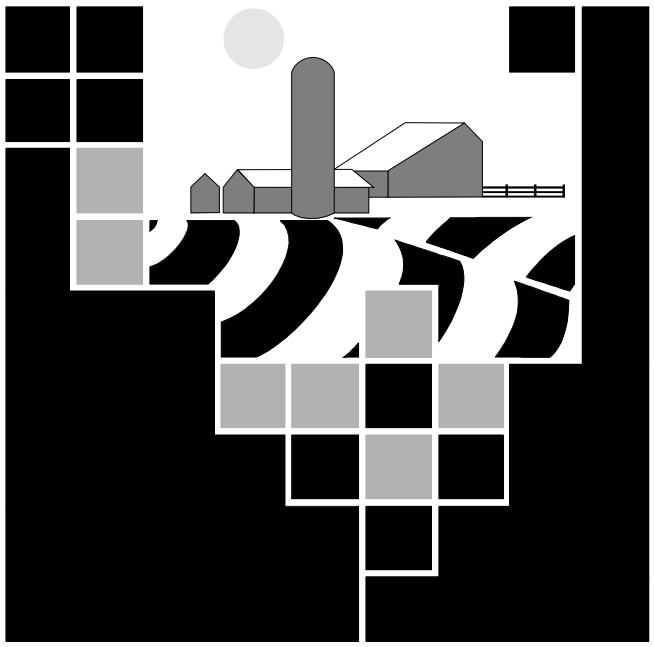
WATER QUALITY FROM THE BLUEGRASS WATERSHED, AUDUBON COUNTY, IOWA: 1987-1992

Geological Survey Bureau
Technical Information Series 35



Iowa Department of Natural Resources
Larry J. Wilson, Director
April 1996

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Prepared by

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Art Bettis drilled and described the Quaternary stratigraphy in the watershed. Christie York analyzed soil samples for organic carbon and particle size analysis. Tom Morris, formerly of ISU-Agronomy, analyzed soil samples for soil nitrate.

Mary Skopec and Angie Bowman provided many of the graphics in this report. Chris Plocher, Amy Matzen, and Mary Clare Jones managed the water-quality database. Pat Lohmann oversaw the design and layout of this report. Mary Skopec and Bob Libra provided editorial comments, and Mary Skopec reviewed the final version.

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PREFACE

Since 1982, the State of Iowa has implemented a number of programs to improve the environmental performance of agriculture. One of these programs, the statewide Integrated Farm Management Demonstration Project (IFMDP), was sponsored by the Iowa Department of Agriculture and Land Stewardship and supported by funds allocated through the 1987 Iowa Groundwater Protection Act. The IFMDP has promoted implementation of improved, integrated farm management across Iowa on many scales, ranging from on-farm demonstrations to a county-scale approach (i.e., Butler County project). The Bluegrass Watershed Project was an effort to implement on-farm demonstrations and education programs on a watershed scale and to monitor water-quality changes in a typical southern Iowa watershed. Iowa State University Extension conducted the on-farm demonstrations and education programs, and the Iowa Department of Natural Resources-Geological Survey Bureau (IDNR-GSB) monitored the quality of surface water and groundwater in the watershed during the period 1987 through 1992.

WATER QUALITY FROM THE BLUEGRASS WATERSHED, AUDUBON COUNTY, IOWA: 1987-1992

Iowa Department of Natural Resources, Geological Survey Bureau
Technical Information Series 35, 1996, 120 p.

L.S. Seigley, G.R. Hallberg, and G.A. Miller

ABSTRACT

From 1987 to 1992, surface water and groundwater quality was monitored in Bluegrass watershed, a 1,024-acre watershed in north-central Audubon County. Groundwater from shallow monitoring wells, active private wells, inactive private wells, and tile lines, and surface water from Bluegrass Creek were sampled for bacteria, nitrate, and pesticides to determine water quality in and around the watershed. Sites were sampled monthly. Rainfall was collected after rainfall events and analyzed for pesticides. The majority of the rural population in western Iowa use shallow (20 to 40 feet deep), large-diameter (three to four feet) "seepage" wells located in the surficial deposits. The groundwater yielded by these wells is susceptible to contamination from modern land-surface activities.

Total coliform and fecal coliform bacteria samples were collected from the actively used private wells. Ninety-two percent of the samples had total coliform bacteria present. The total coliform bacteria results showed no seasonal trends. Thirty-one percent of the samples from the active wells were positive for fecal coliform bacteria.

Results of the nitrate monitoring showed several trends related to landuse, climate, geological materials, and landscape position. Nitrate-N results from the monitoring wells were related to topographic position of the well and the geologic materials in which the wells were screened. Landuse around the wells had minimal effect on nitrate-N concentrations. Wells situated in the uplands in loess (generally well-drained soils) had the highest nitrate-N concentrations, generally greater than 20 mg/L. Wells in Roberts Creek Member alluvium had the lowest nitrate-N concentrations, generally less than 0.2 mg/L. The low nitrate-N concentrations are likely the result of denitrification.

Nitrate-N concentrations from the active private wells declined through time, from 6.7 mg/L in 1987 to 2.7 mg/L in 1992. Annual median concentrations for the individual wells varied, ranging from less than 0.2 mg/L to 28.4 mg/L. The variability in nitrate-N concentrations among the wells is related to landscape position, the geologic materials the wells are situated in, and land management around the wells. Well W1 showed the most significant decline in nitrate-N concentrations of all monitored sites. Median nitrate-N concentrations at well W1 declined from 14.9 mg/L in 1987 to 0.9 mg/L in 1990, 1991, and 1992. In 1987, the land surrounding W1 was taken out of row-crop production and placed in the Conservation Reserve Program. The dramatic decline in nitrate-N concentrations continued after the drought years of 1988 and 1989, and suggests that landuse caused this trend.

The inactive private wells were not used on a regular basis, and results from these wells could not be used to analyze trends in nitrate-N concentrations to landuse changes.

The tile lines had the highest annual median nitrate-N concentrations, varying from 13.1 mg/L to 15.6 mg/L. Annual concentrations for tile lines as a category declined from 1987

to 1989, increased in 1990, and declined from 1990 to 1992. Except for major changes in landuse, it was difficult to relate changes in nitrate-N concentrations from individual tile lines to changes in landuse practices. Nitrate-N concentrations from Bluegrass Creek showed trends similar to the tile lines, although annual median concentrations were lower than concentrations for the tile lines. For Bluegrass Creek, nitrate-N concentrations declined from 1987 to 1989, increased in 1990, and declined from 1990 to 1992.

Data from the pesticide monitoring showed few if any trends related to landuse, climate, geological materials, and landscape position. Unlike the nitrate data, the monitoring wells showed no trends between the pesticide data and the geologic materials the wells were situated in nor the surrounding landuse. Herbicides were still detected in settings where denitrification removed the nitrate. Five herbicides were detected in the monitoring wells (alachlor, atrazine, cyanazine, metolachlor, and metribuzin) at concentrations ranging from 0.10 to 0.43 µg/L. Six herbicides were detected in the active private wells (alachlor, atrazine, cyanazine, metolachlor, pendimethalin, and trifluralin) at concentrations from 0.10 to 24.00 µg/L. In addition to those herbicides detected in the active private wells, metribuzin was also detected in the inactive wells. Concentrations of detected pesticides from the inactive wells ranged from 0.10 to 28.00 µg/L. Alachlor, atrazine, cyanazine, metolachlor, pendimethalin, and trifluralin were detected in the tile lines at concentrations from 0.10 to 7.40 µg/L. Five herbicides (alachlor, atrazine, cyanazine, metolachlor, and pendimethalin) were detected in Bluegrass Creek at concentrations from 0.10 to 4.60 µg/L. Precipitation in Bluegrass watershed was monitored for pesticides from May 1989 through September 1992. Eight herbicides (alachlor, atrazine, cyanazine, eptam, metolachlor, metribuzin, pendimethalin, and propachlor) were detected at concentrations from 0.10 to 28.00 µg/L. The majority of detections were less than 1.00 µg/L. The herbicides detected in rainfall showed a relationship to pesticide use in the state. Atrazine, alachlor, and cyanazine are three of the most commonly used herbicides and were the most commonly detected in Bluegrass precipitation. Insecticides are less frequently used, and no insecticides were detected in the rainfall. According to farm survey information from Bluegrass watershed, all of the herbicides detected in rainfall, except propachlor, were used in the watershed.

INTRODUCTION

From 1987 to 1992, the 1,024-acre Bluegrass watershed in north-central Audubon County (Figure 1) was the site of on-farm demonstrations and education programs designed to increase the efficiency of chemical inputs, and to monitor water-quality in a typical, dominantly agricultural, southern Iowa watershed. Iowa State University Extension conducted the on-farm demonstrations and education programs, and the Iowa Department of Natural Resources-Geological Survey Bureau (IDNR-GSB) monitored the quality of surface water and groundwater in the watershed.

The water quality of eight private wells, 15 monitoring wells, 15 tile lines, precipitation, and Bluegrass Creek was monitored from May 1987 through September 1992 (Figure 2). These sites were sampled monthly for nitrate-N and periodically for pesticides. Several private wells were also sampled monthly for total and fecal coliform bacteria. Precipitation was sampled for pesticides. Because previous studies have shown that water quality may change rapidly during periods of groundwater recharge (primarily after rainfall events when infiltrating water flows through the soil, Everts et al., 1989; Kanwar et al., 1985; Hallberg et al., 1984; Kross et al., 1990), all sites were also sampled after rainfall events of at least one inch (25.4 mm) to monitor possible changes. This event sampling occurred from 1987 to 1989. Field schedules allowed for only monthly sampling during 1990 to 1992.

This report summarizes the water quality data collected from 1987 through 1992 for all locations.

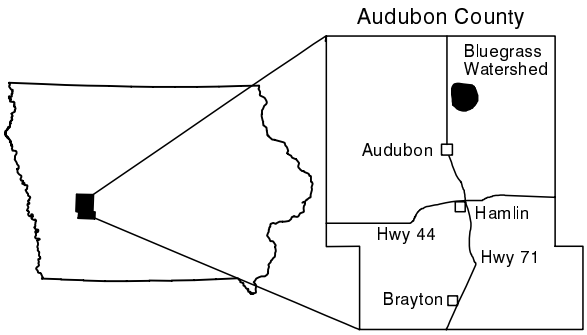

Figure 1. Location map of the Bluegrass watershed, Audubon County, Iowa.

On-Farm Demonstrations and Education Programs

There were several components to the on-farm demonstrations and education programs conducted in Bluegrass watershed by Iowa State University Extension. Farmers in the watershed were encouraged to adopt best management practices that included using fertilizer recommendations based on yield goals and soil tests (P and K), and using integrated weed and insect management practices recommended by Iowa State University. Four demonstration plots were established in and around the watershed, which evaluated various tillage practices and herbicide and nitrogen application rates and methods. Project cooperators and county residents were kept informed of project activities through a bi-monthly newsletter and press releases. Through an Integrated Pest Management program, scouts inventoried fields in the watershed to efficiently target the use of pesticides. Extensive soil sampling of the watershed and plot areas was done to increase the efficient use of fertilizers. A survey was completed in 6 of the 12 townships in Audubon County to assess attitudes and practices of farm operators. Field days were held to present results from the demonstration plots and the water quality monitoring. A county-wide sampling of private water wells was conducted to increase awareness among residents about the susceptibility of shallow wells to groundwater contamination and to emphasize the importance of periodically testing well-water quality (Seigley et al., 1993).

Geologic Setting

The Bluegrass watershed is located in the Southern Iowa Drift Plain landform region (Prior, 1991), an area characterized by an integrated stream network and rolling topography. Land use in Bluegrass watershed is predominantly agricultural, with 90% in cropland. Corn and soybeans are the

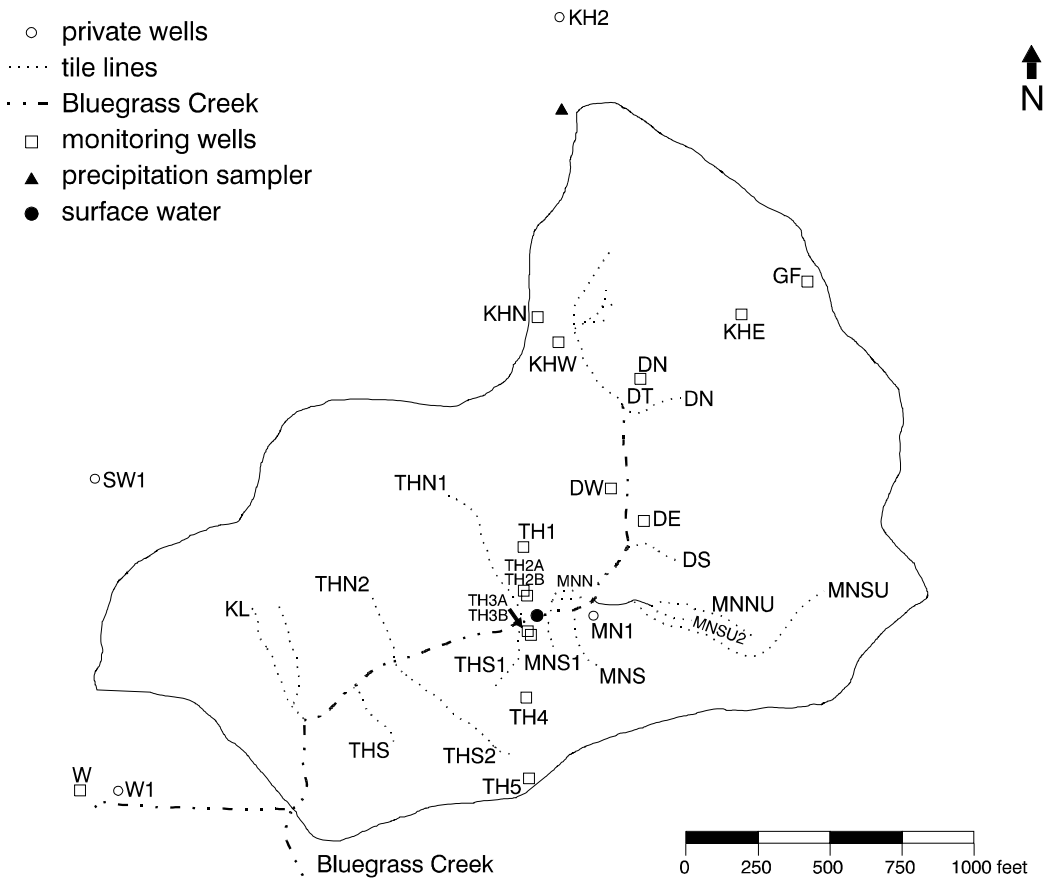

Figure 2. Location of water-quality monitoring sites in and around the Bluegrass watershed.

primary crops grown, with the remainder in small grains, hay, permanent pasture, and commercial sod. About 6% of the watershed is enrolled in the Conservation Reserve Program.

Relief in the watershed is about 150 feet. Figure 3 is a generalized cross section of the Quaternary stratigraphy in the watershed. Upland divide areas are underlain by 20 to 25 feet (6.1 to 7.6 m) of Wisconsinan-age Peoria Loess overlying the Sangamon Geosol (buried soil) developed, in part, in the underlying Pre-Illinoian-age glacial till. Eolian sand, ranging in thickness from one to eight feet (0.3 to 2.4 m), occurs in the lower part of the loess in parts of the watershed, and is interbedded with the loess in others. The paleosol developed in the Pre-Illinoian till represents a stratum of greatly reduced permeability which limits downward movement of water. Groundwater flow at this horizon is predominantly lateral towards Bluegrass Creek and its tributary drainages, and supplies the baseflow of Bluegrass Creek.

Drainageways are underlain by silty alluvial fills of the Camp Creek, Roberts Creek, and Gunder members of the Holocene-age DeForest Formation (these have been described in other parts of the state by Bettis and Littke, 1987; Bettis et al., 1992; and Bettis, 1990). In the Bluegrass watershed, the Camp Creek Member is yellowish-brown, oxidized, silty, stratified alluvium. It varies from two to seven feet (0.6 to 2.1 m) in thickness, and is thickest next to Bluegrass Creek. The Roberts Creek Member is gray to greenish-gray to black,

stratified, organic-rich silty alluvium adjacent to the modern creek channel. Thickness of the Roberts Creek Member varies from 12 to more than 20 feet (3.7 to 6.1 m). The Gunder Member is brown to grayish-brown, oxidized, silty to loamy alluvium, present beneath a low terrace along Bluegrass Creek (E.A. Bettis, III, IDNR, personal communication). Unlike the Roberts Creek Member, the Gunder Member contains little organic matter. Thickness of the Gunder Member ranges from 14 to 16 feet (4.3 to 4.9 m).

The till sequence beneath the upland loess and stream alluvium in Audubon County varies in thickness from 0 to 370 feet (0 to 112.8 m), but in the Bluegrass watershed is typically about 300 feet (91.5 m) thick. It varies from yellow, oxidized, leached till in the upper portion to unoxidized and unleached at depth. Multiple tills occur within the sequence.

Bedrock in the area is Cretaceous Dakota Sandstone, an important aquifer in portions of western Iowa. Well-log information for Audubon County indicates the Dakota Sandstone varies in thickness from 25 to 90 feet (7.6 to 27.4 m), and lies 35 to 300 feet (10.7 to 91.5 m) beneath the surface. In the Bluegrass watershed area, the top of the Dakota Sandstone is approximately 300 feet (91.5 m) below the land surface and is not typically used for domestic/farm wells because natural water quality is generally poor in areas where it is buried this deep (Runkle, 1986; Munter et al., 1983; Burkart, 1982).

Soils in the Bluegrass watershed are primarily of the Marshall-Exira, Sharpsburg-Shelby-Marshall, Judson-Colo-Ackmore, and Colo-Ackmore-Zook associations. The soils are located on gentle to moderately steep slopes. The Marshall-Exira association formed on uplands in nearly level to moderately steep slopes. These silty soils formed in loess and tend to be well drained. The Sharpsburg-Shelby-Marshall formed on uplands in gently sloping to steep positions. The soils are well-drained to moderately well-drained silty and loamy soils formed in loess and glacial till. The Judson-Colo-Ackmore association formed in upland drainageways that are gently sloping. The silty soils of this association formed in alluvium.

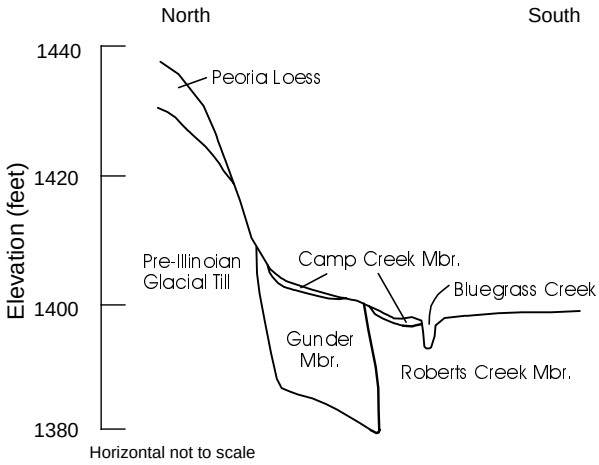

Figure 3. Generalized cross section showing the Quaternary stratigraphy of Bluegrass watershed.

The Colo-Ackmore-Zook association are poorly drained, silty soils formed in alluvium on bottom land that is nearly flat (Minger and Reeves, 1984).

Well Construction of Private Wells

The private water-supply wells in this part of the state are generally shallow (20 to 40 feet; 6.1 to 12.2 m), large-diameter "seepage" wells (Figure 4). The wells are constructed of stacked concrete curbing with each section 2.5 to 3 feet (0.8 to 0.9 m) high and generally 3 to 4 feet (0.9 to 1.2 m) in diameter; some older wells have brick curbing. The wells are usually located in areas of groundwater discharge or where groundwater flow converges (in low areas on upland positions or in alluvium along creeks or rivers); these settings maximize sustained seepage to the wells. Such areas are typically in the middle of row-cropped fields. The wells are usually bored to the loess/paleosol-till contact. The large perimeter area is designed to enhance seepage from the surrounding low-permeability sediments, and the large volume of these wells provides a storage reservoir. The shallow depth and location make this type of well inherently susceptible to contamination from modern land-surface activities.

These wells are typical for this part of the state because the bedrock aquifers are deeply buried and

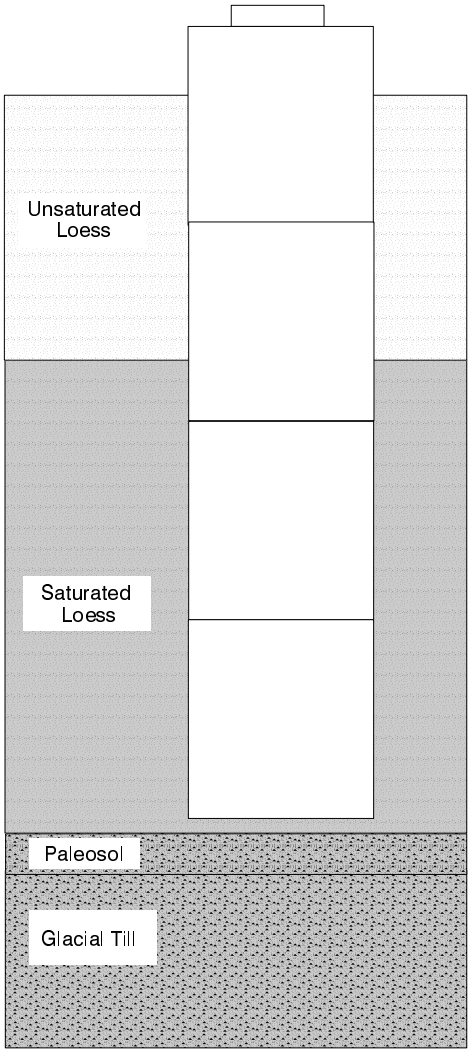

Figure 4. Generalized diagram of a large-diameter "seepage" well.

have relatively poor water quality. The Iowa State-Wide Rural Well-Water Survey (SWRL; Kross et al., 1990; SWRL) was a statewide sampling of 686 private wells in 1988 and 1989 that was designed to provide a statistically valid assessment of the proportion of private rural wells and rural Iowa residents affected by various environmental contaminants. Results from SWRL indicated that approximately 54% of the wells in western and southern Iowa are less than 50 feet deep (15 m), and large-diameter seepage wells accounted for over half of the wells that were less than 50 feet deep (15 m) (Hallberg et al., 1992). These shallow wells had the greatest percent detections of all contaminants.

A county-wide sampling of 231 private wells was conducted in Audubon County in September 1988. Results from the sampling showed that the majority of the wells inventoried were large-diameter "seepage" wells, and 67% of the wells were less than 40 feet (12 m) deep (Seigley et al., 1993). These wells generally were located in the middle of row-cropped fields, commonly 1/4 to 1/2 mile (0.4 to 0.8 km) from the houses they supply. The Audubon county-wide sampling indicated that the majority of wells were greater than 50 feet (15 m) from a septic system; greater than 100 feet (30 m) from an active barnyard/feedlot; and 92% were greater than 50 feet (15 m) from chemical mixing locations.

Previous Water-Quality Data from Audubon County

Previous water-quality data from Audubon County has shown unsafe total coliform bacteria levels and elevated nitrate-N concentrations. Initial analysis of data from 1987 through 1989 for the Bluegrass watershed is provided in Seigley and Hallberg (1991). Data was summarized from private wells, tile lines, and a surface water site. Sampling included 1988 and 1989, the driest consecutive two-year period in Iowa climatic records. Coliform bacteria was detected in 90% of the samples from active wells. Yearly mean nitrate-N concentrations showed a statistically significant decline from 1987 to 1989. Forty-one percent of the water samples collected for pesticide analysis had detections of one or more herbicides. Six herbicides were detected at concentrations ranging from the detection limit of 0.10 to 28.00 µg/L. Atrazine was the most commonly detected herbicide followed by cyanazine, alachlor, metolachlor, trifluralin, and pendimethalin. Eighty-four percent of all herbicide detections occurred during the months of May to September.

Water quality samples from Audubon County submitted to the University Hygienic Laboratory in Iowa City have also shown unsafe total coliform

Table 1. Summary, from the University Hygienic Laboratory database, of the nitrate-N and total coliform bacteria results from private wells in Audubon County; 1986-1993. Unsafe samples are defined as positive for total coliform bacteria or nitrate-N greater than 10 mg/L.

	1986	1987	1988	1989	1990	1991	1992	1993
	Number of Unsafe Samples (%)							
Audubon County								
Total Coliform Bacteria	24 (73%)	26 (54%)	19 (53%)	53 (67%)	62 (63%)	37 (67%)	36 (49%)	51 (64%)
Nitrate-N	13 (45%)	21 (49%)	8 (29%)	23 (29%)	29 (33%)	26 (48%)	22 (30%)	28 (35%)
Statewide								
Total Coliform Bacteria	4236 (39%)	4413 (37%)	3429 (33%)	3846 (33%)	4535 (35%)	4029 (36%)	3141 (31%)	5608 (37%)
Nitrate-N	1632 (18%)	1801 (18%)	1475 (16%)	1517 (15%)	1766 (15%)	1587 (16%)	1482 (14%)	1668 (11%)

bacteria and nitrate-N concentrations. From 1986 through 1993, 523 total coliform bacteria and 474 total nitrate-N samples from private wells in Audubon County were submitted to the University Hygienic Laboratory (UHL; Table 1). Annually, 49% to 73% of the samples were positive for total coliform bacteria, and 29% to 49% exceeded the U.S. Environmental Protection Agency (USEPA) drinking-water standard for nitrate-N (10 milligrams per liter, mg/L, as nitrate-N; Cathy Russell, UHL, personal communication). The percent of Audubon County samples unsafe for total coliform bacteria and nitrate-N was higher than statewide averages.

A volunteer, county-wide sampling of 231 rural wells in Audubon County in September 1988 showed that 78% of the samples collected were positive for total coliform bacteria, and 26% of the samples had nitrate-N concentrations greater than 10 mg/L (Seigley et al., 1993). The majority of the wells were large-diameter "seepage" wells. Twenty-six percent of the samples were from wells using cisterns; 93% of these samples tested positive for total coliform bacteria. Total coliform bacteria are ubiquitous in soils, surface water, and shallow groundwater. Cisterns are commonly associated with unsafe coliform bacteria counts (Hallberg et al., 1983; Hallberg et al., 1992). Twenty-six percent of the wells had nitrate-N concentrations greater than 10 mg/L. Mean nitrate-N concentrations and detections of total coliform bacteria decreased with increasing well depth. There were no obvious widespread point source problems. The majority of wells were greater than 100 feet (30 m) from an active barnyard/feedlot; greater than 50 feet (15 m) from a septic system; and 92% were greater than 50 feet (15 m) from chemical mixing locations.

The Iowa State-Wide Rural Well-Water Survey (Kross et al., 1990) showed a significant correspondence between areas in western Iowa (including Audubon County) dominated by shallow, water-table wells and the number of wells with contamination problems. In the two different hydrogeologic regions covering western Iowa, 59 to 63% of the wells in western Iowa were large diameter bored/dug wells (Hallberg et al., 1992). At least 50% of the wells in western Iowa were less than 50 feet (15 m) deep. Of those wells, 71 to 78% were positive for total coliform bacteria; 30 to 52% had concentrations greater than 10 mg/L nitrate-N; and 8% were positive for fecal coliform bacteria (Kross et al., 1990).

HYDROLOGIC MONITORING

Water sampling in Bluegrass watershed was conducted from May 1987 through September 1992. Private wells, monitoring wells, tile lines, a surface water site, and a precipitation site were

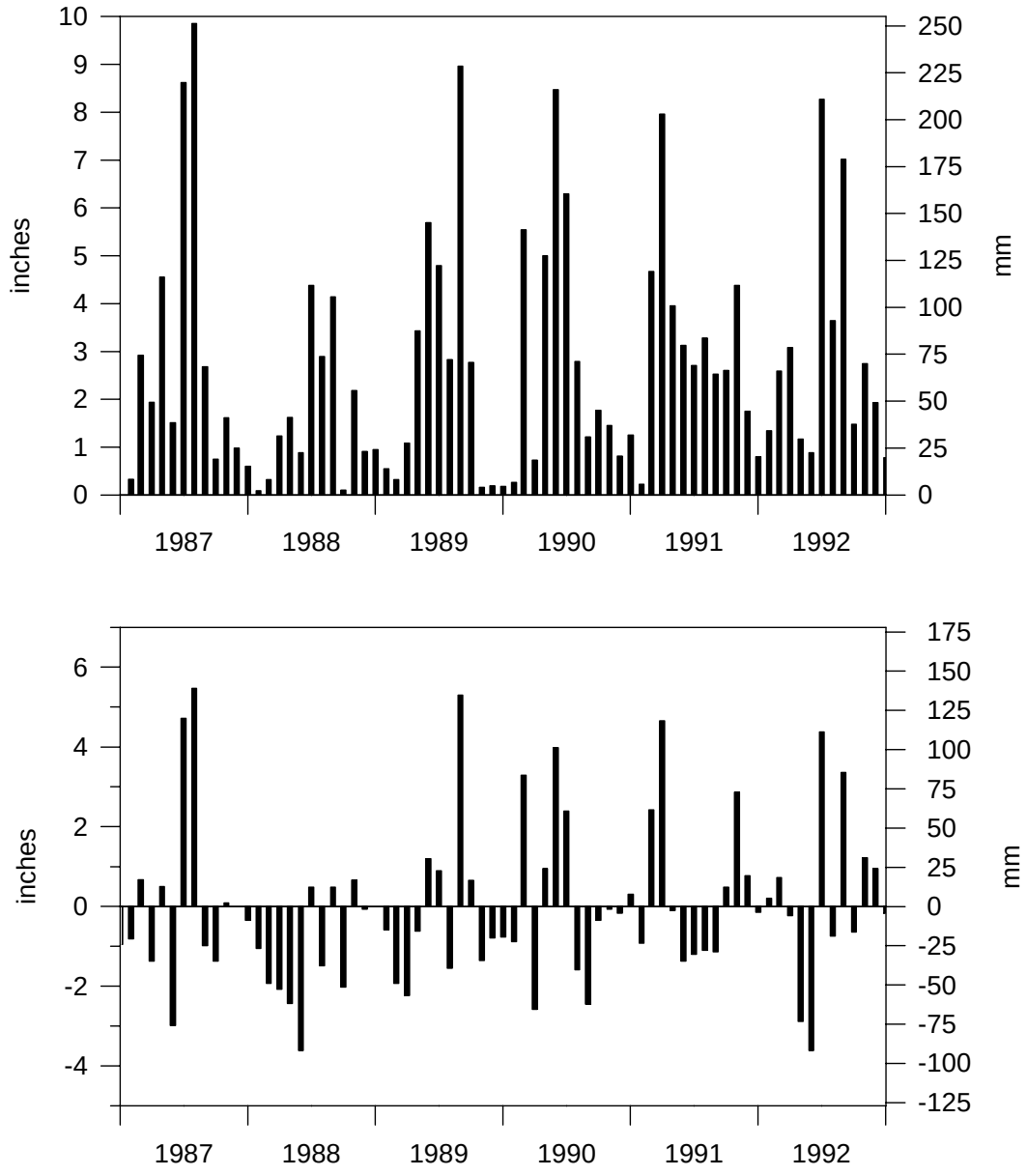

Figure 5. Monthly precipitation and departure from normal precipitation for the Audubon 1SSE climatic station from 1987 through 1992.

monitored to determine if changes in water quality occurred in association with the on-farm demonstration and education program the Iowa State University Extension was conducting in the watershed. The Iowa State University Extension program focused on reducing nutrient and chemical inputs in the watershed through use of nutrient management, integrated pest and weed management, and conservation tillage.

All of the water-quality results are tabulated in Appendix 1. Sites were primarily sampled for total coliform bacteria, nitrate-N, and pesticides. Total coliform bacteria and nitrate-N are two water tests used to determine whether the quality of drinking water may be a health concern. Because some private wells were not pumped on a regular basis,

the private wells were separated into two categories: active and inactive wells. Four private wells (KH2, MN1, SW1, W1) were classified as active wells because they were regularly pumped for household and/or livestock water supplies. Two of these sites were also connected to rural-water supply systems, either for back-up or for household use. At the other two active sites the wells were the only water source. Beginning in January 1989, these active wells were also sampled for fecal coliform bacteria to further assess the health concerns associated with the water from these wells. The presence of fecal coliform bacteria indicates contamination from a relatively fresh waste source such as home sewage disposal system or animal feedlot runoff.

In the initial Bluegrass watershed study (Seigley and Hallberg, 1991) covering 1987 through 1989, three wells were classified as inactive wells (D1, D2, KH1). Sampling of an additional well (KH3) began in May 1990, and this well was classified as inactive. This well was used as a back-up to provide water to livestock and was pumped more frequently than the other inactive wells. An inactive well is here defined as a well that is not pumped on a regular basis, but kept as a potential back-up water supply or is no longer in use, but has not yet been plugged and sealed. Of the four inactive wells, two were occasionally used to water livestock. The inactive wells were too large to pump or bail effectively when monthly samples were collected, and therefore, relatively stagnant water was sampled. Samples from these wells may not be representative of groundwater conditions; inactive wells are not pumped, and consequently do not remove the water they hold in storage and do not continuously promote "new" groundwater into the well. Sampling of one of the inactive wells was discontinued in August 1991 because of extensive deterioration of the well. This well (KH1) has since been properly plugged according to IDNR guidelines for well abandonment.

Precipitation

Mean annual precipitation (based on the period 1951-1980) in Audubon County is 32.75 inches (831.9 mm). Precipitation data was used from the Audubon 1SSE climatic station, located six miles (9.7 km) south of the Bluegrass watershed (Climatological Data Iowa, 1987; Iowa Climate Review, 1988-1993). Figure 5 shows the monthly precipitation from January 1987 through December 1992 and the departure from normal monthly precipitation for the same time period. Table 2 lists the annual rainfall totals and departure from normal.

Table 2. Precipitation totals and departure from normal rainfall by year for the Audubon 1SSE climatic station.

Year	Precipitation inches (mm)	Departure from normal inches (mm)	Percent of normal precipitation
1987	35.74 (908)	2.99 (76)	109%
1988	19.34 (491)	-13.41 (-340)	59%
1989	31.72 (806)	-1.03 (-26)	97%
1990	35.04 (890)	2.29 (58)	107%
1991	38.4 (975)	5.65 (143)	117%
1992	34.94 (887)	2.19 (56)	107%

In 1987, rainfall was close to normal, followed by 1988 and 1989, the driest consecutive two-year period on record for Iowa. Rainfall was 59% of normal in 1988 and 97% of normal in 1989. The annual rainfall for 1989 approached the annual mean only because September rainfall was 245% of the monthly normal. Most other months in 1989 were below normal for rainfall (Figure 5). The drought conditions in 1988 and 1989 resulted in several dry tile lines and a decline in water levels in the private wells. Rainfall was close to normal during 1990 through 1992.

Groundwater Levels and Stream Discharge

Groundwater level and stream discharge data recorded by the U.S. Geological Survey (USGS) reflect the regional nature of the drought conditions during 1988 and 1989, and the above normal rainfall conditions during 1990 through 1992. During 1986 to 1989, water levels in a sand and

gravel (alluvial aquifer) well along the East Nishnabotna River in Audubon County declined almost six feet (1.8 m). Water levels recovered to normal levels with the above normal rainfall from 1990-1992. The highest water level recorded at this well was in May 1983 and the lowest in October 1988. The well has been monitored by the USGS since June 1982.

The closest USGS surface-water gaging station to the Bluegrass watershed is on the East Nishnabotna River near the town of Atlantic in Cass County, just south of Audubon County. Most of the drainage basin above Atlantic is in Audubon County, and Bluegrass Creek is a tributary, joining the East Nishnabotna River south of the town of Audubon. The drainage area of the East Nishnabotna River at this gaging station is 436 mi^2 (1129 km^2). Table 3 lists the annual discharge for the East Nishnabotna River at Atlantic for 1987 through 1992 (Melcher et al., 1988, 1989; O'Connell et al., 1989, 1990, 1991; Gorman et al., 1992; Southard et al., 1993). Average annual discharge for this gaging station is 245 cubic feet per second (cfs; 6.93 cubic meters per second, m^3/s), based on the period of record from 1961-1993. Discharge was near normal in 1987, substantially below normal in 1988 and 1989, and above normal from 1990 through 1992.

Water-Quality Sampling and Analyses

The water quality of eight private wells, 15 monitoring wells, 15 tile lines, and Bluegrass Creek was monitored from May 1987 through September 1992 (Figure 2). These sites were sampled monthly for nitrate-nitrogen (nitrate-N) and periodically for pesticides. In addition, a few samples were analyzed for common anions and cations, and total organic carbon (methods and analytes are in Table 4). The private wells were also sampled monthly for total and fecal coliform bacteria. Precipitation was sampled for pesticides.

The fifteen monitoring wells were installed in and around the watershed to monitor the shallow groundwater in various landscape positions. Well depths ranged from 12 to 23 feet (3.7 to 7.0 m), and each well had a screen in the bottom, two feet (0.6 m) in length. Water levels in the monitoring wells were measured on a monthly basis. Laboratory analyses included nitrate-N (May 1989-September 1992), periodic pesticides (June 1989-September 1991), and immuno assay for triazine herbicides (IMA) (May 1992-September 1992). Mineral scan analyses were completed August 1989 for water from three of the monitoring wells. Field tests for conductivity, dissolved oxygen, nitrate, and iron were completed June 1990.

Water-quality samples were analyzed by the University of Iowa Hygienic Laboratory (UHL) in Iowa City. The University of Iowa Hygienic Laboratory is an U.S. EPA (USEPA) certified laboratory with an approved QA/QC plan. Samples were collected in pre-treated containers supplied by the laboratory. Collected samples were placed in coolers and chilled until delivery to the laboratory. Table 4 summarizes the Bluegrass watershed water-quality analytes and lists references for the laboratory methods for the analytes.

Total coliform bacteria was determined using the Most Probable Number (MPN) method and reported as the statistical MPN of total coliform individuals per 100 milliliters of water (APHA, 1985). MPN categories include 0, 2.2, 5.1, 9.2, 16, and 16+. Results are reported as safe (for zero coliforms) or unsafe (if coliforms are present). Samples for fecal coliform bacteria were analyzed using the standard multiple tube fermentation (MTF) method, performed according to standard methods of APHA (1985) and the USEPA (1982). The results are also reported as MPN. Nitrate-N was analyzed by cadmium reduction using a Technicon auto-analyzer system, and included nitrate-N plus nitrite-N. Nitrate-N results, reported as NO_3-N, are in milligrams per liter (mg/L); one mg/L is equal to one part per million (ppm). The drinking water standard for nitrate-N, as set by the USEPA, is 10 mg/L. Analyses below the quantitation limit for nitrate-N were reported as <0.2 mg/L. For statistical analysis, values below the quantitation limit were given a value of 0.1 mg/L.

Pesticides were analyzed by gas chromatography (GC) (after USEPA, 1980). All pesticide detections were confirmed and quantified on two

Table 3. Annual discharge for the East Nishnabotna River at Atlantic, Iowa for 1987 through 1992.

Year	Annual discharge cubic feet/second (cubic meters/second)	Departure from normal discharge	Runoff in inches (mm)*
1987	263 (7.44)	107%	8.18 (207.77)
1988	70 (1.98)	29%	2.16 (54.86)
1989	135 (3.82)	55%	4.22 (107.19)
1990	258 (7.30)	105%	8.02 (203.71)
1991	352 (9.96)	144%	10.97 (278.64)
1992	359 (10.16)	147%	11.23 (285.24)

* Depth to which the drainage area would be covered if all the runoff for the year was uniformly distributed on it.

Table 4. Summary of analytes and references for laboratory methods for Bluegrass watershed water-quality analytes.

Analyte	Units	Method Reference
total coliform bacteria	MPN	Standard Methods 908A (APHA, 1985)
fecal coliform bacteria	MPN	APHA (1985) and USEPA (1982)
nitrate plus nitrite-nitrogen	mg/L	USEPA Method 353.2 (USEPA, 1983)
common herbicides, multi residues	µg/L	USEPA Method 507 (USEPA, 1980, and revisions)
organophosphate insecticides	µg/L	USEPA, Method 81.40 (USEPA, 1986)
IMA-triazines	µg/L	Millipore triazine kit
Mineral Scan Parameters		
pH value (lab)	pH units	USEPA Method 150.1
specific conductance	µmhos @ 25 °C	USEPA Method 120.1
total alkalinity	mg/L as $CaCO_3$	USEPA Method 310.1
total hardness	mg/L as $CaCO_3$	USEPA Method 130.2
silica	mg/L	USEPA Method 370.1
total solids	mg/L @ 103 °C	USEPA Method 160.3
dissolved solids	mg/L @ 180 °C	USEPA Method 160.1
calcium	mg/L	USEPA Method 215.2
magnesium	mg/L	USEPA Method 200.7
dissolved manganese	mg/L	USEPA Method 200.7
total manganese	mg/L	USEPA Method 200.7
potassium	mg/L	USEPA Method 258.1
sodium	mg/L	USEPA Method 273.1
bicarbonate	mg/L	Standard Method 403
chloride	mg/L	USEPA Method 325.3
fluoride	mg/L	USGS Method 1432784
nitrite+nitrate-N	mg/L	USEPA Method 353.2
sulfate	mg/L	USEPA Method 275.4
total organic carbon	mg/L	USEPA Method 415.1
dissolved iron	mg/L	USEPA Method 200.7
total iron	mg/L	USEPA Method 200.7

Table 5. Pesticides analyzed for in the Bluegrass watershed samples.

INSECTICIDES		HERBICIDES	
Chemical name	Typical product name	Chemical name	Typical product name
chlorpyrifos	Lorsban	alachlor	Lasso
diazinon	Many product names	atrazine	Aatrex
dimethoate	Cygon	butylate	Sutan
ethoprop	Mocap	cyanazine	Bladex
fonofos	Dyfonate	metolachlor	Dual
malathion	Many product names	metribuzin	Sencor
parathion	Many product names	pendimethalin	Prow l
phorate	Thimet	propachlor	Ramrod
terbufos	Counter	trifluralin	Treflan

columns with periodic confirmations with electron-capture detectors and GC-mass spectrometry (GC/MS). Eighteen pesticides were included in the pesticide scan by UHL. The quantitation limit (smallest concentration the lab confidently quantifies for reporting) for the 18 pesticides was 0.10 micrograms per liter (µg/L); one µg/L is one part per billion (ppb). Table 5 lists the common chemical names and typical product names for the 18 pesticides analyzed. The lab routinely runs internal calibration standards for the listed pesticides, as well as other spikes, duplicates, and blanks for quality assurance and quality control. Hallberg and others (1990) provide a more detailed review of the pesticide methods. Pesticide samples from the precipitation site were analyzed using a combination of GC, immuno assay, and immuno assay on the sample extract.

Description of Monitoring Sites

Fifteen monitoring wells were installed in various landscape positions in the watershed. Twelve of the monitoring wells were installed in May 1989 and the other three in November 1990. The wells were installed by the IDNR-GSB using a Giddings hydraulic soil coring machine. Three-inch (7.6 cm) cores were drilled and collected at each well site and described to provide a detailed record of the deposits. Wells were constructed using 1 1/4 inch (5.1 cm) diameter, flush threaded, schedule 40 polyvinyl (PVC) pipe. Two-foot (0.6 m) long PVC slotted screens (0.01 slot size) were filter wrapped and attached to the bottom of the well pipe. The screened intervals were sand packed and bentonite used to seal the annulus of the boreholes.

Table 6 lists the monitoring well sites, total depth, screened interval depth, and geologic materials at the screened interval depth. Figure 2 shows the location of the monitoring wells. The wells were completed in Wisconsinan-age Peoria Loess or in alluvium of the Holocene-age DeForest Formation.

All eight of the private wells sampled as part of the Bluegrass study were shallow, large-diameter wells. The wells ranged in depth from 20 to 30 feet (6.1 to 9.1 m). Seven of the eight wells were constructed of concrete curbing; the other well was constructed of brick curbing. Three of the wells were mounded a few feet above the surrounding surface. Five of the wells were located at the edge of a row-cropped field. Two of the wells were located in pasture along Bluegrass Creek. Land surrounding the other well was in the Conservation Reserve Program since 1987.

The tile lines were generally three to five feet (0.9 to 1.5 m) below the ground surface and constructed of either slotted PVC pipe or clay tile. Figure 2 shows the location of the tile lines. Sampling depended on climatic conditions. Tile lines were sampled monthly, however, during the drought years of 1988 and 1989, many tile lines were dry

Table 6. Well depths and geologic materials for monitoring wells located in the Bluegrass watershed.

Monitoring Well	Well Depth (feet)	Screened Interval (feet)	Geologic Material
KHE	11.3	9.3-11.3	Loess
KHW	14.2	12.2-14.2	Roberts Creek alluvium
KHN	10.3	8.3-10.3	Gunder alluvium
W	15.7	13.7-15.7	Roberts Creek alluvium
TH1	16.9	14.9-16.9	Loess
TH2A	14.3	12.3-14.3	Roberts Creek alluvium
TH2B	20.9	18.9-20.9	Roberts Creek alluvium
TH3A	10.8	8.8-10.8	Gunder alluvium
TH3B	15.0	13.0-15.0	Gunder alluvium
TH4	13.0	11.0-13.0	Gunder alluvium
TH5	12.1	10.1-12.1	Gunder alluvium
GF	22.8	20.8-22.8	Loess
DE	15.0	13.0-15.0	Roberts Creek alluvium
DW	12.6	10.6-12.6	Roberts Creek alluvium
DN	17.5	15.5-17.5	Gunder alluvium

for several consecutive months. During the winter months, water in the tile lines was frequently frozen or the tile lines were buried in snow, and water samples were not collected.

The surface water samples from Bluegrass Creek were collected near a bridge crossing in the middle of the watershed. The samples were collected either from the bridge itself or from the stream bank. Nine tile lines discharge upstream of the sampling site and six tile lines discharge downstream.

Precipitation falling in the watershed was sampled for pesticides from May 1989 to September 1992. This location was one of several across Iowa monitored by the IDNR-GSB to assess the occurrence of pesticides in precipitation (Nations and Hallberg, 1992; Nations et al., 1993). Precipitation samples were collected using two methods: (1) a large-diameter (42 cm) galvanized steel basin (similar to Richards et al., 1987) that remained outdoors and collected bulk deposition, both wet and dry; and (2) automatic precipitation samplers (Aerochem Metrics Model 301, Aerochem Metrics, Bushnell, FL), identical to those used by the National Atmospheric Deposition Program to monitor acid rain. The automatic sampler opens only during precipitation, therefore, it collects only wet deposition and not dry. Samples were collected in the galvanized steel basin from May 1989 to November 1990 and in the automatic precipitation

Table 7. Summary of total coliform bacteria from active and inactive wells in Bluegrass watershed on an annual and monthly basis; 1987-1992.

By Year	1987	1988	1989	1990	1991	1992	TOTAL
ACTIVE WELLS							
# of safe (%)	1 (4)	0 (0)	12 (21)	2 (5)	2 (5)	3 (8)	20 (8%)
# of unsafe (%)	22 (96)	47 (100)	45 (79)	42 (95)	37 (95)	33 (92)	226 (92%)
INACTIVE WELLS							
# of safe (%)	0 (0)	0 (0)	1 (8)	NS	0 (0)	NS	1 (3%)
# of unsafe (%)	9 (100)	10 (100)	12 (92)	NS	2 (100)	NS	33 (97%)

By Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ACTIVE WELLS												
# of safe (%)	5 (21)	0 (0)	5 (16)	4 (20)	2 (9)	2 (5)	1 (5)	0 (0)	0 (0)	0 (0)	0 (0)	1 (25)
# of unsafe (%)	19 (79)	11 (100)	26 (84)	16 (80)	21 (91)	35 (95)	19 (95)	16 (100)	26 (100)	20 (100)	14 (100)	3 (75)
INACTIVE WELLS												
# of safe (%)	0 (0)	0 (0)	1 (9)	0 (0)	0 (0)	0 (0)	0 (0)	NS	0 (0)	0 (0)	0 (0)	NS
# of unsafe (%)	4 (100)	2 (100)	10 (91)	2 (100)	2 (100)	5 (100)	1 (100)	NS	3 (100)	2 (100)	2 (100)	NS

NS = no sample

sampler from April 1991 to September 1992. The precipitation sampler was located less than 350 feet (107 m) from row-cropped areas which received pesticide application.

BACTERIA MONITORING

Total Coliform Bacteria

Total coliform bacteria samples were collected monthly from the active private wells and periodically from the inactive wells. Only an MPN value of 0 is reported as "safe" related to total coliform bacteria. Tile lines and surface water were not analyzed because total coliforms are ubiquitous in surface water and shallow groundwater (tile water) and these would always contain high MPN values.

Ninety-two percent of the samples from the active private wells had total coliform bacteria present (Table 7). The bacteria results showed no seasonal trends. The percent detection was higher than results from the Audubon county-wide sampling of private wells. In the county-wide sampling, 78% of the samples were positive for total coliform bacteria (Seigley et al., 1993). The percentage of samples with bacteria were lower in the county-wide sampling because both shallow seepage and drilled wells were sampled. Drilled wells are deeper and, if properly constructed, are not as susceptible to contamination. The repeated occurrence of total coliform bacteria in the seepage wells is typical for shallow wells completed at or near the water table (Thompson, 1984; Kross et al., 1990). Total coliform bacteria are not a health hazard themselves; they occur naturally in the near surface soil-water environment. Their presence implies that shallow groundwater or surface water has entered the water system. They are used as an indicator that possible pathogens may be able to enter the water system as well.

Fecal Coliform Bacteria

Although total coliform bacteria are not a health hazard, their presence does indicate that disease-causing organisms may be able to enter the well. Because of this concern, in January 1989, testing for fecal coliform bacteria began. The presence of fecal coliform bacteria indicates contamination

Table 8. Summary of fecal coliform bacteria from active wells in Bluegrass watershed on an annual and monthly basis; 1989-1992.

By Year	1989	1990	1991	1992	TOTAL
ACTIVE WELLS					
# of safe(%)	13 (81)	0 (0)	13 (62)	27 (75)	53 (69%)
# of unsafe(%)	3 (19)	4 (100)	8 (38)	9 (25)	24 (31%)
TOTAL	16	4	21	36	77

By Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ACTIVE WELLS												
# of safe(%)	6 (75)	4 (100)	15 (94)	4 (100)	9 (100)	4 (50)	6 (50)	1 (25)	3 (37.5)	1 (25)	NS	NS
# of unsafe(%)	2 (25)	0 (0)	1 (6)	0 (0)	0 (0)	4 (50)	6 (50)	3 (75)	5 (62.5)	3 (75)	NS	NS
TOTAL	8	4	16	4	9	8	12	4	8	4	----	----

NS = no sample

from a relatively fresh waste source such as home sewage disposal system or animal feedlot runoff. Samples were not collected every month for fecal coliform bacteria as they were for total coliform bacteria.

In total, 77 samples from the active private wells were analyzed for fecal coliform bacteria (Table 8). Since fecal coliforms are a subset of the total coliform group, all samples that were positive for fecal coliforms were also positive for total coliform bacteria. Of the samples tested for both total coliform and fecal coliform bacteria, 88% were positive for total coliform bacteria and 31% were positive for fecal coliform bacteria.

Samples for fecal coliform analysis were collected from the wells all months except November and December. Fecal coliform bacteria were detected all months of sampling except during February, April, and May. Two of the wells (MN1 and W1) were positive for fecal coliform bacteria in January 1989. The detection of fecal coliforms in January seems unusual, however, climatic conditions prior to sampling may explain their occurrence. For the three weeks prior to the January 1989 sampling, Bluegrass watershed and the surrounding area experienced unseasonably warm temperatures. During this period, daytime high temperatures were all above freezing, and for two of the three weeks, temperatures were above 40° F (4.4° C). The day of sampling was 58° F (14.5° C). This period of warm temperatures caused an early melting of the snow cover, likely allowing shallow groundwater movement into the wells.

Fecal coliform bacteria were detected at all four wells during the July 1990 sampling, and at three of the four sites during the September and October 1991, and August 1992 samplings. Close to two inches (50.8 mm) of rain fell the day prior to the July 1990 sampling and close to one inch (25.4 mm) fell the day prior to the August 1992 sampling. Rainfall may have affected the detection of fecal coliform bacteria in the wells during both samplings. There were no unusual climatic conditions to explain the September and October 1992 fecal coliform bacteria detections.

Several recent groundwater studies in Iowa have included the analysis for fecal coliform bacteria. In September 1991, 15 samples were collected from active wells in the Bluegrass watershed and surrounding area (Nancy Hall, UHL, personal communication). Ninety-three percent of the samples were positive for fecal coliform bacteria. Fecal coliform bacteria tests were also done on a portion of the 686 sites sampled as part of the Iowa State-Wide Rural Well-Water Survey (SWRL) completed in 1988 and 1989 (Kross et al., 1990; Hallberg et al., 1990). Fecal coliform bacteria were found in only 5.4% of private rural water supplies state-wide, on a population-weighted basis. This compares to 44.6% of private rural water

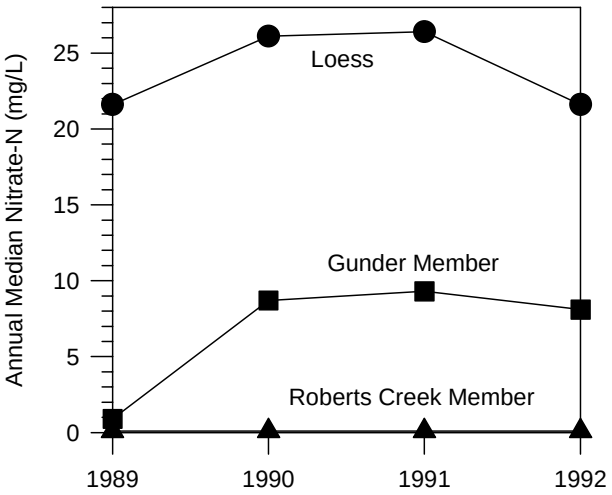

Figure 6. Annual median nitrate-N concentrations for the three categories of monitoring wells.

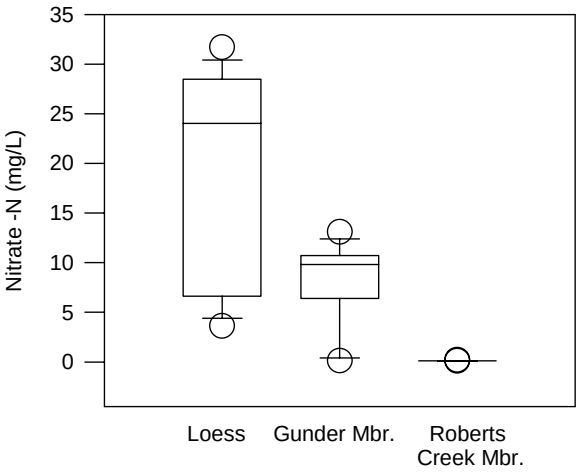

Figure 7. Box plots of nitrate-N concentrations for monitoring wells for 1989 through 1992. Box plots illustrate the 25th, 50th (median), and 75th percentiles; the whiskers indicate the 10th and 90th percentiles; and the circles represent the 5th and 95th percentiles.

supplies that contained total coliform bacteria. The majority of positive samples for fecal coliform bacteria (80%) came from water supply systems using wells <100 feet (30 m) deep. In addition to the initial sampling of 686 sites sampled for SWRL, a 10% subset (68) of all sites was selected for repeat sampling in October 1990 and June 1991. For the October 1990 sampling, 19% of the sites were positive for fecal coliform bacteria, and 47% of the samples from wells less than 50 feet (15 m) deep were positive (Rex et al., 1993). Twenty-four percent of the samples from the June 1991 sampling were positive, and 48% of the samples from wells less than 50 feet (15 m) deep were positive (Libra et al., 1993) In the original survey, 8% of all samples from wells less than 50 feet (15 m) deep were positive for fecal coliform bacteria (Kross et al., 1990).

In conjunction with the Big Spring Basin Demonstration Project and the Sny Magill Watershed Nonpoint Source Monitoring Project, private wells in northern Clayton County in northeast Iowa were tested for fecal coliform bacteria in October 1992. Of the 151 wells sampled in Sny Magill and Bloody Run watersheds, 10% were positive for fecal coliform bacteria (Seigley and Hallberg, 1994), and 13% of the 181 wells tested in the Big Spring basin were positive (Seigley and Quade, 1992).

NITRATE MONITORING

Results of the nitrate monitoring showed several trends related to landuse, climate, geologic materials, and landscape position. Nitrate-N data from the monitoring wells, active wells, inactive wells, tile lines, and surface water is summarized below. Appendix I is a summary of the nitrate data from all sites.

Monitoring Wells

The nitrate-N data from the monitoring wells showed several distinct trends related to the topographic position of the well and the geologic materials in which the wells are screened. The dominant effects of the hydrogeologic setting obscured most relationships with landuse. Table 9 is a summary of the annual mean and median nitrate-N concentrations for each well, the number of

samples collected, range in nitrate-N concentrations, the geologic material in which the wells are screened, and the landuse around the wells.

Monitoring wells were divided into three categories based on the type of geologic material in which the well screens were positioned: loess, Gunder Member alluvium, and Roberts Creek Member alluvium. During the four years of monitoring, the highest annual median nitrate-N concentrations occurred in wells located high in the landscape where the well screens were placed down to the loess/paleosol contact (Figure 6). Annual median nitrate-N concentrations for loess wells ranged from 21.6 to 26.4 mg/L. The lowest nitrate-N concentrations occurred in wells located low in the landscape where the well screens were placed into the organic-rich alluvium of the Roberts Creek Member. Annual concentrations from these wells were all <0.2 mg/L. Annual nitrate-N concentrations from wells located in the Gunder Member alluvium ranged from 0.9 to 9.3 mg/L. Figure 7 shows box plots for the nitrate-N data from the three categories of monitoring wells. Wells situated in loess showed the greatest variation in nitrate-N concentrations, and wells in Roberts Creek alluvium showed the least variability in concentration.

Three of the monitoring wells were located in loess: KHE, GF, and TH1. Well KHE is located along a fence row and surrounded by row crops. Well GF is situated close to the landscape divide and is next to a row-cropped field and a farmstead. Both of these wells, KHE and GF, had median nitrate-N concentrations greater than 20.0 mg/L all four years of monitoring. Well TH1 is also located in loess but nitrate-N concentrations were much lower (medians of 1.1 - 7.1 mg/L) for this well (Table 9). The area immediately surrounding well TH1 was in row crops, however, the area upgradient of the well site, or the immediate recharge area, was in pasture. The recharge area for the well did not receive nitrogen fertilizer application as did the row-cropped fields surrounding wells KHE and GF. All three loess wells showed an increase in nitrate-N concentration from 1989 to 1990, probably the result of above normal rainfall in 1990 following two drought years (Table 9). A

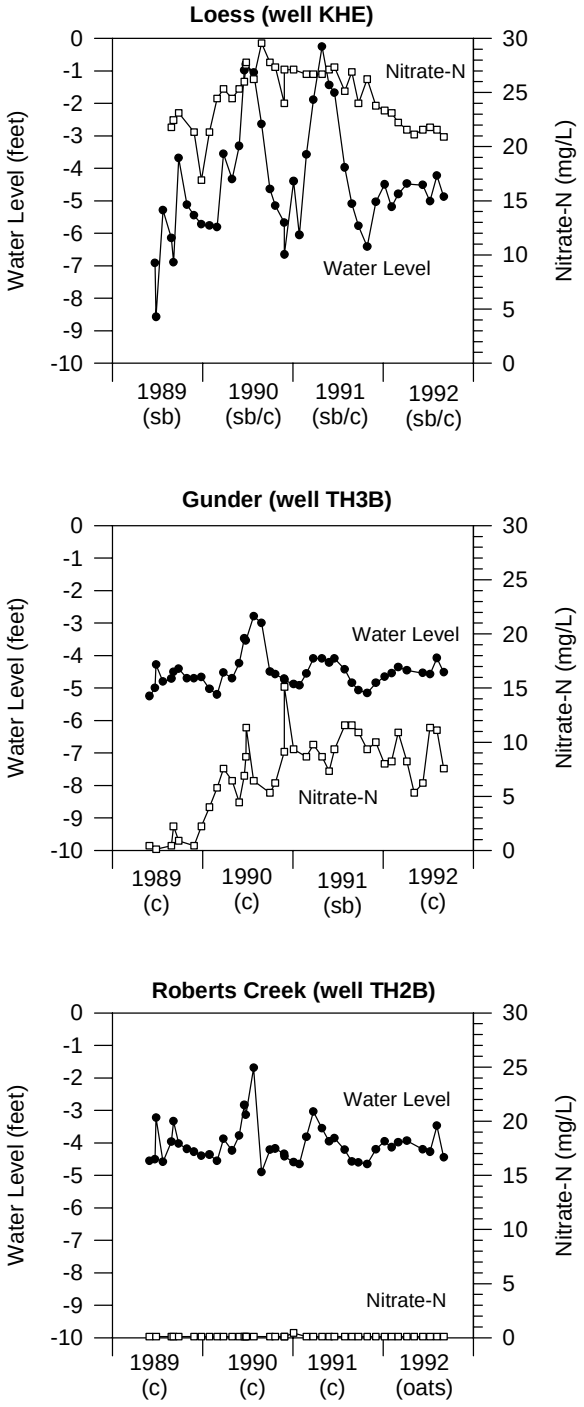

Figure 8. Water level and nitrate-N concentrations from three monitoring wells. Each well is located in different geologic materials. Information in parentheses below the year indicates the type of crop in the field adjacent to the well (c=corn; sb=soybeans).

Table 9. Summary of nitrate-N concentrations from monitoring wells.

Geologic Material / Site (Well Depth)	1989	1990	1991	1992
Loess				
GF (22.8 feet)				
Mean nitrate-N concentrations; mg/L	22.7	30.0	28.7	29.9
Median nitrate-N concentrations; mg/L	23.6	31.1	28.9	29.8
Number of samples	3	14	8	9
Range in concentration; mg/L	19.8 - 24.7	22.9 - 32.2	28.2 - 29.6	28.9 - 30.7
Landuse	corn	soybeans	corn	soybeans
KHE (11.3 feet)				
Mean nitrate-N concentrations; mg/L	21.1	26.0	26.1	21.9
Median nitrate-N concentrations; mg/L	21.8	26.2	26.7	21.6
Number of samples	5	14	11	9
Range in concentration; mg/L	16.9 - 23.1	21.3 - 29.6	23.8 - 27.3	20.9 - 23.3
Landuse	soybeans	soybeans/corn	soybeans/corn	soybeans/corn
TH1 (16.9 feet)				
Mean nitrate-N concentrations; mg/L	1.2	4.1	5.0	6.6
Median nitrate-N concentrations; mg/L	1.1	4.0	4.9	7.1
Number of samples	2	10	11	9
Range in concentration; mg/L	<0.2 - 2.2	2.2 - 5.3	3.6 - 6.4	5.3 - 7.3
Landuse	corn	corn	corn	oats
Alluvium - Gunder				
DN (17.5 feet)				
Mean nitrate-N concentrations; mg/L	<0.2	0.3	<0.2	<0.2
Median nitrate-N concentrations; mg/L	<0.2	0.2	<0.2	<0.2
Number of samples	2	2	11	9
Range in concentration; mg/L	<0.2 - <0.2	<0.2 - 0.4	<0.2 - 0.2	<0.2 - <0.2
Landuse	soybeans	corn	soybeans	corn
KHN (10.3 feet)				
Mean nitrate-N concentrations; mg/L	- -	9.0	9.6	10.1
Median nitrate-N concentrations; mg/L	- -	9.1	9.6	10.0
Number of samples	- -	2	11	9
Range in concentration; mg/L	- -	8.2 - 9.8	9.1 - 10.0	9.8 - 10.7
Landuse	- -	corn	soybeans	corn
TH3A (10.8 feet)				
Mean nitrate-N concentrations; mg/L	- -	3.6	8.3	11.8
Median nitrate-N concentrations; mg/L	- -	3.6	6.7	11.1
Number of samples	- -	2	11	9
Range in concentration; mg/L	- -	2.7 - 4.4	<0.2 - 13.8	8.9 - 13.6
Landuse	- -	corn	soybeans	corn
TH3B (15.0 feet)				
Mean nitrate-N concentrations; mg/L	1.0	7.5	9.7	8.5
Median nitrate-N concentrations; mg/L	0.4	6.4	9.3	8.2
Number of samples	7	13	11	9
Range in concentration; mg/L	<0.2 - 2.2	4.0 - 15.1	7.8 - 11.6	5.3 - 11.3
Landuse	corn	corn	soybeans	corn

Table 9. Continued.

Geologic Material / Site (Well Depth)	1989	1990	1991	1992
TH4 (13.0 feet)				
Mean nitrate-N concentrations; mg/L	10.8	11.5	9.7	10.6
Median nitrate-N concentrations; mg/L	11.6	12.4	10.7	10.7
Number of samples	5	11	11	9
Range in concentration; mg/L	8.2 - 13.6	8.4 - 13.1	10.4 - 11.1	10.2 - 10.7
Landuse	corn	corn	alfalfa	corn
TH5 (12.1 feet)				
Mean nitrate-N concentrations; mg/L	- -	1.1	<0.2	0.3
Median nitrate-N concentrations; mg/L	- -	0.4	<0.2	0.4
Number of samples	- -	4	5	2
Range in concentration; mg/L	- -	0.4 - 3.1	<0.2 - 0.4	0.2 - 0.4
Landuse	- -	corn	oats	corn
Alluvium - Roberts Creek				
DE (15.0 feet)				
Mean nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Median nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Number of samples	7	9	10	9
Range in concentration; mg/L	<0.2 - 0.2	<0.2 - 0.7	<0.2 - <0.2	<0.2 - <0.2
Landuse	pasture	pasture	pasture	pasture
DW (12.6 feet)				
Mean nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Median nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Number of samples	7	11	10	11
Range in concentration; mg/L	<0.2 - <0.2	<0.2 - 0.7	<0.2 - <0.2	<0.2 - <0.2
Landuse	corn	soybeans	corn	soybeans
KHW (14.2 feet)				
Mean nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Median nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Number of samples	8	14	11	9
Range in concentration; mg/L	<0.2 - 0.2	<0.2 - 0.7	<0.2 - 0.2	<0.2 - <0.2
Landuse	soybeans	corn	soybeans	corn
TH2A (14.3 feet)				
Mean nitrate-N concentrations; mg/L	- -	1.1	<0.2	<0.2
Median nitrate-N concentrations; mg/L	- -	1.1	<0.2	<0.2
Number of samples	- -	2	10	9
Range in concentration; mg/L	- -	<0.2 - 2.0	<0.2 - <0.2	<0.2 - <0.2
Landuse	- -	corn	corn	oats
TH2B (20.9 feet)				
Mean nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Median nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Number of samples	7	13	11	9
Range in concentration; mg/L	<0.2 - <0.2	<0.2 - <0.2	<0.2 - 0.4	<0.2 - <0.2
Landuse	corn	corn	corn	oats
W (15.7 feet)				
Mean nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Median nitrate-N concentrations; mg/L	<0.2	<0.2	<0.2	<0.2
Number of samples	8	13	11	9
Range in concentration; mg/L	<0.2 - 0.4	<0.2 - 0.4	<0.2 - 0.2	<0.2 - <0.2
Landuse	pasture	pasture	pasture	pasture

similar increase in nitrate-N concentrations occurred for the monitoring wells in the Gunder Member. Figure 8 shows the fluctuations in water levels and nitrate-N concentrations for well KHE through time.

Wells situated in the Gunder Member alluvium reported variable nitrate-N concentrations (Table 9). Annual median concentrations during 1989 to 1992 ranged from 0.9 to 9.3 mg/L. Well TH5, located relatively high in the landscape and along the edge of a row-cropped field, had relatively low median nitrate-N concentrations all three years. This well had very little water in it, and water levels were slow to recover after the well was pumped. The vertical movement of nitrate-N to the shallow groundwater table may have been limited in this topographic position. Water levels in this well averaged 11 feet (3.4 m) below the ground surface. Well DN had very low nitrate-N concentrations, generally at or below the detection limit of 0.2 mg/L. This well is located in a drainageway where the water table is generally shallow, usually less than three feet (0.9 m) below the ground surface. The well was located along a fence row with row-cropped fields around it. Figure 8 shows the water levels and nitrate-N concentrations for well TH3B through time.

The most significant trend occurred in the wells located in Roberts Creek Member alluvium. Nitrate-N concentrations in these wells were very low, generally below the detection limit (Figure 6 and Table 9). These low nitrate-N concentrations are probably the result of denitrification. The Roberts Creek Member is organic-rich alluvium. The high organic carbon content of Roberts Creek alluvium provides a conducive environment for denitrification. The greatest potential for denitrification occurs in oxygen-deficient, water-saturated materials (Rolston, 1981). The denitrification process is also dependent on an available supply of bio-degradable organic carbon. Organic carbon is present in the Roberts Creek Member (water-quality data from one of the monitoring wells in Roberts Creek alluvium reported a total organic carbon content of 8.9 mg/L). Periodic field measurements for dissolved oxygen from these wells were low. Water levels generally were shallow, less than four feet (1.2 m) below the ground surface (Figure 8). During the course of monitoring, wells situated in the Roberts Creek alluvium also showed the least amount of variation in water levels. Roberts Creek alluvium is located beneath the surface in topographically low positions, causing the deposits to be saturated most of the time. Water levels in individual wells varied 1 to 4 feet (0.3 to 1.2 m). Wells in the Gunder Member had water level fluctuations from 1 to 8 feet (0.3 to 2.4 m), and wells in the loess showed the greatest range, varying from 8 to 15 feet (2.4 to 4.6 m; Figure 8).

A transect of monitoring wells parallel to shallow groundwater flow showed decreased nitrate levels from loess wells to wells in the Roberts Creek Member. A reduction in nitrate-N concentrations occurs as groundwater from TH1 moves toward Bluegrass Creek and passes through Roberts Creek Member alluvium on the north side of the creek (wells TH2A and TH2B), and provides baseflow to Bluegrass Creek. The alluvium along the north side of Bluegrass Creek at this location was Roberts Creek Member, whereas the south side was Gunder Member (wells TH3A and TH3B). Regardless of landuse (landuse was corn, soybeans, or oats), nitrate-N concentrations were higher in wells in the Gunder Member on the south side of the creek compared to wells in the Roberts Creek Member on the north side of the creek (Figure 8).

Landuse around the monitoring wells had the greatest effect on wells in loess or Gunder Member alluvium. Nitrate-N concentrations for wells in the Roberts Creek Member alluvium were low, regardless of whether the land surrounding the well was in corn, soybeans, or pasture. For the loess and Gunder wells, nitrate-N concentrations were more variable. The high nitrate-N concentrations in these monitoring wells appear as the result of normal rainfall and infiltration through the soil and movement of available nitrate nitrogen downward into the groundwater.

Active Wells

Nitrate-N concentrations varied among the four active private wells. Unlike the monitoring wells,

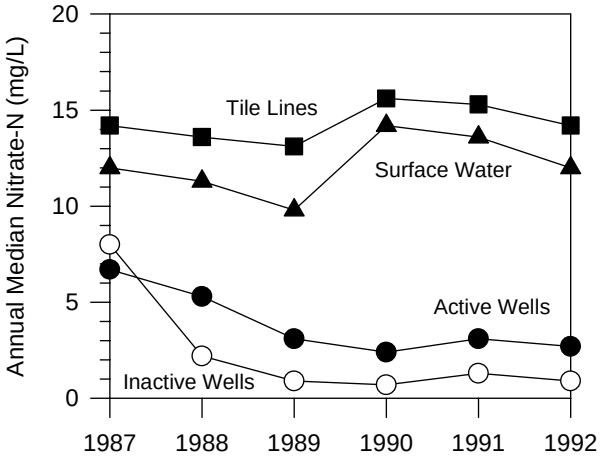

Figure 9. Annual median nitrate-N concentrations for the active wells, inactive wells, tile lines, and surface water.

the water in the private wells represents the integration of groundwater that has entered the well along its total depth. Overall, the median nitrate-N concentrations for the active private wells showed a general decline through time (Figure 9). Table 10 is a summary of the annual mean and median nitrate-N concentrations for each well, the number of samples collected, the range in nitrate-N concentrations, and the landuse around the wells.

Annual median nitrate-N concentrations for the individual wells ranged from <0.2 to 28.4 mg/L (Table 10). The large range in concentrations appears related to landscape position, the geologic materials in which the wells are situated, and land management around the wells.

Well KH2 had annual median concentrations greater than 20 mg/L all six years of monitoring (Table 10 and Figure 10). This well was situated relatively high in the landscape near the head of a drainageway. The well is most likely completed in loess at the contact with the underlying paleosol. Elevated nitrate-N concentrations also occur in two monitoring wells located in a similar landscape position and in similar geologic materials to KH2 (wells GF and KHE). The high nitrate-N concentrations in these monitoring wells appear the result of normal rainfall and infiltration through the soil and movement of available nitrate-nitrogen downward into the groundwater. Well KH2 is mounded a few feet above the land surface and has a secure concrete cover. The field adjacent to the well was in soybeans in 1987, 1989, and 1992, and in corn in 1988, 1990, and 1991. A buffer strip was placed around the well in 1989 and remained around the well through the 1992 sampling. Annual median nitrate concentrations from this well reached a high of 28 mg/L in 1989. Nitrate-N concentrations declined from 1990 to 1992 in spite of the return of significant rain. Even though the type of crops grown in the field adjacent to the well changed during 1990 through 1992, it did not appear to affect the nitrate-N concentrations during those three years. The addition of the buffer strip reduced the area immediately adjacent to the well that was receiving fertilizer application. Since this area serves as a recharge area to the shallow groundwater that supplies water to the well, the addition of the buffer strip may have affected the decline in nitrate-N concentrations.

The other three active private wells had annual concentrations generally less than 6 mg/L. These wells were situated lower in the landscape. Well MN1 had the lowest median nitrate-N concentrations of the four active wells (Table 10 and Figure 10). The well is constructed of concrete curbing with a secure cover and is mounded a few feet above the land surface. The well is located in a grassed area along Bluegrass Creek with row-cropped fields upgradient of the well. Annual median nitrate-N concentrations varied from <0.2 to 2.9 mg/L, with the highest median concentration occurring in 1992. The well is located along Bluegrass Creek, most likely in Roberts Creek Member alluvium. Movement of groundwater from beneath row-cropped fields through the area where the well is situated to Bluegrass Creek may allow denitrification to occur. The organic-rich alluvium and high water table associated with the Roberts Creek Member alluvium are conditions favorable for denitrification. Monitoring wells in similar positions suggest denitrification as being the primary factor causing low nitrate-N concentrations in these wells.

Overall median nitrate-N concentrations de-

Table 10. Summary of nitrate-N concentrations from active private wells.

Site	1987	1988	1989	1990	1991	1992
KH2						
Mean nitrate-N concentrations; mg/L	24.4	23.8	27.6	22.7	21.1	22.9
Median nitrate-N concentrations; mg/L	24.0	24.7	28.4	20.9	21.1	21.6
Number of samples	5	13	14	12	12	9
Range in concentration; mg/L	20.0-30.4	18.0-27.8	20.7-32.4	18.0-30.0	18.0-30.0	20.2-25.6
Landuse	soybeans	corn	soybeans/ set aside	corn/ set aside	corn/ set aside	soybeans/ set aside
MN1						
Mean nitrate-N concentrations; mg/L	2.0	0.9	0.4	1.1	2.0	2.4
Median nitrate-N concentrations; mg/L	1.8	0.9	<0.2	0.7	1.8	2.9
Number of samples	7	10	16	11	9	9
Range in concentration; mg/L	0.9-3.6	<0.2-1.8	<0.2-1.8	<0.2-3.6	<0.2-4.2	0.7-3.8
Landuse	soybeans/ grass	corn/ grass	soybeans/ grass	corn/ grass	soybeans/ grass	soybeans/ grass
SW1						
Mean nitrate-N concentrations; mg/L	5.3	5.1	5.8	2.7	3.6	2.7
Median nitrate-N concentrations; mg/L	5.3	5.1	6.9	2.4	3.1	2.7
Number of samples	8	13	16	13.0	10	9
Range in concentration; mg/L	2.7-7.1	3.6-8.2	2.7-8.9	2.0-3.8	2.0-5.8	2.2-2.9
Landuse	corn	soybeans	soybeans	soybeans	corn	soybeans
W1						
Mean nitrate-N concentrations; mg/L	15.1	5.6	2.2	2.2	1.3	1.3
Median nitrate-N concentrations; mg/L	14.9	5.1	1.3	0.9	0.9	0.9
Number of samples	7	13	16	12	11	9
Range in concentration; mg/L	8.9-18.4	1.8-10.0	<0.2-6.9	<0.2-10.2	<0.2-4.2	0.2-3.3
Landuse	Conservation Reserve	Conservation Reserve	Conservation Reserve	Conservation Reserve	Conservation Reserve	Conservation Reserve
Overall						
Median nitrate-N concentrations; mg/L	6.7	5.3	3.1	2.4	3.1	2.7

clined from 1987 to 1992 in well SW1 (Figure 10 and Table 10). The well, constructed of small brick curbing, has a concrete well cover level with the ground surface, and is situated along a first-order drainageway in local upland alluvium. The field adjacent to SW1 was in corn in 1987, 1991, and 1992, and in soybeans in 1988, 1989, and 1990. Median nitrate-N concentrations varied from 5.3 to 6.9 mg/L during 1987 to 1989, and declined to 2.4 to 3.1 mg/L during 1990 to 1992, in spite of increased rain during that period. This trend did not appear related to any changes in landuse around the wells.

Well W1 showed the most significant decline in nitrate-N concentrations of the sites monitored (Figure 10 and Table 10). Yearly median nitrate-N concentrations declined from 14.9 mg/L in 1987 to 0.9 mg/L in 1990, 1991, and 1992. This well is situated along a small tributary to Bluegrass Creek and, based on soil coring done in the area, is

probably situated in Roberts Creek Member alluvium. The organic-rich alluvium may be affecting the nitrate-N concentrations, however, a change in landuse around the well appears to be the more direct cause of this decline. In 1987, the land surrounding the well was taken out of row-crop production and placed in the Conservation Reserve Program. After the drought years of 1988 and 1989, the nitrate-N concentrations continued to decline with occasional increases associated with snowmelt and rainfall events. This trend suggests that landuse caused this substantive decline rather than climatic conditions.

Inactive Wells

Nitrate-N data from the four inactive wells does not represent "true" groundwater quality. As previously mentioned, these wells are not pumped on a regular basis, and it was not possible to pump the wells prior to collecting monthly samples. As a result, relatively stagnant water was sampled. In May 1990, sampling of well KH3 began and in August 1991, sampling of well KH1 was discontinued because of extensive deterioration of the well. Overall, the median nitrate-N concentrations for the inactive private wells showed a general decline through time (Figure 9), similar to the active private wells. Results from inactive well KH3 were not used to calculate annual median concentrations of inactive wells for two reasons: sampling of well KH3 did not begin until 1990, and the nitrate-N concentrations from well KH3 were much higher than concentrations from the other three inactive wells. The higher concentrations for the period 1990 through 1992 would have skewed the median nitrate-N concentrations for the inactive wells. Table 11 is a summary of the annual mean and median nitrate-N concentrations for each well, the number of samples collected, the range in nitrate-N concentrations, and the landuse around the wells.

Nitrate-N concentrations from the inactive wells (excluding KH3) declined from 1987 to 1992, from a median of 8.0 mg/L in 1987 to 0.9 mg/L in 1992 (Table 11 and Figure 11). This was similar to the trend seen with the active wells. Despite

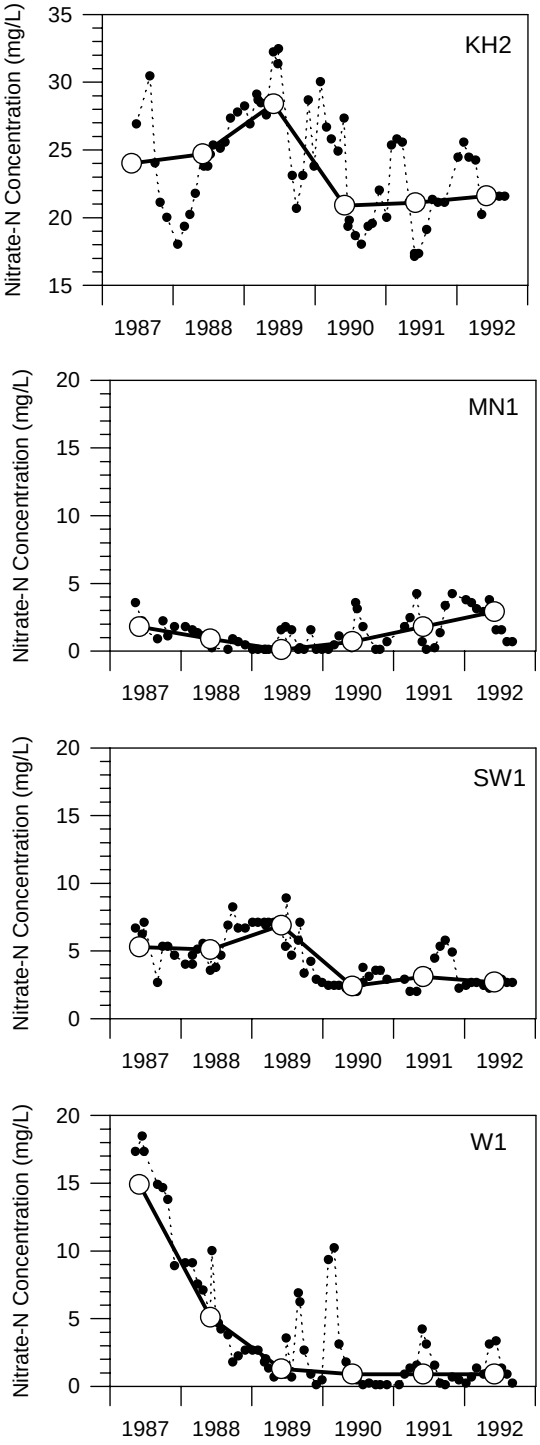

Figure 10. Nitrate-N concentrations from active private wells. Solid circles represent individual samples and open circles represent annual median concentrations. Note that nitrate-N scale is different for well KH2.

Table 11. Summary of nitrate-N concentrations from inactive private wells.

Site	1987	1988	1989	1990	1991	1992
D1						
Mean nitrate-N concentrations; mg/L	7.6	7.3	1.1	0.7	2.2	3.1
Median nitrate-N concentrations; mg/L	8.7	7.6	<0.2	0.7	2.2	3.3
Number of samples	7	12	16	13	8	8
Range in concentration; mg/L	<0.2-9.8	4.7-8.9	<0.2-3.6	<0.2-0.9	0.7-3.8	<0.2-4.2
Landuse	pasture	pasture	pasture	pasture	pasture	pasture
D2						
Mean nitrate-N concentrations; mg/L	- -	1.1	0.4	0.2	<0.2	0.2
Median nitrate-N concentrations; mg/L	- -	1.3	<0.2	0.2	<0.2	<0.2
Number of samples	- -	12	13	13	8	8
Range in concentration; mg/L	- -	<0.2-2.4	<0.2-2.0	<0.2-0.9	<0.2-0.2	<0.2-0.9
Landuse	pasture	pasture	pasture	pasture	pasture	pasture
KH1						
Mean nitrate-N concentrations; mg/L	5.3	1.6	5.8	4.9	6.2	- -
Median nitrate-N concentrations; mg/L	4.4	0.9	5.6	4.0	6.7	- -
Number of samples	7	13	16	13	9	- -
Range in concentration; mg/L	0.2-13.3	<0.2-4.4	<0.2-13.1	<0.2-13.3	<0.2-10.7	- -
Landuse	corn	soybeans/ set aside	corn/oats set aside	corn/ set aside	soybeans/ set aside	corn/ set aside
KH3						
Mean nitrate-N concentrations; mg/L	- -	- -	- -	59.6	66.2	60.9
Median nitrate-N concentrations; mg/L	- -	- -	- -	59.6	73.1	60.7
Number of samples	- -	- -	- -	6	11	8
Range in concentration; mg/L	- -	- -	- -	50.2-69.8	45.1-80.4	53.6-62.2
Landuse	corn/ set aside	soybeans/ set aside	corn/ set aside	corn/ set aside	soybeans/ set aside	corn/ set aside
Overall (KH3 excluded)						
Median nitrate-N concentrations; mg/L	8.0	2.2	0.9	0.7	1.3	0.9
Overall (KH3 included)						
Median nitrate-N concentrations; mg/L	8.0	2.2	0.9	2.9	4.2	3

increased rainfall following the drought years of 1988 and 1989, nitrate-N concentrations declined.

Wells D1 and D2 were located at opposite ends of a pasture, downslope and down flow of surrounding row-cropped fields. The pasture is on the alluvial plain of Bluegrass Creek; D1 is in a poorly drained and intermittently wet area, and D2 is in a better drained area that is normally dry. Both areas have been in pasture since at least 1987. Both wells are constructed of concrete curbing with concrete covers. The curbing extends two feet (0.6 m) above the ground surface on D1. For D2, the curbing is flush with the ground surface. Well D2 originally had a deteriorating wooden cover that was replaced by a concrete cover the summer of 1989.

Groundwater from well D2 had the lowest median nitrate-N concentrations of the four inactive wells. The median nitrate-N concentration was 1.3 mg/L in 1988, and declined to levels at or

below the detection limit of 0.2 mg/L during 1989 to 1992 (Table 11 and Figure 11). Nitrate-N concentrations in well D1 showed a steady decline from a median concentration of 8.7 mg/L in 1987 to concentrations below 3.4 mg/L during the period 1989 to 1992. Based on soil cores, both wells are in Roberts Creek alluvium. The low nitrate-N concentrations may result from the wells' location in unfertilized pastures, denitrification of the groundwater as it moves laterally beneath row-cropped fields through Roberts Creek Member alluvium adjacent to Bluegrass Creek, and/or denitrification within the wells or at the well-soil interface because the wells are used infrequently.

Well KH1 had the greatest range in nitrate-N concentrations of the inactive wells, ranging from <0.2 to 13.3 mg/L (Table 11 and Figure 11). The well is constructed of concrete curbing with less than two feet (0.6 m) of curbing extending above the ground surface. The well cover is wooden. Well KH1 is located halfway up a first-order drainageway that is a tributary to Bluegrass Creek. The well is completed in interlayered silts and sands. Data from a monitoring well (KHN) located less than 100 feet (30 m) from well KH1 showed similar nitrate-N concentrations, although data from well KH1 showed a greater range in concentrations. The field surrounding KH1 was in corn in 1987, 1989, 1990, and 1992, and in soybeans in 1988 and 1991. In 1988, a strip of land adjacent to the well was taken out of row-crop production and placed in annual set-aside acres.

Well KH3 had the highest nitrate-N concentrations of the inactive wells. Sampling of this site began in 1990. This well was used as a back-up to provide water to livestock and was pumped more frequently than the other inactive wells. Median nitrate-N concentrations increased from 59.6 mg/L in 1990 to 73.1 mg/L in 1991, and declined to 60.7 mg/L in 1992 (Table 11 and Figure 11). This well is situated relatively high in the landscape, similar to active well KH2 and monitoring wells GF and KHE. Nitrate-N concentrations at well KH3, however, were much higher than concentrations at any of the three sites previously mentioned. The higher concentrations in well KH3 may be the result of having both row-cropped

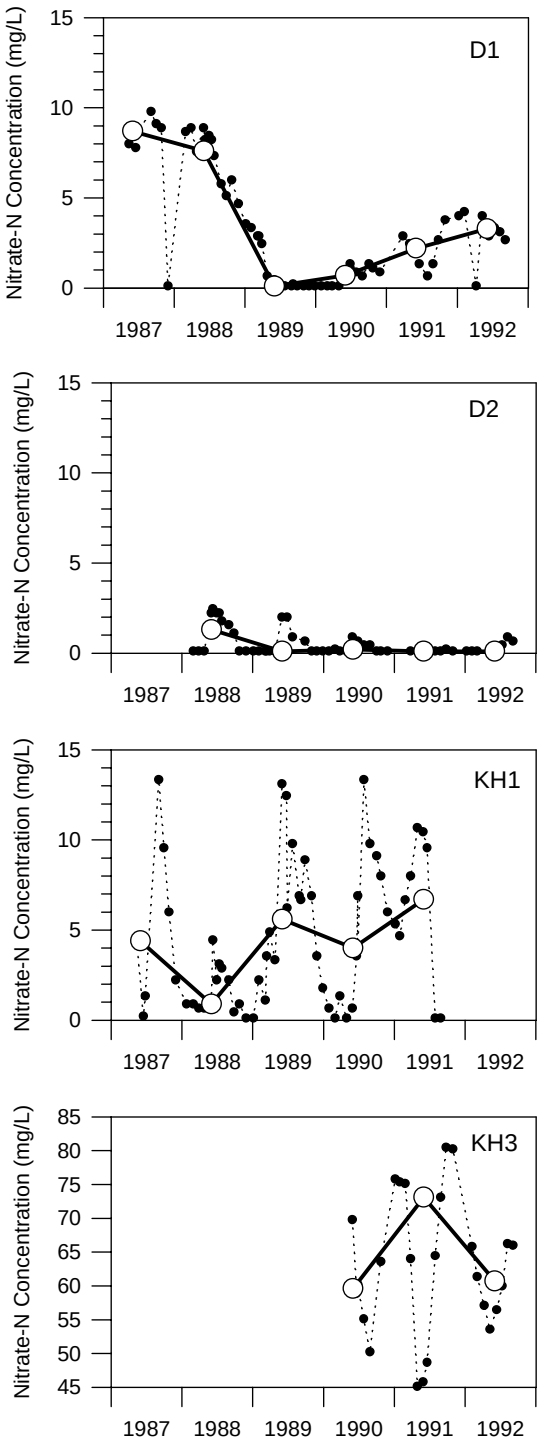

Figure 11. Nitrate-N concentrations from inactive private wells. Solid circles represent individual samples and open circles represent annual median concentrations. Note that nitrate-N scale is different for well KH3.

fields and a small feedlot located in the recharge area that supplies shallow groundwater to the well. Well KH3 was located in a strip of set aside acres, but did not show any improvement in water quality from it as was suggested by active well KH2. Any improvement may not have been noted because the set aside acres were in place prior to when sampling of well KH3 began.

It is difficult to attribute trends in nitrate-N concentrations from the inactive wells to changes in landuse. As previously mentioned, it was not possible to pump the wells prior to sample collection, therefore, relatively stagnant water was sampled, though the trends they illustrate are similar to those from monitoring wells in similar settings.

Tile Lines

Tile lines, as a category, had the highest annual median nitrate-N concentrations (Figure 9). None of the tiles had surface intakes. Tile lines in the watershed drain primarily fields in corn-soybean rotations; a few acres were in alfalfa, set aside, oats, or commercial sod. Some tiles drained a field with more than one type of crop. The lack of rain during 1988 and 1989 caused several tile lines to go dry. Eight tile lines had data available all six years and this data was used to calculate the annual medians in Figure 9. Table 12 summarizes the nitrate-N data for the eight tile lines with data from all six years of monitoring. Table 13 summarizes the nitrate-N data for the seven tile lines with less than six years of data.

For the tile lines, annual median nitrate-N concentrations declined from 1987 to 1989, increased in 1990 to a concentration greater than 1987, and declined from 1990 through 1992 (Figure 9). The lack of rain during 1988 and 1989 may have caused the overall decline in nitrate-N concentrations from 1987 to 1989. Individually, however, only one tile line showed this same trend (tile THS2; Figure 12 and Table 12). All eight of the tile lines with data available from all six years showed an increase in annual median concentration from 1989 to 1990. For five of the eight tile lines, the highest annual median concentration occurred when the field being drained by the tile line was in corn. For the other three tile lines, the highest nitrate-N concentration occurred when two of the tiles were draining fields in soybeans, and the other tile was draining soybeans and commercial sod.

The highest annual median nitrate-N concentration occurred in 1988 for two of the tiles, in 1990 for three of the tiles, in 1991 for two of the tiles, and in 1992 for one of the tiles. Other studies have shown seasonal or annual time lags between changes in landuse or management and water quality in tile line effluents, even though tiles drain water from the very top of the groundwater system (Hallberg, 1987). Except for major changes in landuse, such as noted below, the tile data did not reveal any consistent patterns of change that could be sorted out from the complex interaction of crop rotation sequences, changing nitrogen management, and natural climatic/hydrologic variation.

Tile line MNN (Figure 12 and Table 12) showed a noticeable decline in annual concentrations since 1987, declining from 20 mg/L in 1987 to 12 mg/L in 1992. The field drained by MNN was taken out of row-crop production and placed in commercial sod in 1990.

Of the seven tile lines having less than six years of monitoring data, two of the tile lines, KL and MNSU2 (Figure 12 and Table 13), showed a consistent increase in annual median nitrate-N concentrations during the sampling period. There were no apparent changes in landuse that would explain these increases.

Surface Water

Annual median nitrate-N concentrations from Bluegrass Creek showed similar trends to the median concentrations from the tile lines (Figure 9). Nitrate-N concentrations declined from 1987 to 1989, increased from 1989 to 1990, and then declined (Table 14 and Figure 13). Annual concentrations from the surface water site were generally greater than 10 mg/L, but lower than nitrate-N concentrations from the tile lines. Of all the categories of monitoring sites, the surface water site had the greatest percent of samples with nitrate-N concentrations greater than 10 mg/L. The

Table 12. Summary of nitrate-N concentrations from tile lines with six years of monitoring data.

Site	1987	1988	1989	1990	1991	1992
DT						
Mean nitrate-N concentrations; mg/L	14.7	15.1	13.3	16.2	15.6	13.3
Median nitrate-N concentrations; mg/L	14.4	15.6	13.3	16.0	15.3	14.7
Number of samples	6	11	11	11	10	9
Range in concentration; mg/L	13.1-16.9	9.6-23.6	10.7-18.4	11.3-20.4	12.9-17.8	5.6-16.0
Landuse	corn/ soybeans	corn/ soybeans	corn/ soybeans	corn	soybeans	corn
MNN						
Mean nitrate-N concentrations; mg/L	19.8	20.7	17.3	18.2	12.0	12.4
Median nitrate-N concentrations; mg/L	20.0	20.4	17.8	18.0	11.1	12.4
Number of samples	7	7	6	9	6	8
Range in concentration; mg/L	18.2-21.3	19.6-22.7	14.0-20.9	12.9-23.3	10.4-17.1	9.8-14.7
Landuse	soybeans	corn	soybeans	sod	sod	sod
MNNU						
Mean nitrate-N concentrations; mg/L	13.6	13.1	10.7	11.8	14.7	16.4
Median nitrate-N concentrations; mg/L	13.3	13.3	10.2	12.4	15.3	16.2
Number of samples	5	14	16	12	11	9
Range in concentration; mg/L	11.6-15.8	12.0-14.2	6.9-13.3	9.3-14.2	12.0-17.1	14.0-19.8
Landuse	corn	soybeans	corn	soybeans	corn	soybeans
MNS						
Mean nitrate-N concentrations; mg/L	15.1	11.3	10.7	16.4	19.8	15.6
Median nitrate-N concentrations; mg/L	14.2	11.6	10.2	15.6	19.1	15.3
Number of samples	7	8	12	9	10	9
Range in concentration; mg/L	12.7-17.8	10.4-12.2	7.1-14.9	12.0-21.3	12.2-25.3	14.0-18.0
Landuse	soybeans	corn	soybeans	corn	soybeans	soybeans
MNSU						
Mean nitrate-N concentrations; mg/L	7.1	7.1	7.8	9.3	10.9	9.1
Median nitrate-N concentrations; mg/L	6.9	6.2	7.6	9.3	11.1	9.6
Number of samples	6	6	5	8	6	9
Range in concentration; mg/L	6.2-8.2	5.3-10.0	6.2-9.8	7.8-10.9	9.3-12.7	7.6-10.2
Landuse	soybeans	corn	soybeans	corn/sod/ soybeans	soybeans/ sod	soybeans/ sod
THS						
Mean nitrate-N concentrations; mg/L	14.2	13.8	13.8	15.6	14.2	12.4
Median nitrate-N concentrations; mg/L	14.2	13.3	14.0	15.3	14.7	12.7
Number of samples	6	9	10	12	7	9
Range in concentration; mg/L	11.3-17.1	12.0-16.2	7.8-19.8	13.3-17.6	10.9-15.3	10.4-14.7
Landuse	corn/ soybeans	corn/ soybeans	corn	corn	soybeans/ oats	corn
THS1						
Mean nitrate-N concentrations; mg/L	16.0	21.8	17.6	20.0	19.1	16.4
Median nitrate-N concentrations; mg/L	16.0	22.9	18.0	19.8	19.1	16.4
Number of samples	5	9	9	11	8	9
Range in concentration; mg/L	15.1-17.3	18.4-24.4	15.3-19.6	17.6-23.8	16.9-21.6	14.7-18.4
Landuse	soybeans	corn	corn	corn	soybeans	corn
THS2						
Mean nitrate-N concentrations; mg/L	14.7	13.1	13.6	18.4	16.2	14.4
Median nitrate-N concentrations; mg/L	13.8	13.3	13.1	18.4	16.7	14.9
Number of samples	5	10	14	10	12	9
Range in concentration; mg/L	12.4-19.3	9.3-14.7	8.9-18.7	15.6-22.0	11.6-18.4	11.1-16.0
Landuse	corn/ soybeans	corn/ soybeans	corn	corn	soybeans/ oats	corn
Overall						
Median nitrate-N concentrations; mg/L	14.2	13.6	13.1	15.6	15.3	14.2

Table 13. Summary of nitrate-N concentrations from tile lines with less than six years of monitoring data.

Site	1987	1988	1989	1990	1991	1992
DN						
Mean nitrate-N concentrations; mg/L	- -	- -	- -	- -	13.3	- -
Median nitrate-N concentrations; mg/L	- -	- -	- -	- -	13.6	- -
Number of samples	- -	- -	- -	1	6	- -
Range in concentration; mg/L	- -	- -	- -	12.9	12.7-14.2	- -
Landuse	soybeans	corn	soybeans	corn	soybeans	corn
DS						
Mean nitrate-N concentrations; mg/L	- -	- -	8.4	9.8	9.3	9.1
Median nitrate-N concentrations; mg/L	- -	- -	7.3	8.9	8.4	9.3
Number of samples	- -	- -	7	11	10	9
Range in concentration; mg/L	- -	- -	6.7-13.1	6.4-13.6	5.1-15.1	6.0-12.9
Landuse	corn	soybeans	corn	soybeans	corn	soybeans
KL						
Mean nitrate-N concentrations; mg/L	- -	5.3	7.6	11.8	11.3	11.3
Median nitrate-N concentrations; mg/L	- -	5.6	7.8	11.1	11.3	11.3
Number of samples	- -	11	15	12	9	9
Range in concentration; mg/L	- -	1.1-7.8	2.9-12.7	7.1-16.2	7.8-14.7	8.2-10.2
Landuse	corn	soybeans	soybeans	corn	soybeans	corn
MNS1						
Mean nitrate-N concentrations; mg/L	- -	- -	- -	- -	20.2	13.8
Median nitrate-N concentrations; mg/L	- -	- -	- -	- -	20.4	16.2
Number of samples	- -	- -	- -	- -	5	9
Range in concentration; mg/L	- -	- -	- -	- -	17.3-22.4	5.1-18.7
Landuse	soybeans	corn	soybeans	corn	soybeans	soybeans
MNSU2						
Mean nitrate-N concentrations; mg/L	- -	- -	3.1	4.4	5.3	5.8
Median nitrate-N concentrations; mg/L	- -	- -	2.4	3.6	4.9	6.7
Number of samples	- -	1	4	7	6	7
Range in concentration; mg/L	- -	6.4	0.7-6.9	1.8-8.7	3.3-8.4	2.9-8.0
Landuse	soybeans	corn	soybeans	corn/sod/ soybeans	soybeans/ sod	soybeans/ sod
THN1						
Mean nitrate-N concentrations; mg/L	- -	3.3	8.0	10.0	12.4	9.8
Median nitrate-N concentrations; mg/L	- -	2.4	8.2	9.8	12.9	10.0
Number of samples	- -	6	7	9	10	9
Range in concentration; mg/L	- -	0.7-6.9	5.1-10.4	7.1-12.0	4.9-18.2	6.0-14.7
Landuse	corn/set aside/alfalfa	orn/set aside soybeans	corn	corn	corn	soybeans
THN2						
Mean nitrate-N concentrations; mg/L	11.1	- -	- -	15.8	16.9	13.6
Median nitrate-N concentrations; mg/L	10.7	- -	- -	16.0	18.0	13.8
Number of samples	6	1	- -	5	6	9
Range in concentration; mg/L	7.1-16.9	7.6	- -	13.3-18.9	12.2-20.0	10.9-16.4
Landuse	corn/ set aside	corn/ set aside	corn	corn	corn	soybeans

decline in 1988 and 1989 is probably drought related, as evidenced by the increase in median concentration in 1990.

Table 15 compares the median nitrate-N concentrations for the surface water site (BGSW), the composite median of the tiles upstream of BGSW, and the composite median of the tiles downstream of BGSW. All three show a decline in nitrate-N concentrations from 1987 to 1989 followed by an increase in 1990.

PESTICIDE MONITORING

Unlike the nitrate data, results of the pesticide monitoring showed few if any trends related to landuse, climate, geologic materials, or landscape position. Pesticide data from the monitoring wells, active wells, inactive wells, tile lines, surface water, and precipitation is summarized below. Appendix II is a summary, on an annual basis, of the pesticide data and landuse information by individual active well, inactive well, tile line, and surface water. Appendix III is a summary of the pesticide data from the precipitation site.

Monitoring Wells

Unlike the nitrate data, the pesticide data from the monitoring wells showed no trends based on the geologic materials the wells were situated in nor the surrounding landuse. Monitoring wells were sampled for pesticides during 1989, 1990, and 1991. During 1992 the wells were sampled only for the triazine herbicides using an immuno assay. A total of 174 samples were collected for pesticide analysis and 71 for immuno assay analysis. During 1989 through 1991, five herbicides were detected (alachlor, atrazine, cyanazine, metolachlor, and metribuzin) at concentrations ranging from 0.10 to 0.43 µg/L (Table 16). Atrazine was the most commonly detected (9% of the samples) and had a median concentration of 0.19 mg/L. Seventy-one samples were analyzed using an immuno assay for the triazine herbicides during 1992. Twenty-five percent of the samples detected triazine herbicides at concentrations ranging from 0.10 to 0.58 µg/L. The median concentration was 0.20 µg/L.

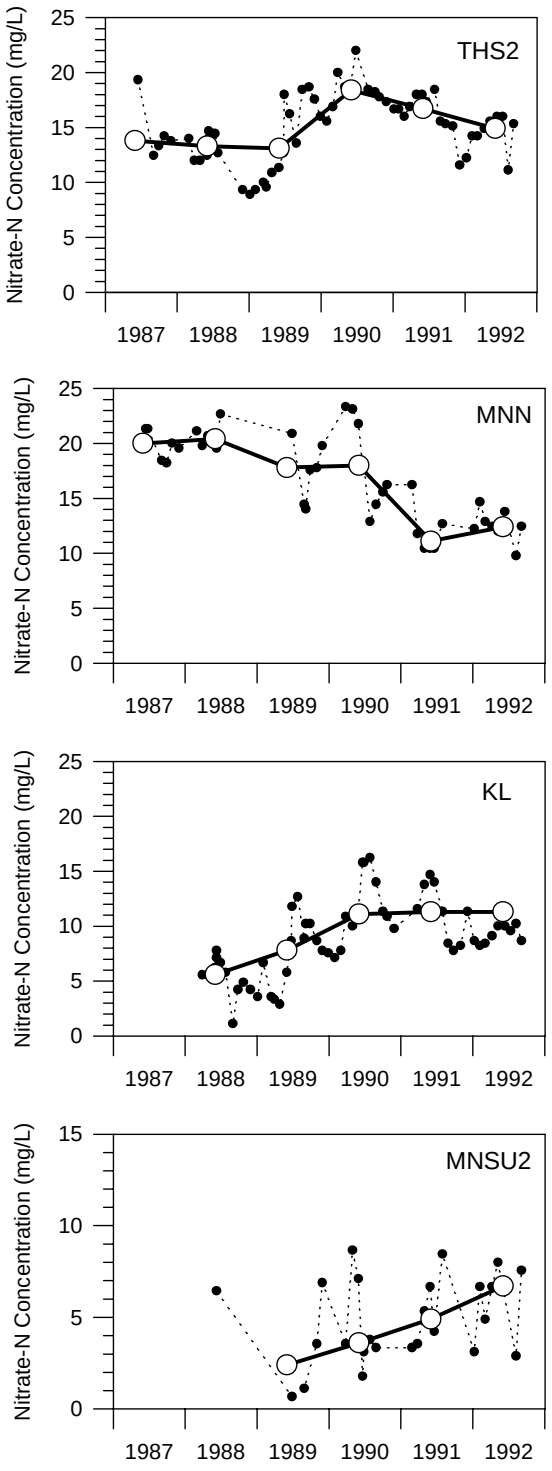

Figure 12. Nitrate-N concentrations from four tile lines. Solid circles represent individual samples and open circles represent annual median concentrations. Note that nitrate-N scale is different for MNSU2.

Table 14. Summary of nitrate-N concentrations from surface water.

Site	1987	1988	1989	1990	1991	1992
BGSW						
Mean nitrate-N concentrations; mg/L	13.3	11.1	8.9	14.2	13.6	11.8
Median nitrate-N concentrations; mg/L	12.0	11.3	9.8	14.2	13.6	12.0
Number of samples	7	12	16	12	12	9
Range in concentration; mg/L	11.6-18.7	7.3-16.0	5.3-12.7	10.7-18.0	11.6-16.0	10.4-13.6

Table 15. Median nitrate-N concentrations for Bluegrass Creek and tile lines; 1987-1992.

	Median nitrate-N concentrations; mg/L					
	1987	1988	1989	1990	1991	1992
Surface Water						
BGSW	12.0	11.3	9.8	14.2	13.6	12.0
9 Tile Lines						
Upstream	14.0	12.9	10.7	12.7	13.6	12.9
6 Tile Lines						
Downstream	14.0	12.4	11.3	15.6	15.3	12.9

During the monitoring period, samples from thirteen of the fifteen monitoring wells detected an herbicide at least once. Wells TH3A and TH5 reported no herbicide detections. Well TH3A is the shallower of a two-well nest located adjacent to Bluegrass Creek in the Gunder Member alluvium. It is not clear why pesticides were detected in the deeper well (TH3B) and not the shallower well at this well nest. Pesticides were detected at site TH3B on four occasions; all occurred during 1989, prior to the installation of TH3A in November 1990. Very few pesticide samples were collected from TH5 and the small sample size may explain the lack of pesticide detections.

One of the monitoring wells, well TH1, located in an upland position in loess, had the most herbicide detections. At least one herbicide was detected in all of the samples collected from well TH1. Of the three loess wells, well TH1 had the lowest median nitrate-N concentration yet the greatest frequency of herbicide detections. The field surrounding this well was in corn all years except 1992.

Active Wells

Six herbicides were detected in the active private wells during this study: alachlor, atrazine, cyanazine, metolachlor, pendimethalin, and trifluralin (Table 17). A total of 157 samples were collected. Concentrations ranged from 0.10 to 24.00 µg/L. The highest concentration for five of the six herbicides (all except pendimethalin) occurred on June 8, 1988, after a 2 1/2 inch rainfall. The only occurrence of alachlor, atrazine, and cyanazine above U.S. EPA Maximum Contaminant Levels occurred on June 8, 1988. Three or more herbicides were detected each of the other years.

Atrazine and metolachlor were detected five of

Table 16. Pesticides detected in monitoring wells.

		# samples	# detections (%)	Range of detected concentrations (µg/L)	Mean of detections (µg/L)	Median of detections (µg/L)
1989						
	Alachlor	30	1 (3%)	0.34	-----	-----
	Atrazine	30	6 (20%)	0.11-0.19	0.15	0.15
	Cyanazine	30	7 (23%)	0.10-0.33	0.16	0.14
	Metolachlor	30	2 (7%)	0.11-0.15	0.13	0.13
1990						
	Atrazine	63	5 (8%)	0.14-0.38	0.26	0.30
	Metolachlor	63	1 (2%)	0.11	-----	-----
1991						
	Atrazine	81	5 (6%)	0.18-0.43	0.28	0.23
	Cyanazine	81	1 (1%)	0.28	-----	-----
	Metribuzin	81	1 (1%)	0.16	-----	-----
1992						
	IMA-triazines	71	18 (25%)	0.10 - 0.58	0.25	0.20
Overall						
	Alachlor	174	1 (<1%)	0.34	-----	-----
	Atrazine	174	16 (9%)	0.11 - 0.43	0.22	0.19
	Cyanazine	174	8 (6%)	0.10 - 0.33	0.18	0.13
	Metolachlor	174	3 (2%)	0.11 - 0.15	0.12	0.11
	Metribuzin	174	2 (1%)	0.16 - 0.18	0.17	0.17
	IMA-triazines	71	18 (25%)	0.10 - 0.58	0.25	0.20

the six years of monitoring (Table 17). Atrazine was the only herbicide detected in 1992, and metolachlor was the only herbicide detected in 1987. The highest median concentration of atrazine (12.20 µg/L) and metolachlor (0.66 µg/L) occurred in 1988. Cyanazine was detected all years except 1987 and 1992, with the highest median concentration (0.99 µg/L) in 1988. Alachlor was detected in 1988 and 1989, with the highest median concentration (5.40 µg/L) in 1988. Pendimethalin was detected in 1989 and 1990, with the highest median concentration (0.31 µg/L) in 1989. Trifluralin was detected in 1988 and 1990, with the highest median concentration (1.10 µg/L) in 1988.

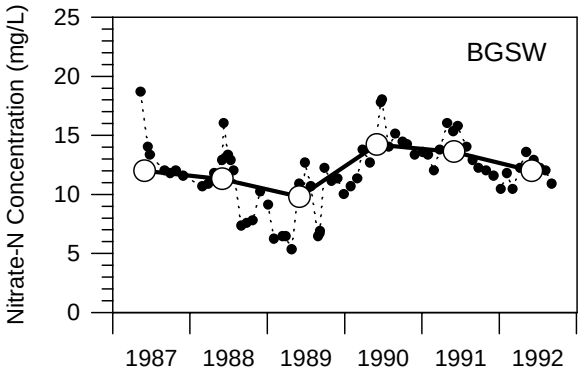

Figure 13. Nitrate-N concentrations from the surface water site. Solid circles represent individual samples and open circles represent annual median concentrations.

Inactive Wells

Seven herbicides (alachlor, atrazine, cyanazine, metolachlor, metribuzin, pendimethalin, and trifluralin) were detected in the inactive private wells at concentrations from 0.10 to 28.00 µg/L (Table 17). A total of 143 samples were collected. Metribuzin was detected only in the inactive wells. The frequency of pesticide occurrence was greater for the inactive wells than for any of the other sites. The inactive wells had the highest herbicide concentration reported from any of the sites; cyanazine at a concentration of 28.00 µg/L. (Cyanazine was also detected at a concentration of 28.00 µg/L in rain water.) The highest concentration of each herbicide occurred in June 1988, July 1988, October 1988, or June 1990. The highest concentrations of the seven herbicides occurred at two of the four inactive wells (wells KH1 and D2).

Atrazine and cyanazine were detected all six years of monitoring (Table 17). The highest median concentration of atrazine (2.20 µg/L) occurred in 1990, and the highest concentration of cyanazine (1.90 µg/L) was in 1989. Metolachlor was detected in 1988 through 1991, with the highest median concentration (0.53 µg/L) in 1990. Alachlor was detected in 1988 through 1990, pendimethalin and trifluralin in 1988 and 1990, and metribuzin in 1990.

Tile Lines

Six herbicides (alachlor, atrazine, cyanazine, metolachlor, pendimethalin, and trifluralin) were detected in tile line effluent at concentrations ranging from 0.10 to 7.40 µg/L (Table 18). A total of 426 samples were collected. Herbicides were detected in the tile lines primarily from June through August. Atrazine was the most commonly detected herbicide and was found in tile lines each of the six years of monitoring. The highest concentration of each detected herbicide occurred in June 1988, May or June 1989, or June 1990.

The median concentration of atrazine, cyanazine, and metolachlor declined from 1988 to 1989, increased from 1989 to 1990, and declined from 1990 to 1991. This was similar to the trend for nitrate. The highest median concentration for atrazine (0.22 µg/L) occurred in 1988 and 1990, in 1990 for cyanazine (0.40 µg/L), and in 1988 for metolachlor (0.42 µg/L). Pendimethalin and trifluralin were each detected once during the sampling period; trifluralin was detected in 1989 and pendimethalin in 1990. Both were detected in the same tile line.

Surface Water

Five herbicides (alachlor, atrazine, cyanazine, metolachlor, and pendimethalin) were detected in surface water samples at concentrations ranging from 0.10 to 4.60 µg/L (Table 18). A total of 43 samples were collected. Atrazine was most frequently detected and was detected all years except 1987 and 1992. The median atrazine concentration was lowest during 1989 and highest during 1991 (only one sample detected atrazine in 1991). Most of the herbicide detections occurred during the May to September growing season. The highest concentration of three of the five pesticides occurred in May and June 1989. No herbicides were detected in samples collected during 1987 or 1992 despite being detected in several tile lines during those years.

Precipitation

A precipitation sampler was installed in the Bluegrass watershed as part of a study to determine if Iowa precipitation contained pesticides and what the potential impact of pesticides in rainfall may be on water resources (Nations and Hallberg, 1992). Results from the Bluegrass precipitation samples can be found in Appendix III. Sixty-one samples of rainfall from the Bluegrass watershed were collected from May 1989 through September 1992 and analyzed using GC lab methods. Eight herbicides (alachlor, atrazine, cyanazine, eptam, metolachlor, metribuzin, pendimethalin, and propachlor) were detected (Table 19 and Appendix III), at concentrations ranging from the 0.10 to 28.00 µg/L (see Figure 14). The majority of detections were less than 1.00 µg/L. Herbicides

Table 17. Summary, by year, of pesticides detected in active and inactive wells.

Pesticides Detected	# samples	# detections (%)	Range of detected concentrations (µg/L)	Mean of detections (µg/L)	Median of detections (µg/L)
ACTIVE WELLS 1987					
Metolachlor	13	1 (8)	0.15	0.15	0.15
ACTIVE WELLS 1988					
Alachlor	11	1 (9)	5.40	5.40	5.40
Atrazine	11	2 (18)	8.40 - 16.00	12.20	12.20
Cyanazine	11	3 (27)	0.18 - 24.00	8.39	0.99
Metolachlor	11	1 (9)	0.66	0.66	0.66
Trifluralin	11	1 (9)	1.10	1.10	1.10
ACTIVE WELLS 1989					
Alachlor	49	2 (4)	0.12 - 0.18	0.15	0.15
Atrazine	49	12 (24)	0.10 - 0.86	0.29	0.21
Cyanazine	49	5 (10)	0.11 - 0.15	0.13	0.13
Metolachlor	49	3 (6)	0.10 - 0.40	0.23	0.20
Pendimethalin	49	2 (4)	0.15 - 0.47	0.31	0.31
ACTIVE WELLS 1990					
Atrazine	40	4 (10)	0.10 - 0.28	0.19	0.18
Cyanazine	40	1 (3)	0.21	0.21	0.21
Metolachlor	40	1 (3)	0.28	0.28	0.28
Pendimethalin	40	1 (3)	0.13	0.13	0.13
Trifluralin	40	1 (3)	0.88	0.88	0.88
ACTIVE WELLS 1991					
Atrazine	24	3 (13)	0.14 - 1.10	0.51	0.30
Cyanazine	24	2 (8)	0.12 - 0.42	0.27	0.27
Metolachlor	24	1 (4)	0.17	0.17	0.17
ACTIVE WELLS 1992					
Atrazine	20	2 (10)	0.11 - 0.41	0.26	0.26
INACTIVE WELLS 1987					
Atrazine	8	5 (62)	0.23 - 0.58	0.38	0.33
Cyanazine	8	4 (50)	0.19 - 1.90	0.88	0.71
INACTIVE WELLS 1988					
Alachlor	21	10 (48)	1.20 - 5.20	2.95	2.45
Atrazine	21	17 (81)	0.27 - 13.00	4.56	0.97
Cyanazine	21	13 (62)	0.23 - 28.00	5.85	1.20
Metolachlor	21	2 (10)	0.18 - 0.65	0.42	0.42
Pendimethalin	21	1 (5)	1.10	1.10	1.10
Trifluralin	21	4 (19)	0.21 - 0.88	0.53	0.52
INACTIVE WELLS 1989					
Alachlor	43	16 (37)	0.20 - 4.00	1.02	0.43
Atrazine	43	31 (72)	0.11 - 17.00	3.78	1.20
Cyanazine	43	28 (65)	0.13 - 15.00	3.57	1.90
Metolachlor	43	6 (14)	0.11 - 0.39	0.21	0.18
INACTIVE WELLS 1990					
Alachlor	36	6 (17)	0.13 - 0.63	0.41	0.46
Atrazine	36	21 (58)	0.15 - 7.20	2.53	2.20
Cyanazine	36	21 (58)	0.23 - 4.30	1.82	1.70
Metolachlor	36	8 (22)	0.17 - 1.60	0.81	0.53
Metribuzin	36	3 (8)	0.17 - 0.33	0.27	0.31
Pendimethalin	36	3 (8)	0.17 - 0.95	0.57	0.59
Trifluralin	36	3 (8)	0.10 - 0.45	0.22	0.12
INACTIVE WELLS 1991					
Atrazine	20	5 (25)	0.27 - 2.40	0.87	0.53
Cyanazine	20	6 (30)	0.21 - 1.90	1.15	1.21
Metolachlor	20	1 (5)	0.27	0.27	0.27
INACTIVE WELLS 1992					
Atrazine	15	1 (7)	0.10	0.10	0.10
Cyanazine	15	7 (47)	0.17 - 0.34	0.24	0.25

Table 18. Summary, by year, of pesticides detected in tile lines and surface water.

Pesticides Detected	# samples	# detections (%)	Range of detected concentrations (µg/L)	Mean of detections (µg/L)	Median of Detections (µg/L)
TILE LINES-1987					
Atrazine	31	7 (23)	0.10 - 0.13	0.11	0.10
TILE LINES-1988					
Atrazine	44	14 (32)	0.12 - 7.40	0.91	0.22
Cyanazine	44	4 (9)	0.11 - 0.49	0.30	0.31
Metolachlor	44	7 (16)	0.12 - 6.50	1.33	0.42
TILE LINES-1989					
Alachlor	112	8 (7)	0.11 - 0.32	0.16	0.15
Atrazine	112	33 (29)	0.10 - 2.20	0.39	0.18
Cyanazine	112	15 (13)	0.10 - 0.91	0.18	0.12
Metolachlor	112	11 (10)	0.11 - 1.60	0.28	0.14
Trifluralin	112	1 (1)	0.18	0.18	0.18
TILE LINES-1990					
Atrazine	104	14 (13)	0.10 - 2.10	0.36	0.22
Cyanazine	104	5 (5)	0.14 - 0.93	0.41	0.40
Metolachlor	104	6 (6)	0.13 - 3.00	0.81	0.37
Pendimethalin	104	1 (1)	0.14	0.14	0.14
TILE LINES-1991					
Atrazine	68	4 (6)	0.11 - 0.38	0.20	0.16
Cyanazine	68	1 (1)	0.10	0.10	0.10
Metolachlor	68	1 (1)	0.13	0.13	0.13
TILE LINES-1992					
Atrazine	67	2 (3)	0.10 - 0.11	0.11	0.11
Cyanazine	67	2 (3)	0.13 - 0.24	0.19	0.19
Metolachlor	67	1 (1)	0.13	0.13	0.13
SURFACE WATER-1987					
no detections	4	-----	-----	-----	-----
SURFACE WATER-1988					
Alachlor	4	1 (25)	1.10	1.10	1.10
Atrazine	4	2 (50)	0.25 - 3.60	1.93	1.93
Cyanazine	4	2 (50)	0.21 - 2.70	1.46	1.46
Metolachlor	4	1 (25)	4.60	4.60	4.60
Pendimethalin	4	1 (25)	0.30	0.30	0.30
SURFACE WATER-1989					
Alachlor	14	2 (14)	0.19 - 1.30	0.75	0.75
Atrazine	14	7 (50)	0.17 - 4.20	0.93	0.22
Cyanazine	14	5 (36)	0.15 - 0.65	0.30	0.25
Metolachlor	14	3 (21)	0.10 - 0.44	0.26	0.24
Pendimethalin	14	1 (7)	0.14	0.14	0.14
SURFACE WATER-1990					
Atrazine	10	2 (20)	0.25 - 0.30	0.28	0.28
SURFACE WATER-1991					
Atrazine	6	1 (17)	2.50	2.50	2.50
SURFACE WATER -1992					
no detections	5	-----	-----	-----	-----

Table 19. Herbicides detected in precipitation from Bluegrass watershed; May 1989 through September 1992.

Common chemical name	Common product name	Range in detection concentration (µg/L)	No. of detections/ no. of analyses	% detections	Detection mean µg/L	Detection median µg/L
Herbicides						
Alachlor	Lasso	0.13 - 1.80	12/61	20%	0.51	0.32
Atrazine	Aatrex	0.13 - 2.30	20/61	33%	0.53	0.43
Cyanazine	Bladex	0.10 - 28.00	21/61	34%	1.85	0.34
EPTC	Eptam	0.13 - 2.80	4/61	7%	1.48	1.60
Metolachlor	Dual	0.10 - 1.30	10/61	16%	0.57	0.50
Metribuzin	Sencor	1.20	1/61	2%	-----	-----
Pendimethalin	Prowl	0.14 - 0.72	4/61	7%	0.31	0.18
Propachlor	Ramrod	0.11 - 0.53	7/61	11%	0.22	0.16
Alachlor (IMAE)*	Lasso	0.02 - 0.103	4/4	100%	0.0645	0.0675
Alachlor (IMA)**	Lasso	0.22	1/1	100%	-----	------
Atrazine (IMAE)*	Aatrex	0.013-0.200	9/9	100%	0.106	0.099
Atrazine (IMA)**	Aatrex	0.14 - 1.35	5/5	100%	0.57	0.27

* Immuno Assay on Sample Extract

** Immuno Assay

were detected from April through September (Table 20). The highest concentration of each detected herbicide occurred in May or June. Four rainfall samples collected during the month of October had no pesticide detections. Other pesticides analyzed for but not detected include the herbicides metribuzin, trifluralin, and butylate, and the insecticides chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

Some rainfall samples were analyzed using immuno assay and immuno assay on sample extract (Table 19 and Appendix III). A smaller volume of water is required for these analyses and the detection levels are lower than for GC analyses for pesticides. Using all pesticide analysis methods, atrazine was detected in 45% of the samples, cyanazine in 34%, alachlor in 26%, metolachlor in 16%, propachlor in 11%, eptam and pendimethalin in 7%, and metribuzin in 2% of the samples.

The herbicides detected in rainfall from Bluegrass watershed showed a relationship to pesticide use in the state. Statewide surveys on pesticide use during 1988 and 1989 indicated that atrazine, alachlor, and cyanazine were three of the most commonly used herbicides in Iowa (Duffy and Thompson, 1991; Hallberg et al., 1990; Kross et al., 1990). Atrazine, cyanazine, and alachlor were the most commonly detected herbicides in the Bluegrass rainfall. Insecticides were used less frequently than herbicides in Iowa, and none were detected in Bluegrass precipitation. Of the three sampling locations in Nations and Hallberg (1992), pendimethalin, eptam, and propachlor were detected mainly in the Bluegrass rainfall. The statewide surveys on pesticide use indicate a greater use of these three products in western Iowa than eastern Iowa. According to farm survey information from residents in the Bluegrass watershed, all of the herbicides detected in rainfall, except propachlor, were used in the watershed.

The Bluegrass precipitation site was part of a larger IDNR-GSB study to monitor precipitation in Iowa for pesticides. Nations and Hallberg (1992) summarized data from three sampling locations across Iowa (two rural settings and one urban), including the site in the Bluegrass watershed. The other sites were in eastern Iowa; the

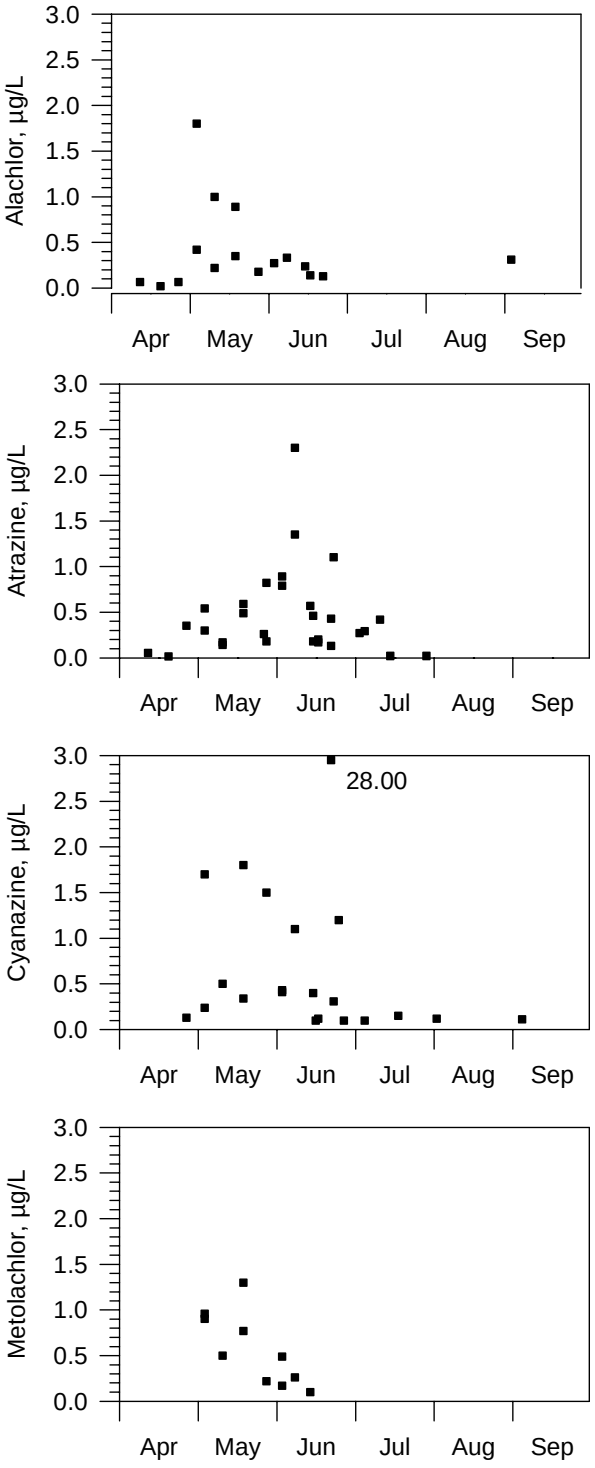

Figure 14. Detections of alachlor, atrazine, cyanazine, and metolachlor in rain water, plotted by month of detection, for 1989 through 1992.

Table 20. Monthly frequency of herbicide detections in precipitation during April through October.

Month	# Samples Collected	# Detections (%)
April	3	3 (100)
May	9	9 (100)
June	15	15 (100)
July	17	5 (29)
August	7	1 (14)
September	11	2 (18)
October	4	0 (0)

other rural site was in the Big Spring basin in Clayton County in northeast Iowa, and the urban site was in Iowa City in Johnson County in east-central Iowa. The data in Nations and Hallberg (1992) was collected from October 1987 through September 1990. Fourteen pesticides, including ten herbicides, were detected. Atrazine, alachlor, cyanazine, and metolachlor were the most commonly detected herbicides, with one or more of these four herbicides found in almost every rainfall sample during the growing season. Pesticide concentrations ranged from 0.10 - 40.00 µg/L, with most detections less than 1.00 µg/L. Pesticide detections began in April and ended in July or August. Samples from the urban site had detections of the same agricultural chemicals found at the rural sites, but in lesser quantities. Variation of pesticide detections were related to regional and local use patterns; pesticide concentrations were greater at sampling sites near fields where pesticides were applied. Pesticide concentrations were highest at the beginning of a rainfall event with concentrations becoming lower in samples taken later in the event.

Discussion

From May 1987 through September 1992, 769 samples from active wells, inactive wells, tile

Table 21. Summary, for entire monitoring period, of pesticides detected in active and inactive wells, tile lines, and surface water.

	# samples	# detections (%)	Range of detected concentrations (µg/L)	Mean of detections (µg/L)	Median of detections (µg/L)
ACTIVE WELLS					
Alachlor	157	3 (2)	0.12 - 5.40	1.90	0.18
Atrazine	157	23 (15)	0.10 - 16.00	1.33	0.22
Cyanazine	157	11 (7)	0.11 - 24.00	2.42	0.15
Metolachlor	158	6 (4)	0.10 - 0.66	0.28	0.20
Pendimethalin	127	3 (2)	0.13 - 0.47	0.25	0.15
Trifluralin	157	2 (1)	0.88 - 1.10	0.99	0.99
INACTIVE WELLS					
Alachlor	143	32 (22)	0.13 - 5.20	1.51	0.68
Atrazine	143	80 (56)	0.10 - 17.00	3.33	0.95
Cyanazine	143	79 (55)	0.13 - 28.00	2.95	1.30
Metolachlor	143	17 (12)	0.11 - 1.60	0.52	0.38
Metribuzin	143	3 (2)	0.17 - 0.33	0.27	0.31
Pendimethalin	129	4 (3)	0.17 - 1.10	0.70	0.77
Trifluralin	143	7 (5)	0.10 - 0.88	0.39	0.28
TILE LINES					
Alachlor	426	8 (2)	0.11 - 0.32	0.17	0.15
Atrazine	426	74 (17)	0.10 - 7.40	0.45	0.17
Cyanazine	426	27 (6)	0.10 - 0.93	0.24	0.14
Metolachlor	426	26 (6)	0.12 - 6.50	0.67	0.18
Pendimethalin	355	1 (<1)	0.14	0.14	0.14
Trifluralin	426	1 (<1)	0.18	0.18	0.18
SURFACE WATER					
Alachlor	43	3 (7)	0.19 - 1.30	0.86	1.10
Atrazine	43	12 (28)	0.18 - 4.20	1.12	0.25
Cyanazine	43	7 (16)	0.15 - 2.70	0.63	0.25
Metolachlor	43	4 (9)	0.10 - 4.60	1.35	0.34
Pendimethalin	32	2 (6)	0.14 - 0.30	0.22	0.22
OVERALL					
Alachlor	769	46 (6)	0.11 - 5.40	1.28	0.53
Atrazine	769	189 (25)	0.10 - 17.00	1.81	0.30
Cyanazine	769	124 (16)	0.10 - 28.00	2.16	0.66
Metolachlor	769	53 (7)	0.10 - 6.50	0.62	0.23
Metribuzin	769	3 (<1)	0.17 - 0.33	0.27	0.31
Pendimethalin	623	10 (2)	0.13 - 1.10	0.41	0.24
Trifluralin	769	10 (1)	0.10 - 1.10	0.50	0.35

lines, and surface water were analyzed for pesticides (Table 21). The number of samples collected varied among sites and annually. One hundred and eighty-nine (189) samples (25%) had a detection of an herbicide. No insecticides were detected in the active wells, inactive wells, tile lines, or surface water. Of the 769 samples, a total of 120 samples (16%) had a detection of two or more

Table 22. Major ion chemistry of water from three of the monitoring wells. Samples were collected August 28, 1989.

Site	W	DW	TH2B
Well screen interval (feet)	13.7 - 15.7	10.6 - 12.6	18.9 - 20.9
Geologic material	Roberts Creek	Roberts Creek	Roberts Creek
pH value	7.6	7.2	7.05
specific conductance (µmhos/cm)	590	330	530
total alkalinity (mg/L as $CaCO_3$)	216	172	218
total hardness (mg/L)	294	320	258
silica (mg/L)	24	21	22
total solids (mg/L)	1,390	12,000	1,520
dissolved solids (mg/L)	225	115	310
calcium (mg/L)	83	87	72
magnesium (mg/L)	21	25	19
dissolved manganese (mg/L)	1.8	3.5	----
total manganese (mg/L)	2.0	7.4	2.3
potassium (mg/L)	1.3	1.8	1.5
sodium (mg/L)	11	10	12
bicarbonate (mg/L)	264	210	266
chloride (mg/L)	13	15	23
fluoride (mg/L)	0.45	0.40	0.40
nitrite+nitrate-N (mg/L)	0.2	0.4	0.3
sulfate (mg/L)	69	18	46
total organic carbon (mg/L)	---	29	8.9
dissolved iron (mg/L)	0.02	0.34	1.10
total iron (mg/L)	5.6	50	25

herbicides. All of the detected herbicides have been used in the watershed. Atrazine was the most commonly detected (25% of the samples) followed by cyanazine (16%), metolachlor (7%), alachlor (6%), pendimethalin (2%), trifluralin (1%), and metribuzin (<1%). Concentrations of these herbicides ranged from 0.10-28.00 µg/L.

Alachlor, atrazine, cyanazine, metolachlor, and pendimethalin were all detected in the active wells, inactive wells, tile lines, and surface water. Trifluralin was detected in the active wells, inactive well, and tile lines. Metribuzin was detected only in the inactive wells. The three most frequently detected herbicides for the active wells, tile lines, and surface water were atrazine, cyanazine, and metolachlor. For the inactive wells, atrazine, cyanazine, and alachlor were the most commonly detected.

The inactive wells had the highest median concentration of atrazine, cyanazine, metolachlor, metribuzin, and pendimethalin. Surface water had the highest median concentration of alachlor, and active wells had the highest median concentration of trifluralin.

The pesticide data support previous observations on the persistence and transport of some of these commonly used herbicides. Atrazine, in particular, was not applied on the soybean fields, yet still was detected in some of the active wells, monitoring wells, and tile lines surrounded by or draining these fields. Atrazine and some other herbicides were also detected in groundwater beneath the Conservation Reserve Program and pasture sites. This may suggest persistence in the soil from prior years, but particularly the detections at depth support the hydrologic observations of lateral flow that occur in Bluegrass watershed. It seems likely many of the herbicide detections that occurred in locations where the herbicides were not being applied, moved laterally in the ground-

Table 23. Major ion chemistry of water from three of the active private wells. Samples were collected August 28, 1989.

Site	MN1	SW1	W1
pH value	7.4	7.3	7.2
specific conductance (µmhos/cm)	450	730	440
total alkalinity (mg/L as $CaCO_3$)	194	244	112
total hardness (mg/L)	205	297	172
silica (mg/L)	20	23	19
total solids (mg/L)	264	394	356
dissolved solids (mg/L)	214	344	240
calcium (mg/L)	59	81	46
magnesium (mg/L)	14	23	14
dissolved manganese (mg/L)	<0.02	0.09	0.03
potassium (mg/L)	3.7	0.4	11
sodium (mg/L)	11	32	13
bicarbonate (mg/L)	237	298	137
chloride (mg/L)	18	56	30
fluoride (mg/L)	0.35	0.40	0.45
nitrite+nitrate-N (mg/L)	0.2	6.0	8.0
sulfate (mg/L)	26	36	28
total organic carbon (mg/L)	3.2	6.2	15
dissolved iron (mg/L)	0.02	<0.02	0.23
total iron (mg/L)	0.15	0.20	0.66

water from adjacent areas, or infiltrated as overland runoff from adjacent areas. It is also possible that the herbicides were deposited with rainwater and, through preferential flow, reached the water table (e.g., Nations et al., 1993). The concentrations of herbicides in Bluegrass rainfall, however, seem to preclude that possibility.

ION CHEMISTRY

Water from three monitoring wells and three active private wells was analyzed for major ion chemistry (Tables 22 and 23) to determine the ion composition of shallow groundwater in the watershed. The other active private well (KH2) was also sampled, but the hydrant sampled was connected to the rural water supply, not the well, that particular day. The three monitoring wells sampled were all from Roberts Creek alluvium.

For most of the ions, concentrations were comparable between the monitoring wells and private wells. Concentrations of total solids were high for the monitoring wells. This was expected as the samples were slightly turbid when collected. Concentrations of dissolved solids were similar for the monitoring wells and active private wells, ranging from 115 to 340 mg/L. Calcium, magnesium, sulfate, and bicarbonate concentrations were relatively low compared to concentrations from bedrock aquifers in Iowa. Calcium concentrations were less than 90 mg/L, magnesium less than 30 mg/L, sulfate less than 70 mg/L, and bicarbonate less than 300 mg/L. Specific conductance was variable, ranging from 330 to 730 µmhos/cm. Total organic carbon concentrations ranged from 3.2 to 29 mg/L.

SOIL ANALYSES

Soil samples from four localities in and around Bluegrass watershed were collected for soil nitrate-N analysis and particle-size analysis. Figure 15 is the particle-size data. Samples were collected near private well KH2, near monitoring

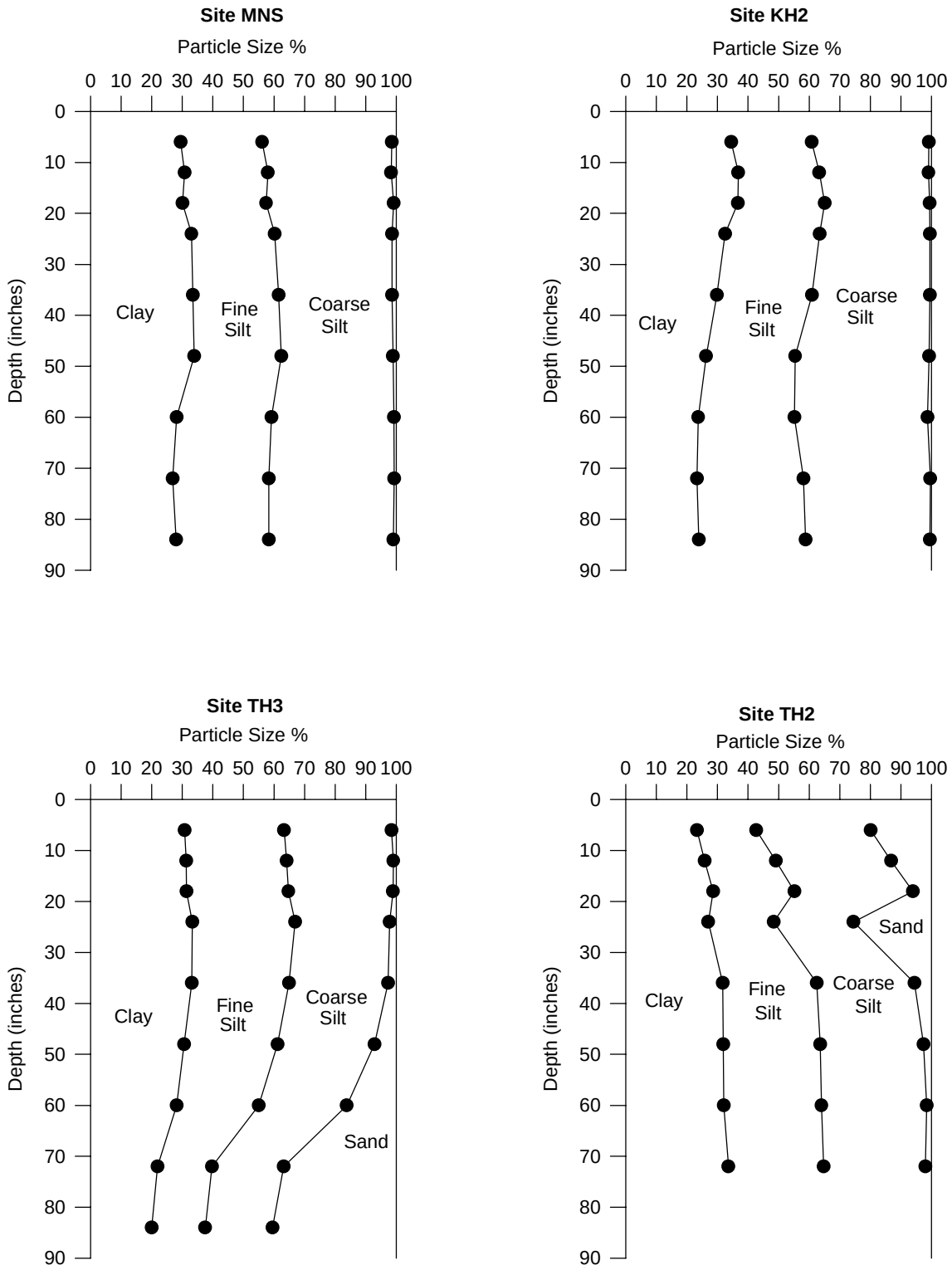

Figure 15. Particle-size data for four cores collected November 1990 in the Bluegrass watershed.

wells TH2 and TH3, and near tile line MNS1 (see Figure 2). Samples were collected on four occasions: November 1990, April 1991, June 1991, and October 1991. Two sets of cores were taken on April 1991 (Set A and Set B). Both sets were analyzed separately, and a composite of the two sets of samples was also analyzed. The soil nitrate-N data is tabulated in Appendix IV. The temporal series of nitrate data from the soil cores showed, as would be expected, that the sites that were in fertilized corn had much greater soil-nitrate concentrations than those in soybeans.

Some of the cores collected on April 1991 were also split and subsampled to assess the nitrate concentration in the soil around possible macropores. Both pore and matrix samples were analyzed for nitrate-N. Table 24 is a summary of the data. Macropores may conduct preferential flow compared to the remaining matrix of the soil sampled. For this, the cores were carefully split and examined. Based on soil morphological characteristics, the soil around features such as prominent vertical structural faces were sampled and analyzed separately from the remainder of the soil. The results showed that, at shallow depths, the "pore" samples had lower nitrate concentrations than the matrix samples. The "pore" samples from site KH2 were lower than the matrix samples to a greater depth than site MNS. Rapid, vertical water movement may have preferentially removed nitrate along the macropore areas relative to the less mobile matrix regions. In prior work, Hallberg showed that such results may vary seasonally, related to rainfall recharge, and that pesticides may show the opposite relation. Pesticides, being more highly adsorbed (and nitrate being very mobile), may occur along the macropore faces and not in the matrix (Hallberg, 1989).

Table 24. Soil nitrate-N data for pore and matrix sampling of two cores collected on April 1991 from Bluegrass watershed.

Depth (inches)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)
	Site MNS pore	Site MNS matrix	Site KH2 pore	Site KH2 matrix
6	3.00	3.75	1.90	2.20
12	7.35	8.55	17.75	19.90
18	5.45	4.45	33.15	35.70
24	3.30	3.50	27.40	29.55
36	1.45	1.45	21.30	22.50
48	2.10	2.25	17.15	17.70
60	3.05	2.90	12.80	11.10
72	4.55	4.25	5.15	5.20
84	5.35	4.75	5.50	5.50
96	4.35	4.80	5.95	5.05
108	4.80	5.00	6.75	6.05
120	-----	5.00	7.65	6.80

DISCUSSION AND SUMMARY

Well construction was a primary factor affecting water quality from the private wells. The type of private wells found in this part of the state, because of their shallow depth and location, tend to be susceptible to contamination. Results from the active private wells showed a high frequency of detection of total (92%) and fecal coliform bacteria (31%) in all wells, nitrate-N concentrations consistently >10 mg/L in one of the wells, and the detection of six herbicides; three of the herbicides were detected at concentrations above U.S. EPA Maximum Contaminant Levels. These wells tap the very top of the water table. Hence, as noted they are very susceptible to contamination, but they should also be responsive over time to improvements in land management.

For the other monitoring sites, the primary factors affecting nitrate-N concentrations were landuse, climate, geologic materials, and landscape position. Chemical use was the primary factor affecting pesticide detections.

Minor improvements in nitrogen management could not be discerned in the well-water quality nitrate-N data because of the substantial annual variability that occurs, and because the hydrogeologic setting promoted denitrification in some settings. In general, definitive improvements, or changes could only be related to the most

dramatic changes in land management. Two examples illustrate this conclusion. In 1987, land surrounding private well W1 was taken out of row-crop production and placed in the Conservation Reserve Program. Annual median nitrate-N concentrations declined dramatically from 14.9 mg/L in 1987 to 0.9 mg/L in 1990, 1991, and 1992. Another private well, KH2, showed indications of declining nitrate-N concentrations after a buffer strip was placed around the well, which eliminated nitrogen applications from the immediate vicinity of the well head.

Unlike the private wells, the monitoring wells sampled groundwater from discrete intervals at depth. Data from these wells showed a strong relationship between nitrate-N concentrations and geologic materials. The highest concentrations occurred in wells situated in loess. Because of the stratigraphy in the watershed, these loess wells are located high in the landscape, in well-drained situations, and in this position, were most consistently surrounded by row crops in their recharge area. Precipitation on these landscape positions infiltrates the soil and moves available nitrate nitrogen downward. Initial groundwater recharge movement is vertical down through the loess to the paleosol-till contact. At this zone, groundwater moves along the loess/paleosol-till contact towards Bluegrass Creek. Along the flow path, groundwater passes through the Gunder Member alluvium and Roberts Creek Member alluvium. Wells in the Gunder Member reported intermediate nitrate-N concentrations. The lowest nitrate-N concentrations occurred in wells in the Roberts Creek Member, and likely result from denitrification. The greatest potential for denitrification occurs in oxygen-deficient, organic carbon-rich, water-saturated materials (Rolston, 1981). This describes the Roberts Creek Member. Hence, only when the wells were not in Roberts Creek Member alluvium did landuse become a factor.

Nitrate-N concentrations from tile lines and surface water were affected primarily by climatic conditions. During the two years of drought (1988 and 1989), concentrations declined and then increased in 1990 with the return to more normal rainfall. It was difficult to determine any trends in nitrate-N data related to landuse for the tile lines, as there was very little change from a corn/soybean rotation. Also, the elevated nitrate-N concentrations in Bluegrass Creek are a direct result of the high concentrations in the tile effluent. The tile lines in the watershed circumvent the normal flow path of groundwater. The tile lines deliver nitrate-rich water directly to the stream rather than allowing nitrate-rich groundwater to pass through the Roberts Creek Member alluvium and possibly be denitrified before entering the creek as baseflow.

Alachlor, atrazine, cyanazine, and metolachlor were the most commonly detected herbicides in groundwater and surface water. All of the herbicides detected were used in the watershed. The herbicide detections showed a seasonal trend, with most detections occurring during the May to September growing season. Based on available crop history information, atrazine and metolachlor were detected in tiles lines most years when the herbicides were applied on fields drained by those tiles. However, several other herbicides that were applied were not detected in tile line effluent. The precipitation sampler detected two herbicides that were not detected in any of the other monitoring sites: eptam and propachlor. According to available crop history information, eptam was applied in the watershed but propachlor was not.

This study has shown that for a typical watershed in this setting, several factors, including landuse, climate, geologic materials, and landscape position, affect water quality. Results from this study have certain implications for drinking water wells in this geologic setting. The water in the private wells represents the integration of groundwater that has entered the well along the well's total depth. This includes shallow groundwater that may have nitrate-N concentrations typical of tile line effluent and deeper groundwater that may have concentrations typical of some of the monitoring wells (that were only open at depth). Because shallow groundwater enters these private wells, total and fecal coliform bacteria will probably continue to be a problem unless improved well construction practices are used (i.e., buried slab). While improved construction (such as buried slab) that eliminates the entry of the most

shallow groundwater may help to minimize coliform occurrence in these wells, it will not likely eliminate nitrate and pesticide detections. The monitoring wells were only open to receive groundwater from the lower depths that the seepage wells accept (e.g., 15 to 25 feet); high nitrate concentrations and pesticides still occur at these depths, dependent on the hydrogeologic setting. These data also show that subtle, annual changes in nitrogen management, for example, may not be discernible in water quality changes in the short term, because of the substantial variability inherent in total landuse and climate from year to year. To document these incremental changes requires a long-term commitment to monitoring. Results from this study do show that changes in landuse around these wells can result in lower nitrate-N concentrations and improved water quality.

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APPENDIX I.

WATER-QUALITY DATA FROM BLUEGRASS WATERSHED FOR MONITORING WELLS, ACTIVE WELLS, INACTIVE WELLS, TILE LINES, AND SURFACE WATER.

(Pesticide detections are shaded.)

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MONITORING WELLS															
KHE	31-May-89	Dry													
KHE	23-Jun-89	-6.92													
KHE	27-Jun-89	-8.58													
KHE	25-Jul-89	-5.29													
KHE	28-Aug-89	-6.15	21.78												
KHE	05-Sep-89	-6.90	22.44												
KHE*	26-Sep-89	-3.69	23.11				<0.1	<0.1	<0.1	0.21	<0.1	<0.1	<0.2	<0.1	<0.1
KHE	30-Oct-89	-5.13													
KHE	27-Nov-89	-5.45	21.33												
KHE	27-Dec-89	-5.73	16.89												
KHE	29-Jan-90	-5.77	21.33												
KHE*	01-Mar-90	-5.82	24.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE*	26-Mar-90	-3.56	25.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE*	30-Apr-90	-4.34	24.44				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
KHE*	29-May-90	-3.32	25.33				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
KHE*	19-Jun-90	-0.99	26.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE*	25-Jun-90	-0.81	27.56				<0.1	<0.5	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
KHE	26-Jun-90		27.78												
KHE*	27-Jul-90	-1.06	26.22				<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE*	27-Aug-90	-2.64	29.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE	01-Oct-90	-4.64	27.78												
KHE	22-Oct-90	-5.16	27.33												
KHE	27-Nov-90	-5.68	24.00												
KHE	28-Nov-90	-6.66	27.11												
KHE	04-Jan-91	-4.40	27.11												
KHE	28-Jan-91	-6.06													
KHE	25-Feb-91	-3.58	26.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KHE	25-Mar-91	-1.90	26.67												
KHE	29-Apr-91	-0.26	26.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KHE*	28-May-91	-1.44	27.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE*	18-Jun-91	-1.68	27.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE*	30-Jul-91	-3.98	25.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHE	28-Aug-91	-5.10	26.89												
KHE	23-Sep-91	-5.78	24.00												

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KHE	29-Oct-91	-6.42	26.22				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
KHE	03-Dec-91	-5.04	23.78												
KHE	07-Jan-92	-4.50	23.33												
KHE	05-Feb-92	-5.19	23.11												
KHE	03-Mar-92	-4.80	22.22												
KHE	07-Apr-92	-4.48	21.56												
KHE	06-May-92		21.11			0.43									
KHE	10-Jun-92	-4.52	21.56			<0.1									
KHE	09-Jul-92	-5.02	21.78			<0.1									
KHE	06-Aug-92	-4.23	21.56			0.15									
KHE	03-Sep-92	-4.88	20.89			<0.1									
KHW	31-May-89	-2.90	<0.20												
KHW	23-Jun-89	-2.83													
KHW*	27-Jun-89	-2.93	<0.20				<0.1	0.11	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1
KHW	25-Jul-89	-3.25	<0.20												
KHW	28-Aug-89	-2.85	<0.20												
KHW*	05-Sep-89	-2.48	<0.20				<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1
KHW	26-Sep-89	-3.10	<0.20												
KHW	30-Oct-89	-3.15													
KHW	27-Nov-89	-3.18	0.22												
KHW*	27-Dec-89	-3.26	0.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW	29-Jan-90	-3.15	<0.20												
KHW*	01-Mar-90	-3.21	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW*	26-Mar-90	-3.06	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW*	30-Apr-90	-3.22	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
KHW*	29-May-90	-3.02	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
KHW*	19-Jun-90	-0.90	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW*	25-Jun-90	-1.46	<0.20				<0.1	<0.3	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
KHW	26-Jun-90		<0.20												
KHW*	27-Jul-90	-0.04	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW*	27-Aug-90	-3.04	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW	01-Oct-90	-3.34	<0.20												
KHW	22-Oct-90	-3.28	<0.20												
KHW	27-Nov-90	-3.20	0.67												
KHW	28-Nov-90	-3.26	<0.20												
KHW	04-Jan-91	-3.26	0.22												

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KHW	28-Jan-91	-3.26													
KHW	25-Feb-91	-2.88	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KHW	25-Mar-91	-2.48	<0.20												
KHW	29-Apr-91	-1.78	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KHW*	28-May-91	-3.22	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW*	18-Jun-91	-2.90	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW*	30-Jul-91	-3.47	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHW	28-Aug-91	-3.80	<0.20												
KHW	23-Sep-91	-3.51	<0.20												
KHW	29-Oct-91	-3.30	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
KHW	03-Dec-91	-3.08	<0.20												
KHW	07-Jan-92	-3.04	<0.20												
KHW	05-Feb-92	-3.26	<0.20												
KHW	03-Mar-92	-3.15	<0.20												
KHW	07-Apr-92	-3.24	<0.20												
KHW	06-May-92		<0.20			0.27									
KHW	10-Jun-92	-3.62	<0.20			<0.1									
KHW	09-Jul-92	-3.50	<0.20			<0.1									
KHW	06-Aug-92	-2.82	<0.20			<0.1									
KHW	03-Sep-92	-3.26	<0.20			<0.1									
KHN	27-Nov-90	-8.13	8.22												
KHN	28-Nov-90	-8.13	9.78												
KHN	04-Jan-91	-8.15	9.56												
KHN	28-Jan-91	-8.15													
KHN	25-Feb-91	-7.63	10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KHN	25-Mar-91	-6.75	10.00												
KHN	29-Apr-91	-4.65	10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KHN*	28-May-91	-7.11	9.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHN*	18-Jun-91	-6.51	9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHN*	30-Jul-91	-7.08	9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KHN	28-Aug-91	-8.23	9.11												
KHN	23-Sep-91	-8.31	9.11												
KHN	29-Oct-91	-8.25	9.11				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
KHN	03-Dec-91	-8.01	10.00												
KHN	07-Jan-92	-7.91	9.78												
KHN	05-Feb-92	-7.99	10.00												

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KHN	03-Mar-92	-7.87	10.67												
KHN	07-Apr-92	-7.63	10.22												
KHN	06-May-92		10.00			0.58									
KHN	10-Jun-92	-7.97	10.00			0.21									
KHN	09-Jul-92	-8.03	9.78			0.10									
KHN	06-Aug-92	-7.38	10.44			<0.1									
KHN	03-Sep-92	-7.85	10.22			<0.1									
W	31-May-89	-3.48	<0.20												
W	23-Jun-89	-1.83													
W*	27-Jun-89	-0.39	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W	25-Jul-89	-2.77	<0.20												
W*	28-Aug-89	-1.09	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	05-Sep-89	-0.52	<0.20				<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	26-Sep-89	-1.40	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W	30-Oct-89	-1.63													
W	27-Nov-89	-2.24	0.44												
W*	27-Dec-89	-2.71	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W	29-Jan-90	-2.63	<0.20												
W*	01-Mar-90	-3.31	<0.20				<0.1	<0.42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	26-Mar-90	-1.82	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	30-Apr-90	-1.78	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	29-May-90	-1.46	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	19-Jun-90	0.12	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	25-Jun-90	-0.06	<0.20				<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	27-Jul-90	0.16	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W*	27-Aug-90	-1.42	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W	01-Oct-90	-2.90	<0.20												
W	23-Oct-90	-3.08	<0.20												
W	27-Nov-90	-3.34	0.44												
W	28-Nov-90	-3.39	<0.20												
W	04-Jan-91	-4.20	0.22												
W	28-Jan-91	-3.60													
W	25-Feb-91	-1.40	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W	25-Mar-91	-0.04	<0.20												
W	29-Apr-91	-0.16	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.2			<0.1
W*	28-May-91	-1.20	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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W*	18-Jun-91	-0.84	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1
W*	30-Jul-91	-2.22	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W	28-Aug-91	-3.30	<0.20												
W	23-Sep-91	-3.04	<0.20												
W	29-Oct-91	-3.46	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
W	03-Dec-91	-1.70	<0.20												
W	07-Jan-92	-0.90	<0.20												
W	05-Feb-92	-1.46	<0.20												
W	03-Mar-92	-0.68	<0.20												
W	07-Apr-92	-0.22	<0.20												
W	06-May-92		<0.20			<0.1									
W	10-Jun-92	-2.14	<0.20			<0.1									
W	09-Jul-92	-2.12	<0.20			0.14									
W	06-Aug-92	-0.16	<0.20			<0.1									
W	03-Sep-92	-1.02	<0.20			<0.1									
TH1	31-May-89	-16.40													
TH1	23-Jun-89	-15.66													
TH1	27-Jun-89	-15.87	<0.20												
TH1	25-Jul-89	-15.16													
TH1	28-Aug-89	-15.20													
TH1	05-Sep-89	-15.47													
TH1	26-Sep-89	-13.29	2.22												
TH1	30-Oct-89	-13.95													
TH1	27-Nov-89	-15.30													
TH1	27-Dec-89	-14.88													
TH1	29-Jan-90	-15.14													
TH1	01-Mar-90	-15.31													
TH1	26-Mar-90	-12.71	2.22												
TH1	30-Apr-90	-13.19	3.78												
TH1*	29-May-90	-11.92	3.56				<0.1	0.38	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
TH1*	19-Jun-90	-11.62	4.22				<0.1	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH1	25-Jun-90	-11.96	4.89												
TH1	26-Jun-90		5.33												
TH1	27-Jul-90	-12.10	4.67												
TH1	27-Aug-90	-11.82	4.67												
TH1	01-Oct-90	-14.14	3.56												

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH1	22-Oct-90	-14.84	3.78												
TH1	27-Nov-90	-15.26													
TH1	28-Nov-90	-16.16													
TH1	04-Jan-91	-15.60	3.56												
TH1	28-Jan-91	-15.86													
TH1	25-Feb-91	-14.06	4.44				<0.1	0.43	<0.1	<0.1	<0.1	<0.1			<0.1
TH1	25-Mar-91	-12.00	4.22												
TH1	29-Apr-91	-8.94	5.11				<0.1	0.19	<0.1	<0.1	<0.1	<0.1			<0.1
TH1	28-May-91	-10.68	5.33												
TH1*	18-Jun-91	-12.04	5.78				<0.1	0.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH1	30-Jul-91	-14.23	6.44												
TH1	28-Aug-91	-15.06	6.00												
TH1	23-Sep-91	-15.48	4.89												
TH1	29-Oct-91	-15.80	4.44												
TH1	04-Dec-91	-14.50	4.89												
TH1	07-Jan-92	-12.88	5.33												
TH1	05-Feb-92	-12.90	5.56												
TH1	03-Mar-92	-12.38	6.44												
TH1	07-Apr-92	-11.96	7.11												
TH1	06-May-92		7.33			0.20									
TH1	10-Jun-92	-13.38	7.11			0.14									
TH1	09-Jul-92	-15.18	7.11			0.27									
TH1	06-Aug-92	-14.86	6.67			0.32									
TH1	03-Sep-92	-15.00	7.11			0.14									
TH2A	27-Nov-90	-4.65	2.00												
TH2A	28-Nov-90	-4.73	<0.20												
TH2A	04-Jan-91	-4.83	<0.20												
TH2A	28-Jan-91	-4.87													
TH2A	25-Feb-91	-4.25	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH2A	25-Mar-91	-3.55	<0.20												
TH2A	29-Apr-91	-3.99					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH2A*	28-May-91	-4.35	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2A*	18-Jun-91	-4.27	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2A*	30-Jul-91	-4.55	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2A	28-Aug-91	-4.83	<0.20												
TH2A	23-Sep-91	-4.81	<0.20												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH2A	29-Oct-91	-4.81	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
TH2A	04-Dec-91	-4.47	<0.20												
TH2A	07-Jan-92	-4.31	<0.20												
TH2A	05-Feb-92	-4.47	<0.20												
TH2A	03-Mar-92	-4.33	<0.20												
TH2A	07-Apr-92	-4.29	<0.20												
TH2A	06-May-92		<0.20			<0.1									
TH2A	10-Jun-92	-4.53	<0.20			<0.1									
TH2A	09-Jul-92	-4.59	<0.20			<0.1									
TH2A	06-Aug-92	-3.95	<0.20			0.15									
TH2A	03-Sep-92	-4.93	<0.20			<0.1									
TH2B	31-May-89	-4.56	<0.20												
TH2B	23-Jun-89	-4.51													
TH2B*	27-Jun-89	-3.23	<0.20				<0.1	0.12	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B	25-Jul-89	-4.59													
TH2B*	28-Aug-89	-3.97	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	05-Sep-89	-3.34	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2
TH2B*	26-Sep-89	-4.03	<0.20				<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B	30-Oct-89	-4.19													
TH2B	27-Nov-89	-4.28	<0.20												
TH2B*	27-Dec-89	-4.40	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B	29-Jan-90	-4.37	<0.20												
TH2B*	01-Mar-90	-4.56	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	26-Mar-90	-3.88	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	30-Apr-90	-4.24	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	29-May-90	-3.78	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	19-Jun-90	-2.84	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	25-Jun-90	-3.14	<0.20				<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B	26-Jun-90		<0.20												
TH2B*	27-Jul-90	-1.70	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	27-Aug-90	-4.90					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B	01-Oct-90	-4.22	<0.20												
TH2B	22-Oct-90	-4.18	<0.20												
TH2B	27-Nov-90	-4.34	<0.20												
TH2B	28-Nov-90	-4.42	<0.20												
TH2B	04-Jan-91	-4.60	0.44												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH2B	28-Jan-91	-4.66													
TH2B	25-Feb-91	-3.82	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH2B	25-Mar-91	-3.04	<0.20												
TH2B	29-Apr-91	-3.56	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH2B*	28-May-91	-3.96	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	18-Jun-91	-3.86	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B*	30-Jul-91	-4.22	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH2B	28-Aug-91	-4.58	<0.20												
TH2B	23-Sep-91	-4.61	<0.20												
TH2B	29-Oct-91	-4.66	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
TH2B	04-Dec-91	-4.20	<0.20												
TH2B	07-Jan-92	-3.96	<0.20												
TH2B	05-Feb-92	-4.14	<0.20												
TH2B	03-Mar-92	-3.99	<0.20												
TH2B	07-Apr-92	-3.94	<0.20												
TH2B	06-May-92		<0.20			<0.1									
TH2B	10-Jun-92	-4.20	<0.20			<0.1									
TH2B	09-Jul-92	-4.28	<0.20			<0.1									
TH2B	06-Aug-92	-3.48	<0.20			<0.1									
TH2B	03-Sep-92	-4.45	9.78			<0.1									
TH3A	27-Nov-90	-4.84	2.67												
TH3A	28-Nov-90	-5.09	4.44												
TH3A	04-Jan-91	-5.01	2.89												
TH3A	28-Jan-91	-5.13													
TH3A	25-Feb-91	-4.73	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH3A	25-Mar-91	-4.13	6.22												
TH3A	29-Apr-91	-4.15	6.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH3A*	28-May-91	-4.33	6.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3A*	18-Jun-91	-4.13	6.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3A*	30-Jul-91	-4.43	10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3A	28-Aug-91	-4.75	13.78												
TH3A	23-Sep-91	-4.99	13.56												
TH3A	29-Oct-91	-5.07	11.56				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
TH3A	04-Dec-91	-4.74	12.67												
TH3A	07-Jan-92	-4.55	11.11												
TH3A	05-Feb-92	-4.39	13.56												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH3A	03-Mar-92	-4.23	16.00												
TH3A	07-Apr-92	-4.31	10.44												
TH3A	06-May-92		8.89			<0.1									
TH3A	10-Jun-92	-4.43	10.67			<0.1									
TH3A	09-Jul-92	-4.47	12.89			<0.1									
TH3A	06-Aug-92	-3.93	12.89			<0.1									
TH3A	03-Sep-92	-3.97	<0.20			<0.1									
TH3B	31-May-89	-5.25	0.44												
TH3B	23-Jun-89	-5.00													
TH3B*	27-Jun-89	-4.28	<0.20				<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1
TH3B	25-Jul-89	-4.81													
TH3B*	28-Aug-89	-4.72	0.44				<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
TH3B*	05-Sep-89	-4.51	2.22				<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	26-Sep-89	-4.41	0.89				<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B	30-Oct-89	-4.70													
TH3B	27-Nov-89	-4.70	0.44												
TH3B*	27-Dec-89	-4.67	2.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B	29-Jan-90	-5.03	4.00												
TH3B*	01-Mar-90	-5.20	5.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	26-Mar-90	-4.53	7.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	30-Apr-90	-4.70	6.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	29-May-90	-4.24	4.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	19-Jun-90	-3.48	6.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	25-Jun-90	-3.54	8.67				<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B	26-Jun-90		11.33												
TH3B*	27-Jul-90	-2.80	6.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	27-Aug-90	-3.00					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B	01-Oct-90	-4.50	5.33												
TH3B	22-Oct-90	-4.58	6.22												
TH3B	27-Nov-90	-4.72	9.11												
TH3B	28-Nov-90	-4.76	15.11												
TH3B	04-Jan-91	-4.88	9.33												
TH3B	28-Jan-91	-4.92													
TH3B	25-Feb-91	-4.56	8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH3B	25-Mar-91	-4.10	9.78												
TH3B	29-Apr-91	-4.10	8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH3B*	28-May-91	-4.22	7.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	18-Jun-91	-4.10	9.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B*	30-Jul-91	-4.43	11.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH3B	28-Aug-91	-4.84	11.56												
TH3B	23-Sep-91	-5.07	10.89												
TH3B	29-Oct-91	-5.16	9.33				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
TH3B	04-Dec-91	-4.85	10.00												
TH3B	07-Jan-92	-4.66	8.00												
TH3B	05-Feb-92	-4.55	8.22												
TH3B	03-Mar-92	-4.36	10.89												
TH3B	07-Apr-92	-4.46	8.22												
TH3B	06-May-92		5.33			<0.1									
TH3B	10-Jun-92	-4.54	6.22			<0.1									
TH3B	09-Jul-92	-4.58	11.33			<0.1									
TH3B	06-Aug-92	-4.08	11.11			<0.1									
TH3B	03-Sep-92	-4.52	7.56			<0.1									
TH4	31-May-89	-12.12													
TH4	23-Jun-89	-11.16													
TH4	27-Jun-89	-11.60	8.22												
TH4	25-Jul-89	-9.62													
TH4	28-Aug-89	-7.97													
TH4	05-Sep-89	-11.22	11.56												
TH4	26-Sep-89	-8.62	13.56												
TH4	30-Oct-89	-7.73													
TH4	27-Nov-89	-6.70	11.56												
TH4	27-Dec-89	-7.14	9.33												
TH4	29-Jan-90	-9.50													
TH4	01-Mar-90	-9.85													
TH4	26-Mar-90	-8.30	13.11												
TH4	30-Apr-90	-8.10	12.89												
TH4*	29-May-90	-7.54	12.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH4	19-Jun-90	-9.20	12.44												
TH4*	25-Jun-90	-9.09	12.89				<0.2	<2.0	<0.1	0.10	<0.2	<0.3	<0.1	<0.2	<0.2
TH4	27-Jul-90	-7.12	12.44												
TH4*	27-Aug-90	-4.90	12.44				<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH4	01-Oct-90	-6.96	10.67												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH4	22-Oct-90	-8.00	9.56												
TH4	27-Nov-90	-7.12	8.67												
TH4	28-Nov-90	-12.07	8.44												
TH4	04-Jan-91	-9.14	10.44												
TH4	28-Jan-91	-9.34													
TH4	25-Feb-91	-7.46	10.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH4	25-Mar-91	-8.70	10.44												
TH4	29-Apr-91	-6.14	10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH4*	28-May-91	-6.33	11.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH4*	18-Jun-91	-7.64	10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH4*	30-Jul-91	-5.70	10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH4	28-Aug-91	-8.56	10.67												
TH4	23-Sep-91	-9.80	10.67												
TH4	29-Oct-91	-9.26	10.89				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
TH4	04-Dec-91	-8.96	10.67												
TH4	07-Jan-92	-7.96	10.44												
TH4	05-Feb-92	-8.30	10.67												
TH4	03-Mar-92	-9.21	10.67												
TH4	07-Apr-92	-8.62	10.44												
TH4	06-May-92		10.67			0.10									
TH4	10-Jun-92	-8.12	10.67			<0.1									
TH4	09-Jul-92	-9.08	10.67			<0.1									
TH4	06-Aug-92	-8.34	10.67			<0.1									
TH4	03-Sep-92	-8.73	10.22			<0.1									
TH5	31-May-89	Dry													
TH5	23-Jun-89	Dry													
TH5	27-Jun-89	Dry													
TH5	25-Jul-89	Dry													
TH5	28-Aug-89	Dry													
TH5	05-Sep-89	Dry													
TH5	26-Sep-89	Dry													
TH5	30-Oct-89	Dry													
TH5	27-Nov-89	Dry													
TH5	27-Dec-89	Dry													
TH5	29-Jan-90	Dry													
TH5	01-Mar-90	Dry													

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
TH5	26-Mar-90	Dry													
TH5	30-Apr-90	Dry													
TH5	29-May-90	Dry													
TH5	19-Jun-90	-8.62	3.11												
TH5*	26-Jun-90	-9.44	0.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH5	27-Jul-90	-9.00	0.44												
TH5	27-Aug-90	-9.00	0.44												
TH5	01-Oct-90	-11.68													
TH5	22-Oct-90	-11.90													
TH5	27-Nov-90	-14.42													
TH5	04-Jan-91	-11.92													
TH5	28-Jan-91	-11.92													
TH5	25-Feb-91	-10.60	0.44												
TH5	25-Mar-91	-9.40	<0.20												
TH5	29-Apr-91	-6.02	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TH5*	28-May-91	-8.48	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TH5	18-Jun-91	-9.76	<0.20												
TH5	30-Jul-91	Dry													
TH5	28-Aug-91	-11.92													
TH5	23-Sep-91	-11.94													
TH5	29-Oct-91	-11.94													
TH5	04-Dec-91	-11.98													
TH5	07-Jan-92	-11.06	0.44												
TH5	05-Feb-92	-11.88													
TH5	03-Mar-92	-11.90													
TH5	07-Apr-92	-11.94													
TH5	06-May-92		0.22			<0.1									
TH5	10-Jun-92	-11.94													
TH5	09-Jul-92	-11.95													
TH5	06-Aug-92	-11.94													
TH5	03-Sep-92	-11.94													
GF	31-May-89	-21.22													
GF	23-Jun-89	-21.47													
GF	27-Jun-89	-21.01													
GF	25-Jul-89	-19.97													
GF	28-Aug-89														

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
GF	05-Sep-89	-21.38													
GF	26-Sep-89	-18.28	24.67												
GF	30-Oct-89	-17.62													
GF	27-Nov-89	-17.47	19.78												
GF	27-Dec-89	-17.49	23.56												
GF	29-Jan-90	-17.71	25.11												
GF	01-Mar-90	-17.97	22.89												
GF	26-Mar-90	-16.96	30.67												
GF*	30-Apr-90	-15.62	31.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GF*	29-May-90	-14.68	31.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GF*	19-Jun-90	-12.68	32.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GF*	25-Jun-90	-10.28	32.00				<0.1	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GF	26-Jun-90		32.00												
GF*	27-Jul-90	-10.60	30.44				<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1
GF*	27-Aug-90	-10.78	32.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GF	01-Oct-90	-15.16	30.89												
GF	22-Oct-90	-16.26	32.22												
GF	27-Nov-90	-17.00	26.89												
GF	28-Nov-90	-17.05	29.78												
GF	04-Jan-91														
GF	28-Jan-91														
GF	25-Feb-91														
GF	25-Mar-91														
GF	29-Apr-91	-6.46	28.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
GF*	28-May-91	-8.48	29.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GF*	18-Jun-91	-9.76	28.89				<0.1	<0.1	<0.1	<0.1	<0.1	0.18	<0.1	<0.1	<0.1
GF*	30-Jul-91	-14.51	28.22				<0.1	<0.1	<0.1	0.28	<0.1	<0.1	<0.1	<0.1	<0.1
GF	28-Aug-91	-17.26	29.11												
GF	23-Sep-91	-18.72	28.44												
GF	29-Oct-91	-19.48	29.56				<0.2	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
GF	03-Dec-91	-16.90	27.33												
GF	07-Jan-92	-14.56	29.56												
GF	05-Feb-92	-14.53	29.78												
GF	03-Mar-92	-14.56	29.78												
GF	07-Apr-92	-13.06	28.89												
GF	06-May-92		29.33			0.37									
GF	10-Jun-92	-12.98	30.67			<0.1									

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
GF	09-Jul-92	-15.04	30.00			<0.1									
GF	06-Aug-92	-13.66	30.22			<0.1									
GF	03-Sep-92	-15.18	30.44			<0.1									
DE	31-May-89	-3.17	<0.20												
DE	23-Jun-89	-3.27													
DE*	27-Jun-89	-2.47	<0.20				0.34	0.19	<0.2	0.33	0.15	<0.2	<0.2	<0.5	<0.2
DE	25-Jul-89	-4.30													
DE*	28-Aug-89	-3.80	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
DE*	05-Sep-89	-2.63	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1
DE*	26-Sep-89	-4.15	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1
DE	30-Oct-89	-4.22													
DE	27-Nov-89	-4.28	0.22												
DE*	27-Dec-89	-4.41	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE	29-Jan-90	-4.19	<0.20												
DE*	01-Mar-90	-4.24	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE*	26-Mar-90	-3.91	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE*	30-Apr-90	-4.14	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE	29-May-90	-3.88													
DE	19-Jun-90														
DE	26-Jun-90														
DE*	27-Jul-90	-1.30	0.67				<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE*	27-Aug-90	-3.76	<0.20				<0.1	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE	01-Oct-90	-4.14	<0.20												
DE	22-Oct-90	-4.16	<0.20												
DE	28-Nov-90	-4.22	<0.20												
DE	04-Jan-91	-4.18	<0.20												
DE	28-Jan-91														
DE	25-Feb-91	-4.00	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DE	25-Mar-91	-2.98	<0.20												
DE	29-Apr-91	-3.32	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DE*	28-May-91	-3.78	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE*	18-Jun-91	-3.55	<0.20				<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE*	30-Jul-91	-4.51	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DE	28-Aug-91	-4.81	<0.20												
DE	23-Sep-91	-4.52	<0.20												
DE	29-Oct-91	-4.44	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
DE	04-Dec-91	-4.16	<0.20												
DE	07-Jan-92	-3.94	<0.20												
DE	05-Feb-92	-4.26	<0.20												
DE	03-Mar-92	-4.10	<0.20												
DE	07-Apr-92	-4.12	<0.20												
DE	06-May-92		<0.20			0.46									
DE	10-Jun-92	-4.58	<0.20			<0.1									
DE	09-Jul-92	-4.62	<0.20			<0.1									
DE	06-Aug-92	-4.11	<0.20			<0.1									
DE	03-Sep-92	-4.52	<0.20			<0.1									
DW	31-May-89	-3.47	<0.20												
DW	23-Jun-89	-3.43	0.00												
DW*	27-Jun-89	-3.11	<0.20				<0.1	<0.1	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1
DW	25-Jul-89	-3.82													
DW*	28-Aug-89	-4.14	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	05-Sep-89	-3.66	<0.20				<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	26-Sep-89	-3.66	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW	30-Oct-89	-3.66													
DW	27-Nov-89	-3.85	<0.20												
DW*	27-Dec-89	-3.89	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW	29-Jan-90	-3.74	<0.20												
DW*	01-Mar-90	-3.90	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	26-Mar-90	-3.12	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW	30-Apr-90	-3.70	<0.20												
DW	29-May-90	-3.43													
DW*	19-Jun-90	-3.04	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	26-Jun-90	-3.01	<0.20				<0.1	<2.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	27-Jul-90	-2.14	0.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	27-Aug-90	-3.56	<0.20				<0.1	0.20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW	01-Oct-90	-3.80	<0.20												
DW	22-Oct-90	-3.76	<0.20												
DW	28-Nov-90	-3.80	<0.20												
DW	04-Jan-91	-3.82	<0.20												
DW	28-Jan-91														
DW	25-Feb-91	-4.48	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DW	25-Mar-91	-3.28	<0.20												

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							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
DW	29-Apr-91	-3.34	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DW*	28-May-91	-3.58	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	18-Jun-91	-3.56	<0.20				<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW*	30-Jul-91	-4.08	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DW	28-Aug-91	-4.46	<0.20												
DW	23-Sep-91	-4.08	<0.20												
DW	29-Oct-91	-3.94	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
DW	04-Dec-91	-3.74													
DW	07-Jan-92	-3.56	<0.20												
DW	05-Feb-92	-3.80	<0.20												
DW	03-Mar-92	-3.66	<0.20												
DW	07-Apr-92	-3.68	<0.20												
DW	06-May-92		<0.20			0.20									
DW	10-Jun-92	-4.00	<0.20			<0.1									
DW	09-Jul-92	-3.94	<0.20			<0.1									
DW	06-Aug-92	-3.55	<0.20			<0.1									
DW	03-Sep-92	-4.98	<0.20			<0.1									
DN	31-May-89	-3.00	<0.20												
DN	23-Jun-89	-2.90													
DN*	27-Jun-89	-2.55	<0.20				<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1
DN	25-Jul-89	-2.99													
DN	28-Aug-89														
DN	05-Sep-89														
DN	26-Sep-89														
DN	30-Oct-89														
DN	27-Nov-89														
DN	27-Dec-89														
DN	29-Jan-90														
DN	01-Mar-90														
DN	26-Mar-90														
DN	30-Apr-90														
DN	29-May-90														
DN	19-Jun-90														
DN	26-Jun-90														
DN	27-Jul-90														
DN	27-Aug-90														

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
DN	01-Oct-90														
DN	22-Oct-90														
DN	27-Nov-90	-2.80	0.44												
DN	28-Nov-90	-2.88	<0.20												
DN	04-Jan-91	-2.60	0.22												
DN	28-Jan-91	-3.04													
DN	25-Feb-91	-2.48	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DN	25-Mar-91	-2.16	<0.20												
DN	29-Apr-91	-1.86	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DN*	28-May-91	-2.30	<0.20				<0.1	0.36	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DN*	18-Jun-91	-2.26	<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DN	30-Jul-91	-2.71	<0.20												
DN	28-Aug-91	-2.98	<0.20												
DN	23-Sep-91	-2.90	<0.20												
DN	29-Oct-91	-2.93	<0.20				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
DN	03-Dec-91	-2.66	<0.20												
DN	07-Jan-92	-2.34	<0.20												
DN	05-Feb-92	-2.64	<0.20												
DN	03-Mar-92	-2.56	<0.20												
DN	07-Apr-92	-2.50	<0.20												
DN	06-May-92		<0.20			<0.1									
DN	10-Jun-92	-2.78	<0.20			0.18									
DN	09-Jul-92	-2.70	<0.20			<0.1									
DN	06-Aug-92	-2.20	<0.20			<0.1									
DN	03-Sep-92	-2.54	<0.20			<0.1									
ACTIVE WELLS															
KH2	26-Jun-87		26.89	0											
KH2*	03-Sep-87		30.44	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	30-Sep-87		24.00	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	26-Oct-87		21.11	16+											
KH2	30-Nov-87		20.00	16+											
KH2	25-Jan-88		18.00	5.1											
KH2*	29-Feb-88		19.33	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	28-Mar-88		20.22	16+											
KH2	25-Apr-88		21.78	5.1											

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							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KH2	31-May-88		25.11	2.2											
KH2*	08-Jun-88		23.78	2.2			5.40	8.40	<0.1	0.99	<0.1	<0.1	<0.1	<0.1	1.10
KH2	28-Jun-88		23.78	16+											
KH2*	11-Jul-88		24.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	25-Jul-88		25.33	16+											
KH2	30-Aug-88		25.11	16+											
KH2*	25-Sep-88		25.56	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	23-Oct-88		27.33	16+											
KH2	28-Nov-88		27.78	16											
KH2*	03-Jan-89		28.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	31-Jan-89		26.89	0	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	06-Mar-89		29.11	9.2	0										
KH2*	13-Mar-89		28.67	16	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	28-Mar-89		28.44	0	0										
KH2*	25-Apr-89		27.56	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	31-May-89		32.22	16+			<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	23-Jun-89		31.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	27-Jun-89		32.44	9.2			<0.1	0.12	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	04-Sep-89		23.11	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	26-Sep-89		20.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	30-Oct-89		23.11				<0.1	0.21	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	27-Nov-89		28.67	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	27-Dec-89		23.78	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	29-Jan-90		30.00	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	01-Mar-90		26.67	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	26-Mar-90		25.78	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	30-Apr-90		24.89	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	29-May-90		27.33	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	19-Jun-90		19.33	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	25-Jun-90		19.78	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	27-Jul-90		18.67	16+	9.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	27-Aug-90		18.00	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	01-Oct-90		19.33	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	22-Oct-90		19.56	16+											
KH2	27-Nov-90		22.00												
KH2	04-Jan-91		20.00	16+											
KH2	28-Jan-91		25.33	0											

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KH2	25-Feb-91		25.78	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH2	25-Mar-91		25.56	16+											
KH2	29-Apr-91		21.11	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH2*	28-May-91		17.33	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	28-May-91		17.11	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	18-Jun-91		17.33	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2*	30-Jul-91		19.11	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH2	28-Aug-91		21.33												
KH2	24-Sep-91		21.11	16+	5.1										
KH2	29-Oct-91		21.11	16+	2.2		<0.1	0.14	<0.1	<0.1	<0.2	<0.1			<0.1
KH2	07-Jan-92		24.44	16	0										
KH2	05-Feb-92		25.56	5.1	0										
KH2	03-Mar-92		24.44	16	0										
KH2	07-Apr-92		24.22	16+	0										
KH2	06-May-92		20.22	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH2	10-Jun-92		21.56	16+	2.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH2	09-Jul-92		21.56	5.1	0		<0.1	0.11	<0.1	<0.1	<0.1	<0.1			<0.1
KH2	06-Aug-92		19.11	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH2	03-Sep-92		21.56	16	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MN1*	13-May-87		3.56	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	16-Jun-87		2.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	26-Jun-87		1.56	16+											
MN1	03-Sep-87		0.89	16+											
MN1*	30-Sep-87		2.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	26-Oct-87		1.11	16+											
MN1	30-Nov-87		1.78	16+											
MN1	25-Jan-88		1.78	9.2											
MN1	29-Feb-88		1.56												
MN1	28-Mar-88		1.33	16+											
MN1	25-Apr-88		1.11	16											
MN1	31-May-88		0.67	16+											
MN1*	08-Jun-88		0.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	28-Jun-88			16+											
MN1	30-Aug-88		<0.20	16+											
MN1*	25-Sep-88		0.89	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	23-Oct-88		0.67	16											

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MN1	28-Nov-88		0.44	16											
MN1*	03-Jan-89		<0.20	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	31-Jan-89		<0.20	2.2	2.2										
MN1	06-Mar-89		<0.20	0	0										
MN1*	13-Mar-89		<0.20	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	28-Mar-89		<0.20	16	0										
MN1*	25-Apr-89		<0.20	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	31-May-89		1.56	0											
MN1*	23-Jun-89		1.78	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	27-Jun-89		<0.20	16+			<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	25-Jul-89		1.56	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	28-Aug-89		<0.20	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	04-Sep-89		0.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	26-Sep-89		<0.20	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	30-Oct-89		1.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	27-Nov-89		<0.20	5.1											
MN1*	27-Dec-89		<0.20	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	29-Jan-90		<0.20	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	01-Mar-90		0.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	26-Mar-90		1.11	5.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	30-Apr-90		0.67	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	29-May-90		0.22	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	19-Jun-90		3.56	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	26-Jun-90		3.11	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	27-Jul-90		1.78	16+	2.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	01-Oct-90		<0.20	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	22-Oct-90		<0.20	16+											
MN1	27-Nov-90		0.67												
MN1	25-Feb-91		1.78	9.2											
MN1	25-Mar-91		2.44	16											
MN1	29-Apr-91		4.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MN1*	28-May-91		0.67	0	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	18-Jun-91		<0.20	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1*	30-Jul-91		0.22	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MN1	28-Aug-91		1.33	16+											
MN1	23-Sep-91		3.33	16+	0										
MN1	29-Oct-91		4.22	16+	0		<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MN1	07-Jan-92		3.78	16+	0										
MN1	05-Feb-92		3.56	16+	0										
MN1	03-Mar-92		3.11	9.2	0										
MN1	07-Apr-92		2.89	0	0										
MN1	06-May-92		3.78	9.2	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MN1	10-Jun-92		1.56	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MN1	09-Jul-92		1.56	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MN1	06-Aug-92		0.67	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MN1	03-Sep-92		0.67	16	2.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1*	13-May-87		6.67	5.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	16-Jun-87		6.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	16-Jun-87		5.11	16+											
SW1	26-Jun-87		7.11												
SW1*	03-Sep-87		2.67				<0.1	<0.1	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1
SW1*	29-Sep-87		5.33	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	26-Oct-87		5.33	16+											
SW1	30-Nov-87		4.67	16+											
SW1	25-Jan-88		4.00	16+											
SW1*	29-Feb-88		4.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	29-Feb-88		4.00												
SW1	28-Mar-88		5.11	16+											
SW1	25-Apr-88		5.56	16+											
SW1	31-May-88		3.56	16											
SW1*	08-Jun-88		5.33	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	28-Jun-88		3.78	16+											
SW1	25-Jul-88		4.67	16+											
SW1	30-Aug-88		6.89	16+											
SW1	25-Sep-88		8.22	16+											
SW1	23-Oct-88		6.67	5.1											
SW1	28-Nov-88		6.67	16+											
SW1*	03-Jan-89		7.11	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	31-Jan-89		7.11	16+	0										
SW1	06-Mar-89		7.11	0	0										
SW1*	13-Mar-89		6.89	5.1	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	28-Mar-89		7.11	0	0										
SW1*	25-Apr-89		7.11	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
SW1*	31-May-89		6.67	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	23-Jun-89		5.33	16+			<0.1	0.41	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
SW1*	27-Jun-89		8.89	16+			0.12	0.86	<0.1	<0.1	0.40	<0.1	<0.1	<0.1	<0.1
SW1*	25-Jul-89		4.67	16			<0.1	0.26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	28-Aug-89		5.78	16+			<0.1	0.26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	04-Sep-89		7.11	16+			<0.1	0.63	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1
SW1*	26-Sep-89		3.33	16+			<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	30-Oct-89		4.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	27-Nov-89		2.89	16+			<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	27-Dec-89		2.67	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	29-Jan-90		2.44	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	01-Mar-90		2.44	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	26-Mar-90		2.44	16+			<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	30-Apr-90		2.22	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	29-May-90		2.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	19-Jun-90		2.00	16+			<0.1	0.22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.88
SW1*	25-Jun-90		2.00	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	27-Jul-90		2.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	27-Jul-90		3.78	16+			<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	27-Aug-90		3.11	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	01-Oct-90		3.56	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	23-Oct-90		3.56	16+											
SW1	27-Nov-90		2.89	9.2											
SW1	25-Feb-91		2.89	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1	25-Mar-91		2.00	16											
SW1	29-Apr-91		2.00	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1*	28-May-91		2.67	5.1	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SW1*	18-Jun-91		3.11	16+	16+		<0.1	1.10	<0.1	0.42	0.17	<0.1	<0.1	<0.1	<0.1
SW1*	30-Jul-91		4.44	16+	0		<0.1	0.30	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1
SW1	28-Aug-91		5.33												
SW1	23-Sep-91		5.78	16+	16+										
SW1	29-Oct-91		4.89	16+	16		<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
SW1	03-Dec-91		2.22												
SW1	07-Jan-92		2.44	16+	0										
SW1	05-Feb-92		2.67	16+	0										
SW1	03-Mar-92		2.67	16+	0										
SW1	07-Apr-92		2.44	16+	0										

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
SW1	06-May-92		2.22	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1	10-Jun-92		2.67	16+	16		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1	09-Jul-92		2.89	16+	5.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1	06-Aug-92		2.67	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SW1	03-Sep-92		2.67	16+			<0.1	0.41	<0.1	<0.1	<0.1	<0.1			<0.1
W1*	13-May-87		17.33	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	16-Jun-87		18.44	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	26-Jun-87		17.33												
W1*	03-Sep-87		14.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	29-Sep-87		14.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	26-Oct-87		13.78	16+											
W1	30-Nov-87		8.89	16+											
W1	25-Jan-88		9.11	16+											
W1	29-Feb-88		9.11	16+											
W1	28-Mar-88		7.56	16+											
W1	25-Apr-88		7.11	16+											
W1	31-May-88		5.33	16+											
W1*	08-Jun-88		10.00	16+			<0.1	16.00	<0.1	24.00	0.66	<0.1	<0.1	<0.1	<0.1
W1	28-Jun-88		5.11	16+											
W1*	11-Jul-88		4.67				<0.1	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1
W1	25-Jul-88		4.22	16+											
W1	30-Aug-88		3.78	16+											
W1*	25-Sep-88		1.78	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	23-Oct-88		2.22	16+											
W1	28-Nov-88		2.67	16+											
W1*	03-Jan-89		2.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	31-Jan-89		2.67	16+	16+										
W1	06-Mar-89		1.78	5.1	0										
W1*	13-Mar-89		2.00	16+	5.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	28-Mar-89		1.33	9.2	0										
W1*	25-Apr-89		0.67	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	31-May-89		0.89	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	23-Jun-89		0.89	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	27-Jun-89		3.56	16+			0.18	0.20	<0.1	0.15	0.20	<0.1	0.47	<0.1	<0.1
W1*	25-Jul-89		0.67	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	28-Aug-89		6.89	16+			<0.1	0.13	<0.1	<0.1	<0.1	<0.1	0.15	<0.1	<0.1

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SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
W1*	04-Sep-89		6.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	26-Sep-89		2.67	16+			<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	30-Oct-89		0.89				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	27-Nov-89		<0.20	9.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	27-Dec-89		0.44	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	29-Jan-90		9.33	5.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	01-Mar-90		10.22	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	26-Mar-90		3.11	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	30-Apr-90		1.78	0			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	29-May-90		1.11	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	19-Jun-90		1.11	16+			<0.1	0.28	<0.1	0.21	0.28	<0.1	0.13	<0.1	<0.1
W1*	25-Jun-90		0.44	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	27-Jul-90		<0.20	16+	9.2		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	27-Aug-90		0.22	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	01-Oct-90		<0.20	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	23-Oct-90		<0.20	16+											
W1	27-Nov-90		<0.20	5.1											
W1	04-Jan-91		<0.20	5.1											
W1	28-Jan-91		<0.20	5.1											
W1	25-Feb-91		0.89	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W1	25-Mar-91		1.33	16											
W1	29-Apr-91		1.56	5.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W1*	28-May-91		4.22	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	18-Jun-91		3.11	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1*	30-Jul-91		1.56	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
W1	28-Aug-91		0.22	16+											
W1	23-Sep-91		<0.20	16+	16+										
W1	29-Oct-91		0.67	16+	9.2		<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
W1	03-Dec-91		0.44												
W1	07-Jan-92		0.22	16+	0										
W1	05-Feb-92		0.67	16+	0										
W1	03-Mar-92		1.33	0	0										
W1	07-Apr-92		0.89	0	0										
W1	06-May-92		3.11	5.1	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W1	10-Jun-92		3.33	5.1	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W1	09-Jul-92		1.33	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W1	06-Aug-92		0.89	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
W-1	03-Sep-92		0.22	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
INACTIVE WELLS															
D1*	13-May-87		8.00	2.2			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	16-Jun-87		7.78	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1	26-Jun-87		8.67												
D1	03-Sep-87		9.78												
D1*	30-Sep-87		9.11	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1	26-Oct-87		8.89	16+											
D1	30-Nov-87		<0.20	16+											
D1*	29-Feb-88		8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	28-Mar-88		8.89	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1	25-Apr-88		7.56	16											
D1*	31-May-88		8.89	16+			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	08-Jun-88		8.22	16+			2.10	3.50	<0.1	0.31	0.18	<0.1	<0.1	<0.1	0.21
D1	28-Jun-88		8.44	16+											
D1*	11-Jul-88		8.22				<0.1	0.47	<0.1	0.23	<0.1	<0.1	<0.1	<0.1	<0.1
D1	25-Jul-88		7.33	16+											
D1*	30-Aug-88		5.78												
D1*	25-Sep-88		5.11				<0.1	0.36	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1	23-Oct-88		6.00												
D1	28-Nov-88		4.67												
D1*	03-Jan-89		3.56				<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	31-Jan-89		3.33	16+	0		<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	06-Mar-89		2.89	9.2	2.2		<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	13-Mar-89		2.89	9.2	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	28-Mar-89		2.44	16+	0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	25-Apr-89		0.67	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	31-May-89		0.44				<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1
D1*	23-Jun-89		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	27-Jun-89		<0.20				0.21	0.23	<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	25-Jul-89		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	28-Aug-89		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	04-Sep-89		0.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	26-Sep-89		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	30-Oct-89		<0.20				<0.1	<0.1	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	27-Nov-89		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	27-Dec-89		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
D1*	29-Jan-90		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	01-Mar-90		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	26-Mar-90		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	30-Apr-90		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	29-May-90		0.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	19-Jun-90		0.44				0.63	0.85	<0.1	<0.1	0.64	<0.1	<0.1	<0.1	0.12
D1*	26-Jun-90		1.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	27-Jul-90		0.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	27-Aug-90		0.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	01-Oct-90		1.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1	22-Oct-90		1.11												
D1	27-Nov-90		0.89												
D1	25-Mar-91		2.89												
D1	29-Apr-91		2.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D1*	28-May-91		2.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	18-Jun-91		1.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1*	30-Jul-91		0.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D1	28-Aug-91		1.33												
D1	23-Sep-91		2.67												
D1	29-Oct-91		3.78				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
D1	07-Jan-92		4.00												
D1	05-Feb-92		4.22												
D1	07-Apr-92		<0.20												
D1	06-May-92		4.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D1	10-Jun-92		2.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D1	09-Jul-92		3.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D1	06-Aug-92		3.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D-1	03-Sep-92		2.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D2	29-Feb-88		<0.20	16+											
D2	28-Mar-88		<0.20												
D2	25-Apr-88		<0.20												
D2	31-May-88		2.22												
D2*	08-Jun-88		2.44				5.20	0.97	<0.1	26.00	0.65	<0.1	1.10	<0.1	<0.1
D2	28-Jun-88		2.22												
D2*	11-Jul-88		2.22				2.70	0.76	<0.1	28.00	<0.1	<0.1	<0.1	<0.1	<0.1

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							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
D2	25-Jul-88		1.78												
D2	30-Aug-88		1.56												
D2	25-Sep-88		1.11												
D2	23-Oct-88		<0.20												
D2	28-Nov-88		<0.20												
D2	03-Jan-89		<0.20												
D2	31-Jan-89		<0.20	9.2	9.2										
D2	06-Mar-89		<0.20	2.2	0										
D2*	13-Mar-89		<0.20	2.2	0		0.33	0.93	<0.1	13.00	0.39	<0.1	<0.1	<0.1	<0.1
D2*	28-Mar-89		<0.20	0			0.34	0.99	<0.1	11.00	0.24	<0.1	<0.1	<0.1	<0.1
D2*	25-Apr-89		<0.20				0.20	0.85	<0.1	15.00	0.17	<0.1	<0.1	<0.1	<0.1
D2*	31-May-89		2.00				<0.3	0.64	<0.1	10.00	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	27-Jun-89		2.00				0.25	0.36	<0.1	3.10	0.19	<0.1	<0.1	<0.1	<0.1
D2*	25-Jul-89		0.89				<0.1	0.47	<0.1	6.70	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	28-Aug-89		0.00				<0.1	0.32	<0.1	5.10	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	26-Sep-89		0.67				<0.1	0.36	<0.1	5.50	<0.1	<0.1	<0.4	<0.1	<0.1
D2*	30-Oct-89		<0.20				<0.1	0.22	<0.1	1.30	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	27-Nov-89		<0.20				<0.1	0.29	<0.1	1.90	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	27-Dec-89		<0.20				<0.1	0.26	<0.1	3.70	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	29-Jan-90		<0.20				<0.1	0.31	<0.1	3.90	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	01-Mar-90		0.22				<0.1	<0.2	<0.1	2.20	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	26-Mar-90		<0.20				<0.1	0.18	<0.1	2.70	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	30-Apr-90		<0.20				<0.1	0.18	<0.1	2.00	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	29-May-90		0.89				<0.1	0.15	<0.1	2.00	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	19-Jun-90		0.44				0.58	0.15	<0.1	4.30	<0.1	<0.1	0.95	<0.1	0.10
D2*	26-Jun-90		0.67				0.63	<0.5	<0.1	3.10	0.17	<0.1	0.59	<0.1	<0.1
D2*	27-Jul-90		0.44				0.33	0.30	<0.1	4.00	<0.1	<0.1	0.17	<0.1	<0.1
D2*	27-Aug-90		0.44				0.17	<0.1	<0.1	2.60	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	01-Oct-90		<0.20				0.13	0.22	<0.1	2.80	<0.1	<0.1	<0.1	<0.1	<0.1
D2	22-Oct-90		<0.20												
D2	27-Nov-90		<0.20												
D2	25-Mar-91		<0.20												
D2	29-Apr-91		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
D2*	28-May-91		<0.20				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	18-Jun-91		<0.20				<0.1	<0.1	<0.1	1.70	<0.1	<0.1	<0.1	<0.1	<0.1
D2*	30-Jul-91		<0.20				<0.1	<0.1	<0.1	0.69	<0.1	<0.1	<0.1	<0.1	<0.1
D2	28-Aug-91		<0.20												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
D2	23-Sep-91		0.22												
D2	29-Oct-91		<0.2				<0.1	<0.1	<0.1	0.72	<0.2	<0.1			<0.1
D2	07-Jan-92		<0.20												
D2	05-Feb-92		<0.20												
D2	03-Mar-92		<0.20												
D2	07-Apr-92		<0.20												
D2	06-May-92		<0.20				<0.1	<0.1	<0.1	0.25	<0.1	<0.1			<0.1
D2	10-Jun-92		<0.20				<0.1	<0.1	<0.1	0.26	<0.1	<0.1			<0.1
D2	09-Jul-92		0.44				<0.1	0.10	<0.1	0.26	<0.1	<0.1			<0.1
D2	06-Aug-92		0.89				<0.1	<0.1	<0.1	0.22	<0.1	<0.1			<0.1
D2	03-Sep-92		0.67				<0.1	<0.1	<0.1	0.18	<0.1	<0.1			<0.1
KH1*	13-May-87		4.44				<0.1	0.44	<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	16-Jun-87		0.22	16+			<0.1	0.58	<0.1	1.90	<0.1	<0.1	<0.1	<0.1	<0.1
KH1	26-Jun-87		1.33												
KH1	03-Sep-87		13.33												
KH1*	30-Sep-87		9.56	16+			<0.1	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	26-Oct-87		6.00	16+			<0.1	0.33	<0.1	0.82	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	30-Nov-87		2.22	16+			<0.1	0.23	<0.1	0.60	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	25-Jan-88		0.89	16+			<0.1	0.35	<0.1	0.95	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	29-Feb-88		0.89	16+			<0.1	0.27	<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	28-Mar-88		0.67	16			<0.1	0.41	<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	25-Apr-88		0.67				<0.1	0.34	<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	31-May-88		0.67				<0.1	0.47	<0.1	1.20	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	08-Jun-88		4.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	28-Jun-88		2.22				5.10	9.30	<0.1	12.00	<0.1	<0.1	<0.1	<0.1	0.88
KH1*	11-Jul-88		3.11				3.80	8.50	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	0.69
KH1*	25-Jul-88		2.89				3.60	8.70	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.35
KH1*	30-Aug-88		2.22				1.90	9.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	25-Sep-88		0.44				2.20	9.80	<0.1	1.20	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	23-Oct-88		0.89				1.70	13.00	<0.1	1.60	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	28-Nov-88		<0.20				1.20	11.00	<0.1	1.30	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	03-Jan-89		<0.20				0.72	11.00	<0.1	0.64	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	31-Jan-89		2.22	16+	2.2		0.50	9.00	<0.1	0.82	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	06-Mar-89		1.11	16+	0		0.32	7.70	<0.1	0.94	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	13-Mar-89		3.56	16+	9.2		<0.1	1.20	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1
KH1*	28-Mar-89		4.89	16+	2.2		<0.1	3.90	<0.1	0.37	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KH1*	25-Apr-89		3.33				<0.1	3.80	<0.1	0.38	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	31-May-89		13.11				2.20	5.00	<0.1	1.20	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	23-Jun-89		12.44				1.90	6.10	<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	27-Jun-89		6.22				4.00	13.00	<0.1	2.90	0.14	<0.1	<0.1	<0.1	<0.1
KH1*	25-Jul-89		9.78				3.30	17.00	<0.1	4.40	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	28-Aug-89		6.89				0.96	5.70	<0.1	1.80	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	04-Sep-89		6.67				0.53	3.30	<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	26-Sep-89		8.89				<0.3	5.00	<0.1	1.50	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	30-Oct-89		6.89				<0.5	3.60	<0.1	1.90	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	27-Nov-89		3.56				0.35	8.30	<0.1	1.90	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	27-Dec-89		1.78				0.22	7.20	<0.1	2.30	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	29-Jan-90		0.67				<0.1	6.80	<0.1	1.70	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	01-Mar-90		<0.2				<0.1	5.20	<0.1	1.40	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	26-Mar-90		1.33				<0.1	4.70	<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	30-Apr-90		<0.2				<0.1	3.30	<0.1	0.66	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	29-May-90		0.67				<0.1	2.60	<0.1	0.55	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	19-Jun-90		3.56				<0.1	6.90	<0.1	1.10	1.50	0.33	<0.1	<0.1	<0.6
KH1*	25-Jun-90		6.89				<0.1	4.40	<0.1	0.67	1.40	0.31	<0.1	<0.1	<0.4
KH1*	26-Jun-90		3.56				<0.1	7.20	<0.1	0.66	1.60	<0.1	<0.1	<0.1	0.45
KH1*	27-Jul-90		13.33				<0.1	2.20	<0.1	0.23	0.38	0.17	<0.1	<0.1	<0.1
KH1*	27-Aug-90		9.78				<0.1	3.30	<0.1	0.26	0.42	<0.1	<0.1	<0.1	<0.1
KH1*	01-Oct-90		9.11				<0.1	3.40	<0.1	0.34	0.39	<0.1	<0.1	<0.1	<0.1
KH1	22-Oct-90		8.00												
KH1	27-Nov-90		6.00												
KH1	04-Jan-91		5.33												
KH1	28-Jan-91		4.67												
KH1	25-Feb-91		6.67				<0.1	2.40	<0.1	0.21	0.27	<0.1			<0.1
KH1	25-Mar-91		8.00												
KH1	29-Apr-91		10.67				<0.1	0.53	<0.1	<0.1	<0.2	<0.1			<0.1
KH1*	28-May-91		10.44				<0.1	0.68	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	18-Jun-91		9.56				<0.1	0.27	<0.1	1.90	<0.1	<0.1	<0.1	<0.1	<0.1
KH1*	30-Jul-91		<0.20				<0.2	0.46	<0.2	1.70	<0.2	<0.2	<0.2	<0.2	<0.2
KH1	28-Aug-91		<0.20												
KH3*	29-May-90		69.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3*	19-Jun-90		58.89				<0.1	0.45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3*	25-Jun-90		60.22				<0.1	0.27	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KH3*	26-Jul-90		55.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3*	27-Aug-90		50.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3	22-Oct-90		63.56												
KH3	04-Jan-91		75.78												
KH3	28-Jan-91		75.33												
KH3	25-Feb-91		75.11												
KH3	25-Mar-91		64.00												
KH3	29-Apr-91		45.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH3*	28-May-91		45.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3*	18-Jun-91		48.67	16+	16+		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3*	30-Jul-91		64.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KH3	28-Aug-91		73.11												
KH3	24-Sep-91		80.44	16+	16										
KH3	29-Oct-91		80.22				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
KH3	05-Feb-92		65.78												
KH3	03-Mar-92		61.33												
KH3	07-Apr-92		57.11												
KH3	06-May-92		53.56				<0.1	<0.1	<0.1	0.34	<0.1	<0.1			<0.1
KH3	10-Jun-92		56.44				<0.1	<0.1	<0.1	0.17	<0.1	<0.1			<0.1
KH3	09-Jul-92		60.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH3	06-Aug-92		66.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KH3	03-Sep-92		66.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
TILE LINES															
DT	13-May-87		15.56												
DT	16-Jun-87		16.89												
DT*	03-Sep-87		14.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	30-Sep-87		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT	26-Oct-87		13.11												
DT	30-Nov-87		14.00												
DT	29-Feb-88		15.78												
DT	28-Mar-88		14.44												
DT	25-Apr-88		16.00												
DT	31-May-88		17.56												
DT	08-Jun-88		23.56												
DT	28-Jun-88		19.11												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
DT	25-Jul-88		15.56												
DT	30-Aug-88		11.78												
DT	25-Sep-88		9.56												
DT	23-Oct-88		10.22												
DT	28-Nov-88		11.56												
DT*	28-Mar-89		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	25-Apr-89		11.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	31-May-89		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	23-Jun-89		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	27-Jun-89		18.44				0.15	0.14	<0.1	0.11	0.15	<0.1	<0.1	<0.1	<0.1
DT*	25-Jul-89		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	28-Aug-89		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	26-Sep-89		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	30-Oct-89		12.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	27-Nov-89		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	27-Dec-89		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	29-Jan-90		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	01-Mar-90		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	26-Mar-90		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	30-Apr-90		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	29-May-90		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	19-Jun-90		20.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	26-Jun-90		19.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	27-Jul-90		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	27-Aug-90		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	01-Oct-90		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT	22-Oct-90		15.78												
DT	25-Feb-91		15.33												
DT	25-Mar-91		17.78												
DT	29-Apr-91		18.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DT*	28-May-91		17.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	18-Jun-91		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DT*	30-Jul-91		15.33				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
DT	28-Aug-91		12.89												
DT	23-Sep-91		13.33												
DT	29-Oct-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
DT	04-Dec-91		14.22												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
DT	07-Jan-92		12.67												
DT	05-Feb-92		14.89												
DT	03-Mar-92		14.67												
DT	07-Apr-92		5.56												
DT	06-May-92		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DT	10-Jun-92		14.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DT	09-Jul-92		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DT	06-Aug-92		14.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DT	03-Sep-92		13.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DN	28-Nov-90		12.89												
DN	25-Feb-91		12.67												
DN	25-Mar-91		12.67												
DN	29-Apr-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DN*	28-May-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DN*	18-Jun-91		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DN*	30-Jul-91		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	16-Jun-87		15.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	26-Jun-87		<0.2				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU	03-Sep-87		11.56												
MNNU*	29-Sep-87		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU	26-Oct-87		13.56												
MNNU	30-Nov-87		13.33												
MNNU	25-Jan-88		13.33												
MNNU*	29-Feb-88		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	28-Mar-88		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	25-Apr-88		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	31-May-88		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	08-Jun-88		12.89				<0.1	1.20	<0.1	0.45	1.40	<0.1	<0.1	<0.1	<0.1
MNNU*	08-Jun-88		12.89				<0.1	0.27	<0.1	0.11	0.20	<0.1	<0.1	<0.1	<0.1
MNNU	28-Jun-88		13.11												
MNNU*	11-Jul-88		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	25-Jul-88		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU	30-Aug-88		13.33												
MNNU	25-Sep-88		12.44												
MNNU	23-Oct-88		12.22												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNNU	28-Nov-88		12.44												
MNNU	03-Jan-89		12.22												
MNNU*	31-Jan-89		10.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU	06-Mar-89		11.33												
MNNU*	13-Mar-89		8.22				<0.1	0.28	<0.1	<0.1	0.19	<0.1	<0.1	<0.1	<0.1
MNNU*	28-Mar-89		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	25-Apr-89		12.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	31-May-89		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	23-Jun-89		8.67				<0.1	1.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	27-Jun-89		6.89				0.14	1.00	<0.1	0.10	0.14	<0.1	<0.1	<0.1	<0.1
MNNU*	25-Jul-89		10.00				<0.1	1.00	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	28-Aug-89		10.44				<0.1	0.51	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	04-Sep-89		10.00				<0.1	0.70	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	26-Sep-89		9.56				<0.1	0.34	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	30-Oct-89		12.22				<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	27-Nov-89		13.11				<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	27-Dec-89		13.33				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	29-Jan-90		12.89				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	01-Mar-90		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	26-Mar-90		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	30-Apr-90		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	29-May-90		9.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	19-Jun-90		9.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	26-Jun-90		11.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	27-Jul-90		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	27-Aug-90		14.22				<0.1	0.65	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	01-Oct-90		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU	22-Oct-90		12.67												
MNNU	27-Nov-90		12.22												
MNNU	04-Jan-91		12.67												
MNNU	25-Feb-91		12.00												
MNNU	25-Mar-91		12.22												
MNNU	29-Apr-91		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNNU*	28-May-91		17.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	18-Jun-91		15.78				<0.1	0.38	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU*	30-Jul-91		15.56				<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNNU	28-Aug-91		15.33												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNNU	23-Sep-91		15.33												
MNNU	29-Oct-91		15.11				<0.1	0.11	<0.1	<0.1	<0.2	<0.1			<0.1
MNNU	04-Dec-91		12.89												
MNNU	07-Jan-92		14.00												
MNNU	05-Feb-92		14.67												
MNNU	03-Mar-92		15.33												
MNNU	07-Apr-92		16.44												
MNNU	06-May-92		19.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNNU	10-Jun-92		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNNU	09-Jul-92		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNNU	06-Aug-92		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNNU	03-Sep-92		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNN	13-May-87		20.00												
MNN*	16-Jun-87		21.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	26-Jun-87		21.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	03-Sep-87		18.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	29-Sep-87		18.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN	26-Oct-87		20.00												
MNN	30-Nov-87		19.56												
MNN*	29-Feb-88		21.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	28-Mar-88		19.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	25-Apr-88		20.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN	31-May-88		20.44												
MNN*	08-Jun-88		19.78				<0.1	<0.1	<0.1	0.49	0.21	<0.1	<0.1	<0.1	<0.1
MNN	08-Jun-88		19.56												
MNN	28-Jun-88		22.67												
MNN*	27-Jun-89		20.89				<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1
MNN*	28-Aug-89		14.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	04-Sep-89		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	26-Sep-89		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	30-Oct-89		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	27-Nov-89		19.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	26-Mar-90		23.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	30-Apr-90		23.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	29-May-90		21.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	19-Jun-90		18.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNN*	25-Jun-90		18.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	27-Jul-90		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	27-Aug-90		14.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	01-Oct-90		15.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN	22-Oct-90		16.22												
MNN	25-Feb-91		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNN	25-Mar-91		11.78												
MNN	29-Apr-91		10.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNN*	28-May-91		10.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	18-Jun-91		10.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN*	30-Jul-91		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNN	07-Jan-92		12.22												
MNN	05-Feb-92		14.67												
MNN	03-Mar-92		12.89												
MNN	07-Apr-92		12.44												
MNN	06-May-92		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNN	10-Jun-92		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNN	06-Aug-92		9.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNN	03-Sep-92		12.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU	13-May-87		8.22												
MNSU*	16-Jun-87		8.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	26-Jun-87		<0.2				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	03-Sep-87		6.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	29-Sep-87		6.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU	26-Oct-87		6.67												
MNSU	30-Nov-87		6.22												
MNSU	25-Jan-88		6.22												
MNSU	29-Feb-88		6.00												
MNSU*	28-Mar-88		5.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	25-Apr-88		5.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	08-Jun-88		10.00				<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	08-Jun-88		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	31-Jan-89		7.11				<0.1	0.47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	23-Jun-89		8.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	27-Jun-89		9.78				0.11	<0.1	<0.1	0.14	0.14	<0.1	<0.1	<0.1	<0.1
MNSU*	04-Sep-89		6.22				<0.1	<0.1	<0.1	<0.1	0.29	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNSU*	26-Sep-89		7.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	26-Mar-90		8.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	30-Apr-90		7.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	29-May-90		8.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	19-Jun-90		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	26-Jun-90		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	27-Jul-90		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	27-Aug-90		9.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	01-Oct-90		8.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU	25-Feb-91		9.33												
MNSU	25-Mar-91		10.22												
MNSU	29-Apr-91		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU*	28-May-91		11.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	18-Jun-91		11.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU*	30-Jul-91		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU	07-Jan-92		8.00												
MNSU	05-Feb-92		9.11												
MNSU	03-Mar-92		9.56												
MNSU	07-Apr-92		9.56												
MNSU	06-May-92		10.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU	10-Jun-92		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU	09-Jul-92		8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU	06-Aug-92		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU	03-Sep-92		7.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU2	08-Jun-88		6.44												
MNSU2*	27-Jun-89		0.67				<0.1	2.20	<0.1	0.91	1.60	<1.0	<0.1	<0.1	0.18
MNSU2*	28-Aug-89		1.11				<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2*	30-Oct-89		3.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2*	27-Nov-89		6.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2*	26-Mar-90		3.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2	30-Apr-90		8.67												
MNSU2	29-May-90		7.11												
MNSU2*	19-Jun-90		1.78				<0.1	0.17	<0.1	0.93	3.00	<0.1	0.14	<0.1	<0.1
MNSU2*	26-Jun-90		3.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2*	27-Jul-90		3.78				<0.1	2.10	<0.1	<0.1	0.80	<0.1	<0.1	<0.1	<0.1
MNSU2	27-Aug-90		3.33												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNSU2	25-Feb-91		3.33												
MNSU2	25-Mar-91		3.56												
MNSU2	29-Apr-91		5.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU2*	28-May-91		6.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2*	18-Jun-91		4.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNSU2	30-Jul-91		8.44												
MNSU2	07-Jan-92		3.11												
MNSU2	05-Feb-92		6.67												
MNSU2	03-Mar-92		4.89												
MNSU2	07-Apr-92		6.67												
MNSU2	06-May-92		8.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNSU2	06-Aug-92		2.89				<0.1	<0.1	<0.1	0.24	<0.1	<0.1			<0.1
MNSU2	03-Sep-92		7.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS*	13-May-87		17.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	16-Jun-87		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	26-Jun-87		17.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	03-Sep-87		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS	29-Sep-87		13.56												
MNS	26-Oct-87		14.22												
MNS	30-Nov-87		12.89												
MNS*	29-Feb-88		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	28-Mar-88		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	25-Apr-88		10.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	31-May-88		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	08-Jun-88		12.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	08-Jun-88		11.56				<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS	28-Jun-88		11.11												
MNS*	11-Jul-88		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	31-Jan-89		7.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	28-Mar-89		9.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	25-Apr-89		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	31-May-89		8.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	23-Jun-89		8.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	27-Jun-89		10.22				<0.1	0.18	<0.1	0.10	0.13	<0.1	<0.1	<0.1	<0.1
MNS*	25-Jul-89		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	28-Aug-89		8.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNS*	26-Sep-89		12.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	30-Oct-89		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	27-Nov-89		14.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	27-Dec-89		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	29-Jan-90		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	01-Mar-90		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	26-Mar-90		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	30-Apr-90		14.67				<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
MNS*	29-May-90		15.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	19-Jun-90		21.33				<0.1	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1
MNS*	25-Jun-90		20.44				<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	27-Jul-90		15.56				<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	01-Oct-90		21.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS	25-Feb-91		12.22												
MNS	25-Mar-91		13.33												
MNS	29-Apr-91		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS*	28-May-91		19.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	18-Jun-91		18.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS*	30-Jul-91		22.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS	28-Aug-91		24.89												
MNS	23-Sep-91		25.33												
MNS	29-Oct-91		24.89				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
MNS	04-Dec-91		13.78												
MNS	07-Jan-92		14.00												
MNS	05-Feb-92		14.44												
MNS	03-Mar-92		14.00												
MNS	07-Apr-92		14.22												
MNS	06-May-92		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS	10-Jun-92		18.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS	09-Jul-92		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS	06-Aug-92		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS	03-Sep-92		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS1*	26-Sep-89		21.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS1	30-Oct-89		20.22												
MNS1	25-Mar-91		20.67												
MNS1	29-Apr-91		22.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES----------								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
MNS1*	28-May-91		20.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS1*	18-Jun-91		20.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MNS1*	30-Jul-91		17.33				<0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
MNS1	07-Jan-92		9.56												
MNS1	05-Feb-92		5.11												
MNS1	03-Mar-92		5.33												
MNS1	07-Apr-92		14.89												
MNS1	06-May-92		18.67				<0.1	<0.1	<0.1	0.13	<0.1	<0.1			<0.1
MNS1	10-Jun-92		18.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS1	09-Jul-92		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS1	06-Aug-92		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
MNS1	03-Sep-92		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN1	29-Feb-88		1.56												
THN1	28-Mar-88		2.89												
THN1*	08-Jun-88		6.89				<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1
THN1	08-Jun-88		6.44												
THN1	28-Jun-88		0.67												
THN1	11-Jul-88		1.78												
THN1*	31-May-89		5.11				<0.1	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.1	<0.1
THN1*	23-Jun-89		5.56				<0.1	1.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	27-Jun-89		10.89				<0.1	0.16	<0.1	0.11	0.14	<0.1	<0.1	<0.1	<0.1
THN1*	04-Sep-89		8.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	26-Sep-89		10.44				<0.1	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	30-Oct-89		8.67				<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	27-Nov-89		7.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	29-Jan-90		7.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	26-Mar-90		8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	30-Apr-90		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	29-May-90		9.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	25-Jun-90		10.89				<0.1	0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	27-Jul-90		8.67				<0.1	0.26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	27-Aug-90		12.00				<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1	22-Oct-90		12.00												
THN1	27-Nov-90		9.56												
THN1	25-Feb-91		4.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN1	25-Mar-91		8.67												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
THN1	29-Apr-91		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN1*	28-May-91		13.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	18-Jun-91		15.56				<0.1	0.13	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1
THN1*	30-Jul-91		18.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN1	28-Aug-91		17.33												
THN1	23-Sep-91		14.22												
THN1	29-Oct-91		12.67				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
THN1	04-Dec-91		10.00												
THN1	07-Jan-92		7.56												
THN1	05-Feb-92		12.00												
THN1	03-Mar-92		10.89												
THN1	07-Apr-92		9.56												
THN1	06-May-92		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN1	10-Jun-92		14.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN1	09-Jul-92		10.00				<0.1	0.10	<0.1	<0.1	<0.1	<0.1			<0.1
THN1	06-Aug-92		6.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN1	03-Sep-92		6.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN2	13-May-87		12.89												
THN2*	26-Jun-87		16.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2*	03-Sep-87		11.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2	29-Sep-87		9.56												
THN2	26-Oct-87		8.00												
THN2	30-Nov-87		7.11												
THN2	29-Feb-88		7.56												
THN2*	25-Jun-90		18.89				<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2*	27-Jul-90		18.00				<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2*	27-Aug-90		16.00				<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2*	01-Oct-90		13.33				<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2	22-Oct-90		13.11												
THN2	25-Mar-91		13.33												
THN2*	29-Apr-91		19.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN2*	28-May-91		20.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2*	18-Jun-91		20.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THN2*	30-Jul-91		16.00				<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
THN2	04-Dec-91		12.22												
THN2	07-Jan-92		13.78												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
THN2	05-Feb-92		12.89												
THN2	03-Mar-92		12.67												
THN2	07-Apr-92		14.67												
THN2	06-May-92		16.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN2	10-Jun-92		14.89				<0.1	<0.1	<0.1	<0.1	0.13	<0.1			<0.1
THN2	09-Jul-92		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN2	06-Aug-92		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THN2	03-Sep-92		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS1*	16-Jun-87		15.78				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	03-Sep-87		16.00				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	29-Sep-87		15.11				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	26-Oct-87		16.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	30-Nov-87		17.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	29-Feb-88		20.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1	28-Mar-88		20.44												
THS1	25-Apr-88		23.11												
THS1	31-May-88		23.56												
THS1*	08-Jun-88		18.44				<0.1	1.10	<0.1	<0.1	0.43	<0.1	<0.1	<0.1	<0.1
THS1*	08-Jun-88		18.44				<0.1	0.99	<0.1	<0.1	0.42	<0.1	<0.1	<0.1	<0.1
THS1	28-Jun-88		22.89												
THS1*	11-Jul-88		23.33				<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1	25-Jul-88		24.44												
THS1*	23-Jun-89		18.00				<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	27-Jun-89		18.22				0.12	0.27	<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	25-Jul-89		19.56				<0.1	0.24	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	28-Aug-89		18.44				<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	04-Sep-89		15.56				<0.1	0.34	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	26-Sep-89		16.67				<0.1	0.21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	30-Oct-89		15.33				<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	27-Nov-89		16.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	27-Dec-89		19.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	29-Jan-90		22.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	26-Mar-90		18.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	30-Apr-90		18.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	29-May-90		18.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	19-Jun-90		23.78				<0.1	<0.1	<0.1	0.41	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
THS1*	25-Jun-90		22.44				<0.1	0.18	<0.1	0.40	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	27-Jul-90		19.78				<0.1	0.30	<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	27-Aug-90		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	01-Oct-90		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1	22-Oct-90		19.78												
THS1	27-Nov-90		21.33												
THS1	25-Mar-91		19.56												
THS1	29-Apr-91		19.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS1*	28-May-91		18.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	18-Jun-91		19.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1*	30-Jul-91		21.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS1	28-Aug-91		18.67												
THS1	23-Sep-91		18.89												
THS1	04-Dec-91		16.89												
THS1	07-Jan-92		14.89												
THS1	05-Feb-92		18.44												
THS1	03-Mar-92		17.78												
THS1	07-Apr-92		16.89												
THS1	06-May-92		15.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS1	10-Jun-92		16.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS1	09-Jul-92		18.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS1	06-Aug-92		14.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS1	03-Sep-92		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS2	16-Jun-87		19.33												
THS2	03-Sep-87		12.44												
THS2*	29-Sep-87		13.33				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	26-Oct-87		14.22				<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	30-Nov-87		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2	29-Feb-88		14.00												
THS2*	28-Mar-88		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	25-Apr-88		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	31-May-88		12.44				<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	08-Jun-88		14.67				<0.1	0.55	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1
THS2*	08-Jun-88		14.00				<0.1	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	28-Jun-88		14.44				<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	11-Jul-88		14.44				<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
THS2	25-Jul-88		12.67												
THS2	28-Nov-88		9.33												
THS2	03-Jan-89		8.89												
THS2*	31-Jan-89		9.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	13-Mar-89		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	28-Mar-89		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	25-Apr-89		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	31-May-89		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	23-Jun-89		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	27-Jun-89		18.00				0.17	0.13	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	25-Jul-89		16.22				<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	28-Aug-89		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	26-Sep-89		18.44				<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	30-Oct-89		18.67				<0.1	0.12	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	27-Nov-89		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	27-Dec-89		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	29-Jan-90		15.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	01-Mar-90		16.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	26-Mar-90		20.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	30-Apr-90		18.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	29-May-90		18.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	25-Jun-90		22.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	27-Aug-90		18.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	01-Oct-90		18.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2	25-Feb-91		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS2	25-Mar-91		16.89												
THS2	29-Apr-91		18.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS2*	28-May-91		18.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	18-Jun-91		17.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2*	30-Jul-91		18.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS2	28-Aug-91		15.56												
THS2	23-Sep-91		15.33												
THS2	29-Oct-91		15.11				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
THS2	04-Dec-91		11.56												
THS2	07-Jan-92		12.22												
THS2	05-Feb-92		14.22												
THS2	03-Mar-92		14.22												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
THS2	07-Apr-92		14.89												
THS2	06-May-92		15.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS2	10-Jun-92		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS2	09-Jul-92		16.00				<0.1	0.11	<0.1	<0.1	<0.1	<0.1			<0.1
THS2	06-Aug-92		11.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS2	03-Sep-92		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS	13-May-87		16.22												
THS	16-Jun-87		17.11												
THS*	26-Jun-87		0.00				<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	03-Sep-87		14.44				<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	29-Sep-87		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	26-Oct-87		12.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS	30-Nov-87		11.33												
THS*	29-Feb-88		13.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	28-Mar-88		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	25-Apr-88		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS	31-May-88		13.11												
THS*	08-Jun-88		16.22				<0.1	7.40	<0.1	<0.1	6.50	<0.1	<0.1	<0.1	<0.1
THS	08-Jun-88		14.44												
THS	28-Jun-88		14.22												
THS*	11-Jul-88		14.22				<0.1	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS	25-Jul-88		12.44												
THS*	31-May-89		7.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	23-Jun-89		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	27-Jun-89		19.78				0.18	0.23	<0.1	0.10	0.11	<0.1	<0.1	<0.1	<0.1
THS*	25-Jul-89		16.00				<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	28-Aug-89		13.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	04-Sep-89		10.44				<0.1	0.20	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1
THS*	26-Sep-89		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	30-Oct-89		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	27-Nov-89		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	27-Dec-89		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	29-Jan-90		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	01-Mar-90		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	26-Mar-90		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	30-Apr-90		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
THS*	29-May-90		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	19-Jun-90		17.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	25-Jun-90		17.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	27-Jul-90		15.78				<0.1	0.24	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	27-Aug-90		17.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS	01-Oct-90		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS	22-Oct-90		15.33												
THS	27-Nov-90		14.22												
THS	25-Feb-91		14.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS	25-Mar-91		14.44												
THS	29-Apr-91		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS*	28-May-91		15.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS*	18-Jun-91		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
THS	30-Jul-91		14.67												
THS	04-Dec-91		10.89												
THS	07-Jan-92		10.44												
THS	05-Feb-92		12.44												
THS	03-Mar-92		12.00												
THS	07-Apr-92		12.67												
THS	06-May-92		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS	10-Jun-92		13.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS	09-Jul-92		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS	06-Aug-92		14.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
THS	03-Sep-92		10.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KL*	28-Mar-88		5.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	25-Apr-88		5.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	31-May-88		6.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	08-Jun-88		7.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	08-Jun-88		7.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL	28-Jun-88		6.67												
KL	25-Jul-88		5.78												
KL	30-Aug-88		1.11												
KL	25-Sep-88		4.22												
KL	23-Oct-88		4.89												
KL	28-Nov-88		4.22												
KL	03-Jan-89		3.56												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KL*	31-Jan-89		6.67				<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	13-Mar-89		3.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	28-Mar-89		3.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	25-Apr-89		2.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	31-May-89		5.78				<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	23-Jun-89		8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	27-Jun-89		11.78				<0.1	0.13	<0.1	0.10	0.12	<0.1	<0.1	<0.1	<0.1
KL*	25-Jul-89		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	28-Aug-89		8.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	04-Sep-89		10.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	26-Sep-89		10.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	30-Oct-89		8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	27-Nov-89		7.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	27-Dec-89		7.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	29-Jan-90		7.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	01-Mar-90		7.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	26-Mar-90		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	30-Apr-90		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	29-May-90		11.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	19-Jun-90		15.78				<0.1	<0.1	<0.1	<0.1	0.50	<0.1	<0.1	<0.1	<0.1
KL*	25-Jun-90		15.78				<0.1	<0.1	<0.1	<0.1	0.24	<0.1	<0.1	<0.1	<0.1
KL*	27-Jul-90		16.22				<0.1	<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1
KL*	27-Aug-90		14.00				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
KL*	01-Oct-90		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL	22-Oct-90		10.89												
KL	27-Nov-90		9.78												
KL	25-Mar-91		11.56												
KL	29-Apr-91		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KL*	28-May-91		14.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	18-Jun-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL*	30-Jul-91		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KL	28-Aug-91		8.44												
KL	23-Sep-91		7.78												
KL	29-Oct-91		8.22				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
KL	04-Dec-91		11.33												
KL	07-Jan-92		8.67												
KL	05-Feb-92		8.22												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
KL	03-Mar-92		8.44												
KL	07-Apr-92		9.11												
KL	06-May-92		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KL	10-Jun-92		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KL	09-Jul-92		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KL	06-Aug-92		10.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
KL	03-Sep-92		8.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DS*	31-May-89		6.89				0.32	<0.1	<0.1	0.29	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	23-Jun-89		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	27-Jun-89		13.11				0.12	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	25-Jul-89		7.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	04-Sep-89		7.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	26-Sep-89		7.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS	30-Oct-89		6.67												
DS	29-Jan-90		6.44												
DS	01-Mar-90		7.33												
DS*	26-Mar-90		8.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	30-Apr-90		8.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	29-May-90		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	19-Jun-90		12.89				<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
DS*	26-Jun-90		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	27-Jul-90		12.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	27-Aug-90		12.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS	22-Oct-90		8.89												
DS	27-Nov-90		8.00												
DS	25-Feb-91		6.67												
DS	25-Mar-91		9.33												
DS	29-Apr-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DS*	28-May-91		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	18-Jun-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS*	30-Jul-91		9.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DS	28-Aug-91		7.56												
DS	23-Sep-91		5.78												
DS	29-Oct-91		5.11												
DS	04-Dec-91		5.33												
DS	07-Jan-92		6.00												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
DS	05-Feb-92		6.44												
DS	03-Mar-92		6.44												
DS	07-Apr-92		8.67												
DS	06-May-92		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DS	10-Jun-92		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DS	09-Jul-92		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DS	06-Aug-92		9.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
DS	03-Sep-92		9.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
SURFACE WATER															
BGSW*	13-May-87		18.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW	16-Jun-87		14.00												
BGSW	26-Jun-87		13.33												
BGSW*	03-Sep-87		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	29-Sep-87		11.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	26-Oct-87		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW	30-Nov-87		11.56												
BGSW*	29-Feb-88		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW	28-Mar-88		10.89												
BGSW	25-Apr-88		11.78												
BGSW*	31-May-88		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	08-Jun-88		16.00				1.10	3.60	<0.1	2.70	4.60	<0.1	0.30	<0.1	<0.1
BGSW	28-Jun-88		13.33												
BGSW*	11-Jul-88		12.89				<0.1	0.25	<0.1	0.21	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW	25-Jul-88		12.00												
BGSW	30-Aug-88		7.33												
BGSW	25-Sep-88		7.56												
BGSW	23-Oct-88		7.78												
BGSW	28-Nov-88		10.22												
BGSW	03-Jan-89		9.11												
BGSW	31-Jan-89		6.22												
BGSW*	13-Mar-89		6.44				<0.1	0.18	<0.1	<0.1	0.24	<0.1	<0.1	<0.1	<0.1
BGSW*	28-Mar-89		6.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	25-Apr-89		5.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	31-May-89		10.89				1.30	<0.1	<0.1	0.65	<0.1	<0.1	0.14	<0.1	<0.1
BGSW*	23-Jun-89		10.22				<0.1	4.20	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES								
							Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
BGSW*	27-Jun-89		12.67				0.19	1.30	<0.1	0.27	0.44	<0.2	<0.1	<0.1	<0.1
BGSW*	25-Jul-89		10.67				<0.1	0.19	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	28-Aug-89		6.44				<0.1	0.22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	04-Sep-89		6.67				<0.1	0.17	<0.1	0.25	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	05-Sep-89		6.89				<0.1	0.22	<0.1	0.18	0.10	<0.1	<0.1	<0.1	<0.1
BGSW*	26-Sep-89		12.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	30-Oct-89		11.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	27-Nov-89		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	27-Dec-89		10.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	29-Jan-90		10.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	01-Mar-90		11.33				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	26-Mar-90		13.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	30-Apr-90		12.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	29-May-90		14.67				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	19-Jun-90		17.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	25-Jun-90		18.00				<0.1	0.30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	27-Jul-90		14.00				<0.1	0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	27-Aug-90		15.11				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	01-Oct-90		14.44				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW	22-Oct-90		14.22												
BGSW	27-Nov-90		13.33												
BGSW	04-Jan-91		13.56												
BGSW	28-Jan-91		13.33												
BGSW	25-Feb-91		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
BGSW	25-Mar-91		13.78												
BGSW	29-Apr-91		16.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
BGSW*	28-May-91		15.33				<0.1	2.50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	18-Jun-91		15.78				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW*	30-Jul-91		14.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BGSW	28-Aug-91		12.89												
BGSW	23-Sep-91		12.22												
BGSW	29-Oct-91		12.00				<0.1	<0.1	<0.1	<0.1	<0.2	<0.1			<0.1
BGSW	04-Dec-91		11.56												
BGSW	07-Jan-92		10.44												
BGSW	05-Feb-92		11.78												

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

SITE NAME	DATE	Water Level (below ground surface-feet)	Nitrate-N mg/L	Total Coliform Bacteria (MPN)	Fecal Coliform Bacteria (MPN)	Immuno assay for triazine herbicides µg/L	HERBICIDES---- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L
BGSW	03-Mar-92		10.44												
BGSW	07-Apr-92		12.22												
BGSW	06-May-92		13.56				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
BGSW	10-Jun-92		12.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
BGSW	09-Jul-92		12.22				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
BGSW	06-Aug-92		12.00				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
BGSW	03-Sep-92		10.89				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

APPENDIX II.

SUMMARY, ON AN ANNUAL BASIS BY SITE, OF PESTICIDE DATA FROM ACTIVE WELLS, INACTIVE WELLS, TILE LINES, AND SURFACE WATER.

Site	1987	1988	1989	1990	1991	1992
Active Wells						
KH2						
Landuse	soybeans	corn	soybeans/ set aside	corn/ set aside	corn/ set aside	soybeans/ set aside
Pesticide Detected	no detects	alachlor	atrazine	no detects	atrazine	atrazine
Mean Concentration; ug/L		5.40	0.17		0.14	0.11
Number of Samples (% detection)	2 (0%)	4 (25%)	12 (17%)	10 (0%)	7 (14%)	5 (20%)
Range in concentration; ug/L		5.40	0.12-0.21		0.14	0.11
Pesticide Detected		atrazine	cyanazine			
Mean Concentration; ug/L		8.40	0.13			
Number of Samples (% detection)		4 (25%)	12 (17%)			
Range in concentration; ug/L		8.40	0.11-0.15			
Pesticide Detected		cyanazine				
Mean Concentration; ug/L		0.99				
Number of Samples (% detection)		4 (25%)				
Range in concentration; ug/L		0.99				
Pesticide Detected		trifluralin				
Mean Concentration; ug/L		1.10				
Number of Samples (% detection)		4 (25%)				
Range in concentration; ug/L		1.10				
MN1						
Landuse	soybeans/ grass	corn/grass	soybeans/ grass	corn/grass	soybeans/ grass	soybeans/ grass
Pesticide Detected	no detects	no detects	cyanazine	no detects	no detects	no detects
Mean Concentration; ug/L			0.11			
Number of Samples (% detection)	3 (0%)	2 (0%)	11 (9%)	9 (0%)	5 (0%)	5 (0%)
Range in concentration; ug/L			0.11			
SW1						
Landuse	corn	soybeans	soybeans	soybeans	corn	soybeans
Pesticide Detected	metolachlor	no detects	alachlor	atrazine	atrazine	atrazine
Mean Concentration; ug/L	0.15		0.12	0.15	0.70	0.41
Number of Samples (% detection)	4 (25%)	2 (0%)	13 (8%)	11 (27%)	6 (33%)	5 (20%)
Range in concentration; ug/L	0.15		0.12	0.10-0.22	0.30-1.10	0.41
Pesticide Detected			atrazine	trifluralin	cyanazine	
Mean Concentration; ug/L			0.38	0.88	0.27	
Number of Samples (% detection)			13 (54%)	11 (9%)	6 (33%)	
Range in concentration; ug/L			0.10-0.86	0.88	0.12-0.42	
Pesticide Detected			metolachlor		metolachlor	
Mean Concentration; ug/L			0.25		0.17	
Number of Samples (% detection)			13 (15%)		6 (17%)	
Range in concentration; ug/L			0.10-0.40		0.17	
W1						
Landuse	Conservation Reserve Program	Conservation Reserve Program	Conservation Reserve Program	Conservation Reserve Program	Conservation Reserve Program	Conservation Reserve Program
Pesticide Detected	no detects	atrazine	alachlor	atrazine	no detects	no detects
Mean Concentration; ug/L		16.00	0.18	0.28		
Number of Samples (% detection)	4 (0%)	3 (33%)	13 (8%)	10 (10%)	6 (0%)	5 (0%)
Range in concentration; ug/L		16.00	0.18	0.28		

Site	1987	1988	1989	1990	1991	1992
Pesticide Detected		cyanazine	atrazine	cyanazine		
Mean Concentration; ug/L		12.09	0.14	0.21		
Number of Samples (% detection)		3 (66%)	13 (23%)	10 (10%)		
Range in concentration; ug/L		0.18-24.00	0.10-0.20	0.21		
Pesticide Detected		metolachlor	cyanazine	metolachlor		
Mean Concentration; ug/L		0.66	0.14	0.28		
Number of Samples (% detection)		3 (33%)	13 (15%)	10 (10%)		
Range in concentration; ug/L		0.66	0.13-0.15	0.28		
Pesticide Detected			metolachlor	pendimethalin		
Mean Concentration; ug/L			0.20	0.13		
Number of Samples (% detection)			13 (8%)	10 (10%)		
Range in concentration; ug/L			0.20	0.13		
Pesticide Detected			pendimethalin			
Mean Concentration; ug/L			0.31			
Number of Samples (% detection)			13 (15%)			
Range in concentration; ug/L			0.15-0.47			
Inactive Wells						
D1						
Landuse	pasture	pasture	pasture	pasture	pasture	pasture
Pesticide Detected	no detects	alachlor	alachlor	alachlor	no detects	no detects
Mean Concentration; ug/L		2.10	0.21	0.63		
Number of Samples (% detection)	3 (0%)	6 (17%)	16 (6%)	10 (10%)	5 (0%)	5 (0%)
Range in concentration; ug/L		2.10	0.21	0.63		
Pesticide Detected		atrazine	atrazine	atrazine		
Mean Concentration; ug/L		1.44	0.16	0.85		
Number of Samples (% detection)		6 (50%)	16 (25%)	10 (10%)		
Range in concentration; ug/L		0.36-3.50	0.11-0.23	0.85		
Pesticide Detected		cyanazine	cyanazine	metolachlor		
Mean Concentration; ug/L		0.27	0.14	0.64		
Number of Samples (% detection)		6 (33%)	16 (13%)	10 (10%)		
Range in concentration; ug/L		0.23-0.31	0.13-0.14	0.64		
Pesticide Detected		metolachlor		trifluralin		
Mean Concentration; ug/L		0.18		0.12		
Number of Samples (% detection)		6 (17%)		10 (10%)		
Range in concentration; ug/L		0.18		0.12		
Pesticide Detected		trifluralin				
Mean Concentration; ug/L		0.21				
Number of Samples (% detection)		6 (17%)				
Range in concentration; ug/L		0.21				
D2						
Landuse	pasture	pasture	pasture	pasture	pasture	pasture
Pesticide Detected	no samples	alachlor	alachlor	alachlor	cyanazine	atrazine
Mean Concentration; ug/L		3.95	0.28	0.37	1.04	0.10
Number of Samples (% detection)		2 (100%)	11 (36%)	10 (50%)	5 (60%)	5 (10%)
Range in concentration; ug/L		2.70-5.20	0.20-0.34	0.13-0.63	0.69-1.70	0.10

Site	1987	1988	1989	1990	1991	1992
Pesticide Detected		atrazine	atrazine	atrazine		cyanazine
Mean Concentration; ug/L		0.87	0.52	0.21		0.23
Number of Samples (% detection)		2 (100%)	11 (100%)	10 (70%)		5 (100%)
Range in concentration; ug/L		0.76-0.97	0.22-0.99	0.15-0.31		0.18-0.26
Pesticide Detected		cyanazine	cyanazine	cyanazine		
Mean Concentration; ug/L		27.00	6.94	2.96		
Number of Samples (% detection)		2 (100%)	11 (100%)	10 (100%)		
Range in concentration; ug/L		26.00-28.00	1.30-15.00	2.00-4.30		
Pesticide Detected		metolachlor	metolachlor	metolachlor		
Mean Concentration; ug/L		0.65	0.25	0.17		
Number of Samples (% detection)		2 (50%)	11 (36%)	10 (10%)		
Range in concentration; ug/L		0.65	0.17-0.39	0.17		
Pesticide Detected		pendimethalin		pendimethalin		
Mean Concentration; ug/L		1.10		0.57		
Number of Samples (% detection)		2 (50%)		10 (30%)		
Range in concentration; ug/L		1.10		0.17-0.95		
Pesticide Detected				trifluralin		
Mean Concentration; ug/L				0.10		
Number of Samples (% detection)				10 (10%)		
Range in concentration; ug/L				0.10		
KH1						
Landuse	corn	soybeans/ set aside	corn/oats/ set aside	corn/ set aside	soybeans/ set aside	corn/ set aside
Pesticide Detected	atrazine	alachlor	alachlor	atrazine	atrazine	no samples
Mean Concentration; ug/L	0.38	2.79	1.36	4.55	0.87	
Number of Samples (% detection)	5 (100%)	13 (54%)	16 (69%)	11 (100%)	5 (100%)	
Range in concentration; ug/L	0.23-0.58	1.20-5.10	0.22-4.00	2.20-7.20	0.27-2.40	
Pesticide Detected	cyanazine	atrazine	atrazine	cyanazine	cyanazine	
Mean Concentration; ug/L	0.88	5.95	6.93	0.79	1.27	
Number of Samples (% detection)	5 (80%)	13 (92%)	16 (100%)	11 (100%)	5 (60%)	
Range in concentration; ug/L	0.60-1.90	0.27-13.00	1.20-17.00	0.23-1.70	0.21-1.90	
Pesticide Detected		cyanazine	cyanazine	metolachlor	metolachlor	
Mean Concentration; ug/L		2.39	1.55	0.95	0.27	
Number of Samples (% detection)		13 (69%)	16 (94%)	11 (55%)	5 (20%)	
Range in concentration; ug/L		0.95-12.00	0.37-4.40	0.38-1.60	0.27	
Pesticide Detected		trifluralin	metolachlor	metribuzin		
Mean Concentration; ug/L		0.64	0.13	0.27		
Number of Samples (% detection)		13 (23%)	16 (13%)	11 (27%)		
Range in concentration; ug/L		0.35-0.88	0.11-0.14	0.17-0.33		
Pesticide Detected				trifluralin		
Mean Concentration; ug/L				0.45		
Number of Samples (% detection)				11 (9%)		
Range in concentration; ug/L				0.45		

Site	1987	1988	1989	1990	1991	1992
KH3						
Landuse	corn/ set aside	soybeans/ set aside	corn/ set aside	corn/ set aside	soybeans/ set aside	corn/ set aside
Pesticide Detected	no samples	no samples	no samples	atrazine	no detects	cyanazine
Mean Concentration; ug/L				0.36		0.26
Number of Samples (% detection)				5 (40%)	5 (0%)	5 (40%)
Range in concentration; ug/L				0.27-0.45		0.17-0.34
Tile Lines						
DNTL						
Landuse	soybeans	corn	soybeans	corn	soybeans	corn
Pesticide Detected	no samples	no samples	no samples	no samples	no detects	no samples
Mean Concentration; ug/L						
Number of Samples (% detection)					4 (0%)	
Range in concentration; ug/L						
DSTL						
Landuse	corn	soybeans	corn	soybeans	corn	soybeans
Pesticide Detected	no samples	no samples	cyanazine	no detects	no detects	no detects
Mean Concentration; ug/L			0.22			
Number of Samples (% detection)			6 (33%)	7 (0%)	4 (0%)	5 (0%)
Range in concentration; ug/L			0.15-0.29			
Pesticide Detected			alachlor			
Mean Concentration; ug/L			0.22			
Number of Samples (% detection)			6 (33%)			
Range in concentration; ug/L			0.12-0.32			
DTTL						
Landuse	corn/ soybeans	corn/ soybeans	corn/ soybeans	corn	soybeans	corn
Pesticide Detected	no detects	no samples	alachlor	no detects	no detects	no detects
Mean Concentration; ug/L			0.15			
Number of Samples (% detection)	2 (0%)		11 (9%)	10 (0%)	5 (0%)	5 (0%)
Range in concentration; ug/L			0.15			
Pesticide Detected			atrazine			
Mean Concentration; ug/L			0.14			
Number of Samples (% detection)			11 (9%)			
Range in concentration; ug/L			0.14			
Pesticide Detected			cyanazine			
Mean Concentration; ug/L			0.11			
Number of Samples (% detection)			11 (9%)			
Range in concentration; ug/L			0.11			
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.15			
Number of Samples (% detection)			11 (9%)			
Range in concentration; ug/L			0.15			

Site	1987	1988	1989	1990	1991	1992
KLTL						
Landuse	corn	soybeans	soybeans	corn	soybeans	corn
Pesticide Detected	no samples	no detects	atrazine	metolachlor	no detects	no detects
Mean Concentration; ug/L			0.14	0.30		
Number of Samples (% detection)		5 (0%)	14 (14%)	10 (30%)	5 (0%)	5 (0%)
Range in concentration; ug/L			0.13-0.15	0.16-0.50		
Pesticide Detected			cyanazine			
Mean Concentration; ug/L			0.10			
Number of Samples (% detection)			14 (7%)			
Range in concentration; ug/L			0.10-0.10			
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.12			
Number of Samples (% detection)			14 (7%)			
Range in concentration; ug/L			0.12-0.12			
MNNTL						
Landuse	soybeans	corn	soybeans	sod	sod	sod
Pesticide Detected	no detects	cyanazine	metolachlor	no detects	no detects	no detects
Mean Concentration; ug/L		0.49	0.11			
Number of Samples (% detection)	4 (0%)	4 (25%)	1 (17%)	8 (0%)	5 (0%)	4 (0%)
Range in concentration; ug/L		0.49	0.11			
Pesticide Detected		metolachlor				
Mean Concentration; ug/L		0.21				
Number of Samples (% detection)		4 (25%)				
Range in concentration; ug/L		0.21				
MNNUTL						
Landuse	corn	soybeans	corn	soybeans	corn	soybeans
Pesticide Detected	no detects	atrazine	alachlor	atrazine	atrazine	no detects
Mean Concentration; ug/L		0.74	0.14	0.38	0.23	
Number of Samples (% detection)	3 (0%)	8 (25%)	14 (7%)	10 (20%)	5 (60%)	5 (0%)
Range in concentration; ug/L		0.27-1.20	0.14	0.10-0.65	0.11-0.38	
Pesticide Detected		cyanazine	atrazine			
Mean Concentration; ug/L		0.28	0.56			
Number of Samples (% detection)		8 (25%)	14 (71%)			
Range in concentration; ug/L		0.11-0.45	0.10-1.30			
Pesticide Detected		metolachlor	cyanazine			
Mean Concentration; ug/L		0.80	0.10			
Number of Samples (% detection)		8 (25%)	14 (7%)			
Range in concentration; ug/L		0.20-1.40	0.10			
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.17			
Number of Samples (% detection)			14 (14%)			
Range in concentration; ug/L			0.14-0.19			

Site	1987	1988	1989	1990	1991	1992
MNS1TL						
Landuse	soybeans	corn	soybeans	corn	soybeans	soybeans
Pesticide Detected	no samples	no samples	no detects	no samples	no detects	cyanazine
Mean Concentration; ug/L						0.13
Number of Samples (% detection)			1 (0%)		4 (0%)	5 (20%)
Range in concentration; ug/L						0.13
MNSTL						
Landuse	soybeans	corn	soybeans	corn	soybeans	soybeans
Pesticide Detected	no detects	atrazine	atrazine	atrazine	no detects	no detects
Mean Concentration; ug/L		0.14	0.18	0.17		
Number of Samples (% detection)	3 (0%)	7 (14%)	12 (8%)	9 (22%)	5 (0%)	5 (0%)
Range in concentration; ug/L		0.14	0.18	0.15-0.19		
Pesticide Detected			cyanazine	metolachlor		
Mean Concentration; ug/L			0.10	0.13		
Number of Samples (% detection)			12 (8%)	9 (11%)		
Range in concentration; ug/L			0.10	0.13		
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.13			
Number of Samples (% detection)			12 (8%)			
Range in concentration; ug/L			0.13			
MNSUTL						
Landuse	soybeans	corn	soybeans	corn/sod/ soybeans	soybeans/ sod	soybeans/ sod
Pesticide Detected	no detects	atrazine	alachlor	no detects	no detects	no detects
Mean Concentration; ug/L		0.15	0.11			
Number of Samples (% detection)	4 (0%)	4 (25%)	5 (20%)	8 (0%)	4 (0%)	5 (0%)
Range in concentration; ug/L		0.15	0.11			
Pesticide Detected			atrazine			
Mean Concentration; ug/L			0.47			
Number of Samples (% detection)			5 (20%)			
Range in concentration; ug/L			0.47			
Pesticide Detected			cyanazine			
Mean Concentration; ug/L			0.14			
Number of Samples (% detection)			5 (20%)			
Range in concentration; ug/L			0.14			
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.22			
Number of Samples (% detection)			5 (40%)			
Range in concentration; ug/L			0.14-0.29			
MNSU2TL						
Landuse	soybeans	corn	soybeans	corn/sod/ soybeans	soybeans/ sod	soybeans/ sod
Pesticide Detected	no samples	no samples	atrazine	atrazine	no detects	cyanazine
Mean Concentration; ug/L			1.17	1.14		0.24
Number of Samples (% detection)			4 (50%)	4 (50%)	3 (0%)	3 (33%)
Range in concentration; ug/L			0.13-2.20	0.17-2.10		0.24

Site	1987	1988	1989	1990	1991	1992
Pesticide Detected			cyanazine	cyanazine		
Mean Concentration; ug/L			0.91	0.93		
Number of Samples (% detection)			4 (25%)	4 (25%)		
Range in concentration; ug/L			0.91	0.93		
Pesticide Detected			metolachlor	metolachlor		
Mean Concentration; ug/L			1.60	1.90		
Number of Samples (% detection)			4 (25%)	4 (50%)		
Range in concentration; ug/L			1.60	0.80-3.00		
Pesticide Detected			trifluralin			
Mean Concentration; ug/L			0.18			
Number of Samples (% detection)			4 (25%)			
Range in concentration; ug/L			0.18			
THN1TL						
Landuse	corn/set aside/alfalfa	soybeans/ corn/set aside	corn	corn	corn	soybeans
Pesticide Detected	no samples	cyanazine	atrazine	atrazine	atrazine	atrazine
Mean Concentration; ug/L		0.16	0.63	0.26	0.13	0.10
Number of Samples (% detection)		1 (100%)	7 (29%)	7 (29%)	6 (17%)	5 (20%)
Range in concentration; ug/L		0.16	0.16-1.10	0.25-0.26	0.13	0.10
Pesticide Detected			cyanazine		cyanazine	
Mean Concentration; ug/L			0.11		0.10	
Number of Samples (% detection)			7 (43%)		6 (17%)	
Range in concentration; ug/L			0.10-0.12		0.10	
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.14			
Number of Samples (% detection)			7 (14%)			
Range in concentration; ug/L			0.14			
THN2TL						
Landuse	corn/ set aside	corn/ set aside	corn	corn	corn	soybeans
Pesticide Detected	no detects	no samples	no samples	atrazine	metolachlor	metolachlor
Mean Concentration; ug/L				0.14	0.13	0.13
Number of Samples (% detection)	2 (0%)			4 (75%)	4 (25%)	5 (20%)
Range in concentration; ug/L				0.12-0.17	0.13	0.13
THSTL						
Landuse	corn/ soybeans	corn/ soybeans	corn	corn	soybeans/ oats	corn
Pesticide Detected	atrazine	atrazine	alachlor	atrazine	no detects	no detects
Mean Concentration; ug/L	0.12	3.79	0.18	0.24		
Number of Samples (% detection)	4 (50%)	5 (20%)	10 (10%)	10 (10%)	4 (0%)	5 (0%)
Range in concentration; ug/L	0.10-0.13	0.17-7.40	0.18	0.24		
Pesticide Detected		metolachlor	atrazine	cyanazine		
Mean Concentration; ug/L		6.50	0.18	0.14		
Number of Samples (% detection)		5 (10%)	10 (30%)	10 (10%)		
Range in concentration; ug/L		6.50	0.11-0.23	0.14		

Site	1987	1988	1989	1990	1991	1992
Pesticide Detected			cyanazine			
Mean Concentration; ug/L			0.10			
Number of Samples (% detection)			10 (10%)			
Range in concentration; ug/L			0.10			
Pesticide Detected			metolachlor			
Mean Concentration; ug/L			0.11			
Number of Samples (% detection)			10 (10%)			
Range in concentration; ug/L			0.11			
THS1TL						
Landuse	soybeans	corn	corn	corn	soybeans	corn
Pesticide Detected	atrazine	atrazine	alachlor	atrazine	no detects	no detects
Mean Concentration; ug/L	0.10	0.74	0.12	0.24		
Number of Samples (% detection)	5 (60%)	4 (75%)	1 (11%)	9 (22%)	4 (0%)	5 (0%)
Range in concentration; ug/L	0.10	0.12-1.10	0.12	0.18-0.30		
Pesticide Detected		metolachlor	atrazine	cyanazine		
Mean Concentration; ug/L		0.43	0.21	0.33		
Number of Samples (% detection)		4 (50%)	9 (78%)	9 (33%)		
Range in concentration; ug/L		0.42-0.43	0.13-0.34	0.19-0.41		
Pesticide Detected			cyanazine			
Mean Concentration; ug/L			0.13			
Number of Samples (% detection)			9 (11%)			
Range in concentration; ug/L			0.13			
THS2TL						
Landuse	corn/ soybeans	corn/ soybeans	corn	corn	soybeans/ oats	corn
Pesticide Detected	atrazine	atrazine	alachlor	no detects	no detects	atrazine
Mean Concentration; ug/L	0.13	0.25	0.17			0.11
Number of Samples (% detection)	3 (33%)	7 (71%)	9 (8%)	8 (0%)	6 (0%)	5 (20%)
Range in concentration; ug/L	0.13	0.12-0.55	0.17			0.11
Pesticide Detected		metolachlor	atrazine			
Mean Concentration; ug/L		0.12	0.12			
Number of Samples (% detection)		7 (14%)	13 (31%)			
Range in concentration; ug/L		0.12	0.11-0.13			
Pesticide Detected			cyanazine			
Mean Concentration; ug/L			0.13			
Number of Samples (% detection)			13 (15%)			
Range in concentration; ug/L			0.12-0.14			
Surface Water						
BGSW						
Pesticide Detected	no detects	alachlor	alachlor	atrazine	atrazine	no detects
Mean Concentration; ug/L		1.10	0.75	0.28	2.50	
Number of Samples (% detection)	4 (0%)	4 (25%)	14 (14%)	10 (40%)	1 (17%)	5 (0%)
Range in concentration; ug/L		1.10	0.19-1.30	0.25-0.30	2.50	

Site	1987	1988	1989	1990	1991	1992
Pesticide Detected		atrazine	atrazine			
Mean Concentration; ug/L		1.93	0.93			
Number of Samples (% detection)		4 (50%)	14 (50%)			
Range in concentration; ug/L		0.25-3.60	0.17-4.20			
Pesticide Detected		cyanazine	cyanazine			
Mean Concentration; ug/L		1.46	0.30			
Number of Samples (% detection)		4 (50%)	14 (36%)			
Range in concentration; ug/L		0.21-2.70	0.15-0.65			
Pesticide Detected		metolachlor	metolachlor			
Mean Concentration; ug/L		4.60	0.26			
Number of Samples (% detection)		4 (25%)	14 (21%)			
Range in concentration; ug/L		4.60	0.10-0.44			

APPENDIX III.

WATER-QUALITY DATA FROM BLUEGRASS WATERSHED FOR THE PRECIPITATION SAMPLER.

(Pesticide detections are shaded.)

DATE	Immuno Assay ALACHLOR µg/L	Immuno Assay ATRAZINE µg/L	Immuno Assay Sample Extract ALACHLOR µg/L	Immuno Assay Sample Extract ATRAZINE µg/L	HERBICIDES									
					Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L	Eptam µg/L
19-May-89 *					0.89	0.59	<0.1	1.80	1.30	1.20	0.72	<0.1	<0.1	1.80
28-May-89 *					0.18	0.18	<0.1	1.50	0.22	<0.1	0.20	<0.1	<0.1	
3-Jun-89 *					<0.1	0.79	<0.1	0.43	0.17	<0.1	0.14	0.11	<0.1	
22-Jun-89 *					0.13	0.13	<0.1	28.00	<0.1	<0.1	<0.1	<0.1	<0.1	0.13
25-Jun-89 *					<0.1	<0.1	<0.1	1.20	<0.1	<0.1	<0.1	<0.1	<0.1	
27-Jun-89 *					<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	
15-Jul-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
18-Jul-89 *					<0.1	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	
30-Jul-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
19-Aug-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
26-Aug-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
27-Aug-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
3-Sep-89 *					0.31	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
4-Sep-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
4-Sep-89 *					<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	
7-Sep-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
8-Sep-89 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
6-Oct-89 *					<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
4-May-90 *					1.80	0.54	<0.1	1.70	0.96	<0.1	<0.1	<0.1	<0.1	2.80
11-May-90 *					1.00	0.17	<0.1	0.50	0.50	<0.1	<0.1	<0.1	<0.1	
8-Jun-90 *					0.33	2.30	<0.1	1.10	0.26	<0.1	<0.1	0.32	<0.1	
14-Jun-90 *					<0.1	0.57	<0.1	<0.1	0.10	<0.1	0.16	0.53	<0.1	
15-Jun-90 *					0.24	0.18	<0.1	0.40	<0.1	<0.1	<0.1	<0.1	<0.1	
16-Jun-90 *					<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	
17-Jun-90 *					<0.1	0.20	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	
17-Jun-90 *					0.14	0.17	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	
22-Jun-90 *					<0.1	0.43	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
5-Jul-90 *					<0.1	0.29	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	
11-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
11-Jul-90 *					<0.1	0.42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
13-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
13-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
20-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	
26-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
26-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
28-Jul-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
19-Sep-90 *					<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
4-Oct-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
8-Oct-90 *					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
12-Apr-91			0.068	0.052	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	
20-Apr-91 *			0.020	0.013	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
27-Apr-91			0.067	0.196	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	
4-May-91 *			0.103	0.099	0.42	0.30	<0.1	0.24	0.90	<0.1	<0.1	<0.1	<0.1	

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

DATE		Immuno Assay ALACHLOR µg/L	Immuno Assay ATRAZINE µg/L	Immuno Assay Sample Extract ALACHLOR µg/L	Immuno Assay Sample Extract ATRAZINE µg/L	HERBICIDES---------- Alachlor µg/L	Atrazine µg/L	Butylate µg/L	Cyanazine µg/L	Metolachlor µg/L	Metribuzin µg/L	Pendimethalin µg/L	Propachlor µg/L	Trifluralin µg/L	Eptam µg/L
11-May-91		0.22	0.14												
19-May-91	*				0.154	0.35	0.49	<0.1	0.34	0.77	<0.1	<0.1	0.12	<0.1	1.20
28-May-91			0.82												
3-Jun-91	*				0.200	0.27	0.89	<0.1	0.41	0.49	<0.1	<0.1	0.16	<0.1	
8-Jun-91			1.35												
15-Jun-91	*				0.200	<0.1	0.46	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	
15-Jul-91					0.020	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	
29-Jul-91	*				0.020	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
12-Aug-91	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
3-Sep-91						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	
11-Oct-91	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
27-May-92			0.26												
23-Jun-92	*					<0.1	1.10	<0.1	0.31	<0.1	<0.1	<0.1	<0.1	<0.1	
3-Jul-92			0.27												
13-Jul-92	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
23-Jul-92	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
2-Aug-92	*					<0.1	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	
6-Aug-92	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
25-Aug-92	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
3-Sep-02	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
9-Sep-92	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
15-Sep-92						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	
28-Sep-92	*					<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	

* Also analyzed for, but not detected, were chlorpyrifos, diazinon, dimethoate, ethoprop, fonofos, malathion, parathion, phorate, and terbufos.

APPENDIX IV.

SUMMARY OF THE SOIL NITRATE-N DATA COLLECTED FROM FOUR LOCATIONS IN THE BLUEGRASS WATERSHED.

Sample depth interval (inches)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)
Field 1 (TH2)						
Landuse	corn	corn	corn	corn	corn	corn
Date Sampled	Nov 90	Apr 91 Set A	Apr 91 Set B	Apr 91 Composite	Jun 91	Oct 91
6	10.55	6.75	4.95	4.20	10.40	8.60
12	9.95	6.60	6.70	6.40	6.20	6.45
18	19.85	8.20	7.95	6.70	5.20	3.85
24	13.35	9.55	8.40	11.55	4.90	3.25
36	40.45	32.15	17.00	16.40	9.10	4.40
48	37.55	28.15	13.35			
60	8.95	4.05	<1			
72	<1	<1	1.75			
84		1.25	1.45			
96		1.25	1.10			
108		<1	<1			
120		<1	<1			
132		<1	<1			
Field 2 (TH3)						
Landuse	corn	soybeans	soybeans	soybeans	soybeans	soybeans
Date Sampled	Nov 90	Apr 91 Set A	Apr 91 Set B	Apr 91 Composite	Jun 91	Oct 91
6	9.85	10.90	2.75	2.90	3.10	5.05
12	10.95	8.60	8.20	5.60	4.30	4.05
18	10.20	6.65	5.80	10.20	7.05	2.50
24	10.15	3.75	4.60	12.90	6.25	1.30
36	10.60	4.90	6.25	6.15	6.10	<1
48	2.95	5.75	5.70			
60	3.80	3.85	4.60			
72	3.95	4.35	4.75			
84	3.95	4.65	4.40			
96		5.10	<1			
108		<1	<1			
120		<1	<1			
132		<1	<1			

Sample depth interval (inches)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)	Soil nitrate-N (mg/kg)
Field 3 (KH2)						
Landuse	corn	corn	corn	corn	corn	corn
Date Sampled	Nov 90	Apr 91 Set A	Apr 91 Set B	Apr 91 Composite	Jun 91	Oct 91
6	6.05	<1	24.30	1.50	9.05	8.60
12	2.15	1.70	29.40	3.45	8.20	5.50
18	<1	3.00	20.60	11.80	7.05	1.55
24	2.05	4.70	18.40	11.20	4.85	<1
36	4.95	3.65	13.05	10.90	4.15	<1
48	3.95	3.40	9.00			
60	3.70	4.65	7.05			
72	3.25	4.30	5.70			
84	3.65	4.70	5.35			
96		4.40	4.25			
108		4.40	6.30			
Field 4 (MNS)						
Landuse	corn	soybeans	soybeans	soybeans	soybeans	soybeans
Date Sampled	Nov 90	Apr 91 Set A	Apr 91 Set B	Apr 91 Composite	Jun 91	Oct 91
6	2.20	2.50	11.25	4.50	8.00	4.80
12	<1	7.35	8.80	6.70	8.20	2.65
18	3.85	5.10	7.45	5.45	4.45	<1
24	<1	3.05	2.05	5.55	4.30	<1
36	1.50	1.50	3.10	4.35	4.45	1.15
48	3.00	2.60	3.65			
60	4.45	3.20	3.50			
72	3.90	5.60	4.65			
84	4.50	6.10	5.35			
96		6.10	5.25			
108		5.45	2.95			
120		2.20				