OCCURRENCE AND DISTRIBUTION OF NITRATE AND HERBICIDES IN THE IOWA RIVER ALLUVIAL AQUIFER, IOWA--MAY 1984 TO NOVEMBER 1985

By Mark G. Detroy and Ronald L. Kuzniar

U.S. GEOLOGICAL SURVEY

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CONVERSION FACTORS

For readers who prefer to use metric (SI) units, conversion factors for terms used in this report are listed below:

Multiply inch-pound units	By	To obtain metric units
inch	25.40	millimeter
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
gallon per minute	0.06308	liter per second
million gallons per day	0.04381	cubic meter per second
	3,785.	cubic meters per day
cubic foot per second	0.02832	cubic meter per second

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows: °F = 9/5 °C + 32.

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 "Mean Sea Level."

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ABSTRACT

From May 1984 to November 1985, the U.S. Geological Survey, in cooperation with the University of Iowa Hygienic Laboratory and the Iowa Department of Natural Resources, Geological Survey Bureau, investigated nitrate and herbicides in the Iowa River alluvial aquifer. The occurrence and distribution of nitrate and selected herbicides were determined in the Iowa River alluvial aquifer, a sand and gravel aquifer beneath agricultural land along the Iowa River in Iowa County, Iowa. Test drilling and water-quality sampling of the aquifer indicated that the areal distribution of nitrate in the aquifer is variable. Nitrate (as nitrogen) concentrations range from less than 0.10 to 19 milligrams per liter. Although nitrate distribution is variable, extensive aquifer contamination by nitrate is not apparent. Median nitrate concentrations were 5.9 milligrams per liter for municipal wells and 7.2 milligrams per liter for area streams, but were less than 2.0 milligrams per liter for test wells and domestic wells. Atrazine, cyanazine, metribuzin, alachlor, metolachlor, and trifluralin were detected in ground-water samples. Maximum concentration of atrazine in ground-water samples was 2.4 micrograms per liter; maximum concentration of metribuzin was 8.1 micrograms per liter. Area streams also contained herbicides in concentrations generally larger than concentrations in ground water. At a municipal well adjacent to a stream, similar seasonal concentrations of atrazine were detected for both ground- and surface-water samples. Surface water sometimes may be a source of nitrate and herbicides to adjacent ground water.

Detailed sampling of vertical profiles using well nests indicated that the distribution of nitrate and selected herbicides is not vertically homogeneous. Generally, larger nitrate concentrations were detected at shallow depths in the aquifer; at greater depths, the nitrate concentrations were near the detection limit. Herbicides were detected in a pattern similar to that determined for nitrate. The true areal distribution of nitrate may be masked by inconsistent depths of sampling or incomplete vertical sampling. Variations in nitrate concentrations with depth possibly are because local aquifer flow is predominantly horizontal and may limit significant vertical dispersion of nitrate and herbicides, and because nitrate may not act conservatively in ground water and may be removed from the system by denitrification.

For nested wells, the seasonal variations of nitrate and herbicides were greater at the shallower sampling depths for domestic and test wells. Seasonal variations of nitrate and herbicides illustrate that these constituents move quickly from surface application to shallow underlying aquifers. These constituents can be detected in ground water soon after chemical applications, usually within 6 weeks.

INTRODUCTION

Agricultural production in the United States during the last several decades increased largely because of the development of efficient cropping methods. The extensive use of nitrogen fertilizers as plant nutrient-supplements and the use of pesticides for weed and insect control have been some of the more important contributing factors to improved agricultural yields. The use of nitrogen fertilizers and pesticides in Iowa is an integral part of the success of the large agricultural industry of the State.

Although the extensive use of nitrogen fertilizers and pesticides has been a boon to the State's agricultural industry, the contamination of surface water and shallow ground water by nitrate and pesticides has become an environmental issue. Previously, concern about the relation of agricultural chemicals to water resources focused on "nonpoint" source contamination of surface water by field runoff and soil erosion from row-crop areas. Nonpoint-source problems involve transport of sediment, nutrients, and pesticides into surface waters from extensive areas of agricultural land use, where chemicals are areally applied to cultivated land. Recently, attention has been focused on the presence of nitrate and herbicides in shallow ground water.

This study is one of several studies of nitrate and pesticide occurrence in ground water by various researchers in the State. In this study, nitrate and herbicides in the Iowa River alluvial aquifer were studied by comprehensive sampling (from May 1984 to November 1985) of water from domestic, municipal, and test wells, and selected surface-water locations. The samples were collected to help determine the areal, vertical, and seasonal distribution of these contaminants.

All water samples for this investigation were collected by the U.S. Geological Survey and analyzed by the University Hygienic Laboratory in Iowa City and Des Moines, Iowa. The authors thank the Hygienic Laboratory staff for their work, and especially Dr. Roger Splinter for his support and cooperation. Test drilling and seismic surveys were conducted by the Iowa Department of Natural Resources, Geological Survey Bureau.

Purpose and Scope

This report describes the results of a study to determine the occurrence and distribution of nitrate and herbicides in a shallow alluvial aquifer beneath agricultural land along the Iowa River, in Iowa County, Iowa. Herbicides were not a part of the original study, but were added in the project to provide information about constituents recently identified as ground-water contaminants in Iowa. The Iowa River valley, because of its broad floodplain, was chosen for the study because of its alluvial aquifer. The area is dominated by agricultural land use; corn is the primary crop. Ground water in this area also has a history of having large concentrations of nitrate, particularly in shallow ground water.

Previous Investigations

Previous studies in Iowa provided information about the distribution and health effects of some agricultural chemicals in hydrologic systems. Although spills and misuse of chemicals have caused more severe problems locally, the widespread contamination of aquifers is the result of conventional usage of agricultural chemicals, and constitutes a nonpoint-source pollution problem (Hallberg, 1984).

Other investigations in Iowa indicate that pesticides, especially herbicides, are moving to shallow ground water. Atrazine and alachlor were detected in shallow ground water and springs in northeast Iowa in concentrations as large as 10 to 15 micrograms per liter (Hallberg and others, 1983). A 1984 sampling survey of public drinking water supplies by the Iowa Department of Water, Air, and Waste Management indicated that 28 of 70 wells sampled had measurable concentrations of herbicides (Kelly, 1985). Atrazine was the most frequently detected herbicide. Kelly and Wnuk (1986) detected pesticides in six of eight municipal wells sampled in the Little Sioux alluvial aquifer system. Kelly and Wnuk established an inverse relation between well depth and the presence of pesticides.

Increasing concentrations of nitrate in ground water is a general trend that has been documented in many shallow aquifers in Iowa, and was summarized on a national basis by Madison and Brunett (1984). Since 1946, a slow but steady increase in nitrate concentrations has occurred Statewide in ground water obtained from wells less than 100 feet deep (McDonald and Splinter, 1982).

DESCRIPTION OF THE STUDY AREA

Geologic Setting

The study area, consisting of 50 square miles in eastern Iowa (fig. 1) includes the 22-mile-long valley of the eastward-flowing Iowa River from Belle Plaine on the west, to near Amana on the east. The width of the valley ranges from 2 to 3 miles. The study area boundaries north and south of the Iowa River coincide with the contact between the unconsolidated materials that comprise the Iowa River alluvial aquifer and the loess-mantled surfaces of the valley sides. The flood plain generally outlines the extent of an underlying alluvial aquifer, except where loess has covered some of the alluvial aquifer.

In the study area, the Iowa River intersects the Southern Iowa Drift Plain (Prior, 1976). Erosion since pre-Illinoian glaciation (Hallberg and others, 1978) produced the topography of the area. Drilling logs indicate a stratigraphic sequence consisting of alluvial clay and silt overlying fine-to-coarse sand and gravel (fig. 2). The sand-and-gravel sequence is 5 to 40 feet thick; 15 to 30 feet thickness is typical in most locations. Depth to the top of the sand and gravel ranges from 5 to 15 feet.

At most locations, the alluvial sediments are underlain by a glacial-till unit; however, near Amana, Pennsylvanian sandstone is exposed along the northern valley wall. Some isolated outliers of limestone, dolomite, and shale of the Devonian Cedar Valley Limestone also are present beneath the alluvium in this area (C. Thompson, Iowa Geological Survey, written commun., 1985). The extent and thickness of the Iowa River alluvial aquifer were determined by both mud rotary test drilling and seismic refraction surveys.

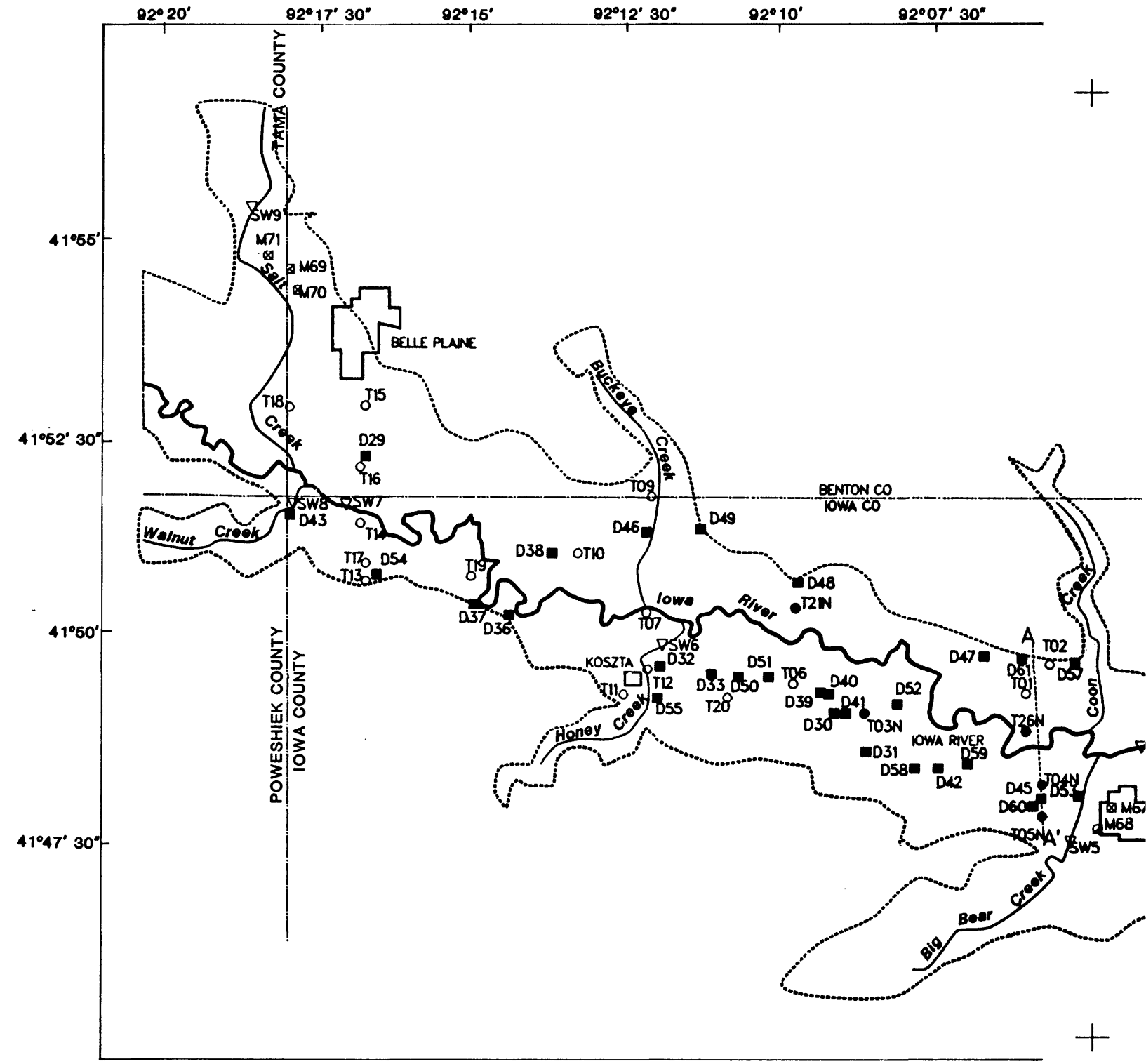

Figure 1.--Location of study area, wells, and surface-water sites.

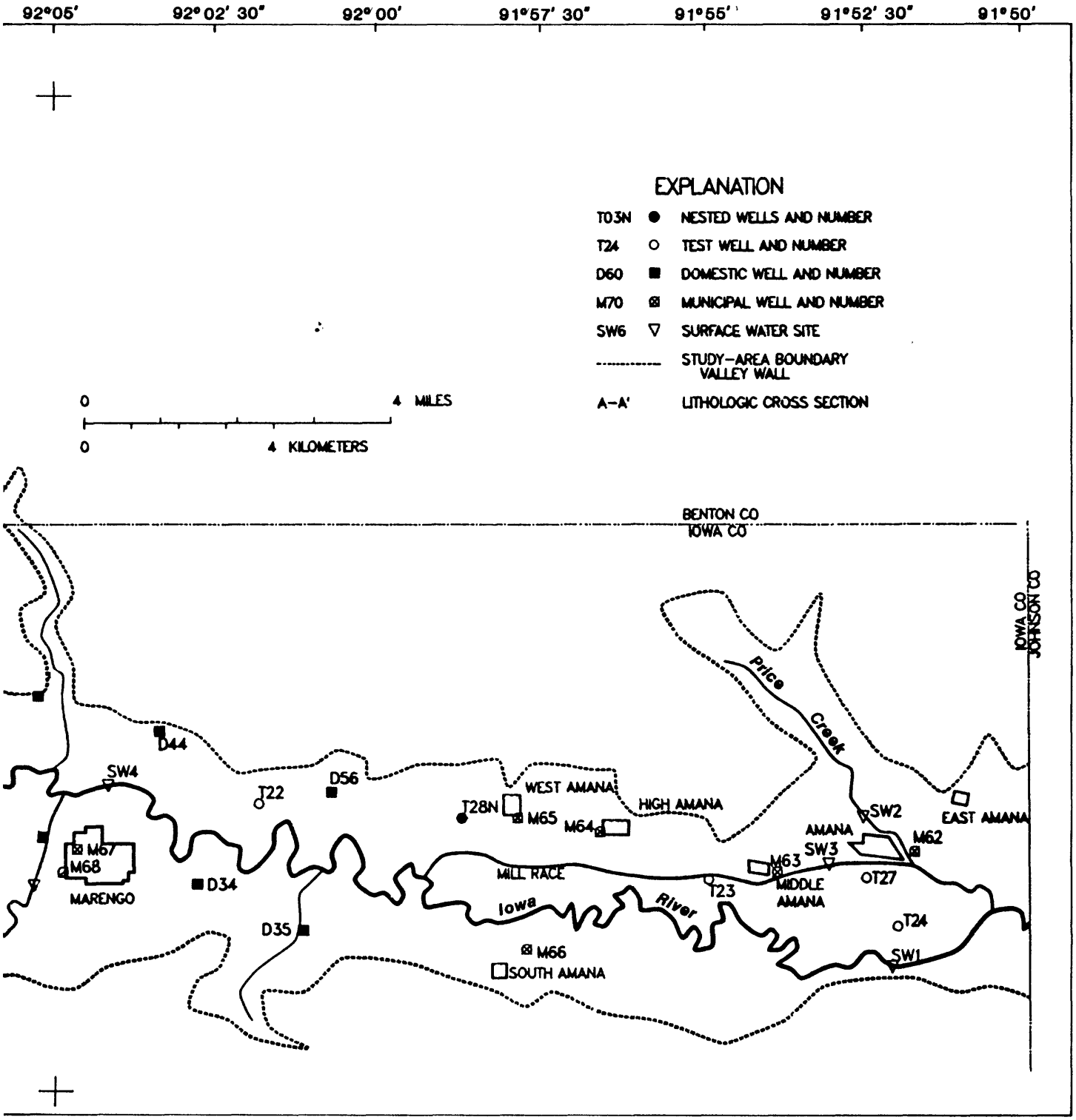

Figure 1.—Location of study area, wells, and surface-water sites— Continued.

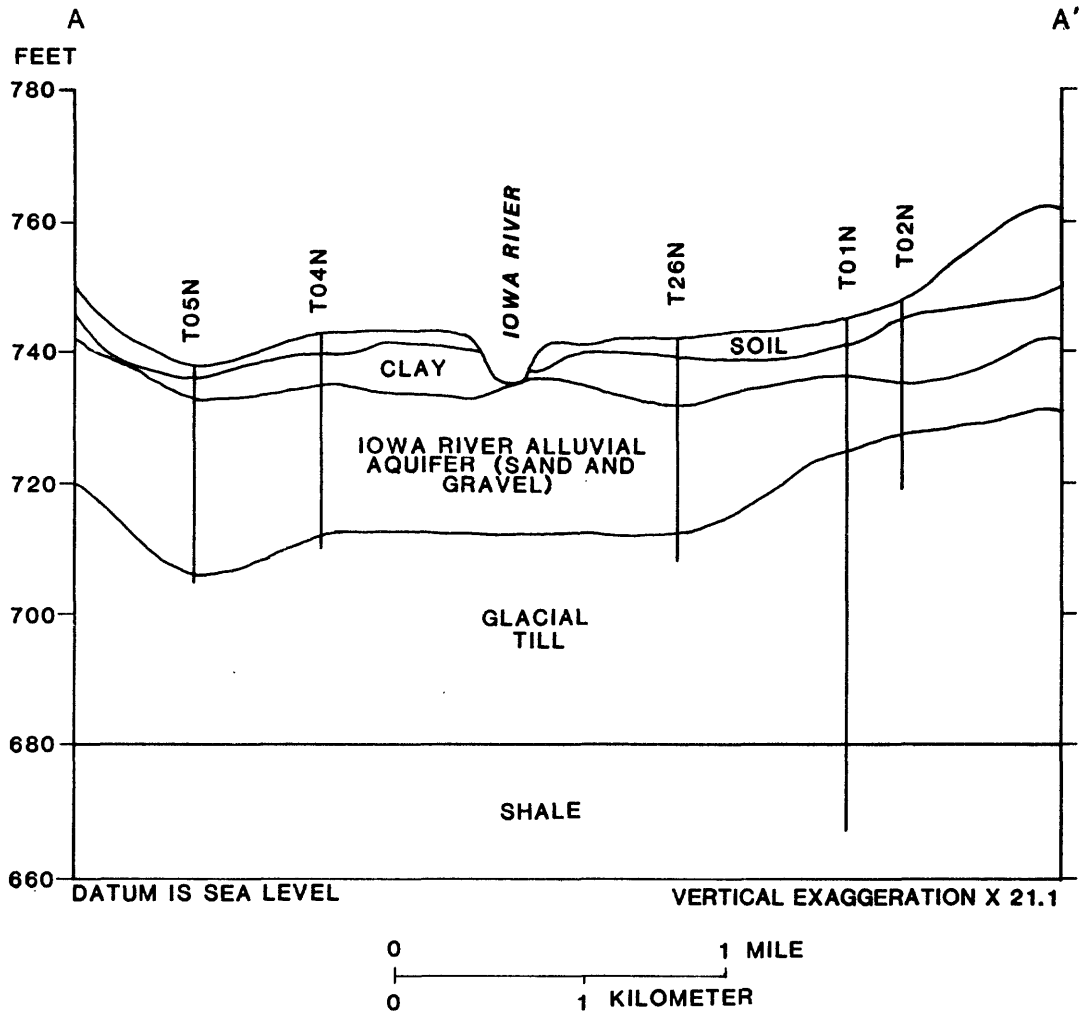

Figure 2.--Lithologic section of the Iowa River alluvial aquifer near Marengo (location of section is shown on figure 1).

The soils in the study area are categorized as the Colo-Bremer-Nevin-Nodaway association: nearly level or undulating soils on bottom lands. The Colo and Bremer soils are the most common of the poorly drained soils. The Nodaway soils are moderately well drained or somewhat poorly drained. They occur nearer to the stream channels. The Nevin soils are at slightly higher elevations and generally are above flood stage; however, the Colo, Bremer, and Nodaway soils are frequently flooded.

The Bremer series consists of dark-colored soils formed in moderately fine textured of fine textured silty alluvium. The Colo series consists of dark-colored soils formed in moderately fine textured alluvium. In some places these soils are buried beneath recently deposited material. The Nevin series consists of somewhat poorly drained, dark-colored soils that formed from silty clay loam alluvium. The Nodaway series consists of soils that developed from stratified light-colored and dark-colored alluvium (Highland and Didericksen, 1967).

Aquifer Description

The Iowa River alluvial aquifer, a sand and gravel aquifer, represents a significant water resource for this area. The communities of Belle Plaine, Marengo, West Amana, South Amana, High Amana, Middle Amana, and Amana (fig. 1) all derive drinking water from this aquifer. In addition, the aquifer is used exclusively for domestic supply along and within the flood plain. The entire thickness of the Iowa River alluvial aquifer is saturated for most of the year. Water levels (fig. 3) can rise within several feet of land surface during the spring, and may cause saturation of the overlying silt-clay zones for extended periods. The thickness of the sand and gravel surficial aquifer, determined by test drilling, ranges from 5 to 35 feet with 25 feet typical in most locations. Yield from this aquifer varies; however, a yield in excess of 100 gallons per minute is common. Actual hydraulic conductivity values are not known for this aquifer. However, values likely are in the range of 3.28×10^{-5} to 3.28×10^{-3} feet per second, typical for a clean sand (Freeze and Cherry, 1979).

Throughout much of the study area, ground-water flow in the Iowa River alluvial aquifer is from the west, southwest, and northwest toward the Iowa River. Water-table surfaces are illustrated for wet and dry weather in figures 4 and 5. Ground-water flow generally follows topography or the slope of the underlying glacial till. The principal source of ground-water recharge to the study area is local precipitation. Subsurface inflow from the west, north, and south boundaries is thought to be minimal. Water-level data collected at the test wells are summarized in table 2, at the back of this report.

WATER-QUALITY OF THE STUDY AREA

Water-quality monitoring consisted of sampling test wells, domestic wells, municipal wells, and streams. Twenty-five test wells, 33 domestic wells, and 10 municipal wells were installed for water-quality sampling. Nine surface-water sites, three on the Iowa River and six on its major tributaries, also were sampled. Miscellaneous samples were collected from May 1984 to November 1985 and analyzed for alkalinity, sulfate, chloride, nitrate, ammonia, and orthophosphate. Herbicide analyses were done on selected samples. All water-quality data collected are in tables 3 to 6, at the back of this report.

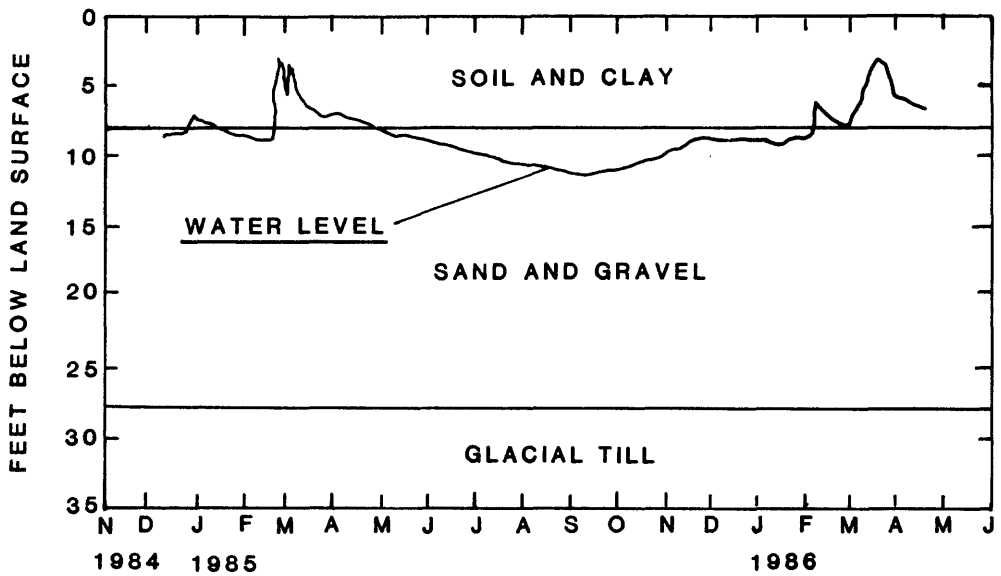

Figure 3.--Fluctuation of water levels in test well T24, November 1984 to June 1986.

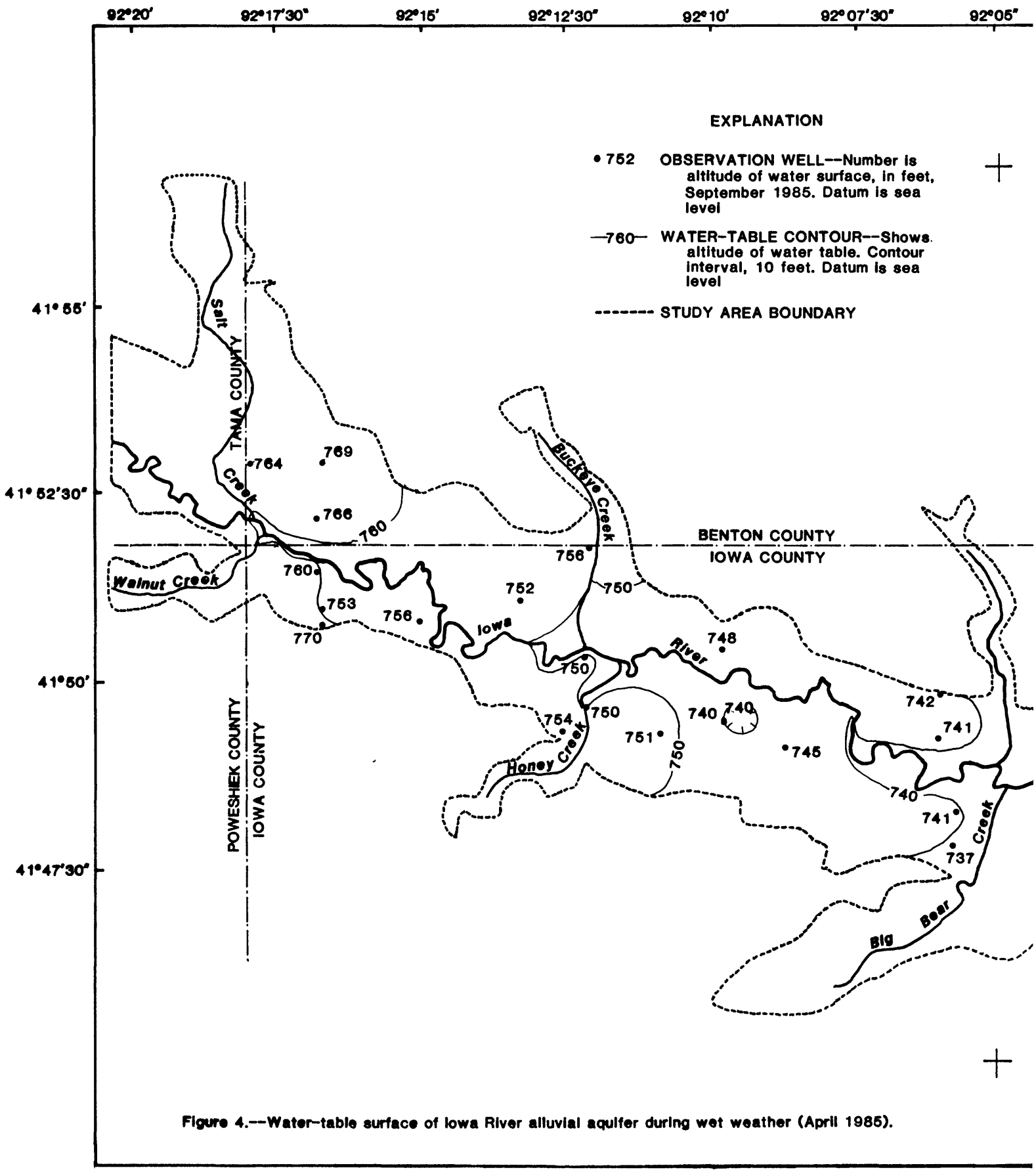

Figure 4.--Water-table surface of Iowa River alluvial aquifer during wet weather (April 1985).

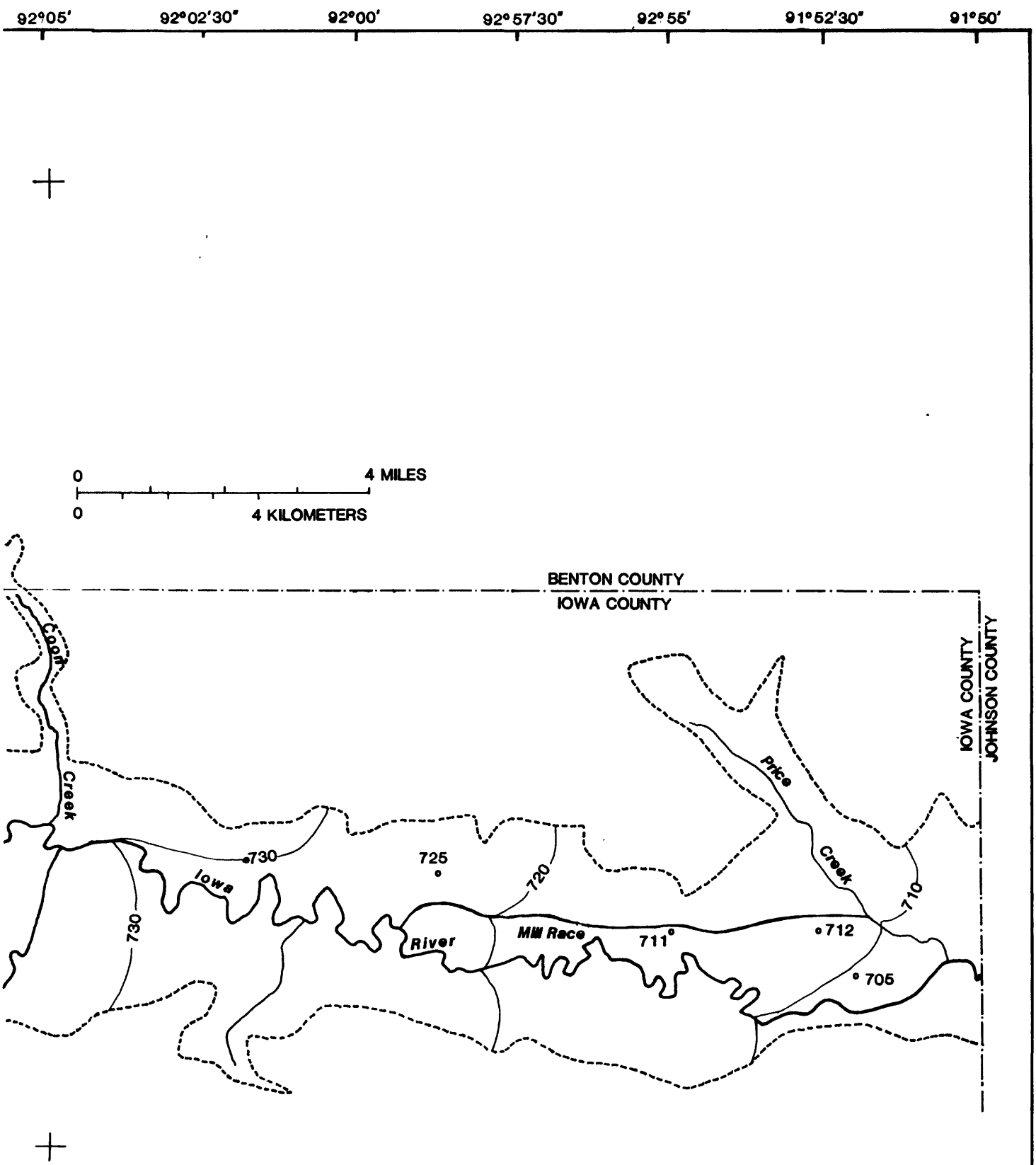

Figure 4.--Water-table surface of Iowa River alluvial aquifer during wet weather (April 1985)--Continued.

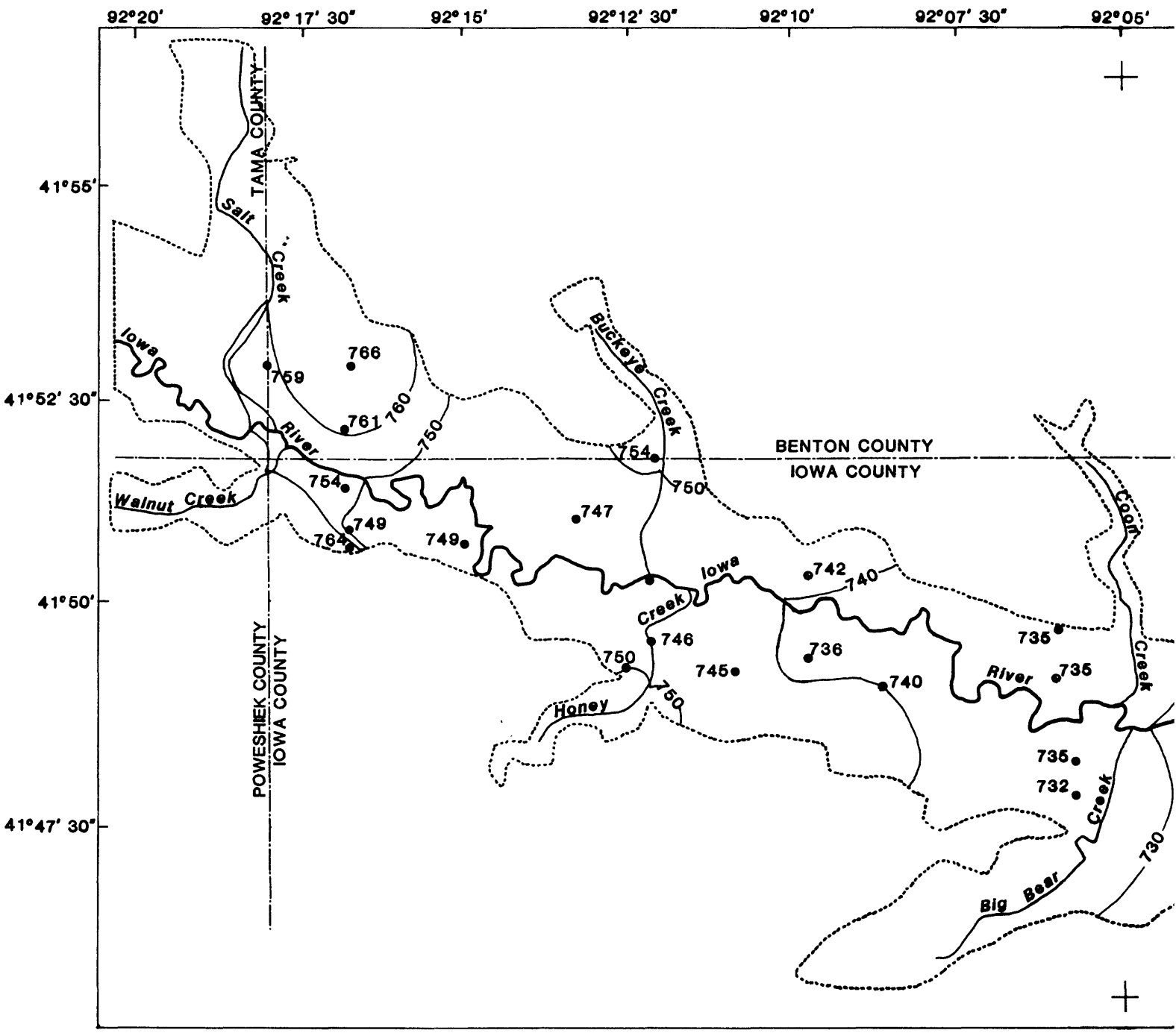

Figure 5.--Water-table surface of the Iowa River alluvial aquifer during dry weather (September 1985).

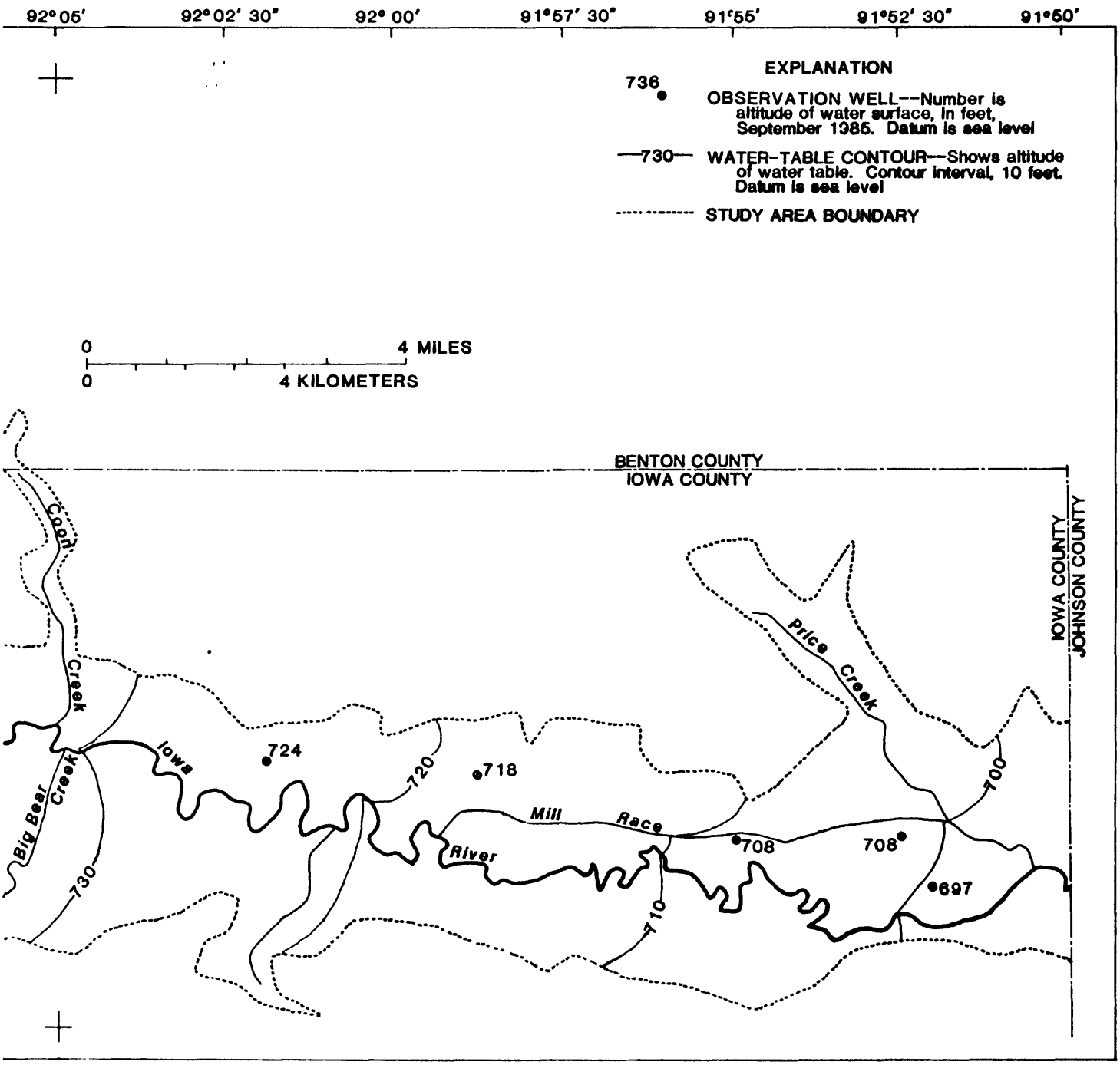

Figure 5.--Water-table surface of the Iowa River alluvial aquifer during dry weather (September 1985) --Continued.

Water in the Iowa River alluvial aquifer is a calcium bicarbonate type with a dissolved-solids concentration usually less than 600 milligrams per liter. Dissolved constituents in ground water and surface water are similar in the study area, especially during low stages when flow in the streams is primarily ground-water discharge from the alluvial aquifer. The median ionic composition of water from the four sources of samples is shown in figure 6. When comparing ionic compositions for the four sources, few differences exist for the primary ions. Nitrate, a minor ion by relative composition, is more prominent in water from municipal wells and area streams than in water from test or domestic wells.

A comparison of two constituents and two properties, summarized by the source of the samples, is shown in figure 7. Nitrogen constituents in municipal wells and area streams are similar; median nitrate concentrations for municipal wells and area streams are similar. Median nitrate concentrations are about 6.0 to 7.0 milligrams per liter for municipal wells and area streams, but are less than 2.0 milligrams per liter for test and domestic wells. This observation may indicate a surface-water effect because most of the municipal wells are adjacent to streams. This also may be related to the pumping characteristics of the wells, and from where in the ground-water profile water is being obtained.

Although all the wells penetrate at least part of the Iowa River alluvial aquifer and derive water from the alluvial sand and gravel, test, domestic, and municipal wells are not uniformly representative of the total population of wells in the area. These well types generally do not have identical physical characteristics. Test wells or piezometers differ from municipal wells because they are pumped intermittently and generally are open to the aquifer in distinct, narrow zones. Generally, domestic wells are more shallow and have considerably less pumpage than municipal wells and generally are older and of less uniform construction than test and municipal wells. Problems associated with domestic wells may include casing deterioration, nearness to septic tanks, and susceptibility to surface runoff entering the well around the casing. Municipal wells generally have longer screened intervals and are pumped at greater volumes than other wells, creating a greater cone of depression in the water table. Consequently, a larger areal and vertical effect on the aquifer is caused by municipal wells.

Maximum concentration data for nitrogen and detected herbicide constituents for the four sources of water-quality samples are summarized in table 1. The maximum concentration of nitrate was 55 milligrams per liter in water from a domestic well. The maximum concentration of these herbicides was 8.1 micrograms per liter metribuzin in water from a shallow test well. Area streams may be a source of nonpoint contaminants, particularly herbicides. Maximum concentrations of atrazine, cyanazine, alachlor, and metolachlor detected in surface water were between 3.7 and 7.0 micrograms per liter, and usually were larger than maximum concentrations detected in ground water.

The S-triazine herbicides--atrazine, cyanazine, and metribuzin--and the phenylamide herbicides--alachlor, metolachlor, and trifuralin--also were detected in ground-water samples.

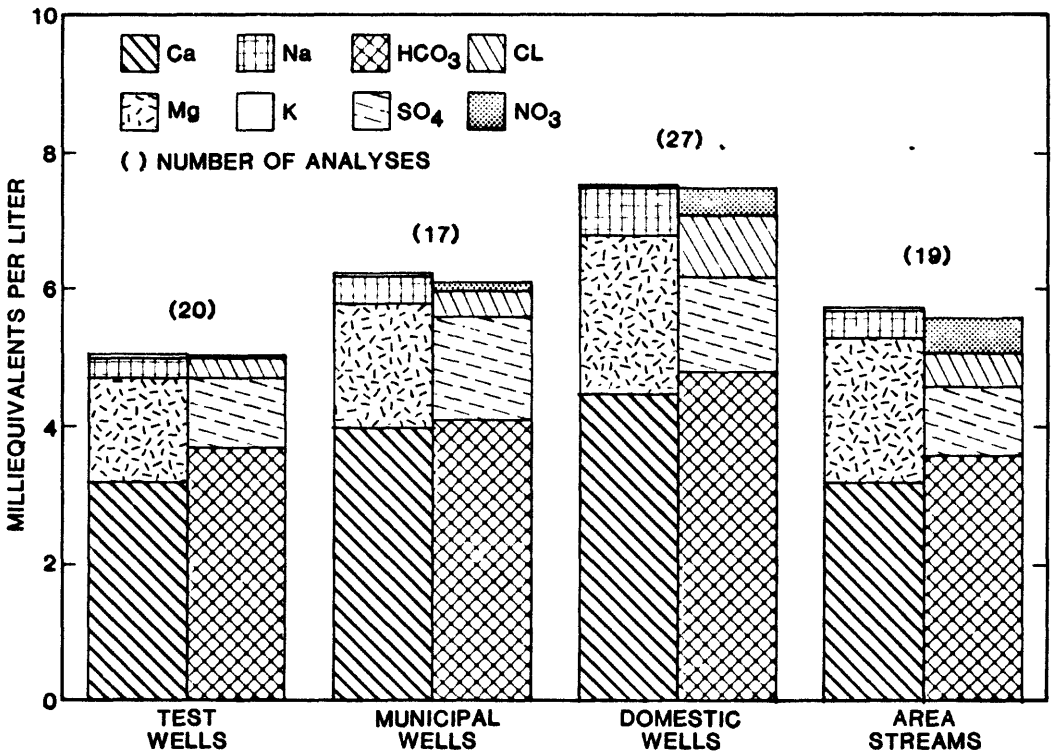

Figure 6.--Median concentrations of major ions for each source of water-quality samples.

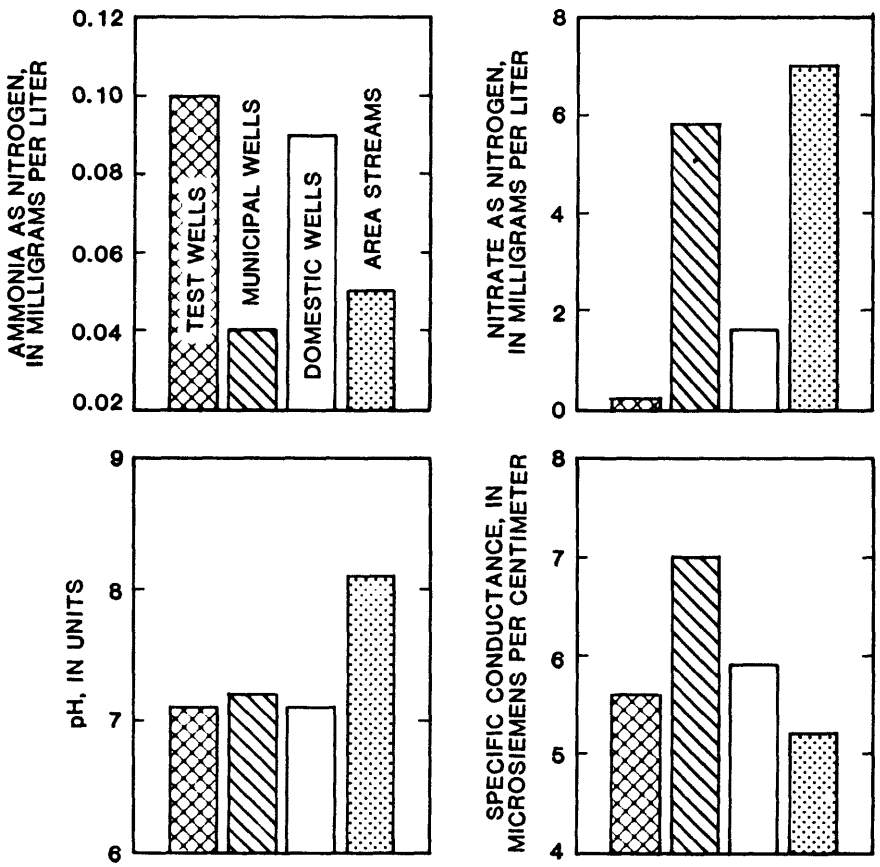

Figure 7.—Median concentrations of ammonia and nitrate and median pH and specific conductance for each source of water-quality samples.

Table 1.--Summary statistics for concentrations of nitrogen and herbicide constituents for each source of water-quality samples

[mg/L, milligrams per liter; <, less than; µg/L, micrograms per liter; nitrogen concentrations are dissolved; herbicide concentrations are total recoverable]

Number of samples	Constituent	Range	Median
	TEST WELLS		
127	Nitrate[1], mg/L as N	<0.10 - 19	0.20
127	Ammonia, mg/L as N	<.01 - 5.30	.10
75	Atrazine, µg/L	<.10 - 2.4	<.10
75	Cyanazine, µg/L	<.10 - .19	<.10
75	Metribuzin, µg/L	<.05 - 8.1	<.05
75	Alachlor, µg/L	<.10	<.10
75	Metolachlor, µg/L	<.10	<.10
75	Trifluralin, µg/L	<.05 - .12	<.05
	DOMESTIC WELLS		
47	Nitrate[1], mg/L as N	<0.10 - 55	1.6
47	Ammonia, mg/L as N	<.01 - 2.0	.09
14	Atrazine, µg/L	<.10 - 1.9	<.10
14	Cyanazine, µg/L	<.10 - .16	<.10
14	Metribuzin, µg/L	<.05	<.05
14	Alachlor, µg/L	<.10 - .65	<.10
14	Metolachlor, µg/L	<.10	<.10
14	Trifluralin, µg/L	<.05	<.05
	MUNICIPAL WELLS		
62	Nitrate[1], mg/L as N	<0.10 - 26	5.9
53	Ammonia, mg/L as N	<.01 - .41	.04
25	Atrazine, µg/L	<.10 - .30	<.10
25	Cyanazine, µg/L	<.10	<.10
25	Metribuzin, µg/L	<.05	<.05
25	Alachlor, µg/L	<.10	<.10
25	Metolachlor, µg/L	<.10	<.10
25	Trifluralin, µg/L	<.05	<.05

Table 1.--Summary statistics for concentrations of nitrogen and herbicide constituents for each source of water-quality samples--Continued

Number of samples	Constituent	Range	Median
	AREA STREAMS		
46	Nitrate[1], mg/L as N	<0.10 - 14	7.2
46	Ammonia, mg/L as N	<.01 - .94	.06
23	Atrazine, µg/L	<.10 - 7.0	.38
23	Cyanazine, µg/L	<.10 - 3.7	.12
23	Metribuzin, µg/L	<.05 - .21	<.05
23	Alachlor, µg/L	<.10 - 6.5	<.10
23	Metolachlor, µg/L	<.10 - 4.7	<.10
23	Trifluralin, µg/L	<.05	<.05

[1] Nitrate plus nitrite, but predominately nitrate.

OCCURRENCE AND DISTRIBUTION OF NITRATE AND HERBICIDES

The distribution and occurrence of selected constituents in water from the Iowa River alluvial aquifer was investigated, with the assumption that soluble nitrate, derived from nitrogen fertilizers, was infiltrating to the underlying water-table aquifer and was migrating as a nonreactive constituent throughout the saturated thickness of the aquifer. Primary nitrate sources were assumed to be soluble nitrate from nitrate salts of mineral fertilizer, nitrate derived from the nitrification of ammonia fertilizers, either ammonium-containing salts or anhydrous ammonia, or nitrate derived from ammonification and nitrification of nitrogenous organic material.

Infiltration of soluble nitrate or pesticides through soil to the water table is a primary mechanism for regional contamination of shallow ground water. Contamination of ground water by nitrate and pesticides also can occur from mishandling or spills of these chemicals in the vicinity of wells because runoff from these spills may flow directly to the well intake.

Another mechanism for the movement of soluble nitrate or pesticides is related to the hydraulic relation between an alluvial aquifer and an adjacent stream. Most alluvial aquifers exchange water with adjacent streams depending on the hydraulic head in the aquifer and stage of the stream. If a discharging well in the aquifer changes the hydraulic gradient so that river water flows into the aquifer, any chemical constituent in the stream will enter the aquifer. If these streams contain nitrate or pesticides, they may be contaminanting the aquifer.

Water-quality data were collected, analyzed, and summarized to describe the areal, vertical, and seasonal patterns of occurrence. At selected sites, water was collected from nested wells to determine the vertical distribution of selected constituents. Seasonal changes of nitrate and herbicides in all well samples, including those from streams, were evaluated to better understand the occurrence of these constituents in the aquifer and adjacent streams.

Areal Distribution

The areal distribution of nitrate in the aquifer is extremely variable (fig. 8). Four ranges of nitrate concentration are plotted; however, no discernible areal pattern is evident. The true areal distribution of nitrate may be masked by inconsistent depths of sampling or incomplete vertical sampling. Sites with nitrate concentrations less than the detection limit are adjacent to or near sites with concentrations of greater than 1.0 milligram per liter.

Water from 41 percent of all wells had nitrate concentrations between 1.1 and 10 milligrams per liter (fig. 9). Nitrate concentrations greater than 10 milligrams per liter, the maximum contaminant level (U.S. Environmental Protection Agency, 1986), were detected in water from 9 percent of the wells. Nitrate concentrations were less than or equal to 1.0 milligram per liter in water from 50 percent of the wells. Water from all of the municipal wells during at least one sampling period, and more than about one-half of the domestic wells, had nitrate concentrations greater than 1.0 milligram per liter.

Vertical Distribution

The reconnaissance sampling of water in area wells indicated that the aquifer probably was not as contaminated as first thought. Water from 80 percent of the test wells had nitrate concentrations of 1.0 milligram per liter or less. The screens for most of the test wells were located near the base of the sand and gravel aquifer. Consequently, the entire profile of ground water in the aquifer was not sampled. Hendry and others (1983) encountered a similar situation when investigating the occurrence of nitrate in a sand aquifer beneath agricultural land in Canada. The vertical distribution of constituents in the Iowa River alluvial aquifer was evaluated. For this study well nests were installed at six of the original test well sites. Each nest consisted of three to four wells drilled to different depths in the aquifer. Detailed sampling was done at these well nests to determine the vertical distribution of chemical constituents.

The vertical distribution of nitrate typically includes larger concentrations at shallower depths, with seasonal variations. Water from wells in five of the six nests had profiles of nitrate concentrations that that were not uniform with depth. Four sites had the largest nitrate concentrations at shallow depths, although the larger concentration was not always at the most shallow depth. At these same sites, the deepest well had nitrate concentrations less than the detection limit (0.1 milligram per liter). The distribution of nitrate at nested site T03N for four months during 1985 is shown in figure 10.

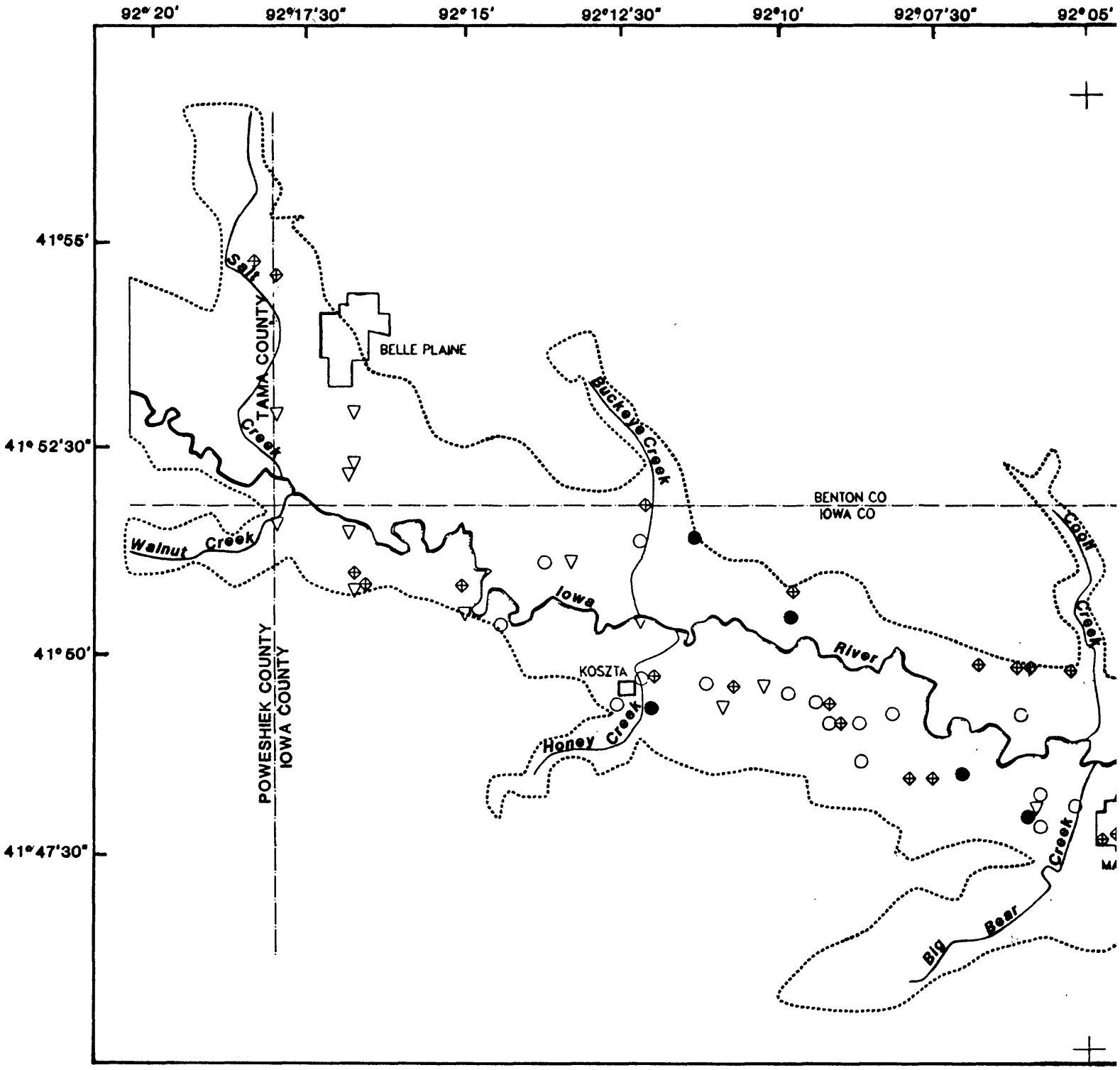

Figure 8.--Areal distribution of nitrate in water from the Iowa River alluvial aquifer.

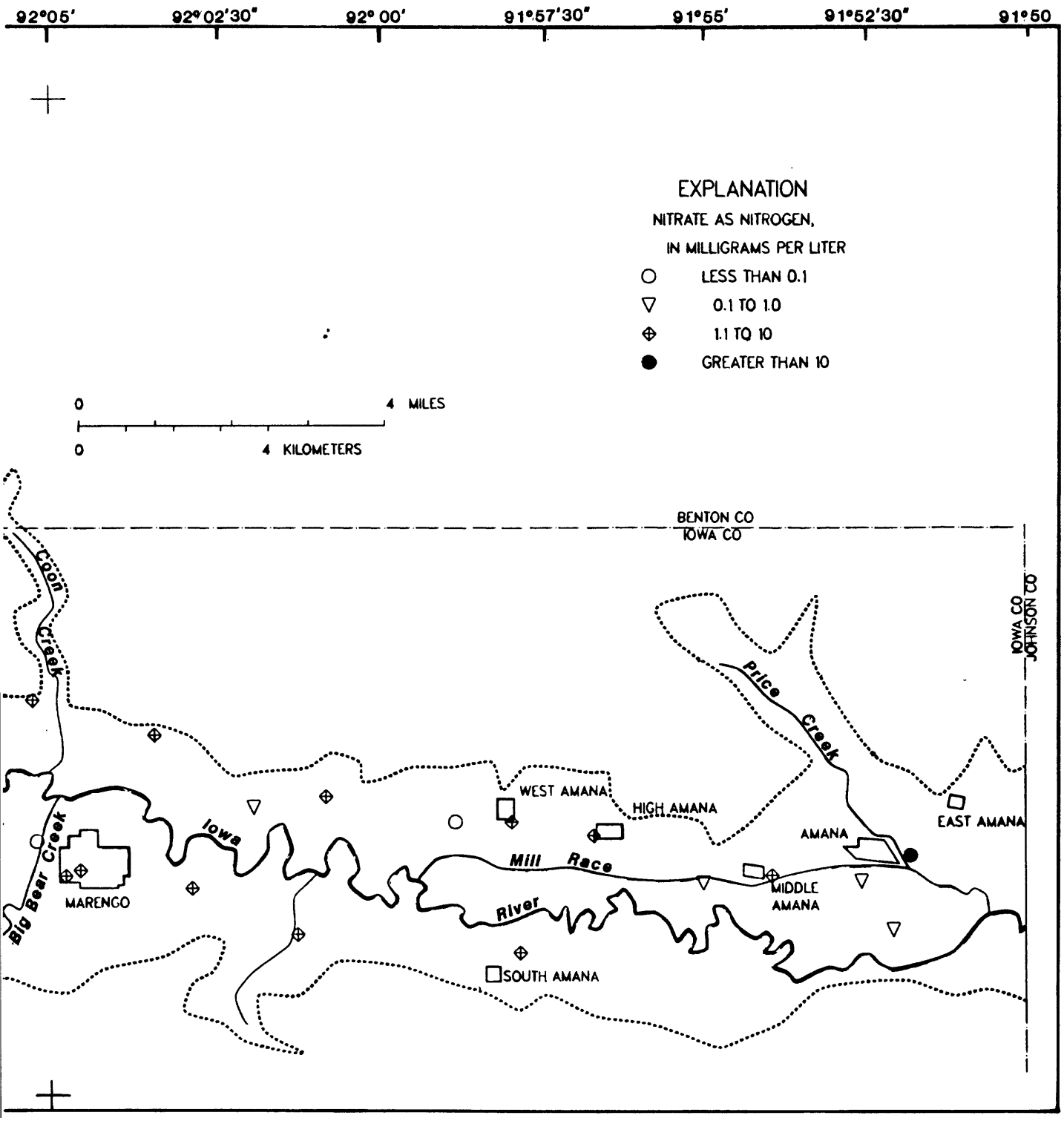

Figure 8.--Areal distribution of nitrate in water from the Iowa River alluvial aquifer --Continued.

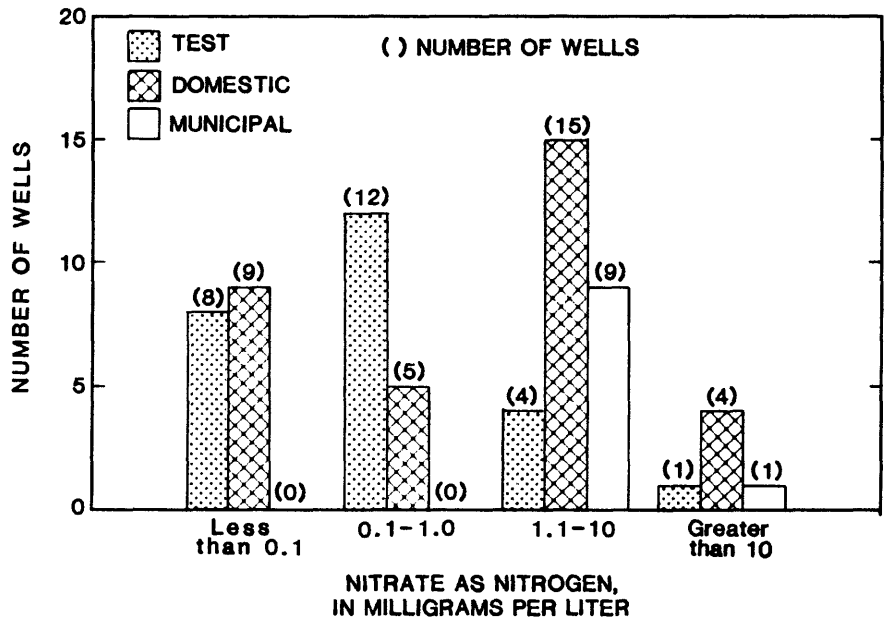

Figure 9.—Distribution of nitrate concentrations by well type.

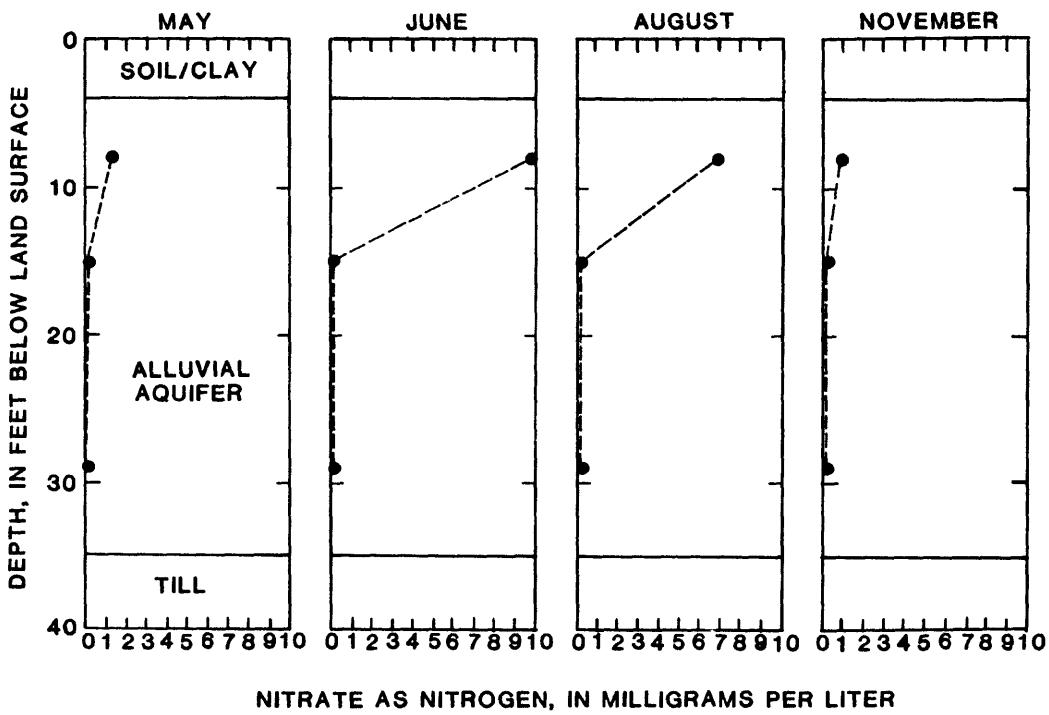

Figure 10.--Vertical profiles of nitrate concentration at well nest site T03N for May, June, August, and November 1985.

Water samples were obtained at 8, 15, and 29 feet below land surface or 4, 11, and 25 feet below the top of the sand and gravel. Seasonal variation of nitrate concentration occurred in the upper part of the aquifer. A nitrate concentration of about 10 milligrams per liter was measured in June and August in water from the shallowest well. Nitrate concentrations near 1 milligram per liter were detected in water from the deeper wells. There is no indication that the seasonal increase in nitrate concentration was distributed to deeper parts of the aquifer.

Unlike the pattern observed in four of the six well nests, nitrate concentrations in water at site T21N were greater with depth, and seasonal variation occurred throughout the vertical profile (fig. 11). At this site, water samples were obtained at 12, 15, 18, and 23 feet below land surface or 2, 5, 8, and 13 feet below the top of the sand and gravel. At site T21N the largest nitrate concentrations generally occurred in water from wells 15 to 18 feet deep. In June 1985, the maximum concentration (19 milligrams per liter) was detected at 18 feet deep. Concentrations of nitrate were less than 10 milligrams per liter in water from the shallowest well in the nest.

The marked decrease in nitrate concentration with depth in water from four of the six well nests was not anticipated. Two theories could explain the vertical distribution of nitrate. First, the process of vertical dispersion is particularly weak in the aquifer, and the movement of nitrate-enriched water within the aquifer primarily is horizontal. Based on field observations and the proximity of well nest T03N to marshy areas, T03N is likely in a discharge area. Infiltrating contaminants move laterally and concentrate at the top of the saturated zone. Detectable nitrate concentrations are almost nonexistent for water from deeper depths. Water from these depths has been in the system longer and has had more time to be diluted and acted on by physical and chemical processes. Based on field observations and the proximity of the site to the aquifer boundaries, T21N is in a recharge area. The vertical component of ground-water flow is greater, and contaminants move downward through the saturated zone. This recharge area is located almost exclusively in farm land. Water from deeper depths in this profile has not been in the system long and is representative of infiltration. Dilution and other physical and chemical processes have not significantly affected the chemical quality of this recharge water. Clay layers, which can significantly alter or retard vertical migration of ground water, may be present.

Another theory that could explain this nonuniform vertical distribution is water moving vertically within the aquifer could lose nitrate through denitrification because the nitrate ion is a reactive solute in the aquifer. The more shallow zones in the aquifer may have conditions favorable for denitrification so nitrate entering the aquifers may be transformed by bacterial reduction of nitrate ion to nitrous oxide and molecular nitrogen under anoxic conditions.

Denitrification may occur where the following conditions are present: small concentrations of dissolved-oxygen; sufficient sources of dissolved organic carbon to sustain biologic activity; reducing conditions; and a slight increase in bicarbonate concentration and a slight decrease in pH (Doner and Velz, 1973). Generally, these conditions occur at site T03N (fig. 12).

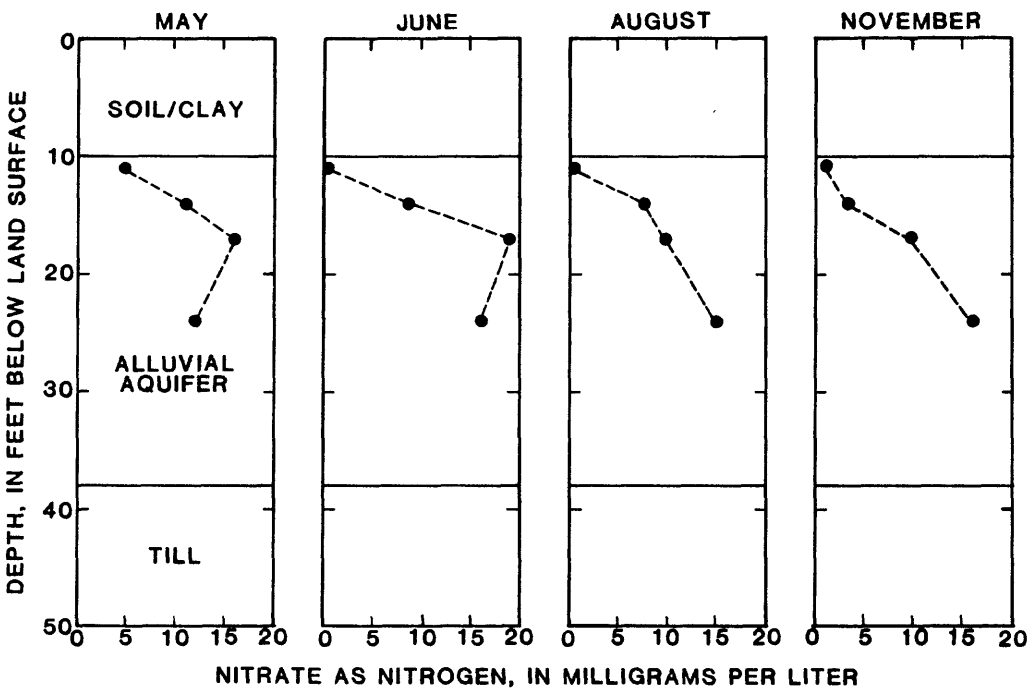

Figure 11.--Vertical profiles of nitrate concentration at well nest T21N for May, June, August, and November 1985.

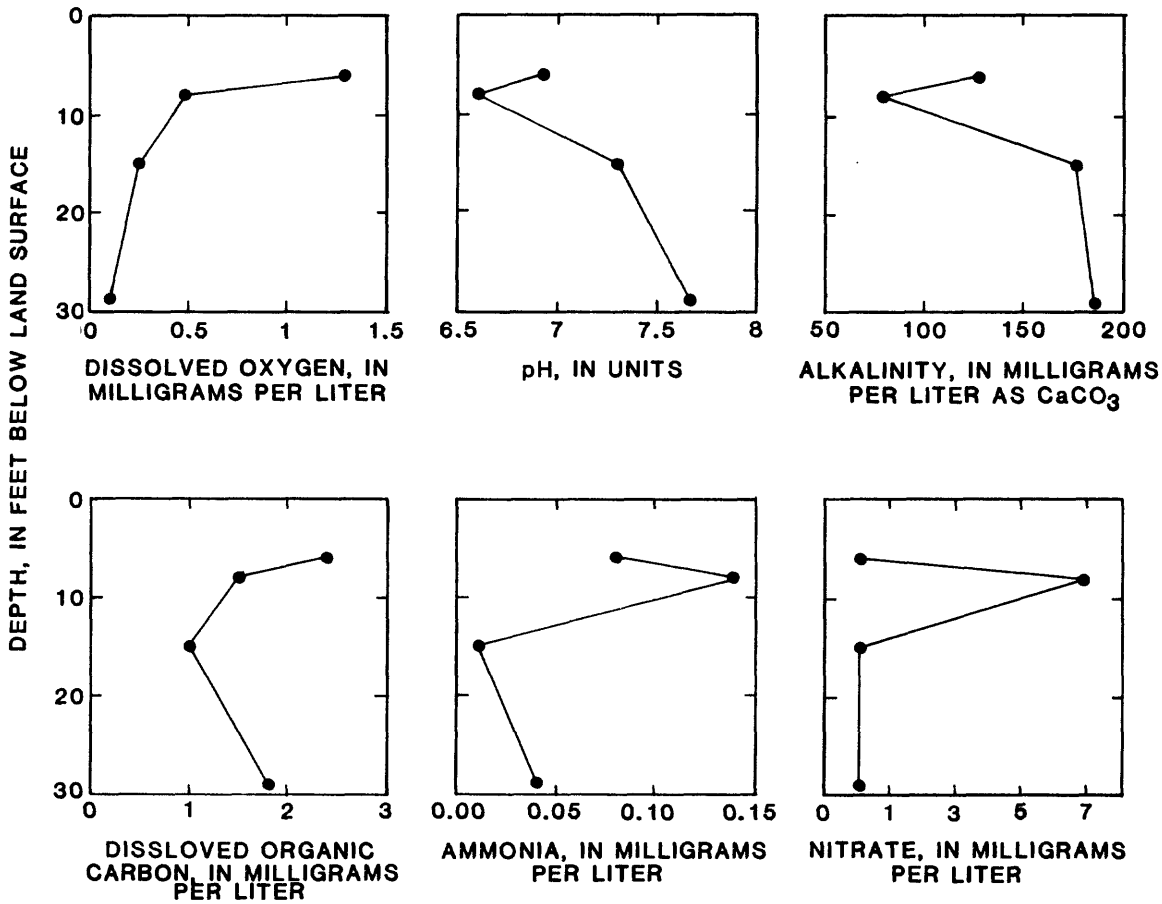

Figure 12.--Vertical variation of selected water-quality constituents at well nest T03N.

Dissolved-oxygen concentrations decrease to almost zero with depth. Considerable vertical variation of pH is apparent with minimum values near the top of the aquifer. Alkalinity concentrations tend to increase slightly with depth. No Eh measurements were obtained to determine redox conditions. With the exception of the deepest well, dissolved organic carbon concentrations were greatest at the top, and decreased to less than 1 milligram per liter at a 12-foot depth. Data are inconclusive to support denitrification as the explanation for the nitrate distribution, although the two primary limiting factors for microbial denitrification, dissolved oxygen and organic carbon, do vary in the aquifer in a pattern that possibly indicates a denitrification potential.

Herbicides exhibit nonuniform vertical distribution similar to that of nitrate. Detectable concentrations of triazine herbicides, collected at well nests at T21N, T03N, and T05N sampled in June or August 1985 were greatest at shallowest depths in the aquifer (fig. 13). Herbicides were not detected in the majority of the saturated thickness. Well nest T21N was adjacent to a soybean field in 1985, the first time soybeans were planted there since 1981. Metribuzin, a herbicide used for soybean weed control, was detected in significant concentrations in the most shallow part of the aquifer during 1985 sampling. The other two well nests, T03N and T05N, are in areas planted primarily in corn. Atrazine, a herbicide used for corn, was detected in water from these wells.

Seasonal Variation

Detectable concentrations of nitrate and herbicides in water from the Iowa River alluvial aquifer vary seasonally. Seasonal variation of nitrate, indicated by ground-water samples from two domestic wells, is shown in figure 14. Precipitation from storms that occur after application of agricultural chemicals may leach some of the chemicals into the aquifer. Maximum nitrate concentrations occurred about 6 weeks after field applications.

Seasonal variations of atrazine at municipal well M63 and in a nearby stream are shown in figure 15. The well is south of Middle Amana (fig. 1) and several hundred feet from Mill Race. Mill Race is a controlled manmade diversion of the Iowa River used for power generation. The diversion begins just east of Amana and extends west for about 11 miles before joining the Iowa River again south of West Amana. The diversion was dug in the middle 1800's. Apart from the typical spring increase of herbicide concentration in Mill Race, the aquifer and the stream had similar atrazine concentrations for an extended period. Crops are not grown in the vicinity of the well; therefore, atrazine contamination may be from the stream. If the stream contains significant concentrations of nitrate or pesticides, the stream could be an indirect source of contaminants to the well. This also could apply to pumped wells that increase recharge to the ground-water system from the stream.

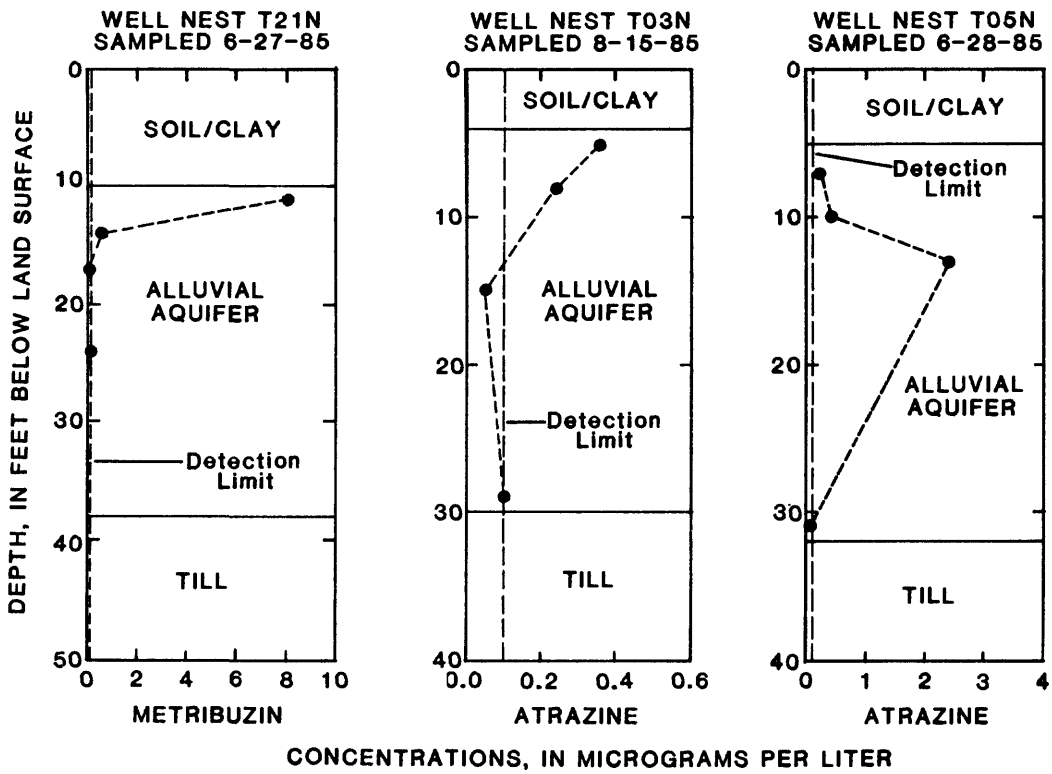

Figure 13.--Vertical profile of triazine herbicide concentrations at well nests T21N, T03N, and T05N.

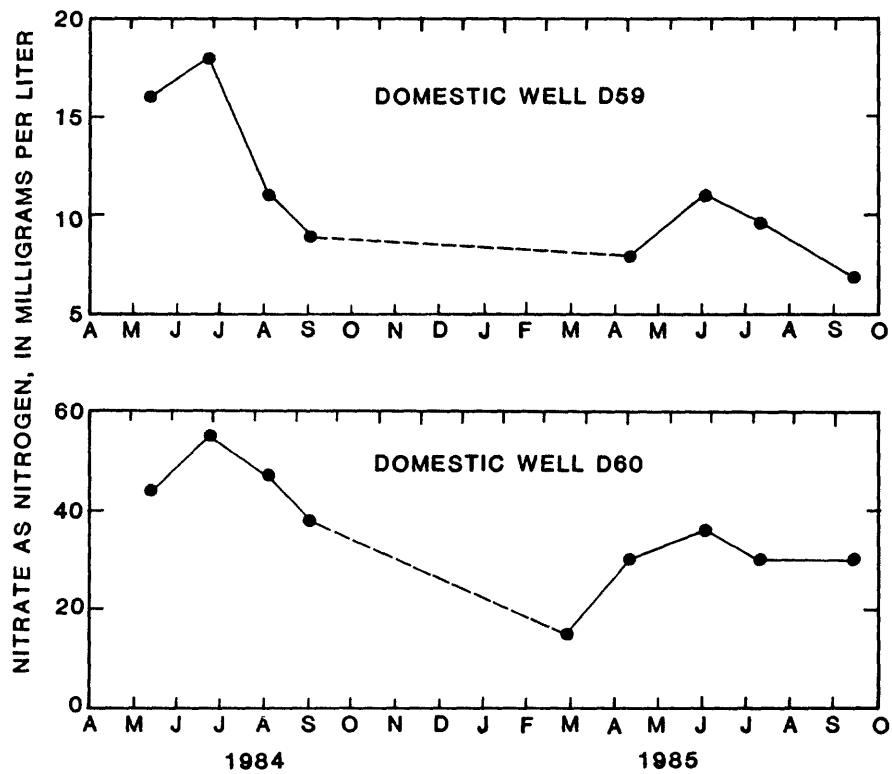

Figure 14.--Seasonal variation of nitrate in water from domestic wells D59 and D60.

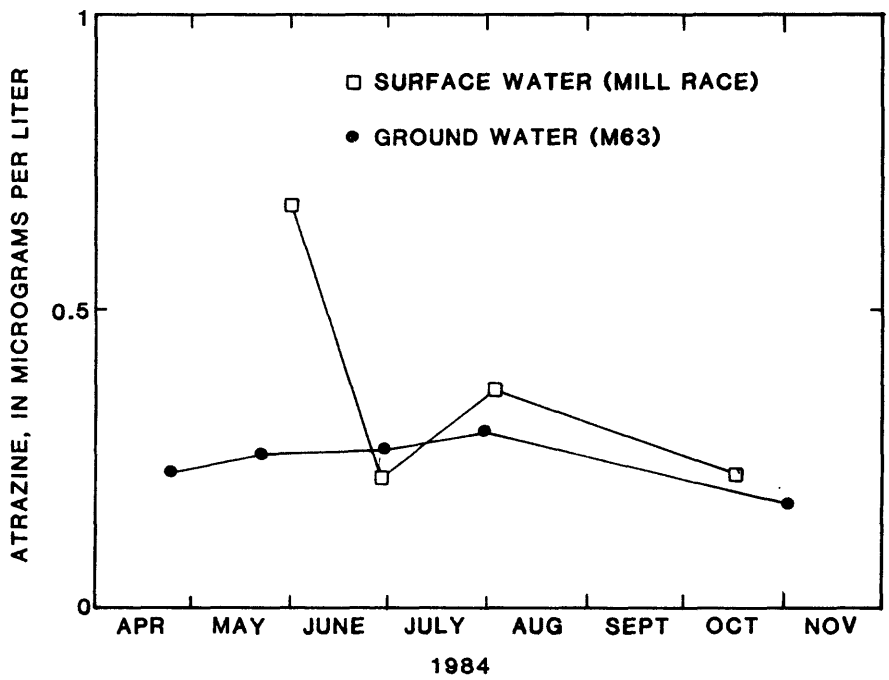

Figure 15.--Comparison of seasonal variation of atrazine concentration at municipal well M63 and Mill Race.

SUMMARY AND CONCLUSIONS

Previous investigations indicate that nitrate and pesticides, especially herbicides, are moving to shallow ground water in Iowa. From May 1984 to November 1985, the U.S. Geological Survey collected water-quality samples from ground- and surface-water sites in the Iowa River alluvial aquifer. The samples were analyzed by the University of Iowa Hygienic Laboratory.

The occurrence and distribution of nitrate and selected herbicides were determined in the Iowa River alluvial aquifer, a sand and gravel aquifer beneath agricultural land along the Iowa River in Iowa County, Iowa. Test drilling and water-quality sampling of the aquifer indicate that the areal distribution of nitrate in the aquifer is variable. Nitrate (as nitrogen) concentrations range from less than 0.10 to 19 milligrams per liter. Although nitrate distribution is variable, extensive aquifer contamination by nitrate is not apparent. Median nitrate concentrations were 5.9 milligrams per liter for municipal wells and 7.2 milligrams per liter for area streams, but were less than 2.0 milligrams per liter for test wells and domestic wells. Atrazine, cyanazine, metribuzin, alachlor, metolachlor, and trifluralin were detected in ground-water samples. Maximum concentration of atrazine in ground-water samples was 2.4 micrograms per liter; maximum concentration of metribuzin was 8.1 micrograms per liter. Area streams also contain herbicides in concentrations generally larger than concentrations in ground water. At a municipal well adjacent to a stream, similar seasonal concentrations of atrazine were detected for both ground- and surface-water samples. Surface water sometimes may be a source of nitrate and herbicides to adjacent ground water.

Detailed sampling of vertical profiles using well nests indicated that the distribution of nitrate and selected herbicides is not vertically homogeneous. Generally, larger nitrate concentrations were detected at shallow depths in the aquifer; at greater depths, the nitrate concentrations were near the detection limit. Herbicides were detected in a pattern similar to that determined for nitrate. The true areal distribution of nitrate may be masked by inconsistent depths of sampling or incomplete vertical sampling. Variations in nitrate concentrations with depth possibly are because local aquifer flow is predominantly horizontal and may limit significant vertical dispersion of nitrate and herbicides, and because nitrate may not act conservatively in ground water and may be removed from the system by denitrification.

Seasonal variation of nitrate and herbicides also was determined for domestic and test wells. For nested wells, the variations were greater at the shallower sampling depths. Seasonal variations of nitrate and herbicides illustrate that these constituents move quickly from surface application to shallow underlying aquifers. These constituents can be detected in ground water soon after chemical applications, usually within 6 weeks.

REFERENCES CITED

Doner, H.E., and Volz, M.G., 1973, Column studies on denitrification in soil, in Nitrate in effluents from irrigated lands: Annual Report to National Science Foundation, University of California, Davis.

Freeze, R.A., and Cherry, J.A., 1979, Ground water: Prentice Hall, p. 28.

Hallberg, G.R., 1984, Agricultural chemicals and groundwater quality in Iowa: Cooperative Extension Service Report CE-2081j, Iowa State University, 6 p.

Hallberg, G.R., Fenton, T.E., Miller, G.A., and Lutenegger, A.J., 1978, The Iowan erosion surface--An old story, an important lesson, and some new wrinkles: 42nd Annual Tri-State Geological Field Conference Guidebook: Iowa Geological Survey, p. 2-1 - 2-94.

Hallberg, G.R., Hoyer, B.E., Bettis, E.A., and Libra, R.D., 1983, Hydrogeology, water quality and land management in the Big Springs basin, Clayton County, Iowa: Iowa Geological Survey Contract Report 82-5500-02, 189 p.

Hendry, M.J., Gillham, R.W., and Cherry, J.A., 1983, An integrated approach to hydrogeologic investigations--A case history: Journal of Hydrology, v. 63, p. 211-232.

Highland, J.D., and Didericksen, R.I., 1967, Soil survey of Iowa County, Iowa: Soil Conservation Service, U.S. Department of Agriculture, 162 p.

Kelly, R.D., 1985, Synthetic organic compound sampling survey of public water supplies: Iowa Department of Water, Air, and Waste Management Report, 32 p.

Kelly, R.D., and Wnuk, M., 1986, Little Sioux River synthetic organic compound municipal well sampling survey: Iowa Department of Water, Air, and Waste Management Report, 24 p.

Madison, R.J., and Brunett, J.O., 1984, Overview of the occurrence of nitrate in ground water of the United States, in National Water Summary 1984--Water-Quality Issues: U.S. Geological Survey Water-Supply Paper 2275, p. 93-103.

McDonald, D.B., and Splinter, R.C., 1982, Long-term trends in nitrate concentration in Iowa water supplies: Research and Technology Journal, American Water Works Association, v. 74, no. 8, p. 437-440.

Prior, J.C., 1976, A regional guide to Iowa landforms: Iowa Geological Survey Educational Series 3, 72 p.

U.S. Environmental Protection Agency, 1986, Maximum contaminant levels (subpart B of part 141, National interim primary drinking-water regulations): U.S. Code of Federal Regulations, Title 40, parts 100 to 149, revised as of July 1, 1986, p. 524-528.

SUPPLEMENTAL DATA

Table 2.--Water-level data for test wells

[Water levels in feet below land surface datum; *, highest water level; #, lowest water level; readings above land surface indicated by +]

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well TO2A							
10-12-84	9.76	2-12-85	9.50	6-06-85	9.06	10-16-85	11.91
10-31-84	8.09	3-12-85	*6.22	7-09-85	10.30	11-16-85	9.14
12-10-84	8.97	4-09-85	6.66	8-01-85	11.39	12-26-85	9.60
1-10-85	8.09	5-08-85	7.90	9-02-85	#12.52	1-29-86	10.00
Observation well TO3A							
10-12-84	3.17	2-12-85	2.69	6-06-85	2.57	10-15-85	4.56
10-31-84	1.44	3-12-85	*+ .01	7-09-85	3.50	11-06-85	1.84
12-10-84	2.03	4-09-85	1.10	8-01-85	4.43	12-26-85	2.31
1-10-85	1.55	5-06-85	1.85	9-02-85	#5.39	1-29-86	2.52
Observation well TO4A							
10-12-84	5.75	2-12-85	5.79	6-06-85	6.15	10-15-85	7.75
10-31-84	4.69	3-12-85	*2.47	7-09-85	7.01	11-06-85	5.81
12-10-84	5.54	4-09-85	3.46	8-01-85	7.60	12-26-85	5.60
1-10-85	4.34	5-06-85	4.79	9-02-85	#8.23	1-29-86	5.51
Observation well TO5A							
10-12-84	4.13	2-12-85	3.75	6-06-85	4.12	10-15-85	5.56
10-31-84	2.51	3-12-85	* .64	7-09-85	4.81	11-06-85	3.90
12-10-84	3.37	4-09-85	1.40	8-01-85	5.43	12-26-85	3.52
1-10-85	2.45	5-06-85	3.00	9-02-85	#5.97	1-29-86	3.55
Observation well TO6							
10-31-84	6.53	3-12-85	*4.80	7-09-85	7.66	11-06-85	7.07
12-10-84	6.20	4-09-85	5.36	8-01-85	8.41	12-26-85	6.65
1-10-85	5.81	5-06-85	5.94	9-02-85	#9.26	1-29-86	6.85
2-12-85	6.50	6-06-85	6.70	10-04-85	9.25		
Observation well TO7							
10-31-84	17.44	3-12-85	*13.35	8-01-85	#18.19	12-26-85	16.36
12-10-84	16.85	4-09-85	14.29	9-02-85	18.13	1-29-86	16.25
1-10-85	15.30	5-06-85	16.03	10-04-85	16.43		
2-12-85	16.84	6-06-85	17.30	11-06-85	16.79		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well TO9							
10-31-84	11.77	3-12-85	10.98	7-09-85	12.02	11-06-85	12.63
12-10-84	11.89	4-09-85	*10.65	8-09-85	12.54	12-26-85	11.95
1-10-85	11.24	5-06-85	11.58	9-02-85	12.77	1-29-86	11.65
2-12-85	11.37	6-06-85	12.07	10-17-85	#12.90		
Observation well T10							
10-31-84	5.83	3-12-85	5.12	7-09-85	7.40	11-06-85	6.73
12-10-84	6.40	4-09-85	*5.06	8-01-85	8.50	12-26-85	6.60
1-10-85	5.64	5-06-85	5.90	9-02-85	9.60	1-29-86	6.96
2-12-85	6.71	6-06-85	6.80	10-04-85	#9.65		
Observation well T11							
10-31-84	5.99	3-12-85	*3.94	7-09-85	6.98	11-06-85	6.84
12-10-84	6.23	4-09-85	4.25	8-01-85	7.56	12-26-85	6.26
1-10-85	5.07	5-06-85	5.40	9-02-85	8.12	1-29-86	6.02
2-12-85	6.13	6-06-85	6.34	10-04-85	#8.17		
Observation well T12							
10-31-84	7.87	3-12-85	5.95	7-09-85	8.68	11-06-85	8.40
12-10-84	7.85	4-09-85	*5.64	8-01-85	9.05	12-26-85	7.58
1-10-85	7.03	5-06-85	7.56	9-02-85	#9.53	1-29-86	7.10
2-12-85	7.34	6-06-85	8.20	10-04-85	9.52		
Observation well T13							
10-31-84	10.68	3-12-85	10.20	7-09-85	13.14	11-06-85	11.18
12-10-84	11.40	4-07-85	* 9.12	8-01-85	14.54	12-26-85	12.55
1-10-85	10.63	5-06-85	10.30	9-02-85	#16.02	1-29-86	11.77
2-12-85	10.87	6-06-85	11.00	10-04-85	13.51		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well T14							
10-31-84	11.27	3-12-85	*7.10	7-09-85	11.94	11-06-85	10.77
12-10-84	11.31	4-09-85	8.10	8-01-85	12.54	12-26-85	10.76
1-10-85	9.79	5-06-85	10.03	9-02-85	#12.68	1-29-86	10.70
2-12-85	10.99	6-06-85	11.49	10-04-85	11.04		
Observation well T15							
10-31-84	2.52	3-12-85	*1.56	7-09-85	3.66	11-06-85	2.26
12-10-84	2.92	4-09-85	1.92	8-01-85	4.62	12-26-85	2.62
1-10-85	2.47	5-06-85	2.65	9-02-85	#5.34	1-29-86	3.00
2-12-85	3.40	6-06-85	3.30	10-04-85	4.44		
Observation well T16							
10-31-84	3.92	3-12-85	*2.28	7-09-85	5.58	11-06-85	4.07
12-10-84	4.09	4-09-85	2.88	8-01-85	6.25	12-26-85	4.14
1-10-85	3.46	5-06-85	4.07	9-02-85	#6.97	1-29-86	3.80
2-12-85	4.63	6-06-85	4.98	10-04-85	6.53		
Observation well T17							
10-31-84	19.14	3-12-85	*17.29	7-09-85	19.64	11-06-85	21.07
12-10-84	19.73	4-09-85	17.79	8-01-85	20.31	12-26-85	20.82
1-10-85	19.10	5-06-85	18.07	9-02-85	21.03	1-29-86	20.67
2-12-85	19.73	6-06-85	18.80	10-04-85	#21.49		
Observation well T18							
10-31-84	2.58	3-12-85	*+0.05	7-09-85	3.24	12-26-85	2.16
12-10-84	2.71	4-09-85	.69	8-01-85	4.06	1-29-86	2.35
1-10-85	1.10	5-06-85	1.82	9-02-85	#4.77		
2-12-85	2.61	6-06-85	2.63	10-04-85	4.64		
Observation well T19							
10-31-84	9.77	3-12-85	*4.53	7-09-85	10.32	11-06-85	9.91
12-10-84	9.94	4-09-85	6.34	8-01-85	10.93	12-26-85	9.44
1-10-85	8.04	5-06-85	7.50	9-02-85	#11.53	1-29-86	9.51
2-12-85	9.19	6-06-85	9.54	10-17-85	10.51		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well T20							
10-31-84	3.23	4-05-85	1.85	8-10-85	5.83	12-15-85	3.62
12-10-84	3.38	4-10-85	2.46	8-20-85	6.17	12-20-85	3.73
12-15-84	3.45	4-15-85	2.62	8-25-85	6.28	12-25-85	3.82
12-20-84	2.83	4-20-85	2.78	8-31-85	6.32	12-31-85	3.95
12-25-84	3.05	4-25-85	2.92	9-02-85	6.42	1-05-86	3.95
12-30-84	2.11	4-30-85	3.02	9-05-85	6.57	1-10-86	4.12
1-05-85	2.63	5-05-85	2.93	9-10-85	6.77	1-15-86	4.20
1-10-85	2.86	5-10-85	3.07	9-15-85	#6.78	1-20-86	3.80
1-15-85	3.08	5-15-85	2.94	9-20-85	6.73	1-25-86	3.50
1-20-85	3.27	5-20-85	3.12	9-25-85	6.66	2-10-86	3.25
1-25-85	3.41	5-25-85	3.22	9-30-85	6.53	2-15-86	3.10
1-31-85	3.46	5-30-85	3.35	10-05-85	6.61	2-20-86	3.05
2-05-85	3.63	6-05-85	3.57	10-10-85	6.25	2-25-86	3.07
2-10-85	3.85	6-10-85	3.77	10-15-85	5.28	2-28-86	2.97
2-15-85	3.92	6-15-85	3.37	10-20-85	5.00	3-05-86	2.17
2-20-85	3.76	6-20-85	3.57	10-25-85	4.37	3-10-86	1.82
2-25-85	2.75	6-25-85	3.82	10-31-85	4.43	3-15-86	1.03
2-28-85	2.59	6-30-85	4.03	11-05-85	3.70	3-20-86	* .70
3-04-85	1.47	7-05-85	4.21	11-10-85	3.86	3-25-86	1.20
3-05-85	1.88	7-10-85	4.48	11-15-85	3.20	3-31-86	1.88
3-10-85	1.42	7-15-85	4.70	11-20-85	2.77	4-05-86	1.82
3-15-85	1.65	7-20-85	4.92	11-25-85	2.88	4-10-86	2.27
3-20-85	2.12	7-25-85	5.13	11-30-85	3.18	4-15-86	2.42
3-25-85	2.37	7-31-85	5.36	12-05-85	3.37	4-20-86	2.45
3-30-85	2.45	8-05-85	5.58	12-10-85	3.53		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well T21A							
10-31-84	6.38	3-11-86	3.04	6-09-86	2.59	7-28-86	3.70
12-10-84	6.69	3-27-86	2.09	6-16-86	2.53	7-30-86	3.91
1-10-85	5.43	4-01-86	3.04	6-18-86	2.87	8-05-86	4.31
2-12-85	6.27	4-09-86	3.44	6-23-86	2.69	8-08-86	4.36
3-12-85	3.23	4-11-86	4.41	6-25-86	2.95	8-18-86	2.51
4-09-85	4.50	4-22-86	4.11	6-27-86	3.18	8-27-86	3.95
5-06-85	5.61	5-12-86	3.67	6-30-86	.91	9-01-86	4.50
6-06-85	6.60	5-19-86	.80	7-03-86	1.07	9-02-86	4.57
7-09-85	7.29	5-21-86	1.09	7-07-86	1.64	9-05-86	4.90
8-01-85	8.03	5-23-86	1.54	7-09-86	.80	9-08-86	5.17
9-02-85	#8.72	5-28-86	*0.45	7-14-86	2.04	9-15-86	5.30
10-16-85	7.82	5-30-86	.72	7-16-86	2.40	9-19-86	5.02
12-26-85	7.06	6-02-86	1.82	7-18-86	2.80	9-22-86	4.49
1-29-86	7.33	6-04-86	2.10	7-22-86	3.30	9-24-86	2.55
2-25-86	4.80	6-06-86	2.20	7-24-86	3.47	9-26-86	1.33
Observation well T22							
10-31-84	1.92	3-12-85	*+0.26	7-09-85	4.75	11-06-85	3.10
12-10-84	2.53	4-09-85	2.20	8-01-85	5.70	12-26-85	2.69
1-10-85	1.51	5-06-85	2.40	9-02-85	#6.40	1-29-86	2.77
2-12-85	2.28	6-06-85	3.62	10-04-85	4.00		
Observation well T23							
10-31-84	7.27	3-12-85	*5.84	7-09-85	9.35	11-06-85	8.45
12-10-84	8.24	4-09-85	6.74	8-01-85	9.40	12-26-85	8.31
1-10-85	6.15	5-06-85	8.13	9-02-85	9.44	1-29-86	8.51
2-12-85	#9.82	6-06-85	9.25	10-04-85	8.40		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well T24							
12-10-84	8.28	4-05-85	7.00	8-25-85	10.95	1-10-86	9.17
12-15-84	8.29	4-10-85	7.26	8-31-85	11.06	1-15-86	9.18
12-20-84	8.14	4-15-85	7.50	9-02-85	11.09	1-20-86	8.82
12-25-84	8.26	4-20-85	7.80	9-05-85	11.09	1-25-86	8.78
12-30-84	6.95	4-25-85	7.95	9-10-85	#11.25	1-31-86	8.95
1-05-85	7.55	4-30-85	8.15	9-15-85	11.14	2-05-86	8.59
1-10-85	7.75	5-05-85	8.32	9-20-85	11.10	2-10-86	6.85
1-15-85	8.00	5-10-85	8.53	9-25-85	11.01	2-15-86	7.41
1-20-85	8.18	5-15-85	8.43	9-30-85	10.94	2-20-86	7.20
1-25-85	8.35	5-20-85	8.62	10-05-85	10.97	2-25-86	7.88
1-31-85	8.40	5-25-85	8.74	10-10-85	10.26	2-28-86	7.95
2-05-85	8.57	5-30-85	8.83	10-15-85	10.53	3-05-86	6.53
2-10-85	8.72	6-05-85	9.06	10-20-85	10.38	3-10-86	5.60
2-15-85	8.78	6-10-85	9.20	10-25-85	10.15	3-15-86	3.85
2-20-85	8.77	6-15-85	9.27	10-31-85	10.03	3-20-86	*3.05
2-21-85	6.88	6-20-85	9.39	11-05-85	9.65	3-25-86	3.57
2-22-85	4.52	6-25-85	9.55	11-10-85	9.58	3-31-86	5.74
2-25-85	3.11	6-30-85	9.67	11-15-85	9.14	4-05-86	6.05
2-28-85	4.10	7-05-85	9.85	11-20-85	8.87	4-10-86	6.33
3-02-85	5.77	7-10-85	10.00	11-25-85	8.73	4-15-86	6.61
3-04-85	4.52	7-15-85	10.14	11-30-85	8.84	4-20-86	6.80
3-05-85	3.73	7-20-85	10.28	12-05-85	8.77	4-25-86	7.05
3-10-85	5.33	7-25-85	10.44	12-10-85	8.85	4-30-86	6.25
3-12-85	6.16	7-31-85	10.48	12-15-85	8.91	5-05-86	6.50
3-15-85	6.55	8-05-85	10.52	12-20-85	8.97	5-10-86	7.00
3-20-85	7.08	8-10-85	10.65	12-25-85	8.84	5-15-86	6.75
3-25-85	7.33	8-15-85	10.75	12-31-85	8.99	5-20-86	3.68
3-30-85	7.06	8-20-85	10.87	1-05-86	9.00		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well T25							
12-10-84	3.96	4-09-85	2.30	8-01-85	6.14	1-29-86	4.40
1-10-85	3.10	5-06-85	3.05	9-02-85	#6.95		
2-12-85	4.22	6-06-85	4.20	10-15-85	6.00		
3-12-85	*1.15	7-09-85	5.32	12-26-85	4.05		
Observation well T26A							
12-10-84	6.09	4-09-85	5.08	8-01-85	8.25	12-26-85	7.51
1-10-85	6.05	5-06-85	6.32	9-02-85	8.95	1-29-86	7.54
2-12-85	6.97	6-06-85	7.08	10-04-85	#8.98		
3-12-85	*4.82	7-09-85	7.71	11-06-85	7.80		
Observation well T27							
12-10-84	3.52	4-09-85	*2.35	7-09-85	5.12	10-04-85	6.19
1-10-85	3.07	5-06-85	3.85	8-01-85	5.88	12-26-85	4.25
2-12-85	4.48	6-06-85	4.44	9-02-85	#6.57		

Table 2.--Water-level data for test wells--Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Observation well T28A							
12-10-84	3.50	4-30-85	3.51	9-05-85	6.54	1-25-86	5.58
12-15-84	3.34	5-05-85	3.71	9-10-85	6.66	1-31-86	4.11
12-20-84	3.06	5-10-85	3.95	9-15-85	6.72	2-05-86	2.95
12-25-84	3.36	5-15-85	3.21	9-20-85	#6.80	2-10-86	2.45
12-30-84	2.72	5-20-85	3.65	9-25-85	5.50	2-15-86	2.30
1-10-85	3.03	5-25-85	3.90	9-30-85	6.15	2-20-86	2.25
1-15-85	3.78	5-30-85	4.07	10-05-85	6.14	2-25-86	4.07
2-12-85	4.44	6-05-85	4.29	10-10-85	5.90	2-28-86	3.89
2-15-85	4.50	6-10-85	4.50	10-20-85	3.80	3-05-86	2.26
2-20-85	3.77	6-15-85	3.96	11-05-85	2.80	3-10-86	1.83
2-22-85	1.13	6-20-85	4.25	11-10-85	3.14	3-15-86	1.04
2-25-85	* .22	6-25-85	4.46	11-15-85	1.93	3-20-86	.73
2-28-85	.70	6-30-85	4.68	11-20-85	2.19	3-25-86	1.16
3-02-85	1.22	7-05-85	4.90	11-25-85	3.03	3-31-86	1.73
3-05-85	.85	7-10-85	5.12	11-30-85	3.30	4-05-86	1.50
3-10-85	1.13	7-15-85	5.27	12-05-85	3.50	4-10-86	2.40
3-15-85	1.45	7-20-85	5.45	12-10-85	3.77	4-15-86	2.65
3-20-85	2.06	7-25-85	5.63	12-15-85	3.96	4-20-86	2.97
3-25-85	2.46	7-31-85	5.77	12-20-85	4.16	4-25-86	3.46
3-30-85	2.33	8-05-85	5.94	12-25-85	4.33	4-30-86	1.65
4-05-85	1.70	8-10-85	6.09	12-31-85	4.44	5-05-86	2.32
4-10-85	2.35	8-20-85	6.32	1-05-86	4.51	5-10-86	2.85
4-15-85	2.74	8-25-85	6.33	1-10-86	4.68	5-15-86	.34
4-20-85	3.10	8-31-85	6.44	1-15-86	4.75	5-20-86	.88
4 25-85	3.23	9-02-85	6.50	1-20-86	3.85		

Table 3.--Water-quality data for test wells

[µS/cm, microsiemens per centimeter at 25 °Celsius; mg/L, milligrams per liter; °C, degrees Celsius; lat, latitude; N, north; long, longitude; W, west; T, township; R, range; --, no data available; total, total recoverable; µg/L, micrograms per liter]

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well TO2, depth 27 feet, lat 41° 49' 48" N, long 092° 05' 53" W, T81N R11W 14BDBB, local number 414948092055301										
3-20-85	900	7.1	490	130	39	9.0	362	96	11	5.5
7-01-85	930	6.9	530	140	43	9.7	379	110	10	6.8
8-06-85	950	7.1	550	150	43	11	382	130	9.0	6.8
10-16-85	890	7.1	--	--	--	--	384	100	8.0	4.1

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
3-20-85	0.01	0.06	--	--	--	--	--	--	--
7-01-85	<.01	.01	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-06-85	<.01	.03	--	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	<.01	.04	1.8	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate, [1] dissolved (mg/L as N)
Observation well T03A, depth 29 feet, lat 41° 49' 07" N, long 092° 08' 30" W, T81N R11W 20AAAA1, local number 414907092083001										
10-10-84	450	7.7	--	--	--	--	--	--	--	<0.10
3-19-85	460	7.3	--	--	--	--	187	--	--	<.10
5-03-85	460	7.3	--	--	--	--	187	38	4.0	<.10
6-28-85	460	7.4	220	60	18	7.2	190	44	3.0	<.10
8-15-85	450	7.4	240	65	19	8.3	186	56	3.0	<.10
10-15-85	440	7.3	--	--	--	--	191	49	2.0	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-10-84	0.04	0.04	--	--	--	--	--	--	--
3-19-85	.06	.09	--	--	--	--	--	--	--
5-03-85	.06	.09	--	--	--	--	--	--	--
6-28-85	.05	.08	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-15-85	.04	.13	1.8	<.10	<.10	<.05	<.10	<.10	<.05
10-15-85	.04	.10	1.1	.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T03C, depth 15.5 feet, lat 41° 49' 07" N, long 092° 08' 30" W, T81N R11W 20AAAA3, local number 414907092083003										
5-03-85	440	7.1	--	--	--	--	179	46	4.0	<0.10
6-28-85	430	7.6	210	56	16	5.7	175	43	5.5	<.10
8-15-85	430	7.3	220	65	15	6.9	177	52	6.0	<.10
10-15-85	410	7.1	--	--	--	--	165	39	7.0	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-03-85	0.03	0.10	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-28-85	.01	.08	--	<.10	<.10	<.05	<.10	<.10	<.05
8-15-85	. 01	.15	1.0	<.10	<.10	<.05	<.10	<.10	<.05
10-15-85	.01	.10	1.1	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T03D, depth 8 feet, lat 41° 49' 07" N, long 092° 08' 30" W, T81N R11W 20AAAA4, local number 414907092083004										
5-03-85	360	7.2	--	--	--	--	134	42	3.5	1.3
6-28-85	300	6.4	110	34	7.2	5.6	69	24	8.0	9.8
8-15-85	380	6.6	130	39	8.0	7.8	78	24	8.0	6.9
10-15-85	320	7.1	--	--	--	--	127	24	2.0	.90

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-03-85	0.40	0.20	--	0.18	<0.10	<0.05	<0.10	<0.10	<0.05
6-28-85	.23	.16	--	.16	<.10	<.05	<.10	<.10	<.05
8-15-85	.14	.22	1.5	--	<.10	<.05	<.10	<.10	<.05
10-15-85	<.01	.17	1.9	.23	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T03E, depth 6.50 feet, lat 41° 49' 07" N, long 092° 08' 30" W, T81N R11W 20AAAA5, local number 414907092083005										
5-03-85	440	6.9	--	--	--	--	194	37	4.5	1.0
6-28-85	430	7.1	200	58	14	7.2	184	25	5.5	<.10
8-15-85	405	6.9	160	47	11	4.0	128	34	8.0	.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-03-85	0.13	0.15	--	--	--	--	--	--	--
6-28-85	.14	.15	--	0.43	.17	<0.05	<0.10	<0.10	<0.05
8-15-85	.08	.30	2.4	.36	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T03F, depth 4 feet, lat 41° 49' 07" N, long 092° 08' 30" W, T81N R11W 20AAAA6, local number 414907092083006										
5-03-85	510	7.1	--	--	--	--	223	38	4.5	0.20

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-03-85	0.66	0.24	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T04A, depth 31 feet, lat 41° 48' 16" N, long 092° 05' 34" W, T81N R11W 23DCCC1, local number 414816092053401										
10-10-84	420	7.6	--	--	--	--	--	--	9.0	<0.10
3-19-85	410	7.5	200	57	15	7.3	183	18	7.5	<.10
5-01-85	400	7.4	--	--	--	--	179	20	8.0	<.10
6-27-85	410	7.1	200	57	13	7.0	185	18	6.5	<.10
10-15-85	375	7.1	--	--	--	--	177	13	8.5	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-10-84	0.24	0.06	--	--	--	--	--	--	--
3-19-85	.27	.12	--	--	--	--	--	--	--
5-01-85	.25	.13	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	.24	.11	--	--	--	--	--	--	--
10-15-85	.23	.13	1.8	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T04B, depth 13.5 feet, lat 41° 48' 16" N, long 092° 05' 34" W, T81N R11W 23DCCC2, local number 414816092053402										
5-01-85	430	6.8	--	--	--	--	140	46	9.5	2.7
6-27-85	430	6.9	80	5.8	16	6.3	132	68	9.5	1.0
10-15-85	350	6.5	--	--	--	--	102	56	8.5	1.1

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-01-85	0.07	0.15	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	<.01	.02	--	--	--	--	--	--	--
10-15-85	.01	<.01	1.6	.21	<.10	<.05	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T04C, depth 11 feet, lat 41° 48' 16" N, long 092° 05' 34" W, T81N R11W 23DCCC3, local number 414816092053403										
5-01-85	550	7.1	--	--	--	--	175	48	9.5	3.7
6-27-85	590	6.7	300	79	24	6.7	222	74	9.5	.70
10-15-85	445	6.8	--	--	--	--	169	58	8.5	1.1

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-01-85	0.02	0.07	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	.02	.05	--	--	--	--	--	--	--
10-15-85	.01	.07	2.1	.22	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T04D, depth 8 feet, lat 41° 48' 16" N, long 092° 05' 34" W, T81N R11W 23CDDD4, local number 414816092053404										
5-01-85	290	7.4	--	--	--	--	111	20	4.5	1.2
6-27-85	340	6.7	170	47	13	3.3	137	20	5.0	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-01-85	0.06	0.27	--	0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	.06	.15	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T05A, depth 30 feet, lat 41° 47' 52" N, long 092° 05' 32" W, T81N R11W 26ACCC1, local number 414752092053201										
10-10-84	500	7.2	--	--	--	--	--	--	18	<0.10
3-19-85	510	7.1	240	67	17	11	159	50	23	<.10
6-28-85	520	6.9	230	64	16	11	167	56	20	<.10
8-14-85	480	7.0	210	61	14	10	148	84	10	<.10
10-15-85	480	7.1	--	--	--	--	144	64	16	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-10-84	0.29	0.03	--	--	--	--	--	--	--
3-19-85	.29	.15	--	--	--	--	--	--	--
6-28-85	.29	.15	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-14-85	.29	.21	1.6	<.10	<.10	<.05	<.10	<.10	<.05
10-15-85	.26	.19	1.2	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T05B, depth 13 feet, lat 41° 47' 52" N, long 092° 05' 32" W, T81N R11W 26ACCC2, local number 414752092053202										
5-02-85	530	6.8	--	--	--	--	213	58	6.0	<0.10
6-28-85	420	6.5	250	65	21	2.4	196	36	5.0	2.3
8-14-85	500	6.4	240	65	18	7.6	205	44	5.0	1.0
10-15-85	480	6.8	--	--	--	--	199	51	6.5	.30

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-02-85	<0.01	0.14	--	0.59	<0.10	<0.05	<0.10	<0.10	<0.05
6-28-85	<.01	.11	--	2.4	<.10	<.05	<.10	<.10	<.05
8-14-85	<.01	.18	1.9	1.7	<.10	<.05	<.10	<.10	<.05
10-15-85	<.01	.15	2.7	.66	<.10	<.05	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T05C, depth 10 feet, lat 41° 47' 52" N, long 092° 05' 32" W, T81N R11W 26ACCC3, local number 414752092053203										
5-02-85	570	7.1	--	--	--	--	228	54	7.0	0.80
6-28-85	550	6.6	260	74	18	6.0	225	44	5.0	1.3
8-14-85	530	6.2	260	76	18	7.6	218	60	6.5	.90
10-15-85	455	6.9	--	--	--	--	211	49	5.0	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-02-85	0.14	0.14	--	0.01	<0.10	<0.05	<0.10	<0.10	<0.05
6-28-85	.06	.13	--	.41	<.10	<.05	<.10	<.10	<.05
8-14-85	<.01	.19	2.1	.26	<.10	<.05	<.10	<.10	<.05
10-15-85	.14	.21	2.7	.57	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T05D, depth 7 feet, lat 41° 47' 52" N, long 092° 05' 32" W, T81N R11W 26ACCC4, local number 414752092053204										
5-08-85	570	7.3	--	--	--	--	244	44	8.5	0.20
6-28-85	550	6.9	310	93	18	17	279	42	8.0	.30
8-14-85	630	6.5	310	100	15	19	265	64	8.5	.50

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-08-85	0.18	0.18	--	0.21	<0.10	<0.05	<0.10	<0.10	<0.05
6-28-85	.11	.16	--	.23	<.10	<.05	<.10	<.10	<.05
8-14-85	<.01	.27	3.3	.45	.19	<.05	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T06, depth 30 feet, lat 41° 49' 30" N, long 092° 09' 38" W, T81N R11W 17CBBC, local number 414930092093801										
10-10-84	470	7.0	--	--	--	--	--	--	5.0	<0.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-10-84	0.11	0.06	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T06A, depth 26 feet, lat 41° 52' 11" N, long 092° 16' 41" W, T82N R12W 31DAAD1, local number 415211092164101										
10-22-84	2,000	7.3	--	--	--	--	--	--	13	0.20

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-22-84	0.13	0.05	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T06B, depth 15 feet, lat 41° 52' 11" N, long 092° 16' 41" W, T82N R12W 31DAAD2, local number 415211092164102										
10-22-84	1,700	7.4	--	--	--	--	--	--	16	0.20
3-21-85	1,800	7.1	1,000	270	91	28	214	780	16	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-22-84	0.09	0.13	--	--	--	--	--	--	--
3-21-85	.08	.13	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T07, depth 71 feet, lat 41° 50' 21" N, long 092° 12' 03" W, T81N R12W 01BBBB, local number 415021092120301										
10-12-84	2,400	7.3	--	--	--	--	--	--	1,600	0.30

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-12-84	2.60	0.04	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T09, depth 24 feet, lat 41° 51' 45" N, long 092° 11' 56" W, T81N R12W 01BBBA, local number 415145092115601										
10-17-84	620	6.8	--	--	--	--	--	--	14	7.9
7-01-85	580	6.8	280	85	17	11	208	45	9.0	11
8-06-85	580	6.7	290	88	18	11	210	48	9.0	9.0
10-17-85	580	6.8	--	--	--	--	182	37	15	6.1

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	<0.01	<0.01	--	--	--	--	--	--	--
7-01-85	<.01	.29	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-06-85	<.01	.31	--	<.10	<.10	<.05	<.10	<.10	<.05
10-17-85	<.01	.32	1.7	.26	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T10A, depth 34 feet, lat 41° 51' 04" N, long 092° 13' 11" W, T81N R12W 02CCBB1, local number 415104092131101										
10-17-84	1,700	7.1	--	--	--	--	--	--	8.0	0.10
3-20-85	1,700	7.2	1,000	240	98	27	208	700	6.5	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	1.3	<0.01	--	--	--	--	--	--	--
3-20-85	1.3	.09	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T10B, depth 17.5 feet, lat 41° 51' 04" N, long 092° 13' 11" W, T81N R12W 02CCBB2, local number 415104092131102										
10-17-84	520	7.1	--	--	--	--	--	--	11	0.50
3-20-85	490	7.1	--	80	--	11	151	70	16	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	0.20	0.16	--	--	--	--	--	--	--
3-20-85	.22	.23	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T11, depth 36 feet, lat 41° 49' 20" N, long 092° 12' 24" W, T81N R12W 14DBDD, local number 414920092122401										
10-17-84	700	7.2	--	--	--	--	--	--	16	<0.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	0.10	0.04	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T12A, depth 35 feet, lat 41° 49' 38" N, long 092° 12' 01" W, T81N R12W 13BCCB1, local number 414938092120101										
10-17-84	1,300	7.1	--	--	--	--	--	--	15	<0.10
3-19-85	1,200	7.2	680	180	57	17	276	420	13	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	0.50	0.12	--	--	--	--	--	--	--
3-19-85	.50	.33	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T12B, depth 17.5 feet, lat 41° 49' 38" N, long 092° 12' 01" W, T81N R12W 13BCCB2, local number 414938092120102										
10-17-84	660	7.4	--	--	--	--	--	--	10	<0.10
3-19-85	620	7.1	310	80	26	96	213	96	10	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	0.36	0.49	--	--	--	--	--	--	--
3-19-85	.08	.66	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T13, depth 40.5 feet, lat 41° 50' 42" N, long 092° 16' 39" W, T81N R12W 08BCBB, local number 415042092163901										
10-17-84	780	7.4	--	--	--	--	--	--	15	0.90

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-17-84	5.30	0.81	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate, [1] dissolved (mg/L as N)
Observation well T14, depth 36 feet, lat 41° 51' 25" N, long 092° 16' 42" W, T81N R12W 06ADDA, local number 415125092164201										
10-19-84	1,200	7.5	--	--	--	--	--	--	8.0	0.20

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-19-84	0.06	0.03	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate, [1] dissolved (mg/L as N)
Observation well T15, depth 20 feet, lat 41° 52' 53" N, long 092° 17' 02" W, T82N R12W 29CBBC, local number 415253092170201										
10-22-84	1,100	7.3	--	--	--	--	--	--	16	0.20

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-22-84	0.05	0.01	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T17, depth 40 feet, lat 41° 50' 39" N, long 092° 16' 40" W, T81N R12W 05CCCB, local number 415039092164001										
10-30-84	710	7.9	--	--	--	--	--	--	22	2.4

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-30-84	0.15	0.10	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T18, depth 35 feet, lat 41° 52' 51" N, long 092° 17' 52" W, T82N R12W 30CCBB, local number 415251092175201										
10-23-84	1,700	7.4	--	--	--	--	--	--	24	0.10
3-21-85	1,700	7.4	990	250	89	32	185	740	26	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-23-84	0.23	0.10	--	--	--	--	--	--	--
3-21-85	.27	.19	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T19, depth 25 feet, lat 41° 50' 45" N, long 092° 14' 56" W, T81N R12W 09ABCB, local number 415045092145601										
10-23-84	500	7.6	--	--	--	--	--	--	9.0	7.2
3-21-85	470	7.5	230	61	19	6.8	161	32	14	7.4
7-01-85	480	7.3	230	63	18	7.0	168	32	11	8.8
8-07-85	490	7.1	250	66	20	8.0	167	36	10	7.9
10-17-85	520	7.3	--	--	--	--	166	30	8.5	6.0

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-23-84	<0.01	0.18	--	--	--	--	--	--	--
3-21-85	<.01	.18	--	--	--	--	--	--	--
7-01-85	<.01	.15	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-07-85	<.01	.18	--	<.10	<.10	<.05	<.10	<.10	<.05
10-17-85	<.01	.10	<1.0	.15	<.10	<.05	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T20, depth 27 feet, lat 41° 49' 17" N, long 092° 10' 42" W, T81N R11W 18CCBD, local number 414917092104201										
10-24-84	460	7.5	--	--	--	--	--	--	3:0	0.20

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-24-84	0.13	0:08	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T21A, depth 25 feet, lat 41° 50' 20" N, long 092° 09' 40" W, T81N R11W 07DAAD1, local number 415020092094001										
10-24-84	570	7.7	--	--	--	--	--	--	13	13
3-19-85	580	6.8	290	72	26	4.7	183	40	17	12
5-09-85	570	7.3	--	--	--	--	189	32	14	13
6-27-85	560	7.1	250	69	20	4.5	183	33	16	16
8-20-85	580	7.5	290	76	24	6.4	194	35	18	15
10-16-85	590	7.4	--	--	--	--	183	30	16	16

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-24-84	<0.01	0.09	--	--	--	--	--	--	--
3-19-85	<.01	.10	--	--	--	--	--	--	--
5-09-85	<.01	.09	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	<.01	.09	--	.10	<.10	<.05	<.10	<.10	<.05
8-20-85	<.01	.16	<1.0	.10	<.10	<.05	<.10	<.10	<.05
10-16-85	<.01	.11	<1.2	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T21B, depth 18 feet, lat 41° 50' 20" N, long 092° 09' 40" W, T81N R11W 07DAAD2, local number 415020092094002										
5-09-85	560	6.9	--	--	--	--	189	46	18	16
6-27-85	580	6.7	280	71	26	3.1	147	49	18	19
8-20-85	620	6.6	300	75	27	4.9	165	65	18	14
10-16-85	590	6.9	--	--	--	--	180	48	16	9.8

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-09-85	<0.01	0.04	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	<.01	.02	--	<.10	<.10	<.05	<.10	<.10	<.05
8-20-85	<.01	.11	1.5	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	<.01	.06	1.1	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate, [1] dissolved (mg/L as N)
Observation well T21C, depth 15 feet, lat 41° 50' 20" N, long 092° 09' 40" W, T81N R11W 07DAAD3, local number 415020092094003										
5-09-85	550	6.9	--	--	--	--	204	70	14	11
6-27-85	630	7.1	560	130	56	3.9	212	61	13	8.7
8-20-85	670	6.7	350	92	30	5.5	223	81	14	7.7
10-16-85	560	7.0	--	--	--	--	229	36	6.5	3.3

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-09-85	<0.01	0.12	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	.05	1.20	--	<.10	<.10	.51	<.10	<.10	<.05
8-20-85	.01	.17	1.2	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	.05	.18	2.4	<.10	<.10	.10	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate, [1] dissolved (mg/L as N)
Observation well T21D, depth 12 feet, lat 41° 50' 20" N, long 092° 09' 40" W, T81N R11W 07DAAD4, local number 415020092094004										
5-09-85	480	6.8	--	--	--	--	180	34	4.0	4.8
6-27-85	480	6.4	210	63	13	8.7	209	32	5.0	.20
8-20-85	500	6.2	220	65	15	9.0	225	32	5.5	<.10
10-16-85	410	6.6	--	--	--	--	174	30	4.5	1.2

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-09-85	0.22	0.11	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-85	.34	.17	--	<.10	<.10	8.1	<.10	<.10	<.05
8-20-85	.44	.30	2.3	<.10	<.10	7.5	<.10	<.10	<.05
10-16-85	.07	.17	2.0	<.10	<.10	.19	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T22, depth 25 feet, lat 41° 48' 28" N, long 092° 01' 42" W, T81N R10W 20DACA, local number 414828092014201										
10-30-84	670	7.4	--	--	--	--	--	--	--	0.40

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-30-84	<0.01	0.07	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T23, depth 20 feet, lat 41° 47' 36" N, long 091° 54' 52" W, T81N R09W 29DBDD, local number 414736091545201										
10-30-84	500	6.9	--	--	--	--	--	--	20	0.50

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-30-84	0.15	0.09	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T24, depth 101 feet, lat 41° 47' 06" N, long 091° 51' 58" W, T81N R09W 35BCAA, local number 414706091515801										
10-30-84	480	7.2	--	--	--	--	--	--	23	0.60

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
10-30-84	0.22	0.05	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T25, depth --, lat 41° 51' 45" N, long 092° 14' 22" W, T81N R12W 04AAAA, local number 415145092142201										
11-14-84	600	7.1	--	--	--	--	--	--	18	0.60

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-14-84	0.23	0.01	--	--	--	--	--	--	--

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T26A, depth 22.5 feet, lat 41° 48' 18" N, long 092° 05' 54" W, T81N R11W 14CCDA1, local number 414818092055401										
11-14-84	610	7.6	--	--	--	--	--	--	9.0	<0.10
3-20-85	600	7.4	300	83	23	5.7	238	55	4.5	<.10
4-30-85	590	7.3	--	--	--	--	234	81	9.5	<.10
6-27-85	610	7.0	310	86	24	6.3	222	95	7.5	<.10
8-16-85	630	7.0	330	89	25	8.2	230	100	7.5	<.10
10-16-85	570	7.2	--	--	--	--	206	95	6.5	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-14-84	0.22	0.02	--	--	--	--	--	--	--
3-20-85	.08	.13	--	--	--	--	--	--	--
4-30-85	.08	.12	--	--	--	--	--	--	--
6-27-85	.07	.10	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-16-85	.07	.17	<1.0	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	.08	.13	<1.0	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T26B, depth 13.5 feet, lat 41° 48' 18" N, long 092° 05' 54" W, T81N R11W 14CCDA2, local number 414818092055402										
4-30-85	530	7.1	--	--	--	--	202	75	10	<0.10
6-27-85	410	6.7	200	54	15	4.1	146	60	9.0	<.10
8-16-85	390	6.5	180	49	14	5.9	122	110	8.5	<.10
10-16-85	370	6.9	--	--	--	--	116	48	7.0	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-30-85	0.06	0.03	--	--	--	--	--	--	--
6-27-85	.04	.06	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-16-85	.02	.12	<1.1	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	.03	.10	1.5	<.10	<.10	<.05	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T26C, depth 11 feet, lat 41° 48' 18" N, long 092° 05' 54" W, T81N R11W 14CCDA3, local number 414818092055403										
4-30-85	520	6.9	--	--	--	--	190	67	9.0	<0.10
6-27-85	360	6.6	170	46	13	4.2	110	54	8.0	<.10
8-14-85	330	6.4	160	45	12	6.1	94	60	8.5	<.10
10-16-85	330	7.1	--	--	--	--	101	42	6.5	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-30-85	0.04	0.03	--	--	--	--	--	--	--
6-27-85	.04	.05	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-14-85	.02	.09	1.9	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	.01	.06	2.6	<.10	<.10	<.05	<.10	<.10	<.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T26D, depth 8 feet, lat 41° 48' 18" N, long 092° 05' 54" W, T81N R11W 14CCDA4, local number 414818092055404										
4-30-85	370	7.1	--	--	--	--	113	58	9.0	<0.10
6-27-85	340	6.7	150	41	12	9.8	106	54	7.5	<.10
8-14-85	350	6.2	160	45	12	9.5	112	45	9.5	.60
10-16-85	320	7.0	--	--	--	--	112	38	4.0	.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-30-85	0.03	0.22	--	--	--	--	--	--	--
6-27-85	.03	.16	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-14-85	<.01	.12	1.1	<.10	<.10	<.05	<.10	<.10	<.05
10-16-85	<.01	.07	<1.0	<.10	<.10	<.05	<.10	<.10	<.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T28A, depth 22.5 feet, lat 41° 48' 20" N, long 091° 58' 40" W, T81N R10W 23CDAA1, local number 414820091584001										
11-15-84	770	7.3	--	--	--	--	--	--	17	<0.10
5-08-85	760	7.4	--	--	--	--	302	86	18	<.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-15-85	0.39	0.01	--	--	--	--	--	--	--
5-08-85	<.10	<.04	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T28B, depth 22 feet, lat 41° 48' 20" N, long 091° 58' 40" W, T81N R10W 23CDAA2, local number 414820091584002										
11-15-84	650	8.0	--	--	--	--	--	--	29	<0.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-15-85	0.13	0.01	--	--	--	--	--	--	--

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T28C, depth 14 feet, lat 41° 48' 20" N, long 091° 58' 40" W, T81N R10W 23CDAA3, local number 414820091584003										
5-08-85	470	7.4	--	--	--	--	165	44	22	<0.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-15-85	0.05	0.10	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05

Table 3.--Water-quality data for test wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T28D, depth 10 feet, lat 41° 48' 20" N, long 091° 58' 40" W, T81N R10W 23CDAA4, local number 414820091584004										
5-08-85	580	7.1	--	--	--	--	209	84	9.5	<0.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-15-85	0.20	0.24	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)
Observation well T28E, depth 7 feet, lat 41° 48' 20" N, long 091° 58' 40" W, T81N R10W 23CDAA5, local number 414820091584005										
5-08-85	490	6.7	--	--	--	--	158	95	7.5	<0.10

Date	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
11-15-85	0.03	0.20	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05

[1] Nitrate plus nitrite, but predominately nitrate.

Table 4.--Water-quality data for domestic wells

[µS/cm, microsiemens per centimeter at 25 °Celsius; mg/L, milligrams per liter; lat, latitude; N, north; long, longitude; W, west; T, township; R, range; --, no data available; total, total recoverable; µg/L, micrograms per liter; <, less than]

Date	Specific conductance (µS/cm)	pH (standard units)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)
Domestic well D29, depth 10 feet, lat 41° 52' 14" N, long 092° 16' 35" W, T82N R12W 32BCCA, local number 415214092163501											
5-11-84	870	7.1	--	--	--	--	--	--	0.60	0.09	0.05
Domestic well D30, depth 22 feet, lat 41° 49' 04" N, long 092° 08' 46" W, T81N R11W 20AABB, local number 414904092084601											
5-15-84	410	7.0	--	--	--	--	--	--	<0.10	0.05	0.25
9-12-84	420	7.4	58	18	5.5	170	53	6.5	<.10	.09	.22
Domestic well D31, depth 6 feet, lat 41° 48' 40" N, long 092° 08' 29" W, T81N R11W 21CBBB, local number 414840092082901											
9-12-84	490	7.6	72	21	5.6	183	59	8.5	1.9	0.01	0.04
Domestic well D32, depth 11 feet, lat 41° 49' 37" N, long 092° 11' 59" W, T81N R12W 13BCBC, local number 414937092115901											
5-15-84	430	6.8	--	--	--	--	--	--	4.9	0.09	0.11
9-11-84	510	7.0	57	20	9.1	142	66	10	3.1	.16	.23
Domestic well D33, depth 16 feet, lat 41° 49' 36" N, long 092° 10' 58" W, T81N R12W 13ADDD, local number 414936092105801											
5-16-84	430	7.4	--	--	--	--	--	--	<0.10	0.12	0.24
9-11-84	450	7.5	65	17	6.6	181	58	4.5	<.10	.10	.22
Domestic well D34, depth 12 feet, lat 41° 47' 23" N, long 092° 02' 41" W, T81N R10W 29CCCC, local number 414723092024101											
5-16-84	430	6.2	--	--	--	--	--	--	1.6	0.13	0.16
9-11-84	440	6.3	45	15	21	68	54	54	1.6	.01	.14
Domestic well D35, depth 20 feet, lat 41° 47' 00" N, long 092° 01' 06" W, T81N R11W 22CADC, local number 414700092010601											
5-16-84	620	7.2	--	--	--	--	--	--	7.6	0.01	0.14
9-10-84	730	7.2	97	23	16	230	68	23	13	.01	.14
Domestic well D36, depth 25 feet, lat 41° 50' 00" N, long 092° 13' 51" W, T81N R12W 10CDDD, local number 415000092135101											
5-15-84	690	7.3	--	--	--	--	--	--	0.80	1.0	0.16
9-13-84	600	7.3	75	29	9.4	273	30	16	<.10	1.0	.19
Domestic well D37, depth 20 feet, lat 41° 50' 12" N, long 092° 14' 18" W, T81N R12W 10CCBA, local number 415012092141801											
5-18-84	620	7.1	--	--	--	--	--	--	<0.10	2.0	0.42

Table 4.--Water-quality data for domestic wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)
Domestic well D38, depth 20 feet, lat 41° 51' 05" N, long 092° 13' 38" W, T81N R12W 03DCAB, local number 415105092133801											
5-15-84	670	7.1	--	--	--	--	--	--	<0.10	0.40	0.29
Domestic well D39, depth 10 feet, lat 41° 49' 22" N, long 092° 09' 15" W, T81N R11W 17CACD, local number 414922092091501											
5-15-84	500	6.6	--	--	--	--	--	--	<0.10	0.19	0.12
Domestic well D40, depth 15 feet, lat 41° 49' 20" N, long 092° 09' 05" W, T81N R11W 17CDAA, local number 414920092090501											
5-15-84	790	7.2	--	--	--	--	--	--	3.8	0.03	0.03
9-13-84	760	7.0	83	25	21	189	99	60	5.0	.06	.03
Domestic well D41, depth 21 feet, lat 41° 49' 04" N, long 092° 08' 44" W, T81N R11W 20AABB, local number 414904092084401											
5-15-84	420	7.0	--	--	--	--	--	--	8.9	0.02	0.17
9-13-84	420	7.0	50	16	13	145	55	13	1.7	.04	.87
Domestic well D42, depth 18 feet, lat 41° 48' 24" N, long 092° 07' 19" W, T81N R11W 22CCBB, local number 414824092071901											
5-16-84	550	7.2	--	--	--	--	--	--	1.6	0.01	0.06
Domestic well D43, depth 25 feet, lat 41° 51' 31" N, long 092° 17' 53" W, T81N R12W 06BCBB, local number 415131092175301											
5-17-84	500	7.1	--	--	--	--	--	--	0.40	0.30	0.04
Domestic well D44, depth 24 feet, lat 41° 49' 23" N, long 092° 03' 10" W, T81N R10W 18DBCC, local number 414923092031001											
5-15-84	780	7.1	--	--	--	--	--	--	6.7	0.01	0.05
9-11-84	750	7.1	100	36	10	301	59	18	7.2	.01	.05
Domestic well D45, depth 18 feet, lat 41° 48' 05" N, long 092° 05' 38" W, T81N R11W 26BADD, local number 414805092053801											
9-12-84	760	7.3	100	22	12	239	140	16	0.70	0.10	0.02
Domestic well D46, depth 26 feet, lat 41° 51' 11" N, long 092° 12' 04" W, T81N R12W 02DAAD, local number 415111092120401											
6-14-84	580	7.0	--	--	--	--	--	--	<0.10	0.31	<0.01
Domestic well D47, depth 20 feet, lat 41° 49' 50" N, long 092° 06' 32" W, T81N R11W 15ABDB, local number 414950092063201											
5-17-84	810	7.0	--	--	--	--	--	--	7.3	0.01	0.10

Table 4.--Water-quality data for domestic wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Nitrate, dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)
Domestic well D48, depth 28 feet, lat 41° 50' 41" N, long 092° 09' 37" W, T81N R11W 08BBCB, local number 415041092093701											
5-11-84	480	7.4	--	--	--	--	--	--	1.5	0.01	0.10
Domestic well D49, depth 20 feet, lat 41° 51' 25" N, long 092° 11' 05" W, T81N R12W 01ADAC, local number 415125092110501											
6-14-84	510	6.8	--	--	--	--	--	--	12	0.25	0.05
Domestic well D50, depth 30 feet, lat 41° 49' 32" N, long 092° 10' 02" W, T81N R11W 18DBAB, local number 414932092100201											
5-15-84	400	7.0	--	--	--	--	--	--	0.40	0.13	0.10
9-13-84	370	7.1	49	15	7.1	125	54	6.5	.20	.11	.11
Domestic well D51, depth 15 feet, lat 41° 49' 32" N, long 092° 10' 32" W, T81N R11W 18CABB, local number 414932092103201											
6-07-84	640	7.3	--	--	--	--	--	--	4.6	0.13	0.19
9-13-84	670	7.4	80	24	13	214	10	14	4.6	.14	.12
Domestic well D52, depth 20 feet, lat 41° 49' 13" N, long 092° 08' 02" W, T81N R11W 16CDDB, local number 414913092080201											
6-07-84	630	7.3	--	--	--	--	--	--	<0.10	0.33	0.10
Domestic well D53, depth 13 feet, lat 41° 48' 05" N, long 092° 05' 06" W, T81N R11W 26AADB, local number 414805092050601											
5-17-84	400	6.5	--	--	--	--	--	--	<0.10	0.16	0.16
Domestic well D54, depth 15 feet, lat 41° 50' 48" N, long 092° 16' 26" W, T81N R12W 08BBAC, local number 415048092162601											
5-09-84	820	7.4	--	--	--	--	--	--	1.4	0.04	0.06
Domestic well D55, depth 20 feet, lat 41° 49' 15" N, long 092° 11' 56" W, T81N R12W 13CCBD, local number 414915092115601											
6-07-84	440	6.6	--	--	--	--	--	--	13	0.09	0.35
Domestic well D56, depth 30 feet, lat 41° 48' 37" N, long 092° 00' 44" W, T81N R10W 21ACDD, local number 414837092004401											
5-17-84	690	6.9	--	--	--	--	--	--	3.8	0.02	0.12
Domestic well D57, depth 17 feet, lat 41° 49' 44" N, long 092° 05' 08" W, T81N R11W 14ADBA, local number 414944092050801											
5-17-84	880	7.1	--	--	--	--	--	--	2.9	0.03	0.01
Domestic well D58, depth 15 feet, lat 41° 48' 24" N, long 092° 07' 39" W, T81N R11W 21DCAA, local number 414824092073901											
9-10-84	560	7.4	80	21	9.4	212	76	9.0	1.2	0.01	0.06

Table 4.--Water-quality data for domestic wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Domestic well D59, depth 25 feet, lat 41° 48' 29" N, long 092° 06' 53" W, T81N R11W 22CADC, local number 414829092065301									
5-15-84	830	7.3	--	--	--	--	--	--	--
6-27-84	790	7.2	--	--	--	--	--	--	--
8-10-84	730	7.3	340	88	29	21	258	69	--
9-10-84	790	7.3	--	--	--	--	--	--	14
5-03-85	730	7.4	--	--	12	--	--	--	20
6-28-85	740	7.1	--	--	--	--	--	--	23
8-07-85	750	7.0	--	--	--	--	--	--	22
10-15-85	700	7.1	--	--	--	--	--	69	22

Date	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-15-84	16	0.01	0.09	--	--	--	--	--	--	--
6-27-84	18	.01	.11	--	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
8-10-84	11	<.01	.03	--	--	--	--	--	--	--
9-10-84	8.9	.01	.09	--	--	--	--	--	--	--
5-03-85	7.9	<.01	.10	--	<.10	<.10	<.05	<.10	<.10	<.05
6-28-85	11	.01	.06	--	<.10	<.10	<.05	<.10	<.10	<.05
8-07-85	9.6	.02	.08	--	<.10	<.10	<.05	<.10	<.10	<.05
10-15-85	6.8	.01	.06	<1.0	<.10	<.10	<.05	<.10	<.10	<.05

Table 4.--Water-quality data for domestic wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Domestic well D60, depth 16 feet, lat 41° 48' 00" N, long 092° 05' 40" W, T81N R11W 26BDAA, local number 414800092054001									
5-16-84	960	6.8	--	--	--	--	--	--	--
6-28-84	1,100	6.6	--	--	--	--	--	--	--
8-10-84	970	6.7	--	--	--	--	--	--	--
9-10-84	960	6.7	310	89	22	25	147	90	33
3-18-85	990	7.2	340	97	23	26	205	78	36
5-03-85	950	7.0	--	--	--	--	--	--	32
6-28-85	920	6.6	--	--	--	--	--	--	33
8-07-85	880	6.6	--	--	--	--	--	--	32
10-15-85	880	6.7	--	--	--	--	--	86	28

Date	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-16-84	44	0.15	0.04	--	--	--	--	--	--	--
6-28-84	55	.28	.06	--	1.4	<0.10	<0.05	<0.10	<0.10	<0.05
8-10-84	47	.22	.03	--	--	--	--	--	--	--
9-10-84	38	.25	.04	--	--	--	--	--	--	--
3-18-85	15	.16	.04	--	.32	<.10	<.05	<.10	<.10	<.05
5-03-85	30	.18	.06	--	.74	<.10	<.05	.23	<.10	<.05
6-28-85	36	<.01	.01	--	1.2	<.10	<.05	.53	<.10	<.05
8-07-85	30	.26	.03	--	1.9	<.10	<.05	.65	<.10	<.05
10-15-85	30	.30	.01	2.8	1.6	<.10	<.05	.28	<.10	<.05

Table 4.--Water-quality data for domestic wells--Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Domestic well D61, depth 15 feet, lat 41° 49' 48" N, long 092° 05' 55" W, T81N R11W 14BBDD, local number 414948092055501									
5-11-84	830	7.2	--	--	--	--	--	--	--
9-12-84	920	7.1	490	130	40	9.8	346	100	12
3-18-85	890	7.2	490	130	39	8.9	365	81	9
5-08-85	920	7.2	--	--	--	--	--	--	12
6-28-85	900	6.7	--	--	--	--	--	--	12
8-06-85	950	7.0	--	--	--	--	--	--	16
10-16-85	950	6.9	--	--	--	--	--	92	12

Date	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, orthophosphate, dissolved (mg/L as P)	Carbon, organic, dissolved (mg/L as C)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-11-84	1.5	<0.01	0.09	--	--	--	--	--	--	--
9-12-84	11	.01	.08	--	--	--	--	--	--	--
3-18-85	5.3	.01	.09	--	--	--	--	--	--	--
5-08-85	5.8	<.01	.07	--	<0.10	.16	<0.05	<0.10	<0.10	<0.05
6-28-85	7.1	<.01	.06	--	<.10	<.10	<.05	<.10	<.10	<.05
8-06-85	9.3	.01	.07	--	--	--	--	--	--	--
10-16-85	9.7	<.01	.01	1.0	<0.10	<.10	<.05	<0.10	<.10	<.05

[1] Nitrate plus nitrite, but predominately nitrate.

Table 5.--Water-quality data for municipal wells

[µS/cm, microsiemens per centimeter at 25 °Celsius; °C, degrees Celsius; mg/L, milligrams per liter; lat, latitude; N, north; long, longitude; W, west; T, township; R, range; --, no data available; total, total recoverable; µg/L, micrograms per liter; <; less than]

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M62 (Amana well 5), depth 33 feet, drilled 1942, lat 41° 47' 45" N, long 91° 52' 12" W, T81N R09W 26BCDC, local number 414745091521201										
5-23-84	1,040	6.8	11.0	460	120	40	32	278	140	56
6-27-84	990	6.7	12.0	--	--	--	--	--	--	--
7-31-84	1,330	6.8	12.0	--	--	--	--	--	--	--
9-04-84	1,500	6.6	12.5	560	130	57	59	281	240	120
11-02-84	1,350	6.6	12.5	--	--	--	--	--	--	98
4-11-85	1,100	6.9	11.0	430	120	32	28	271	120	58

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-23-84	434	14	0.12	0.06	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-84	--	11	.11	.08	--	--	--	--	--	--
7-31-84	--	14	<.01	.04	--	--	--	--	--	--
9-04-84	972	26	.10	.03	--	--	--	--	--	--
11-02-84	882	22	.15	2.1	--	--	--	--	--	--
4-11-85	656	15	--	--	<.10	<.10	<.05	<.10	<.10	<.05

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M63 (Amana well 8), depth 34 feet, drilled 1967, lat 41° 47' 36" N, long 91° 53' 45" W, T81N R09W 28DBDB, local number 414736091534501										
4-25-84	700	7.0	12.0	--	--	--	--	--	--	--
5-23-84	705	7.2	12.5	350	87	33	15	272	56	32
6-27-84	700	6.9	12.5	--	--	--	--	--	--	--
7-31-84	695	7.0	12.5	--	--	--	--	--	--	--
9-04-84	710	7.1	12.0	350	84	35	15	257	60	36
11-02-84	710	7.0	12.5	--	--	--	--	--	--	34
4-11-85	745	7.0	11.5	360	86	35	15	282	46	34

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-25-84	--	2.1	0.12	0.15	0.23	<0.10	<0.05	<0.10	<0.10	<0.05
5-23-84	434	2.3	.17	.16	.26	<.10	<.05	<.10	<.10	<.05
6-27-84	--	2.7	.13	.11	.27	<.10	<.05	<.10	<.10	<.05
7-31-84	--	2.7	.12	.18	.30	<.10	<.05	<.10	<.10	<.05
9-04-84	403	2.6	.11	.17	--	--	--	--	--	--
11-02-84	430	1.6	.24	.15	.18	<.10	<.05	<.10	<.10	<.05
4-11-85	441	1.0	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M64 (Amana well 10), depth 40 feet, drilled 1969, lat 41° 48' 11" N, long 91° 56' 40" W, T81N R09W 30BBAB, local number 414811091564001										
5-23-84	600	7.2	12.0	300	75	28	7.8	272	20	9.0
6-27-84	605	6.9	11.5	--	--	--	--	--	--	--
8-01-84	615	7.0	12.5	--	--	--	--	--	--	--
9-04-84	600	7.5	11.0	330	78	32	9.1	274	23	11
11-02-84	865	7.2	12.0	--	--	--	--	--	--	38
4-11-85	770	7.2	9.5	370	88	36	12	322	25	14

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
5-23-84	345	4.6	0.01	0.16	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-27-84	--	4.6	.01	.18	<.10	<.10	<.05	<.10	<.10	<.05
8-01-84	--	5.1	<.01	.15	--	--	--	--	--	--
9-04-84	350	5.8	.04	.15	--	--	--	--	--	--
11-02-84	533	7.9	.10	.13	--	--	--	--	--	--
4-11-85	414	3.2	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M65 (Amana well 11), depth 33 feet, drilled 1954, lat 41° 48' 21" N, long 91° 57' 51" W, T81N R10W 24CCAC, local number 414821091575101										
4-23-84	825	6.9	10.0	--	--	--	--	--	--	--
5-23-84	855	7.0	12.0	400	98	38	27	298	68	38
6-26-84	770	6.7	11.0	--	--	--	--	--	--	--
7-31-84	860	6.8	11.5	--	--	--	--	--	--	--
9-04-84	860	6.9	11.5	410	92	44	27	311	72	39
11-02-84	870	7.0	11.0	--	--	--	--	--	--	38
4-11-85	860	7.1	10.0	390	90	39	26	294	60	36

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-23-84	--	8.4	0.01	0.10	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
5-23-84	500	7.9	<.01	.12	<.10	<.10	<.05	<.10	<.10	<.05
6-26-84	--	4.8	.01	.13	<.10	<.10	<.05	<.10	<.10	<.05
7-31-84	--	6.0	<.01	.09	--	--	--	--	--	--
9-04-84	510	7.0	.04	.11	--	--	--	--	--	--
11-02-85	526	7.6	.11	.13	--	--	--	--	--	--
4-11-85	497	7.8	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M66 (Amana well 12), depth 28 feet, drilled 1980, lat 41° 46' 47" N, long 91° 58' 07" W, T81N R10W 35DAAC, local number 414647091580701										
4-23-84	720	6.7	9.0	--	--	--	--	--	--	--
5-23-84	730	7.4	11.0	330	90	26	21	427	64	34
7-31-84	730	7.0	11.5	--	--	--	--	--	--	--
9-04-84	780	7.0	11.0	350	90	30	28	241	73	48
11-02-84	780	7.2	12.0	--	--	--	--	--	--	48

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-23-84	--	6.1	<0.01	0.08	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
5-23-84	427	5.0	<.01	.08	<.10	<.10	<.05	<.10	<.10	<.05
7-31-84	--	5.6	<.01	.07	<.10	<.10	<.05	<.10	<.10	<.05
9-04-84	466	7.6	.01	.08	--	--	--	--	--	--
11-02-84	476	4.8	.11	.11	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M67 (Marengo well 3), depth 38 feet, lat 41° 47' 38" N, long 92° 04' 21" W, T81N R11W 25DBCD, local number 414738092042101										
8-01-84	580	7.2	18.0	--	--	--	--	--	--	--
9-04-84	670	7.4	12.0	280	83	18	24	219	65	42
11-01-84	650	7.3	13.0	--	--	--	--	--	--	38
4-11-85	700	7.4	10.5	280	83	17	23	219	70	36

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
8-01-84	--	7.5	<0.01	0.04	--	--	--	--	--	--
9-04-84	408	<.10	.28	.09	--	--	--	--	--	--
11-01-84	403	0.10	.41	.06	--	--	--	--	--	--
4-11-85	412	0.10	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M68 (Marengo well 9), depth 40 feet, drilled 1980, lat 41° 47' 37" N, long 92° 04' 41" W, T81N R11W 25CACD, local number 414737092044101										
4-18-84	525	7.5	11.5	--	--	--	--	--	--	--
5-22-84	580	7.6	11.5	240	73	15	15	158	61	29
6-26-84	530	7.4	11.0	--	--	--	--	--	--	--
8-01-84	570	7.5	14.0	--	--	--	--	--	--	--
9-04-84	560	7.5	11.5	250	73	16	14	156	58	31
11-01-84	555	7.4	12.0	--	--	--	--	--	--	28
4-11-85	560	7.1	10.5	220	68	13	14	148	59	22

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-18-84	--	5.8	0.07	0.09	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
5-22-84	342	5.9	.05	.08	<.10	<.10	<.05	<.10	<.10	<.05
6-26-84	--	6.3	.07	.06	<.10	<.10	<.05	<.10	<.10	<.05
8-01-84	--	3.5	<.01	.05	<.10	<.10	<.05	<.10	<.10	<.05
9-04-84	332	6.3	.07	.07	--	--	--	--	--	--
11-01-84	333	6.3	.18	.07	--	--	--	--	--	--
4-11-85	316	6.0	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M69 (Belle Plaine well 2), depth 42 feet, lat 41° 54' 22" N, long 92° 18' 01" W, T82N R13W 13DDD, local number 415422092180101										
4-18-84	630	7.3	10.5	--	--	--	--	--	--	--
5-22-84	685	7.3	9.5	330	96	23	9.3	207	120	12
6-26-84	665	7.2	12.0	--	--	--	--	--	--	--
7-31-84	700	7.4	11.5	--	--	--	--	--	--	--
9-04-84	700	7.5	12.0	340	94	26	9.9	202	120	14
11-01-84	720	7.4	12.0	--	--	--	--	--	--	11
4-11-85	730	7.2	10.0	340	100	23	9.0	203	120	12

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-18-84	--	4.6	0.03	0.07	0.10	<0.10	<0.05	<0.10	<0.10	<0.05
5-22-84	459	4.4	.03	.05	<.10	<.10	<.05	<.10	<.10	<.05
6-26-84	--	4.0	.03	.07	<.10	<.10	<.05	<.10	<.10	<.05
7-31-84	--	4.8	<.01	.04	<.10	<.10	<.05	<.10	<.10	<.05
9-04-84	447	5.4	.01	.04	--	--	--	--	--	--
11-01-84	477	7.8	.12	.05	--	--	--	--	--	--
4-11-85	446	5.7	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)
Municipal well M70 (Belle Plaine well 3), depth 33 feet, drilled 1949, lat 41° 54' 26" N, long 92° 17' 59" W, T82N R13W 13DDAD, local number 415426092175901										
4-18-84	675	7.6	10.0	--	--	--	--	--	--	--
5-22-84	700	7.4	10.0	330	96	23	9.9	205	100	13
6-26-84	710	7.2	13.0	--	--	--	--	--	--	--
7-31-84	715	7.2	12.0	--	--	--	--	--	--	--
9-04-84	720	7.3	11.0	350	95	27	10	178	160	16
11-01-84	635	7.8	12.0	--	--	--	--	--	--	12
4-11-85	705	7.6	10.0	320	92	23	8.6	211	91	12

Date	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-18-84	--	7.8	0.03	0.07	--	--	--	--	--	--
5-22-84	457	6.3	.01	.05	0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-26-84	--	7.5	.02	.08	--	--	--	--	--	--
7-31-84	--	7.5	<.01	.04	--	--	--	--	--	--
9-04-84	470	8.4	.01	.05	--	--	--	--	--	--
11-01-84	428	6.2	.14	.06	--	--	--	--	--	--
4-11-85	421	7.5	--	--	--	--	--	--	--	--

Table 5.--Water-quality data for municipal wells-Continued

Date	Specific conductance (mS/cm)	pH (standard units)	Temperature, °C	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as CL)
Municipal well M71 (Belle Plaine well 5), depth 37 feet, drilled 1977, lat 41° 54' 42" N, long 92° 18' 02" W, T82N R13W 13DACB, local number 415442092180201										
4-18-84	640	7.5	8.0	--	--	--	--	--	--	--
5-22-84	590	7.5	10.0	280	79	21	10	183	120	10
6-26-84	580	7.3	15.0	--	--	--	--	--	--	--
8-03-84	590	7.4	14.0	--	--	--	--	--	--	--
11-01-84	605	7.4	12.0	--	--	--	--	--	--	10
4-11-85	705	7.6	8.5	320	92	23	8.6	211	91	12

Date	Solids, residue at 105 °C dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (mg/L)	Cyanazine, total (mg/L)	Metribuzin, total (mg/L)	Alachlor, total (mg/L)	Metolachlor, total (mg/L)	Trifluralin, total (mg/L)
4-18-84	--	3.4	0.03	0.03	--	--	--	--	--	--
5-22-84	388	.50	.24	.12	<0.10	<0.10	<0.05	<0.10	<0.10	<0.05
6-26-84	--	.50	.31	.06	--	--	--	--	--	--
8-03-84	--	.60	.22	.11	--	--	--	--	--	--
11-01-84	394	.70	.36	.11	--	--	--	--	--	--
4-11-85	421	7.5	--	--	--	--	--	--	--	--

Table 6.--Water-quality data for area streams

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 °Celsius; °C, degrees Celsius; mg/L, milligrams per liter; lat, latitude; N, north; long, longitude; W, west; --, no data available; total, total recoverable; µg/L, micrograms per liter; <; less than]

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance (µS/cm)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW1 (Iowa River below Amana), lat 41° 46' 38" N, long 91° 51' 50" W, downstream order number 05453180												
4-12-84	0915	--	585	8.2	9.0	11.7	104	--	--	--	--	--
5-30-84	0845	--	495	8.1	13.0	9.4	91	230	62	19	5.8	169
6-29-84	1315	--	510	7.9	23.5	6.1	74	--	--	--	--	--
8-03-84	0930	--	490	8.2	24.5	7.1	88	--	--	--	--	--
9-06-84	1015	319	480	7.5	18.5	6.2	68	230	46	28	12	159
10-19-84	1100	--	410	7.9	11.0	8.6	81	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-12-84	--	--	--	9.0	0.08	0.10	--	--	--	--	--	--
5-30-84	28	14	251	14	.09	.11	--	--	--	--	--	--
6-29-84	--	--	--	7.6	.05	.17	--	--	--	--	--	--
8-03-84	--	--	--	7.0	.01	.16	--	--	--	--	--	--
9-06-84	59	19	255	.20	.02	.02	--	--	--	--	--	--
10-19-84	--	15	--	1.9	.18	.08	0.79	0.18	<0.05	0.11	<0.10	<0.05

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW2 (Price Creek at Amana), lat 41° 48' 18" N, long 91° 52' 23" W, downstream order number 05453200												
4-12-84	1230	25	505	8.2	12.0	10.2	98	--	--	--	--	--
5-30-84	0945	--	495	8.1	13.0	9.4	91	240	64	19	5.5	170
9-06-84	1430	4.2	425	8.8	20.0	8.3	94	240	49	28	12	142
10-17-84	1130	11	550	7.8	13.0	8.8	86	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-12-84	--	--	--	6.7	0.06	0.06	--	--	--	--	--	--
5-30-84	25	14	250	9.6	.09	.11	--	--	--	--	--	--
9-06-84	60	20	234	<.10	.01	.02	--	--	--	--	--	--
10-17-84	--	29	--	1.3	.04	.07	0.69	<0.10	<0.05	<0.10	<0.10	<0.05

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW3 (Mill Race at Amana), lat 41° 30' 16" N, long 91° 51' 54" W, downstream order number 05453210												
4-12-84	1115	61	600	8.3	10.5	10.6	98	--	--	--	--	--
6-01-84	1415	--	575	8.0	23.0	8.8	105	270	75	20	8.3	185
6-29-84	1130	--	560	7.8	22.0	8.8	103	--	--	--	--	--
8-03-84	1130	--	580	8.2	23.0	8.6	104	--	--	--	--	--
9-05-84	1445	146	545	8.3	26.0	8.6	109	290	76	24	10	220
10-17-84	1330	295	450	8.1	14.0	9.0	90	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-12-84	--	--	--	8.8	0.06	0.09	--	--	--	--	--	--
6-01-84	36	14	329	11	.37	.09	0.68	0.25	<0.05	0.16	0.16	<0.05
6-29-84	--	--	--	10	.04	.08	.22	.14	<.05	<.10	<.10	<.05
8-03-84	--	--	--	7.3	.04	.10	.37	<.10	<.05	<.10	<.10	<.05
9-05-84	48	14	318	3.9	.07	.10	--	--	--	--	--	--
10-17-84	--	14	--	3.2	.37	.27	.23	<.10	<.05	<.10	<.10	<.05

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW4 (Iowa River near Marengo), lat 41° 48' 41" N, long 92° 03' 42" W, downstream order number 05453100												
4-16-84	1030	5,400	570	8.1	10.0	11.0	101	--	--	--	--	--
5-29-84	1120	6,370	475	8.1	13.0	9.4	91	230	62	18	5.4	164
6-27-84	1300	9,100	500	7.9	24.0	--	--	--	--	--	--	--
8-08-84	1215	1,180	600	8.6	30.0	10.1	--	--	--	--	--	--
9-05-84	1340	425	460	8.9	19.0	13.2	145	240	47	29	12	150
10-22-84	1300	842	570	8.3	10.5	10.8	98	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-16-84	--	--	--	10	0.03	0.09	--	--	--	--	--	--
5-29-84	25	14	231	9.8	.09	.12	7.0	3.7	0.21	6.50	4.7	<0.05
6-27-84	--	--	--	7.4	.09	.19	.20	.23	.08	.12	<.10	<.05
8-08-84	--	--	--	5.4	<.01	.08	.25	<.10	<.05	<.10	<.10	<.05
9-05-84	55	19	259	.40	.02	.02	--	--	--	--	--	--
10-22-84	--	18	--	4.5	.01	.15	.38	<.10	<.05	<.10	<.10	<.05

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW5 (Big Bear Creek at Ladora), lat 41° 44' 58" N, long 92° 10' 55" W, downstream order number 05453000												
4-11-84	1215	289	460	8.0	8.5	11.1	98	--	--	--	--	--
5-29-84	1430	531	448	7.9	12.0	9.8	92	200	53	17	7.6	144
6-29-84	1015	190	505	8.4	19.0	8.5	94	--	--	--	--	--
8-08-84	1500	46	585	8.0	30.0	7.2	98	--	--	--	--	--
9-05-84	1030	16	655	7.9	16.0	9.5	98	280	71	26	30	193
10-23-84	1330	34	655	8.5	8.0	11.3	97	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-11-84	--	--	--	7.4	0.04	0.08	--	--	--	--	--	--
5-29-84	29	12	228	10	.05	.09	2.1	1.9	<0.05	2.3	1.0	<0.05
6-29-84	--	--	--	8.6	.02	.12	.28	.12	<.05	<.10	<.10	<.05
8-08-84	--	--	--	4.9	<.01	.11	.21	<.10	<.05	<.10	<.10	<.05
9-05-84	74	54	398	1.6	.06	.09	--	--	--	--	--	--
10-23-84	--	59	--	4.2	.12	.13	.27	<.10	<.05	<.10	<.10	<.05

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW6 (Honey Creek at Koszta), lat 41° 31' 35" N, long 92° 12' 09" W, downstream order number 05452600												
4-11-84	1430	39	450	8.0	10.0	10.8	99	--	--	--	--	--
5-29-84	0930	--	450	8.0	10.0	10.1	91	220	56	20	6.8	162
6-27-84	0930	--	480	8.2	16.0	9.0	94	--	--	--	--	--
8-03-84	1230	5.8	615	8.4	24.0	10.0	123	--	--	--	--	--
9-04-84	1230	1.4	500	7.9	17.5	8.8	94	270	66	25	13	225
10-17-84	1500	4.3	520	7.6	11.5	9.1	85	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-11-84	--	--	--	6.7	0.07	0.06	--	--	--	--	--	--
5-29-84	24	10	226	9.9	.06	.08	0.81	0.90	<0.05	0.91	0.50	<0.05
6-27-84	--	--	--	8.2	.09	.04	.29	.21	<.05	<.10	<.10	<.05
8-03-84	--	--	--	6.5	.02	.08	.29	<.10	<.05	<.10	<.10	<.05
9-04-84	190	11	--	1.2	.11	.07	--	--	--	--	--	--
10-17-84	--	21	--	2.4	.94	.52	.78	.70	<.05	.32	<.10	<.05

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW7 (Iowa River near Belle Plaine), lat 51° 30' 35" N, long 92° 16' 60" W, downstream order number 05452500												
4-16-84	1515	5,000	580	8.1	10.0	11.2	102	--	--	--	--	--
5-29-84	1045	--	500	8.1	13.0	9.1	88	240	65	18	5.2	173
6-27-84	1445	--	535	8.3	25.0	7.0	88	--	--	--	--	--
8-09-84	1415	--	575	8.5	28.5	10.3	137	--	--	--	--	--
9-12-84	1230	--	475	8.6	19.0	11.0	122	250	51	29	11	174
10-18-84	1500	--	515	8.2	12.0	8.8	85	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total ($\mu g/L$)	Cyanazine, total ($\mu g/L$)	Metribuzin, total ($\mu g/L$)	Alachlor, total ($\mu g/L$)	Metolachlor, total ($\mu g/L$)	Trifluralin, total ($\mu g/L$)
4-16-84	--	--	--	9.9	0.06	0.11	--	--	--	--	--	--
5-29-84	23	14	244	10	.14	.12	--	--	--	--	--	--
6-27-84	--	--	--	8.3	.05	.19	--	--	--	--	--	--
8-09-84	--	--	--	4.9	<.01	.08	--	--	--	--	--	--
9-12-84	50	20	274	1.0	.04	.01	--	--	--	--	--	--
10-18-84	--	17	--	3.2	.11	.15	1.1	0.19	<.05	0.18	<.10	<.05

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW8 (Walnut Creek), lat 41° 50' 06" N, long 92° 22' 31" W, downstream order number 05452200												
4-16-84	0930	--	--	--	--	--	--	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total ($\mu g/L$)	Cyanazine, total ($\mu g/L$)	Metribuzin, total ($\mu g/L$)	Alachlor, total ($\mu g/L$)	Metolachlor, total ($\mu g/L$)	Trifluralin, total ($\mu g/L$)
4-16-84	--	--	--	--	--	--	--	--	--	--	--	--

Table 6.--Water-quality data for area streams--Continued

Date	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (standard units)	Temperature (°C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Alkalinity, lab (mg/L as $CaCO_3$)
Surface-water site SW9 (Salt Creek near Elberon), lat 41° 57' 51" N, long 92° 18' 47" W, downstream order number 05452000												
4-16-84	1415	326	525	8.0	10.0	11.0	101	--	--	--	--	--
5-29-84	1300	937	500	7.8	10.5	10.3	94	230	64	18	5.9	160
6-27-84	1230	313	545	8.3	18.0	8.4	91	--	--	--	--	--
8-08-84	1200	76	560	8.2	25.0	7.2	90	--	--	--	--	--
9-04-84	1320	18	540	7.8	18.0	10.0	108	530	130	51	14	207
10-19-84	1420	120	515	8.1	10.0	9.5	87	--	--	--	--	--

Date	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Solids, residue at 105 °C, dissolved (mg/L)	Nitrate,[1] dissolved (mg/L as N)	Nitrogen, ammonia, dissolved (mg/L as N)	Phosphorus, ortho-phosphate, dissolved (mg/L as P)	Atrazine, total (µg/L)	Cyanazine, total (µg/L)	Metribuzin, total (µg/L)	Alachlor, total (µg/L)	Metolachlor, total (µg/L)	Trifluralin, total (µg/L)
4-16-84	--	--	--	9.9	0.05	0.03	--	--	--	--	--	--
5-29-84	28	12	253	13	.12	.10	3.8	1.5	<0.05	4.2	2.4	<0.05
6-27-84	--	--	--	8.4	.05	.11	1.5	.65	<.05	<.10	<.10	<.05
8-08-84	--	--	--	7.4	.02	.09	1.1	<.10	<.05	<.10	<.10	<.05
9-04-84	52	16	--	3.8	.03	.06	--	--	--	--	--	--
10-19-84	--	16	--	7.2	.31	.22	.33	<.10	<.05	<.10	<.10	<.05

[1] Nitrate plus nitrite, but predominately nitrate.