6.7	6.8	26	4.4	1.5
75th Percentile	.6	475	7.6	8.8	9.7	54	17	3.1
Minimum	.2	175	5.9	5.4	5.9	3.4	.8	.4
Maximum	.8	490	7.7	10.3	10.5	59	21	3.5
				Upgradient Wells				
MC1	.0	171	6.8	5.6	6.5	21	4.7	3.0
MC2	.2	166	7.1	6.8	4.6	23	6.9	4.1
MC3	.3	326	7.1	9.1	3.6	60	17	11
MC11	.4	142	8.3	6.2	9.6	15	3.1	1.4
MC15	.4	537	7.0	6.8	6.1	88	18	4.9
MC17	.5	307	6.6	6.4	2.2	42	9.9	3.4
Mean	.3	275	7.1	6.8	5.4	41	10	4.7
Median	.3	239	7.1	6.6	5.4	33	8.4	3.8
25th Percentile	.2	166	6.8	6.2	3.6	21	4.7	3.0
75th Percentile	.4	326	7.1	6.8	6.5	60	17	4.9
Minimum	.0	142	6.6	5.6	2.2	15	3.1	1.4
Maximum	.5	537	8.3	9.1	9.6	88	18	11

Table 2.--Results of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Depth of bottom of screen below water table, in meters	Specific conductance (µS/cm at 25°C)	pH (standard units)	Temperature, water (°C)	Dissolved oxygen (mg/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)
				Wetland Wells				
MC9	0.6	280	6.7	3.9	6.7	35	8.0	4.7
MC33	.8	325	8.0	4.0	9.7	18	3.6	9.6
MC34	.9	184	7.6	6.5	10.3	37	8.3	2.4
Mean	.8	263	7.4	4.8	8.9	30	6.6	5.5
Median	.8	280	7.6	4.0	9.7	35	8.0	4.7
25th Percentile	.7	232	7.2	3.9	8.2	26	5.8	3.5
75th Percentile	.8	303	7.8	5.3	10.0	36	8.2	7.1
Minimum	.6	184	6.7	3.9	6.7	18	3.6	2.4
Maximum	.9	325	8.0	6.5	10.3	37	8.3	9.6
				Off-site Wells				
MC12	1.6	370	7.6	9.7	4.6	36	13	4.9
MC13	1.5	187	8.4	9.2	7.1	22	7.6	2.5
MC14	.8	375	8.4	9.5	7.2	28	8.3	2.1
MC16	.4	394	7.1	7.4	8.5	52	16	2.4
MC18	1.5	156	7.0	5.5	3.2	17	3.2	1.7
MC20	1.0	281	8.3	7.0	6.3	31	8.9	2.7
MC21	.8	318	7.0	6.6	3.2	51	7.2	7.7
MC23	1.1	248	7.3	8.3	6.5	32	9.2	2.2
MC24	.8	252	8.2	7.9	8.4	15	4.3	3.8
MC25	1.4	424	6.7	6.3	2.4	60	11.4	11
MC30	.5	352	7.5	9.3	8.4	44	14	3.4
MC31	.6	488	7.3	9.3	6.8	71	18	4.1
MC32	.7	299	7.7	9.3	6.8	24	10	1.7
Mean	1.0	319	7.6	8.1	6.1	37	10	3.8
Median	.8	318	7.5	8.3	6.8	32	9.2	2.7
25th Percentile	.6	250	7.1	6.8	3.9	23	7.4	2.1
75th Percentile	1.4	385	8.3	9.3	7.8	51	13	4.5
Minimum	.4	156	6.7	5.5	2.4	15	3.2	1.7
Maximum	1.6	488	8.4	9.7	8.5	71	18	11
Confined-drift aquifer	16.8	307	7.2	9.7	.2	46	9.4	3.1
Mt. Simon-Hinckley aquifer	40.5	418	7.1	10.0	.2	62	15	6.3
Battle Brook	NA	220	7.6	9.3	12.9	17	1.9	1.2

Table 2.--Results of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Potassium, dissolved (mg/L as K)	Bicarbonate (mg/L as HCO_3)	Laboratory alkalinity, total (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Bromide (mg/L as Br)	Silica, dissolved (mg/L as SiO_2)
				Field Wells				
MC10	2	24	20	6.2	11	<0.02	<0.02	8.0
MC19	.9	166	136	3.6	23	<.02	.03	9.8
MC22	1	124	102	4.3	20	<.02	<.02	7.8
MC26	.9	188	154	2.7	102	<.02	<.02	8.0
MC27	.5	7	6	.9	1.2	<.02	<.02	3.2
MC28	.4	101	83	1.3	11	<.02	<.02	6.5
MC29	1	123	101	3.0	26	.04	<.02	7.4
Mean	.9	105	86	3.1	15	<.02	<.02	7.2
Median	.9	123	101	3.0	11	<.02	<.02	7.8
25th Percentile	.5	24	20	1.3	10	<.02	<.02	6.5
75th Percentile	1	166	136	4.3	23	<.02	<.02	8.0
Minimum	.4	7	6	.9	1.2	<.02	<.02	3.2
Maximum	2	188	154	6.2	26	.04	.03	9.8
				Upgradient Wells				
MC1	.4	62	50	11	.6	<.02	<.02	11.5
MC2	1	59	48	43	3.5	<.02	<.02	9.2
MC3	.8	220	180	32	23	.02	.06	11.3
MC11	1	44	36	5.5	2.8	<.02	<.02	6.1
MC15	.7	336	275	26	4.1	.13	.04	10.9
MC17	1	98	80	5.8	12	.13	<.02	7.4
Mean	.9	136	112	21	7.8	.05	.02	9.4
Median	.9	80	65	19	3.8	<.02	<.02	10.1
25th Percentile	.7	59	48	5.8	2.8	<.02	<.02	7.4
75th Percentile	1	220	180	32	12	.13	.04	11.3
Minimum	.4	44	36	5.5	.6	<.02	<.02	6.1
Maximum	1	336	275	43	23	.13	.06	11.5

Table 2.--Results of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Potassium, dissolved (mg/L as K)	Bicarbonate (mg/L as HCO_3)	Laboratory alkalinity, total (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Bromide (mg/L as Br)	Silica, dissolved (mg/L as SiO_2)
				Wetland Wells				
MC9	0.9	129	106	8.9	11	<0.02	0.03	5.4
MC33	.8	46	38	6.4	9.2	.02	<.02	3.2
MC34	1	137	112	3.0	6.7	.02	<.02	5.5
Mean	.9	104	85	6.1	9.1	<.02	<.02	4.7
Median	.9	129	106	6.4	9.2	.02	<.02	5.4
25th Percentile	.9	88	72	4.7	8.0	<.02	<.02	4.3
75th Percentile	1	133	109	7.6	10	.02	.02	5.5
Minimum	.8	46	38	3.0	6.7	<.02	<.02	3.2
Maximum	1	137	112	8.9	11	.02	.03	5.5
				Off-site Wells				
MC12	6	148	121	10	9.0	.07	<.02	7.9
MC13	.6	66	54	7.1	7.7	<.02	<.02	6.8
MC14	.8	77	63	2.0	10	.08	<.02	7.7
MC16	.8	166	136	10	16	.19	<.02	7.6
MC18	<.3	66	54	1.9	1.2	<.02	.04	5.0
MC20	1	77	63	7.6	2.7	.05	<.02	5.4
MC21	.6	160	131	17	21	<.02	<.02	10.8
MC23	.7	110	90	15	4.9	<.02	<.02	8.5
MC24	.7	51	42	11	3.4	<.02	<.02	5.8
MC25	1.6	232	190	13	12	<.02	.04	10.5
MC30	<.3	201	165	7.4	2.3	.16	<.02	10.5
MC31	.6	207	170	10	27	.12	<.02	9.9
MC32	.7	103	84	6.8	6.2	.14	<.02	6.8
Mean	1	128	105	9.2	9.5	.06	<.02	7.9
Median	.7	110	90	10	7.7	.05	<.02	7.7
25th Percentile	.6	72	59	7.0	3.0	<.02	<.02	6.3
75th Percentile	1	184	151	12	14	.13	<.02	10.2
Minimum	<.3	51	42	1.9	1.2	<.02	<.02	5.0
Maximum	6	232	190	17	27	.19	.04	10.8
Confinded-drift aquifer	1	187	153	4.4	5.3	.14	<.02	12.8
Mt. Simon-Hinkley aquifer	1	283	232	<.02	.5	.14	<.02	13.3
Battle Brook	.7	57	47	5.9	2.4	<.02	<.02	4.0

Table 2.--Resutls of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Nitrate, dissolved (mg/L as N)	Nitrite, dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, total Kjeldahl (mg/L as N)	Phosphorus, total (mg/L as P)	Phosphate, ortho, total (mg/L as PO_4)	Aluminum, dissolved (mg/L as Al)	Barium, dissolved (mg/L as Ba)
				Field Wells				
MC10	14	<0.02	<0.02	<0.20	0.05	0.07	<0.02	0.02
MC19	21	<.02	<.02	.21	<.02	<.03	.06	.04
MC22	6.7	<.02	<.02	.27	<.02	<.03	.02	.02
MC26	6.3	<.02	<.02	.37	.02	<.03	<.02	.02
MC27	2.1	<.02	<.02	<.20	<.02	<.03	<.02	.01
MC28	10	<.02	<.02	<.20	<.02	<.03	.02	.02
MC29	23	<.02	<.02	<.20	<.02	<.03	.02	.03
Mean	11.8	<.02	<.02	.12	<.02	<.03	.02	.02
Median	10	<.02	<.02	<.20	<.02	<.03	.02	.02
25th Percentile	6.3	<.02	<.02	<.20	<.02	<.03	<.02	.02
75th Percentile	21	<.02	<.02	.27	.02	<.03	.02	.03
Minimum	2.1	<.02	<.02	<.20	<.02	<.03	<.02	.01
Maximum	23	<.02	<.02	.37	.05	.07	.06	.04
				Upgradient Wells				
MC1	4.4	.05	<.02	<.20	.02	<.03	.03	.02
MC2	.2	<.02	<.02	<.20	<.02	<.03	.03	.02
MC3	.02	<.02	<.02	.38	<.02	<.03	.05	.05
MC11	3.9	<.02	<.02	<.20	.02	<.03	.02	.02
MC15	.03	<.02	<.02	.21	<.02	<.03	.07	.05
MC17	15	.55	<.02	<.20	<.02	<.03	.03	.05
Mean	4.0	.10	<.02	.10	<.02	<.03	.04	.03
Median	2.1	<.02	<.02	<.20	<.02	<.03	.03	.03
25th Percentile	.03	<.02	<.02	<.20	<.02	<.03	.03	.02
75th Percentile	4.4	.05	<.02	.21	.02	<.03	.05	.05
Minimum	.02	<.02	<.02	<.20	<.02	<.03	.02	.02
Maximum	15	.55	<.02	.38	.02	<.03	.07	.05

Table 2.--Resutls of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Nitrate, dissolved (mg/L as N)	Nitrite, dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, total Kjeldahl (mg/L as N)	Phosphorus, total (mg/L as P)	Phosphate, ortho, total (mg/L as PO_4)	Aluminum, dissolved (mg/L as Al)	Barium, dissolved (mg/L as Ba)
				Wetland Wells				
MC9	0.03	<0.02	0.02	0.20	0.04	<0.03	0.03	0.04
MC33	9.0	.28	.04	.38	.02	<.03	<.02	.03
MC34	3.4	<.02	.06	.21	<.02	<.03	<.02	.04
Mean	4.1	.09	.04	.26	.02	<.03	<.02	.04
Median	3.4	<.02	.04	.21	.02	<.03	<.02	.04
25th Percentile	1.7	<.02	.03	.21	<.02	<.03	<.02	.04
75th Percentile	6.2	.14	.05	.30	.03	<.03	.02	.04
Minimum	.03	<.02	.02	.20	<.02	<.03	<.02	.03
Maximum	9.0	.28	.06	.38	.04	<.03	.03	.04
				Off-site Wells				
MC12	5.6	<.02	<.02	<.20	.02	<.03	.03	.04
MC13	5.8	.11	<.02	<.20	.04	<.03	.02	.01
MC14	10	<.02	<.02	<.20	.04	<.03	.02	.02
MC16	10	<.02	<.02	<.20	<.02	<.03	.06	.02
MC18	.92	<.02	<.02	<.20	.04	<.03	<.02	.02
MC20	14	.14	<.02	.21	<.02	<.03	.03	.03
MC21	.33	<.02	<.02	.37	<.02	<.03	.05	.03
MC23	3.2	<.02	<.02	.37	<.02	<.03	.02	.01
MC24	3.1	<.02	<.02	.39	.02	<.03	.22	.01
MC25	1.4	.14	<.02	.54	<.02	<.03	.07	.06
MC30	4.8	<.02	<.02	<.20	.06	<.03	.04	.03
MC31	6.5	<.02	<.02	<.20	.02	<.03	.07	.03
MC32	4.0	<.02	<.02	<.20	<.02	<.03	.04	.02
Mean	5.4	.03	<.02	.14	.02	<.03	.05	.02
Median	4.8	<.02	<.02	<.20	<.02	<.03	.04	.02
25th Percentile	2.3	<.02	<.02	<.20	<.02	<.03	.02	.02
75th Percentile	8.3	.06	<.02	.37	.04	<.03	.07	.03
Minimum	.33	<.02	<.02	<.20	<.02	<.03	<.02	.01
Maximum	14	.14	<.02	.54	.06	<.03	.22	.06
Confined-drift aquifer	<.02	<.02	.03	.24	.05	<.03	.03	.05
Mt. Simon-Hinkley aquifer	<.02	<.02	.12	.24	.07	<.03	<.02	.06
Battle Brook	.11	<.02	<.02	.47	.02	<.03	<.02	.01

Table 2.-- Results of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)	Strontium, dissolved (mg/L as Sr)
	Field Wells		
MC10	<0.06	0.03	0.17
MC19	<.06	.02	.15
MC22	<.06	<.02	.11
MC26	<.06	.02	.09
MC27	<.06	<.02	.02
MC28	<.06	.02	.09
MC29	<.06	.03	.10
Mean	<.06	.02	.10
Median	<.06	.02	.10
25th Percentile	<.06	<.02	.09
75th Percentile	<.06	.03	.15
Minimum	<.06	<.02	.02
Maximum	<.06	.03	.17
	Upgradient Wells		
MC1	<.06	.15	.07
MC2	<.06	<.02	.08
MC3	.12	.44	.25
MC11	<.06	.02	.05
MC15	<.06	.04	.13
MC17	<.06	.45	.17
Mean	<.06	.18	.13
Median	<.06	.10	.11
25th Percentile	<.06	.02	.07
75th Percentile	<.06	.44	.17
Minimum	<.06	<.02	.05
Maximum	.12	.45	.25

Table 2.-- Results of inorganic analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Iron, dissolved (mg/L as Fe)	Manganese, dissolved (mg/L as Mn)	Strontium, dissolved (mg/L as Sr)
	Wetland Wells		
MC9	2.0	0.47	0.07
MC33	<.06	.06	.08
MC34	.66	.25	.09
Mean	.87	.26	.08
Median	.66	.25	.08
25th Percentile	.33	.16	.08
75th Percentile	1.3	.36	.09
Minimum	<.06	.06	.07
Maximum	2.0	.47	.09
	Off-site Wells		
MC12	<.06	.02	.13
MC13	<.06	<.02	.05
MC14	<.06	<.02	.07
MC16	<.06	.02	.08
MC18	6.7	.54	.06
MC20	<.06	.10	.10
MC21	<.06	.63	.16
MC23	<.06	<.02	.04
MC24	.12	<.02	.04
MC25	.30	1.1	.21
MC30	<.06	.04	.07
MC31	.28	.04	.09
MC32	<.06	<.02	.06
Mean	.57	.19	.09
Median	<.06	.02	.07
25th Percentile	<.06	<.02	.05
75th Percentile	.20	.32	.11
Minimum	<.06	<.02	.04
Maximum	6.7	1.1	.21
Confined-drift aquifer	.28	1.1	.07
Mt. Simon-Hinkley aquifer	2.3	.48	.12
Battle Brook	.20	.04	.03

Table 3..--Results of herbicide analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991

[µg/L, micrograms per liter; <, less than detection limit; NA, not applicable; ND, no detection of either compound in calculation of ratio; infin., value is infinity; N, negative result from immunoassay test (no detection); P, positive result from immunoassay test (detection)]

Well number or identifier	Atrazine, total (µg/L)	Immunoassay triazines	De-ethylatrazine (DEA) (µg/L)	DEA to atrazine ratio (DAR)	De-isopropyl-atrazine (DIA) (µg/L)	DIA to DEA ratio (D^2R)	Alachlor, (µg/L)	Immunoassay alachlor
				Field Wells				
MC10	<0.01	N	<0.03	ND	<0.06	ND	<0.01	N
MC19	<.01	N	.21	infin.	<.06	0	<.01	N
MC22	<.01	P	.32	infin.	<.06	0	<.01	N
MC26	<.01	N	.12	infin.	<.06	0	<.01	N
MC27	<.01	N	<.03	ND	<.06	ND	<.01	N
MC28	.04	N	.14	3.5	<.06	0	<.01	N
MC29	.17	P	.20	1.2	<.06	0	<.01	N
Mean	.03	NA	.14	NA	<.06	NA	<.01	NA
Median	<.01	NA	.14	NA	<.06	NA	<.01	NA
25th Percentile	<.01	NA	<.03	NA	<.06	NA	<.01	NA
75th Percentile	.04	NA	.21	NA	<.06	NA	<.01	NA
Minimum	<.01	NA	<.03	NA	<.06	NA	<.01	NA
Maximum	.17	NA	.32	NA	<.06	NA	<.01	NA
				Upgradient Wells				
MC1	<.01	N	<.03	ND	<.06	ND	<.01	N
MC2	<.01	N	.04	infin.	<.06	0	<.01	N
MC3	<.01	N	<.03	ND	<.06	ND	<.01	P
MC11	<.01	N	2.30	infin.	.98	.4	<.01	N
MC15	<.01	P	<.03	ND	<.06	ND	<.01	N
MC17	<.01	P	<.03	ND	<.06	ND	<.01	N
Mean	<.01	NA	.39	NA	.16	NA	<.01	NA
Median	<.01	NA	<.03	NA	<.06	NA	<.01	NA
25th Percentile	<.01	NA	<.03	NA	<.06	NA	<.01	NA
75th Percentile	<.01	NA	.04	NA	<.06	NA	<.01	NA
Minimum	<.01	NA	<.03	NA	<.06	NA	<.01	NA
Maximum	<.01	NA	2.30	NA	.98	NA	<.01	NA

Table 3.--Results of herbicide analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	Atrazine, total (µg/L)	Immunoassay triazines	De-ethylatrazine (DEA) (µg/L)	DEA to atrazine ratio (DAR)	De-isopropyl-atrazine (DIA) (µg/L)	DIA to DEA ratio (D^2R)	Alachlor, (µg/L)	Immunoassay alachlor
				Wetland Wells				
MC9	<0.01	N	<0.03	ND	<0.06	ND	<0.01	N
MC33	<.01	P	.13	infin.	.18	1.4	<.01	N
MC34	<.01	N	.07	infin.	.21	3.0	<.01	N
Mean	<.01	NA	.07	NA	.13	NA	<.01	NA
Median	<.01	NA	.07	NA	.18	NA	<.01	NA
25th Percentile	<.01	NA	.04	NA	.09	NA	<.01	NA
75th Percentile	<.01	NA	.10	NA	.20	NA	<.01	NA
Minimum	<.01	NA	<.03	NA	<.06	NA	<.01	NA
Maximum	<.01	NA	.13	NA	.21	NA	<.01	NA
				Off-site Wells				
MC12	<.01	N	.83	infin.	<.06	0	<.01	N
MC13	.11	N	1.40	12.7	.34	.2	<.01	N
MC14	<.01	P	<.03	ND	<.06	ND	<.01	N
MC16	<.01	N	<.03	ND	<.06	ND	<.01	N
MC18	<.01	N	<.03	ND	<.06	ND	<.01	N
MC20	<.01	P	<.03	ND	<.06	ND	<.01	N
MC21	<.01	N	<.03	ND	<.06	ND	<.01	N
MC23	<.01	N	<.03	ND	<.06	ND	<.01	N
MC24	<.01	N	.14	infin.	<.06	0	<.01	N
MC25	<.01	N	<.03	ND	<.06	ND	<.01	P
MC30	.10	N	.18	1.8	.30	1.7	<.01	N
MC31	<.01	N	<.03	ND	<.06	ND	<.01	N
MC32	.28	N	.36	1.3	<.06	0	<.01	N
Mean	.04	NA	.22	NA	.05	NA	<.01	NA
Median	<.01	NA	<.03	NA	<.06	NA	<.01	NA
25th Percentile	<.01	NA	<.03	NA	<.06	NA	<.01	NA
75th Percentile	.05	NA	.27	NA	<.06	NA	<.01	NA
Minimum	<.01	NA	<.03	NA	<.06	NA	<.01	NA
Maximum	.28	NA	1.40	NA	.34	NA	<.01	NA
Confined-drift aquifer	<.01	N	<.03	ND	<.06	ND	<.01	N
Mt. Simon-Hinckley aquifer	<.01	N	<.03	ND	<.06	ND	<.01	N
Battle Brook	<.01	N	<.03	ND	<.06	ND	<.01	P

Table 3.--Results of herbicide analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	2,6-diethylanaline (µg/L)	Chloroalachlor (µg/L)	Metolachlor (µg/L)	Metribuzin (µg/L)
		Field Wells		
MC10	<0.01	<0.06	<0.01	<0.03
MC19	<.01	<.06	<.01	<.03
MC22	<.01	<.06	<.01	<.03
MC26	.03	<.06	<.01	<.03
MC27	<.01	<.06	<.01	<.03
MC28	<.01	<.06	<.01	<.03
MC29	<.01	<.06	<.01	<.03
Mean	<.01	<.06	<.01	<.03
Median	<.01	<.06	<.01	<.03
25th Percentile	<.01	<.06	<.01	<.03
75th Percentile	<.01	<.06	<.01	<.03
Minimum	<.01	<.06	<.01	<.03
Maximum	.03	<.06	<.01	<.03
		Upgradient Wells		
MC1	<.01	<.06	<.01	<.03
MC2	<.01	<.06	<.01	<.03
MC3	<.01	<.06	<.01	<.03
MC11	<.01	<.06	<.01	<.03
MC15	<.01	<.06	<.01	<.03
MC17	<.01	<.06	<.01	<.03
Mean	<.01	<.06	<.01	<.03
Median	<.01	<.06	<.01	<.03
25th Percentile	<.01	<.06	<.01	<.03
75th Percentile	<.01	<.06	<.01	<.03
Minimum	<.01	<.06	<.01	<.03
Maximum	<.01	<.06	<.01	<.03

Table 3.--Results of herbicide analyses of water samples collected at the Princeton, Minnesota Management Systems Evaluation Area, April 1991--Continued

Well number or identifier	2,6-diethylanaline (µg/L)	Chloroalachlor (µg/L)	Metolachlor (µg/L)	Metribuzin (µg/L)
		Wetland Wells		
MC9	<0.01	<0.06	<0.01	<0.03
MC33	<.01	<.06	<.01	<.03
MC34	<.01	<.06	<.01	<.03
	<.01			
Mean	<.01	<.06	<.01	<.03
Median	<.01	<.06	<.01	<.03
25th Percentile	<.01	<.06	<.01	<.03
75th Percentile	<.01	<.06	<.01	<.03
Minimum	<.01	<.06	<.01	<.03
Maximum		<.06	<.01	<.03
	<.01	**Off-site Wells**		
MC12	<.01	<.06	<.01	<.03
MC13	<.01	<.06	<.01	<.03
MC14	<.01	<.06	<.01	<.03
MC16	<.01	<.06	<.01	<.03
MC18	<.01	<.06	<.01	<.03
MC20	<.01	<.06	<.01	<.03
MC21	<.01	<.06	<.01	<.03
MC23	<.01	<.06	<.01	<.03
MC24	<.01	<.06	<.01	<.03
MC25	<.01	<.06	<.01	<.03
MC30	<.01	<.06	<.01	<.03
MC31	<.01	<.06	<.01	<.03
MC32		<.06	.10	<.03
	<.01			
Mean	<.01	<.06	.01	<.03
Median	<.01	<.06	<.01	<.03
25th Percentile	<.01	<.06	<.01	<.03
75th Percentile	<.01	<.06	<.01	<.03
Minimum	<.01	<.06	<.01	<.03
Maximum		<.06	.10	<.03
	<.01			
Confined-drift aquifer	<.01	<.06	<.01	<.03
Mt. Simon-Hinckley aquifer	<.01	<.06	<.01	<.03
Battle Brook	<.01	<.06	<.01	<.03

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