Hydrologic Data for the Big Spring Basin, Clayton County, Iowa, Water Year 1991

By STEPHEN J. KALKHOFF and RONALD L. KUZNIAR

U.S. GEOLOGICAL SURVEY
Open-File Report 94-56

Prepared in cooperation with the
Iowa Department of Natural Resources (Geological
Survey Bureau)

Iowa City, Iowa
1994

U.S. DEPARTMENT OF THE INTERIOR

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U.S. GEOLOGICAL SURVEY

Gordon P. Eaton, Director

For additional information write to:

District Chief
U.S. Geological Survey
Rm. 269, Federal Building
400 South Clinton Street
Iowa City, Iowa 52244

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CONVERSION FACTORS, ABBREVIATIONS, AND VERTICAL DATUM

Multiply	By	To obtain
Length		
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
Area		
square foot (ft^2)	0.09290	square meter
square mile (mi^2)	2.590	square kilometer
Mass		
pound (lb)	453.6	gram
ton (short)	0.9072	megagram
ton per day (ton/d)	0.0105	kilogram per second
Flow		
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
Temperature		
degree Fahrenheit (^oF)	(1)	degree Celsius (^oC)

[1] $^oC = 5/9 (^oF - 32)$.
$^oF = 9/5 (^oC) + 32$.

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

Water year: A water year is a 12-month period, from October 1 through September 30, designated by the calendar year in which it ends. Years are water years in this report unless otherwise stated.

WATER-QUALITY ABBREVIATIONS

centibars (cbar)
micrograms per liter (µg/L)
milligrams per liter (mg/L)
microsiemens per centimeter at 25 degrees Celsius (µS/cm)

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ABSTRACT

Hydrologic data were collected in the Big Spring Basin located in Clayton County, Iowa, during the 1991 water year. The data were collected by the U.S. Geological Survey in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau, to provide information on variation and movement of agricultural chemicals in the hydrologic cycle in the basin. Precipitation, surface-water, and ground-water data were collected.

The largest amount of rainfall during water year 1991 (54.69 inches) was measured at the monitoring site on Unnamed Creek near Luana. The largest monthly rainfall (14.72 inches) occurred in June. Analyses of 39 rain samples indicated that calcium and sulfate were the predominant ions and that median concentrations of nitrate and ammonia as nitrogen were 0.36 and 0.49 mg/L (milligrams per liter), respectively.

Stream discharge, specific conductance, pH, and water temperature were monitored continuously, and monthly water-quality samples were collected at a site on Roberts Creek and at Big Spring. Nitrite plus nitrate as nitrogen concentrations in 27 samples from Roberts Creek at the point where it leaves the study area ranged from 1.8 to 22 mg/L. Herbicide concentrations in 26 samples from the Roberts Creek site ranged from less than 0.10 µg/L (micrograms per liter) to 43 µg/L. Alachlor was detected in 42 percent of the samples; atrazine in 92 percent; and cyanazine and metolachlor in 35 percent of the samples. The total suspended-sediment load discharged in Roberts Creek was about 160,000 tons. At Big Spring, the ground-water discharge point, the daily mean specific conductance ranged from 414 to 788 microsiemens per centimeter at 25 degrees Celsius, the daily median pH ranged from 6.7 to 7.1, and the daily mean water temperature ranged from 8.5 to 13.0 degrees Celsius. Concentrations of nitrite plus nitrate as nitrogen in 23 samples ranged from 4.2 to 17 mg/L. The total measured suspended-sediment discharged from Big Spring was about 17,000 tons. Alachlor was detected in 26 percent; atrazine in 100 percent; cyanazine in 26 percent, and metolachlor in 9 percent of the samples. The maximum atrazine concentration was 16 µg/L.

INTRODUCTION

There is interest nationally, as well as within the State of Iowa, to understand, quantify, and minimize the occurrence of agricultural chemicals in surface and ground water. In response to this interest, the Big Spring ground-water basin in Clayton County, Iowa, has become nationally known since 1980 for studies to improve ground-water quality through modification of agricultural practices. Numerous multidisciplinary studies that include agronomy, geology, hydrology, biology, and socioeconomics of the basin currently (1991) are being conducted.

The unique ground-water flow system in the Big Spring Basin aids in studying the movement of agricultural chemicals. Much of the ground water in the basin is intercepted by a moderately developed karst system within the Galena aquifer and is discharged at Big Spring. Thus, ground

water that discharges from Big Spring is composited from the entire basin. The extent of the ground-water drainage basin has been defined by dye tracing and potentiometric-surface mapping (Hallberg and others, 1983). Nearly all land in the basin is farmed and a clear link between agricultural chemicals and ground-water contamination has been established (Hallberg and others, 1983, 1984; Libra and others, 1986).

Beginning in October 1987, the U.S. Geological Survey, in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau, has collected water quantity and quality data in the Big Spring Basin. These data are needed to refine the understanding of the hydrologic cycle in the basin and the agricultural-chemical transport processes in the surface- and ground-water systems. The dynamic nature of surface- and ground-water flow in the basin requires that some facets of water quantity and quality be monitored continuously. The data collected in this study will aid the understanding of this flow system.

This report is the fourth in a series of data reports that present the data collected by the U.S. Geological Survey in the Big Spring Basin. Previous reports document data collected by the U.S. Geological Survey in water years 1988 (Kalkhoff, 1989), 1989 (Kalkhoff and Kuzniar, 1991), and 1990 (Kalkhoff and others, 1992).

Purpose and Scope

The purpose of this report is to present hydrologic data collected in the Big Spring Basin during water year 1991 by the U.S. Geological Survey. These data include information on the quantity and quality of precipitation, and of surface and ground water. The scope of data-collection activities includes measuring the input (precipitation) and the output (stream and spring discharge) from the hydrologic system. Also included are data from continuous monitoring of selected physical properties and water-quality constituents (water temperature, specific conductance, and pH) of the water leaving the system. In addition, suspended-sediment load leaving the basin was determined. Hydrologic data were collected in the Deer Creek subbasin to study surface- and ground-water relations.

Hydrologic data are summarized and presented graphically in the text and are tabulated in the hydrologic data section in the back of the report. Additional water discharge and chemistry data are collected by State, Federal, and university researchers through ongoing studies. This report does not include the additional data. A report detailing hydrogeologic observations from bedrock monitoring wells in the Big Spring Basin was released in water year 1991 by the Iowa Department of Natural Resources, Geological Survey Bureau (Rowden and Libra, 1990).

Study Area

The study area (fig. 1), located in Clayton County in northeastern Iowa, is a 103 mi^2 ground-water basin that drains through Big Spring (Hallberg and others, 1983). Streams in the study area include Roberts Creek and its major tributary, Silver Creek, which drain approximately 69 percent (70.7 mi^2) of the basin. The rest of the basin is drained by Howard Creek (approximately 18 mi^2), Hatchery Creek (8.8 mi^2), and several small intermittent streams. The hydrogeology of the Big Spring Basin is described in detail by Hallberg and others (1983) and will be briefly summarized here. Unconsolidated aquifers generally are found throughout the basin in loess and alluvial deposits. The Galena and the Saint Peter aquifers are in bedrock material that underlie the entire basin.

Methodology

Precipitation was measured at four monitoring sites (fig. 1). At three sites, DC5, RC2, and BOOGD, precipitation was recorded digitally every 15 minutes. At Big Spring, precipitation was recorded continuously.

Precipitation samples were collected automatically at Big Spring with a wet/dry precipitation collector. During periods of precipitation, a container was exposed to catch the rain or snow. Between rainfall occurrences the container was covered to avoid the collection of particulate matter. Containers were removed, and the contents

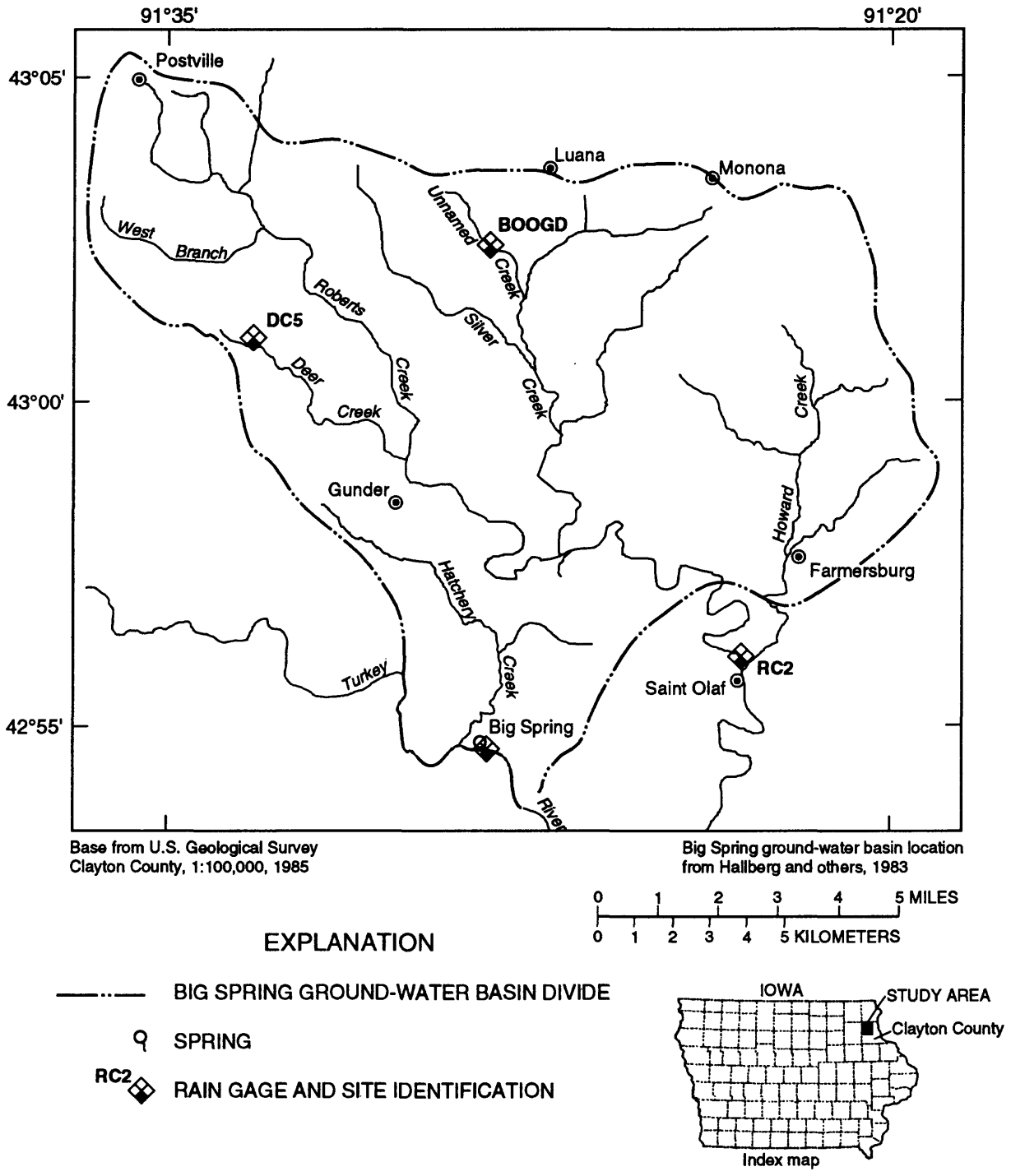


Figure 1. Location of Big Spring study area and rain gages.

analyzed weekly. Site operations are described by the National Atmospheric Deposition Program/National Trends Network (1988).

Water quality was monitored continuously in Roberts Creek above Saint Olaf (RC2), the primary surface-water discharge point, and at Big Spring, the primary ground-water discharge point (fig. 2). Continuous water-quality monitoring was discontinued at site RC2 on June 15, 1991, when floodwaters destroyed the instrument shelter. Water samples for chemical analyses were collected monthly and during periods of snowmelt and intense rainfall at two sites--Unnamed Creek near Luana (BOOGD) and Deer Creek near Postville (DC5). Stream and spring stage also were recorded continuously for later calculation of discharge and

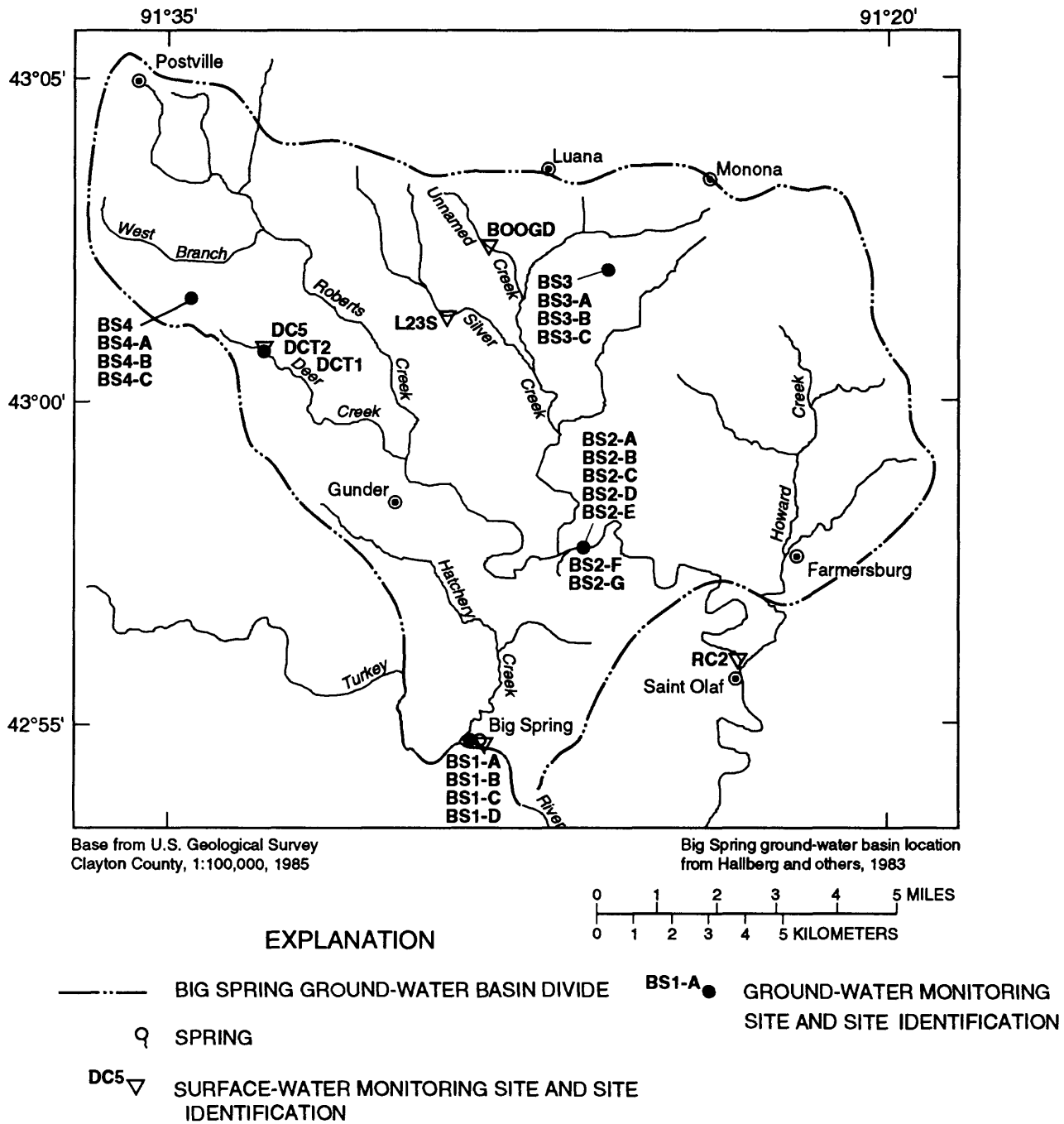


Figure 2. Location of surface- and ground-water-quality monitoring sites.

sediment load. Location data for the water-quality monitoring sites are shown in table 1 at the end of this report.

The physical properties and chemical constituents continuously monitored in Roberts Creek and Big Spring are specific conductance, pH, and water temperature. These constituents are measured using a multiple-parameter meter that digitally records readings at 15-minute intervals. The data are retrieved weekly by computer through a telephone modem. Values determined by the multiple-parameter meter were calibrated weekly against specific-conductance reference and pH buffer solutions. Temperature values were calibrated with a mercury thermometer. Stage was recorded continuously at stream sites DC5, RC2, L23S, and BOOGD with bubble-gage sensors and digital recorders (Rantz and others, 1982a, p. 32-39). Stage measurements were calibrated by comparison to permanent reference marks. Stream discharge was calculated from stage using stage-discharge relations (Kennedy, 1983, p. 30-32) or by using the theoretical-discharge equation for V-notch weirs (Rantz and others, 1982b, p. 305). Daily mean values were calculated from the 15-minute observations and permanently stored in the U.S. Geological Survey National Water Data Storage and Retrieval System (WATSTORE) data base. Stream discharge normally was measured by current-meter methods (Buchanan and Somers, 1969).

Water temperatures and dissolved-oxygen concentrations were measured in a flowing section of the stream or spring pool at the time of sample collection. Water temperatures were measured with a standard mercury or alcohol thermometer that had been compared with a laboratory-grade thermometer for accuracy. Dissolved-oxygen concentrations were measured with a dissolved-oxygen meter. The pH and specific conductance of the water were measured immediately after sample collection.

Suspended-sediment samples were collected periodically by local observers, technicians, and by automatic samplers during storms. The observers collected depth-integrated samples at one vertical in the center of flow using techniques described by Guy and Norman (1970). Samples were collected three times per week at Roberts Creek above Saint Olaf (RC2), intermittently at Unnamed Creek near Luana (BOOGD), and weekly at Big Spring.

Water levels in the principal water-supply aquifers in the basin were recorded at four well nests (table 2). At each well nest, water levels were recorded for the unconsolidated aquifers, the Galena aquifer, and the Saint Peter aquifer. Water levels were sensed by a float and then recorded hourly for subsequent storage in the WATSTORE data base. Seven additional wells were used to monitor water levels and water quality in the Deer Creek watershed. Water samples for chemical analyses were collected from wells after a minimum of three casing volumes had been pumped from the well or the well had been bailed dry and allowed to recover.

Water samples also were collected from lysimeters and tile lines to determine the ground-water quality in the Deer Creek watershed. Seven lysimeters were used to collect samples from the water table or unsaturated zone depending on the water level at the time of sampling in the Deer Creek watershed. Lysimeters DCLA through DCLD are located near Deer Creek in alluvium, and lysimeters DCLE through DCLG are located in the loess on the hillslope approximately 400 ft from Deer Creek. During water year 1991, lysimeters DCLA, DCLB, and DCLC always were in the saturated zone. DCLD was in the saturated zone from March 1991 through the middle of July. Lysimeters were evacuated to a vacuum of 60 to 70 cbar with a hand pump and allowed to equilibrate about 24 hours; this allowed water to flow into the lysimeter under partial vacuum conditions. The sample was removed by purging with air. Tile lines were sampled at two sites (DCT1 and DCT2).

Samples for chemical analyses were prepared as described in table 3 for shipment to the laboratory. Analyses of water samples by the University of Iowa Hygienic Laboratories in Iowa City and Des Moines, Iowa, followed the analytical methods listed in table 3.

Suspended-sediment concentrations were determined by the U.S. Geological Survey Sediment Laboratory in Iowa City, Iowa, using standard filtration and evaporation methods (Guy, 1969).

In this report, a shorthand terminology is used to describe the results of the chemical analyses for nitrogen species and herbicides. The results of the

analyses of the nitrogen species are reported in concentrations as nitrogen for nitrite plus nitrate, ammonia, and organic nitrogen. To save space and yet show that the results are concentrations as nitrogen, "nitrate-N" is used for nitrate plus nitrite as nitrogen; "ammonia-N" is used for ammonia as nitrogen, and "organic-N" is used for organic nitrogen. A fraction of the herbicides in a sample generally are lost during the extraction procedure. Therefore, results of the analyses are reported as total-recoverable concentrations. No attempt was made to correct herbicide concentrations for extraction loss.

Acknowledgments

This study was supported, in part, by the Iowa Department of Natural Resources, Geological Survey Bureau, through the Big Spring Basin Demonstration Project, with funds provided from the Iowa Groundwater Protection Act. George Hallberg, coordinator of the Big Spring Basin Demonstration Project, and other members of the Iowa Department of Natural Resources, Geological Survey Bureau, Robert Libra, Debra Quade, and Robert Rowden provided technical advice and field support. Jerry Spykerman, manager of the Big Spring Fish Hatchery, provided support for data collection at the spring and collected precipitation samples. Area residents, Leann Hilgerson, Karen and Eugene Voss, and Jerry Koonze collected sediment samples.

HYDROLOGIC DATA SUMMARY

Precipitation

Precipitation data for site DC5 is complete except for 5 days in March. Precipitation data for Unnamed Creek near Luana are complete except for a 9-day period from May 9 through 18 due to equipment malfunction, and precipitation data for Roberts Creek above Saint Olaf (RC2) are complete except for a 5-day period from June 15 through 19. Precipitation was measured and sampled 46 of 52 weeks at Big Spring during water year 1991(O'Connell and others, 1991). Data were not collected from June 11 to July 23 because the rain gage and sampler were damaged by floodwaters from the Turkey River.

Quantity

Rainfall for the 46 weeks that data were collected at Big Spring totaled 32.67 in. with a median weekly rainfall of 0.44 in. (table 4). During the period the gage was not in operation, 11.42 and 16.98 in. were recorded at sites DC5 and BOOGD in the Big Spring Basin.

Precipitation at Deer Creek near Postville (DC5), Unnamed Creek near Luana (BOOGD), and Roberts Creek above Saint Olaf (RC2) is listed in table 5. The rainfall measured for water year 1991 was 37.63 in. at site DC5, 54.69 in. at site BOOGD, and 40.37 in. at site RC2. The largest monthly rainfall occurred in June when 14.72 in. fell at site BOOGD and 9.93 in. fell at site DC5. The largest daily rainfall at site BOOGD was 11.98 in. on June 14, 1991.

Quality

Weekly precipitation samples were collected during 39 weeks when measurable rainfall occurred at Big Spring. Results of chemical analyses of these samples are summarized in table 4. The median concentration of the predominant cation, calcium, was 0.47 mg/L, and the median concentration of the predominant anion, sulfate, was 1.5 mg/L. The median concentrations of nitrate-N and ammonia-N were 0.36 and 0.49 mg/L, respectively. Maximum concentrations of all major ions were less than 10 mg/L.

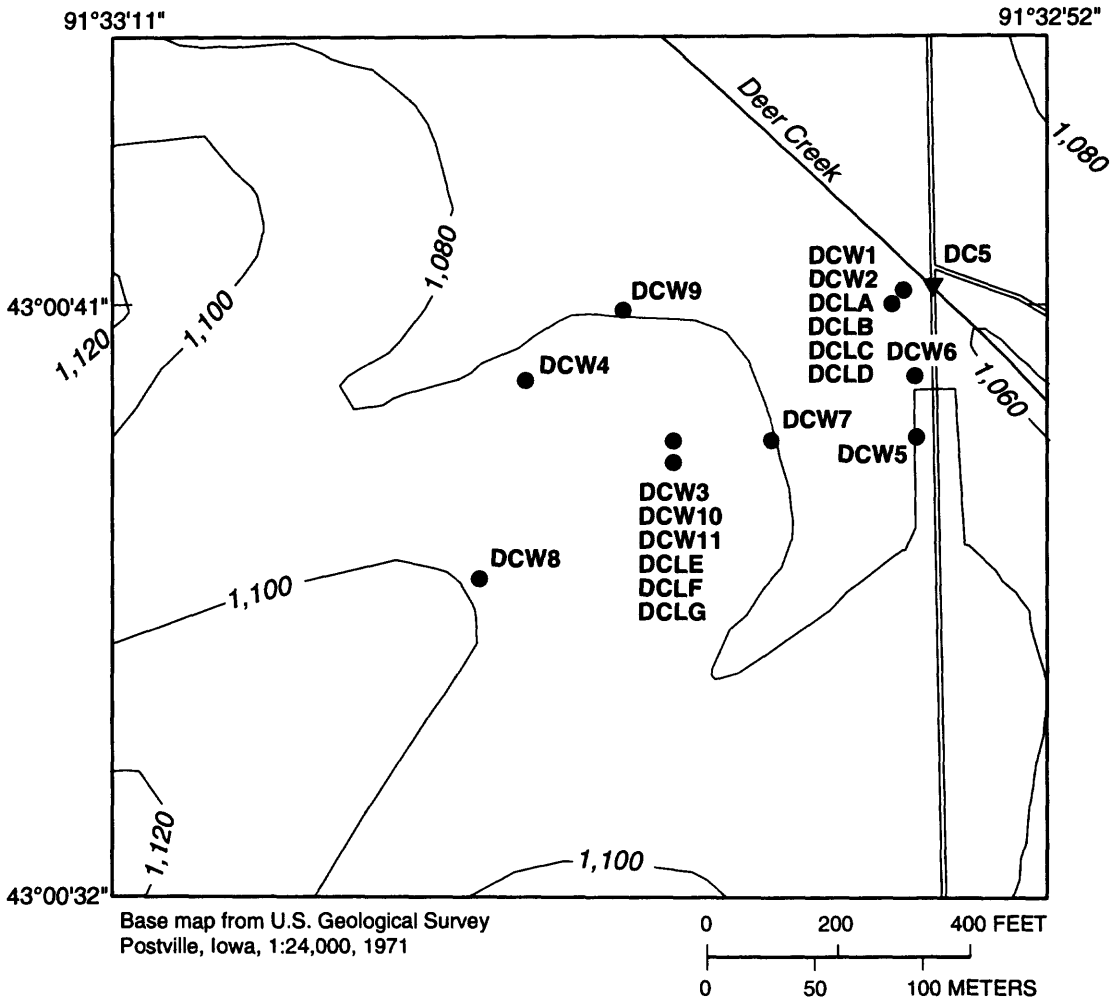
Surface Water

Deer Creek

Discharge and water-quality data were collected at site DC5 on Deer Creek (fig. 3) to determine the relation between surface and ground water in this 1.1 mi^2 watershed.

Discharge

Stream discharge data were continuously recorded except for the periods from March 9 through 12 and June 14 through 19 when the instrumentation was not operational because of



EXPLANATION

—*1,080*— TOPOGRAPHIC CONTOUR--Shows altitude of land surface. Contour interval 20 feet. Datum is sea level

DCW1● GROUND-WATER MONITORING SITE AND NUMBER

DC5▼ SURFACE-WATER MONITORING SITE AND NUMBER

Figure 3. Location of surface- and ground-water monitoring sites in part of the Deer Creek watershed.

flooding (table 6). Daily mean discharge recorded at site DC5 ranged from 0.10 ft^3/s on February 14 and 15 to 3.1 ft^3/s on April 15, 1991. The largest recorded daily mean discharge was 3.1 ft^3/s. However, the largest daily mean discharge for the water year actually occurred after the greatest daily rainfall (table 5) on June 14, which caused flooding and destroyed the recording equipment. Mean monthly discharge for months that have complete record ranged from 0.14 ft^3/s in February to 1.21 ft^3/s in April 1991.

Water Quality

The specific conductance at site DC5 on Deer Creek ranged from 350 to 660 µS/cm, pH from 7.2 to 8.2 standard units, and dissolved oxygen from 6.2 to 14.1 mg/L (table 7). Nitrate-N was the predominant nitrogen species in 21 of 22 samples, and organic-N was the predominant nitrogen species in one sample (table 8). Nitrate-N concentrations ranged from 0.80 to 12 mg/L. Organic-N concentrations ranged from 0.20 to 17 mg/L.

Three herbicides, alachlor, atrazine, and metolachlor, were detected in 14 of the 22 samples collected at site DC5 on Deer Creek (fig. 4 and table 9). Alachlor concentrations ranged from less than the detection limit (0.10 µg/L) to 0.34 µg/L and were greater than the detection limit in 9 percent of the samples. Atrazine concentrations ranged from less than the detection limit (0.10 µg/L) to 11 µg/L and were equal to or greater than the detection limit (0.10 µg/L) in 64 percent of the samples. Metolachlor concentrations ranged from less than the detection limit (0.10 µg/L) to 11 µg/L and were equal to or greater than the detection limit in about 23 percent of the samples. Butylate, cyanazine, metribuzin, and trifluralin were not detected.

Silver Creek

The maximum daily mean discharge (431 ft^3/s) at site L23S on Silver Creek was recorded on June 15, 1991, and the minimum daily mean discharge (0.22 ft^3/s) was recorded on December 5, 1990 (fig. 5 and table 10). The maximum instantaneous discharge for the period of record (3,300 ft^3/s) was recorded on June 15, 1991. This peak discharge is 1.23 times the 100-year recurrence interval (O'Connell and others, 1991). Daily mean discharge exceeded 10 ft^3/s about 5 percent of the year; 1.0 ft^3/s about 55 percent; and 0.10 ft^3/s, 100 percent (fig. 6). The median daily discharge was 1.3 ft^3/s.

Unnamed Creek

Discharge

Generally, there was no streamflow in Unnamed Creek at site BOOGD from October 30, 1990, through February 28, 1991 (table 11). The maximum daily mean discharge at site BOOGD was 100 ft^3/s on June 15, 1991. The maximum instantaneous discharge (880 ft^3/s) for the period of record was recorded on June 15, 1991. This peak discharge has a calculated recurrence interval of 25 years (O'Connell and others, 1991) Daily mean discharge exceeded 10 ft^3/s about 2 percent of the year, 1.0 ft^3/s about 27 percent, and 0.10 ft^3/s approximately 50 percent. There was no streamflow during 33 percent of the days during water year 1991.

Water Quality

The specific conductance in 16 samples ranged from 265 to 793 µS/cm, pH from 7.1 to 8.1 standard units, and dissolved oxygen from 7.5 to 11.8 mg/L (table 7). Nitrate-N concentrations ranged from 4.2 to 27 mg/L. Ammonia-N concentrations ranged from less than 0.10 to 0.60 mg/L. Organic-N concentrations ranged from less than 0.10 to 2.7 mg/L.

Herbicides were detected in 15 of 16 samples from site BOOGD (table 9). Alachlor was detected in 25 percent of the samples, atrazine in about 94 percent, cyanazine in about 38 percent of the samples, and metolachlor in about 12 percent of the samples. Alachlor concentrations ranged from less than 0.10 to 2.4 µg/L, atrazine from less than 0.10 to 9.0 µg/L, cyanazine from less than 0.10 to 2.6 µg/ L, and metolachlor from less than 0.10 to 0.3 µg/L.

Measured daily-mean suspended-sediment concentrations ranged from 7.0 mg/L on April 26, 1991, to 2,170 mg/L on June 14, 1991. The suspended-sediment load ranged from 0 on days of no streamflow to 1,060 ton/d on June 14 (fig. 7 and table 12). The suspended-sediment discharged during 2 days, June 14 and 15, was about

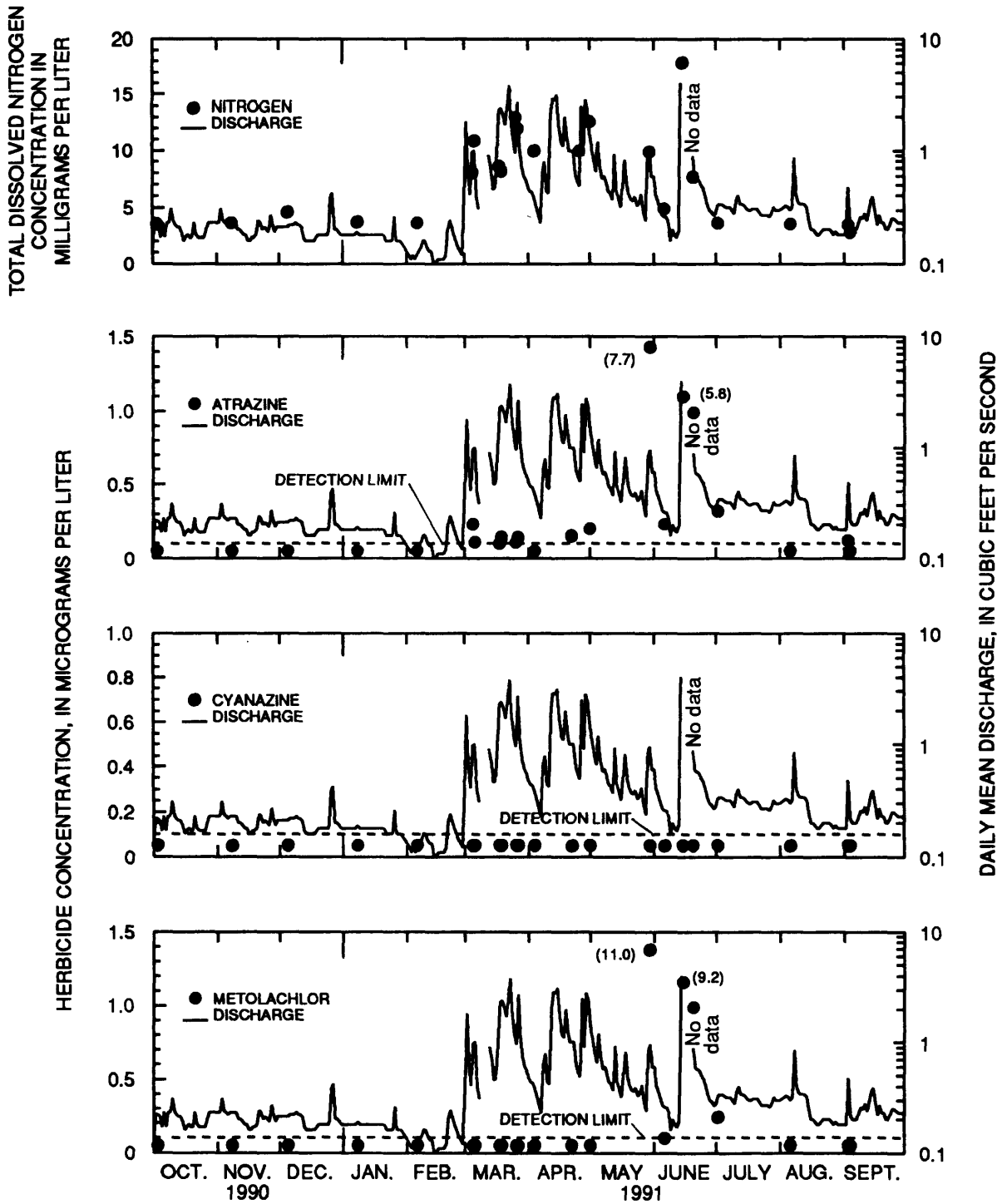


Figure 4. Concentrations of selected chemical constituents in surface-water samples and stream discharge at site DC5, Deer Creek near Postville, Iowa, water year 1991.

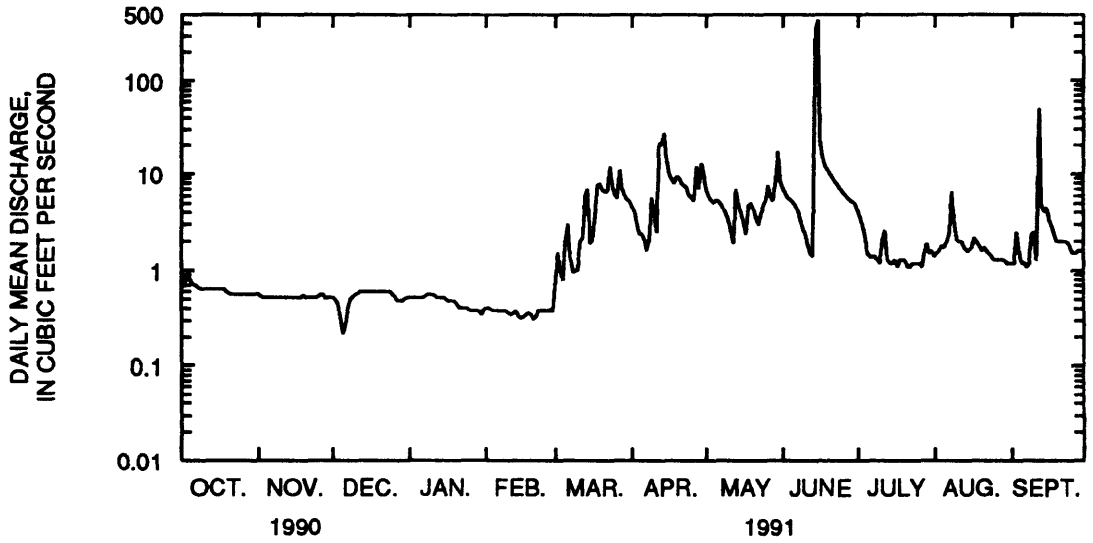


Figure 5. Daily mean discharge at site L23S, Silver Creek near Luana, Iowa, water year 1991.

77 percent of the total suspended-sediment load for water year 1991.

Roberts Creek

Discharge

Daily mean discharge at site RC2 on Roberts Creek is listed in table 13 and illustrated in figure 8. The median discharge at site RC2 for the 1991 water year was 3.3 ft^3/s. Maximum daily mean discharge (7,090 ft^3/s) occurred on June 15, 1991. The maximum instantaneous discharge was 19,600 ft^3/s at 3:30 a.m. on June 15, 1991. No streamflow was recorded during 6 days in September 1991. Flow duration is shown in figure 6. Mean daily discharge exceeded 0.10 ft^3/s approximately 87 percent of the time during water year 1991, exceeded 1.0 ft^3/s approximately 59 percent of the time, and exceeded 10 ft^3/s approximately 39 percent of the time.

Water Quality

The specific conductance, pH, and water temperature were monitored continuously during about 37 percent of the water year. The maximum daily mean specific conductance during water year 1991 was 788 µS/cm recorded on November 10 and 11, 1990 (table 13). The minimum daily mean specific conductance (580 µS/cm) was recorded on March 22, 1991. Daily median pH varied from 7.1 on November 8, 1990, to 8.5 on 2 days in April and 3 days in May 1991 (table 14). The daily mean water temperature varied from 0.5 °C (degrees Celsius) on December 2 and 3, 1990, to 31.5°C on May 29.

Twenty-seven samples were collected from site RC2 on Roberts Creek for the analyses of nitrogen, phosphorus, and carbon species (table 8). Total nitrate-N concentrations were greater than the detection limit (0.10 mg/L) in all samples and greater than 10 mg/L in 56 percent of the samples. Nitrate-N concentrations ranged from 1.8 to 22 mg/L. Ammonia-N was detected in 59 percent of the samples. Total ammonia-N concentrations ranged from less than 0.10 to 1.4 mg/L. Total organic-N concentrations ranged from 0.30 to 22 mg/L. Total orthophosphorus concentrations ranged from less than 0.10 to 0.80 mg/L.

Twenty-six samples were collected from site RC2 for the analyses of seven herbicides. Four of the seven herbicides were detected (concentration greater than 0.10 µg/L). Alachlor was detected in 42 percent of the samples, atrazine in 92 percent, and cyanazine and metolachlor in about 35 percent of the samples (table 9). Butylate, metribuzin, and trifluralin were not detected. Alachlor concentrations ranged from less than 0.10 to 29 µg/L, atrazine from less than 0.10 to 43 µg/L, cyanazine

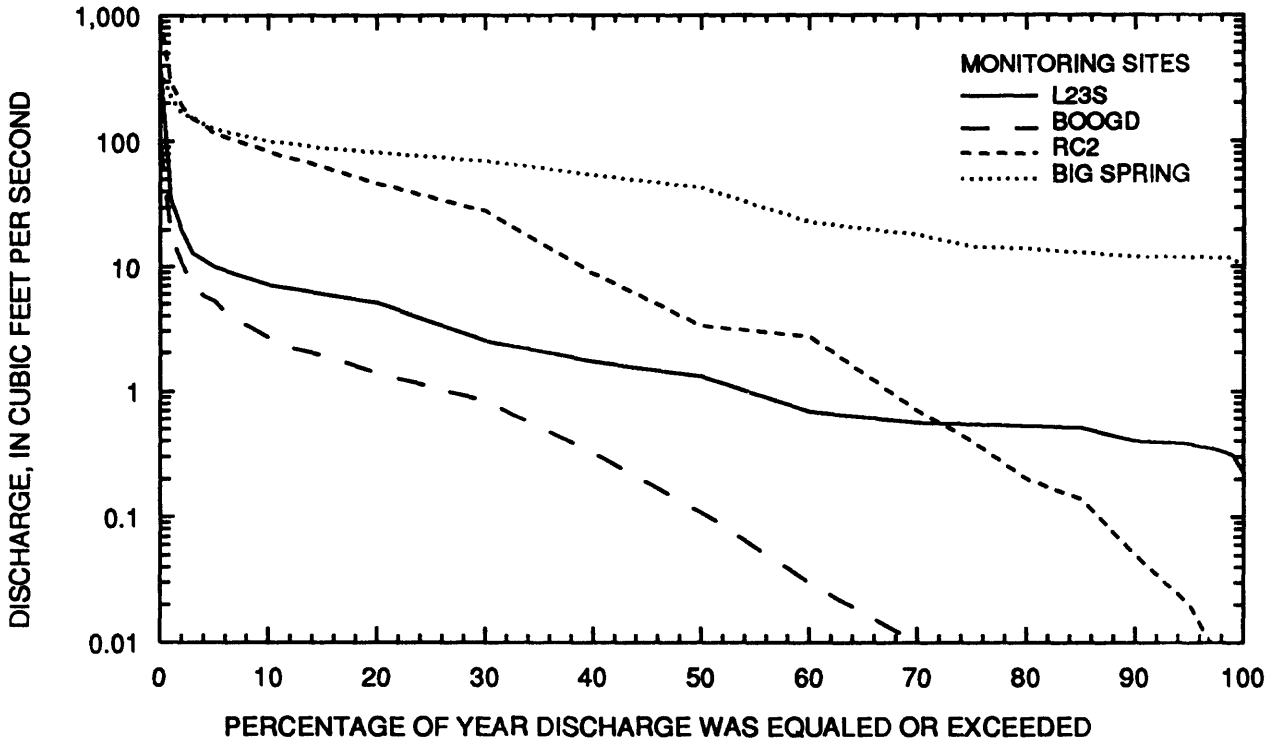


Figure 6. Flow duration at monitoring sites in Big Spring study area, water year 1991.

from less than 0.10 to 6.6 µg/L, and metolachlor from less than 0.10 to 6.7 µg/L.

The daily mean suspended-sediment concentration at site RC2 ranged from 6.0 mg/L on 6 days in December 1990, to 5,340 mg/L on June 15, 1991. The daily mean suspended-sediment loads ranged from less than 0.01 ton/d on many days during the winter (December, January, and February) to 144,000 ton/d on June 15, 1991 (fig. 7 and table 15) following the greatest rainfall during the water year. The largest monthly sediment load also was measured in June (about 150,000 tons). The suspended-sediment discharged during June 14 and 15, 1991 (about 148,000 tons) was about 93 percent of the total suspended-sediment load for water year 1991 (about 160,000 tons).

Ground Water

Water levels were recorded continuously at six wells screened in unconsolidated material in the Big Spring Basin. Well BS1-A is screened in alluvial material in the Turkey River Valley, well BS3-C in weathered limestone and loess, wells BS4-B and BS4-C in glacial drift, well DCW1 in Deer Creek alluvial material, and well DCW10 in loess. Water levels in the bedrock Galena aquifer were recorded continuously at four monitoring wells (BS1-B, BS2-E, BS3-A, and BS4-A), and water-quality data were collected at the ground-water discharge point, Big Spring. Water levels in the Saint Peter aquifer were monitored continuously at two wells (BS2-G and BS4), and two wells (BS1-D and BS3) were measured monthly (table 16).

Unconsolidated Aquifers

The highest water levels in the unconsolidated aquifers generally were recorded in June 1991 (table 17). The highest recorded water levels in water year 1991 were 6.22 ft below land surface in well BS1-A, 7.77 ft below land surface in well BS3-C, 70.30 ft below land surface in well BS4-B, 53.56 ft below land surface in well BS4-C, 2.90 ft below land surface in well DCW1, and 0.29 ft below land surface in well DCW10. The water level in well BS1-A (fig. 9) was the highest in April 1991 (6.22 ft below land surface) and the lowest in December 1990 (13.71 ft below land surface). Data were lost from well BS1-A from June 15 through June 25, 1991, because the recorder was inundated when the Turkey River flooded. The lowest water level in well BS3-C was 15.36 ft below land surface on November 7, 1990,

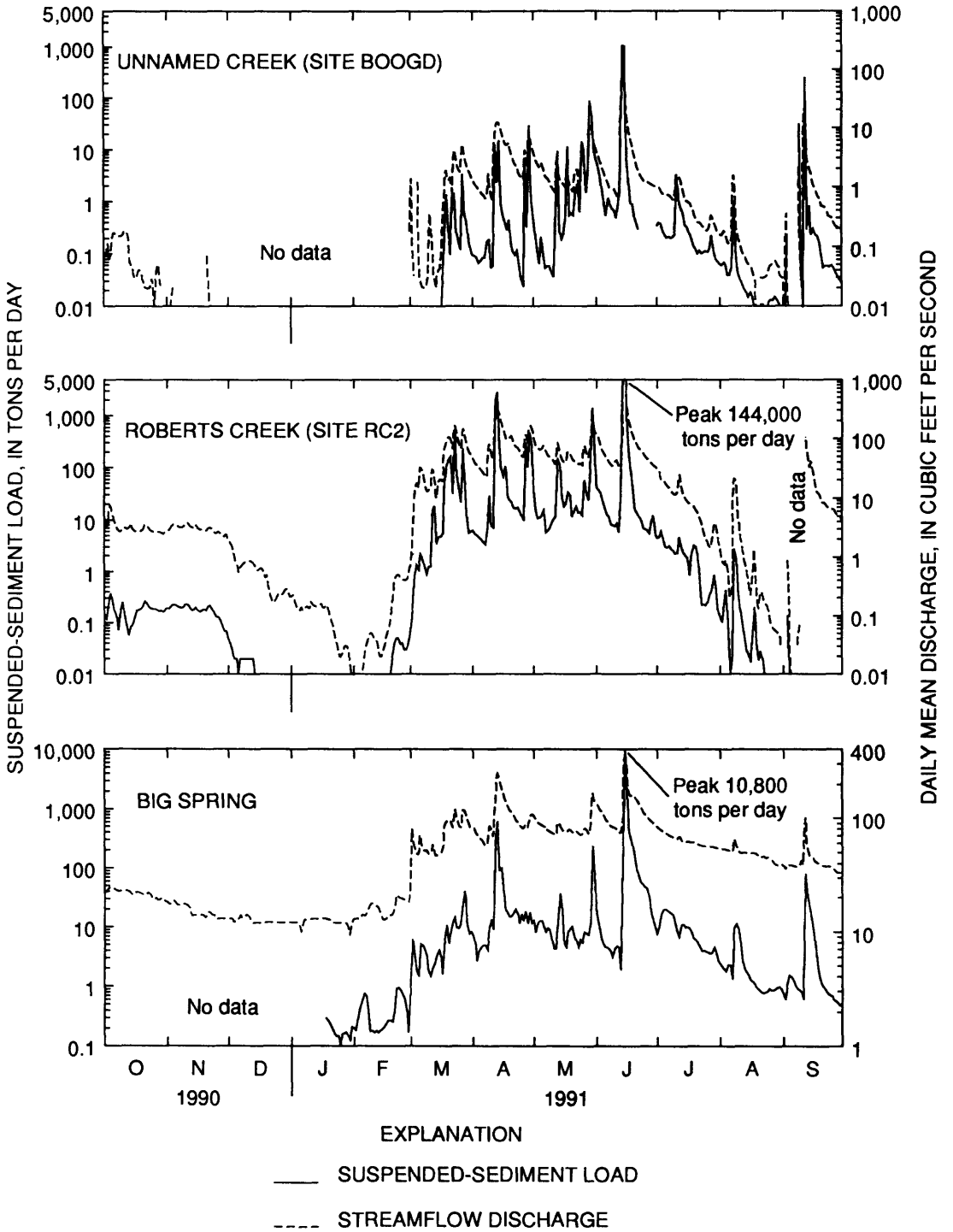


Figure 7. Suspended-sediment load and discharge at three monitoring sites in the Big Spring study area, water year 1991.

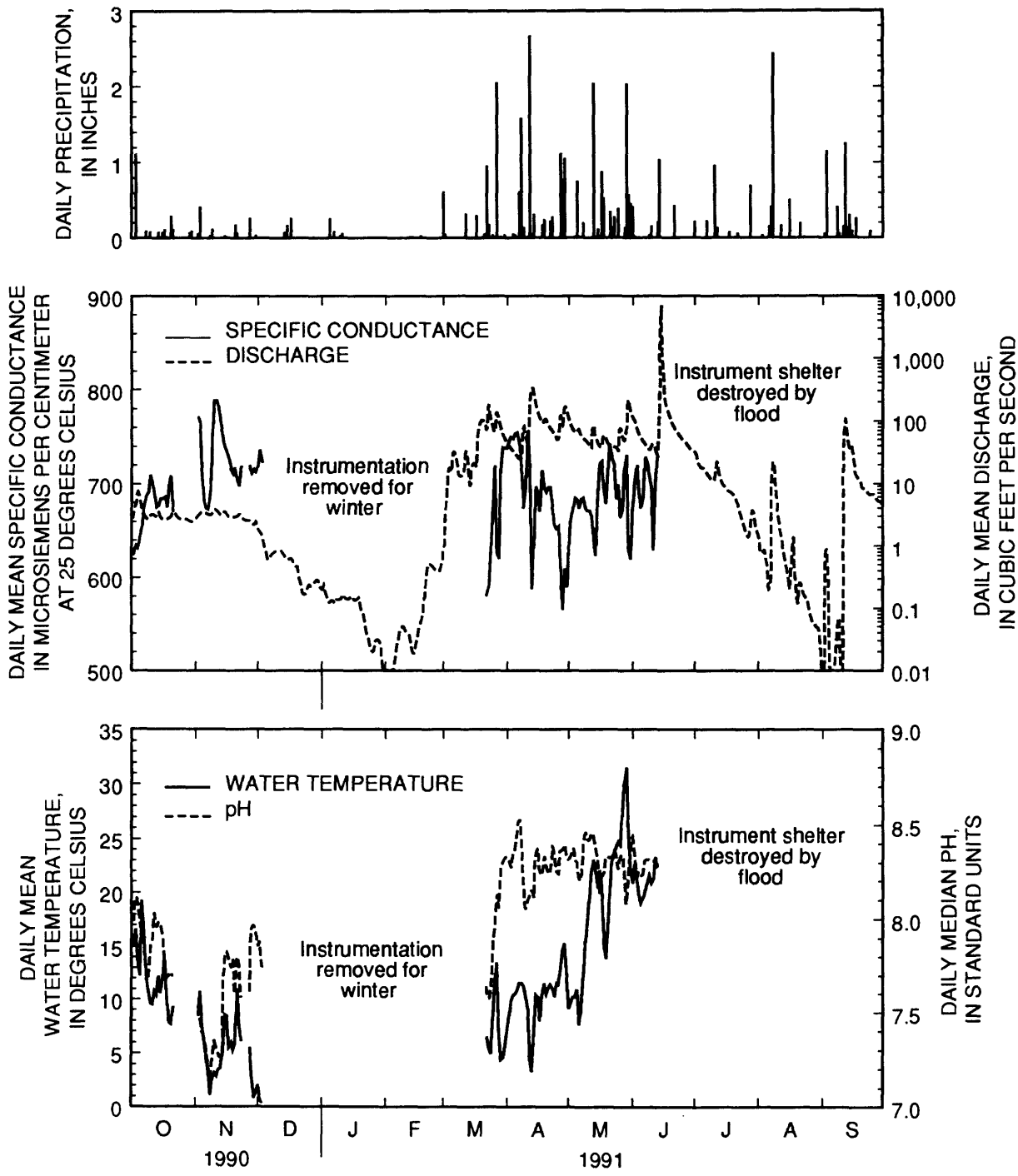


Figure 8. Daily precipitation, daily mean specific conductance, discharge, water temperature, and daily median pH at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991.

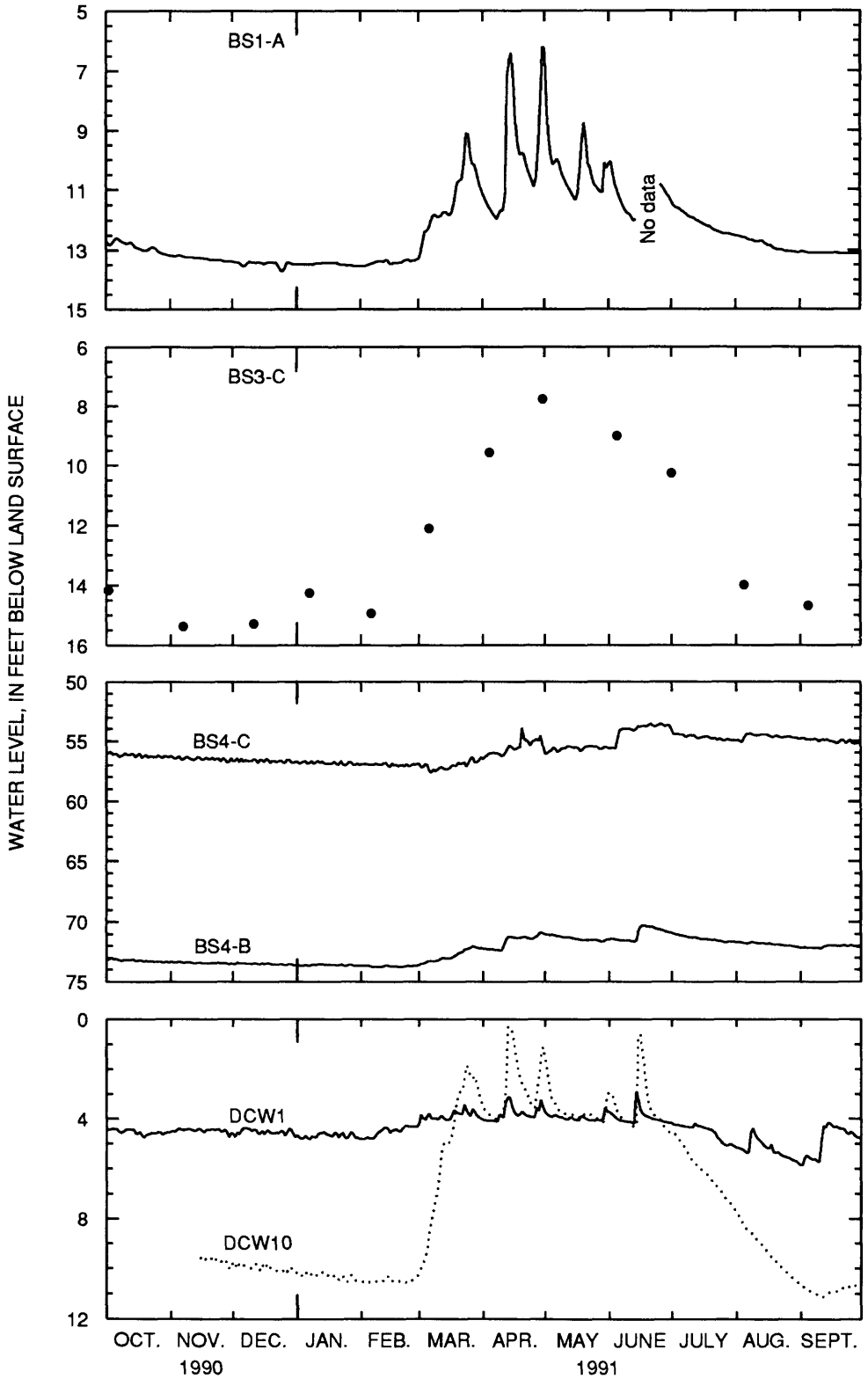


Figure 9. Water levels in unconsolidated aquifers in the Big Spring Basin, water year 1991.

and the water level in well BS4-B was lowest (73.77 ft below land surface) on February 20, 1991. The lowest water level in well BS4-C was 57.63 ft below land surface; in well DCW1, 5.86 ft below land surface; and in well DCW10, 11.15 ft below land surface.

As part of an investigation to study the relation between shallow ground water and surface water, samples were collected for chemical analyses from five wells (DCW2, DCW3, DCW7, DCW8, and DCW11) and seven suction lysimeters (DCLA to DCLG) completed in unconsolidated material in the Deer Creek watershed. Discharge from a tile line that drains unconsolidated material in the Deer Creek watershed also was sampled (DCT2). The location and well-construction data for the wells and lysimeters are given in table 2. Onsite determinations of selected water-quality constituents in water from the wells, tile lines, and the lysimeters are listed in table 18.

Onsite measurements of selected water-quality constituents were made for 12 samples collected from each of wells DCW2 and DCW3, 5 from well DCW7, 6 from well DCW8, and 7 samples from well DCW11 (table 18). Nitrogen, phosphorous, and carbon species, and seven herbicides also were analyzed for the 42 well samples (tables 19 and 20). The following discussion summarizes the results from all 42 samples. Nitrate-N was detected in 69 percent of the samples, and concentrations ranged from less than 0.10 to 33 mg/L. Ammonia-N was detected in 76 percent of the samples, and concentrations ranged from less than 0.10 to 1.5 mg/L. Organic-N was detected in 83 percent of the samples, and concentrations ranged from less than 0.10 to 8.8 mg/L. Orthophosphorus concentrations were less than the detection limit (0.10 mg/L) in about 45 percent of the samples. Alachlor was detected in two samples, atrazine was detected in 31 percent of the samples, and metolachlor was detected in 14 percent of the well samples. The atrazine concentrations ranged from less than 0.10 to 8.3 µg/L, and metolachlor concentrations ranged from less than 0.10 to 4.0 µg/L.

Nitrate-N concentrations in water from the deepest lysimeters, DCLA and DCLB, near Deer Creek were less than or at the detection limit (0.10 mg/L) in all samples (table 19). Nitrate-N concentrations in the two shallowest lysimeters, DCLC and DCLD, located near Deer Creek were greater than the detection limit in all samples and ranged from 0.20 to 63 mg/L. Nitrate-N concentrations in samples from DCLC ranged from 0.20 to 8.3 mg/L, and concentrations in samples from DCLD ranged from 16 to 63 mg/L. Nitrate-N concentrations in samples from the lysimeters located on the hillslope, DCLE through DCLG, were greater than 10 mg/L. Nitrate-N concentrations in the lysimeter 10 ft below land surface (DCLE) ranged from 13 to 16 mg/L, in the lysimeter 7.0 ft below land surface ranged from 39 to 47 mg/L, and in the lysimeter 4.0 ft below land surface ranged from 100 to 140 mg/L.

Ammonia-N concentrations were less than the detection limit (0.10 mg/L) in 72 percent of 53 samples from all lysimeters. Ammonia-N concentrations exceeded 0.20 mg/L in only one sample. Organic-N concentrations in the seven lysimeters ranged from less than 0.10 to 1.1 mg/ L. Total nitrogen concentrations (nitrate-N, ammonia-N, and organic-N) in samples from the lysimeters located near Deer Creek (alluvium) are shown in figure 10, and those located on the hillslope (loess) are shown in figure 11.

One of the seven analyzed herbicides, atrazine, was detected in lysimeters DCLA and DCLC installed at 8.5 and 5.5 ft below land surface near Deer Creek (table 20). Atrazine was detected in about 31 percent of the 27 samples from the three deepest lysimeters. The maximum concentration was 0.25 µg/L. Both atrazine and metolachlor were detected in samples from lysimeter DCLD installed at 4.0 ft below land surface. Atrazine was detected in all samples from lysimeter DCLD in concentrations from 0.58 to 1.6 µg/L, and metolachlor was detected in three samples in concentrations ranging from 0.12 to 0.37 µg/L. Atrazine and metolachlor were the only herbicides detected in samples from the hillslope lysimeters (DCLE through DCLG). Atrazine concentrations in samples from these lysimeters ranged from less than 0.10 to 0.91 µg/L. Metolachlor concentrations ranged from less than 0.10 to 0.27 µg/L Atrazine and metolachlor concentrations in lysimeter water samples are shown in figures 12 to 15.

Eleven ground-water samples were collected at site DCT2 and one sample was collected from site DCT1 in the Deer Creek watershed for the analyses of nitrogen, phosphorus, and carbon

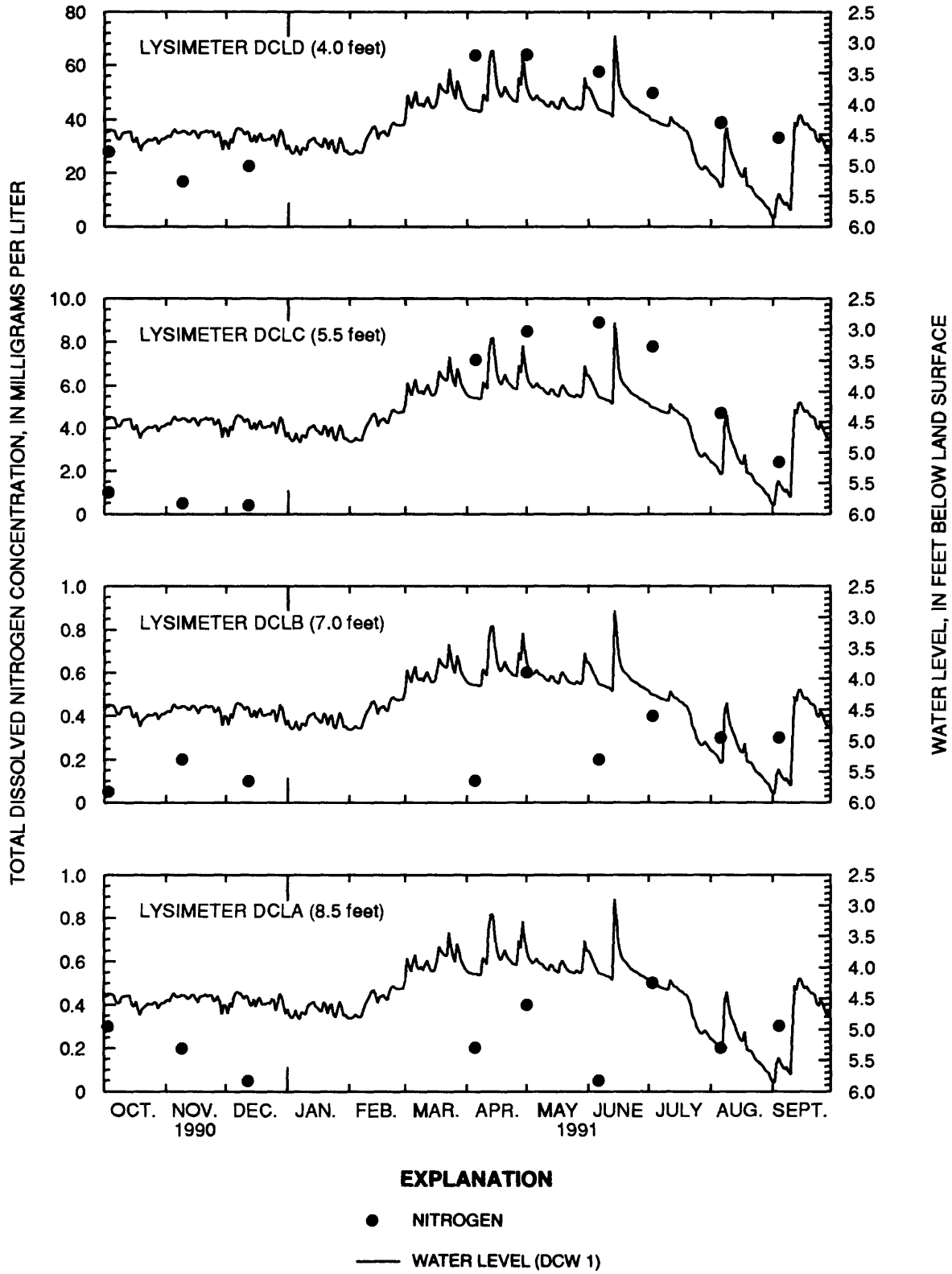


Figure 10. Total dissolved nitrogen and the water level in the alluvium in the Deer Creek watershed, water year 1991.

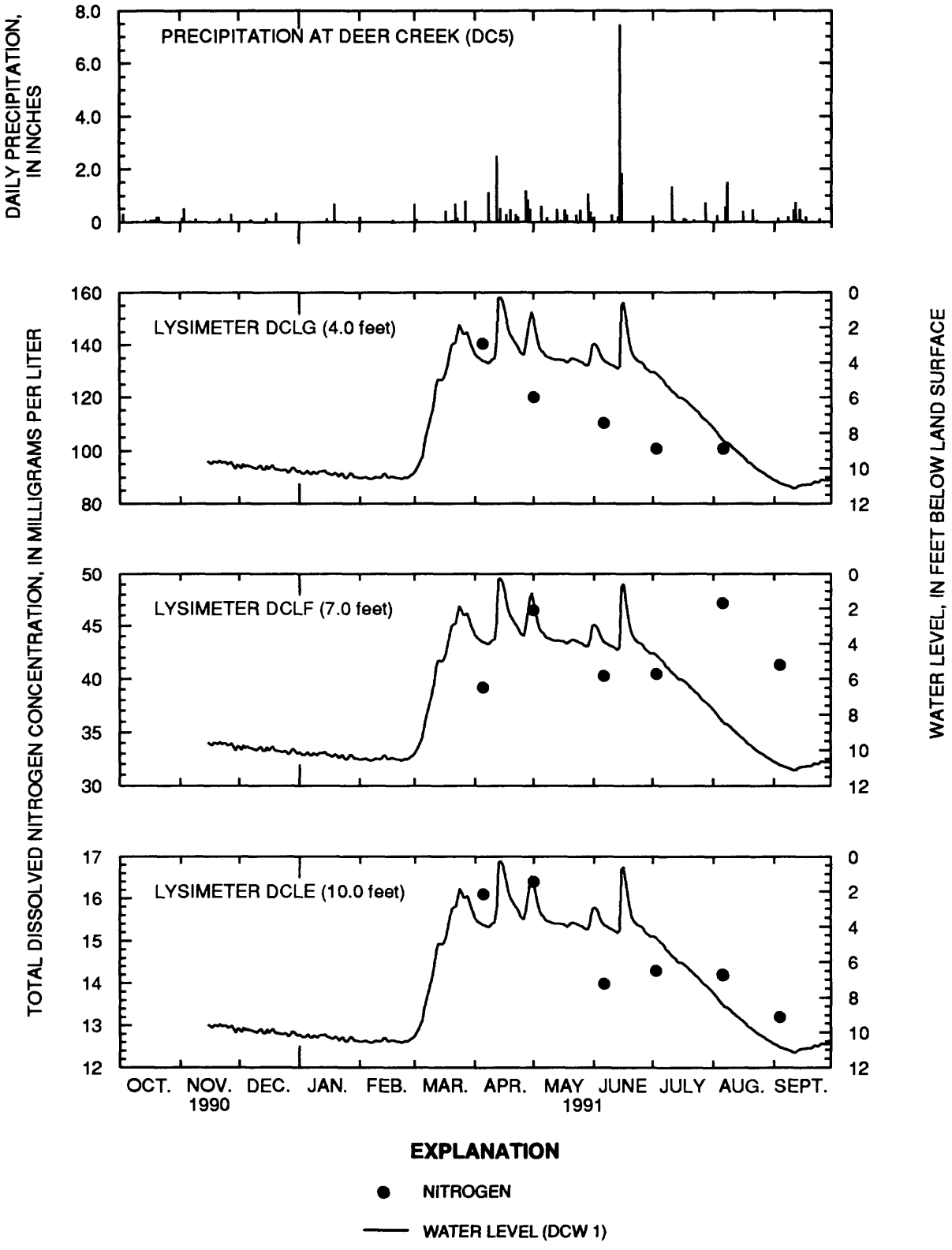


Figure 11. Daily precipitation, total dissolved nitrogen, and the water level in the loess at a site in the Deer Creek watershed, water year 1991.

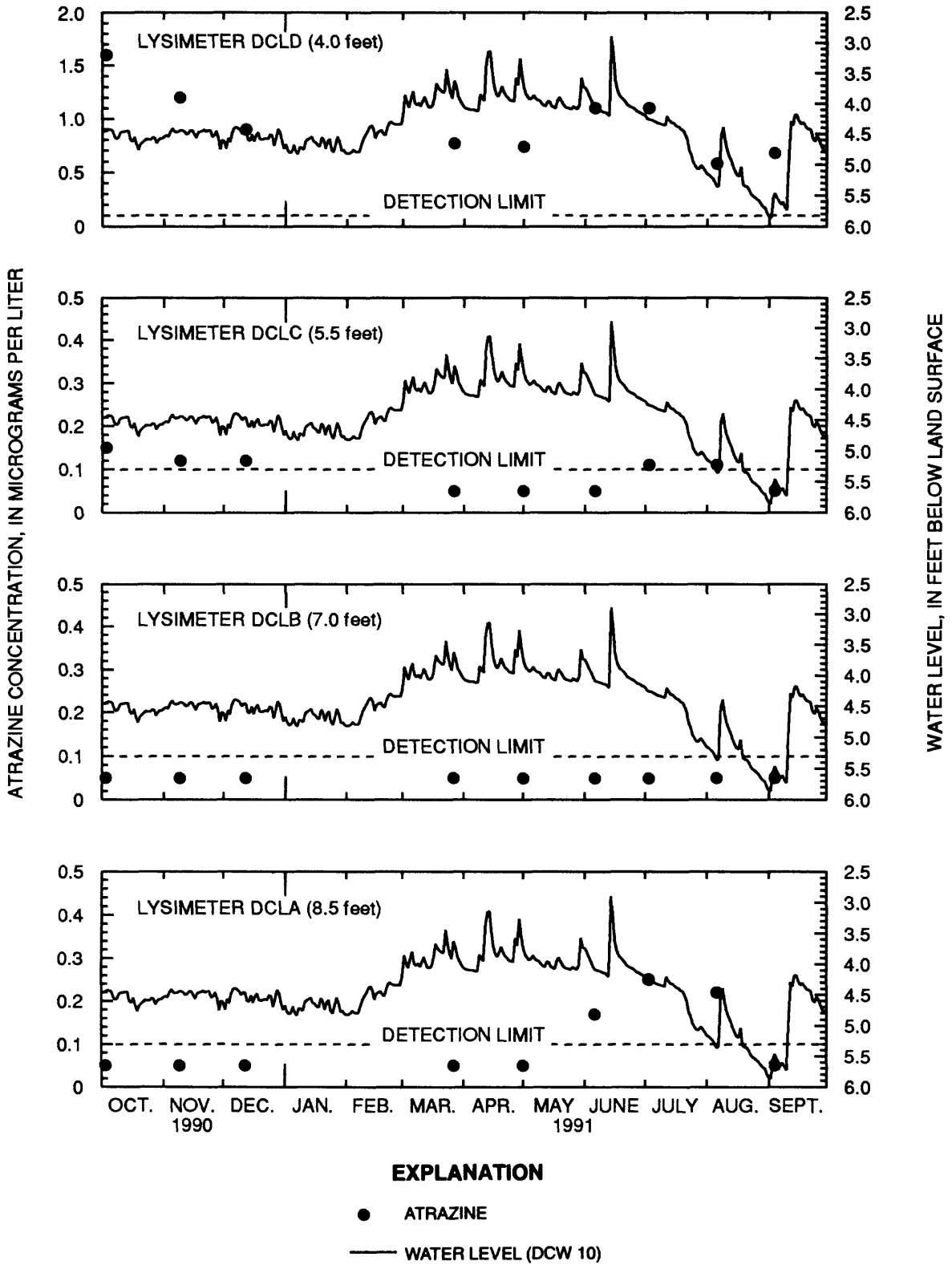


Figure 12. Total-recoverable atrazine and the water level in alluvium in the Deer Creek watershed, water year 1991.

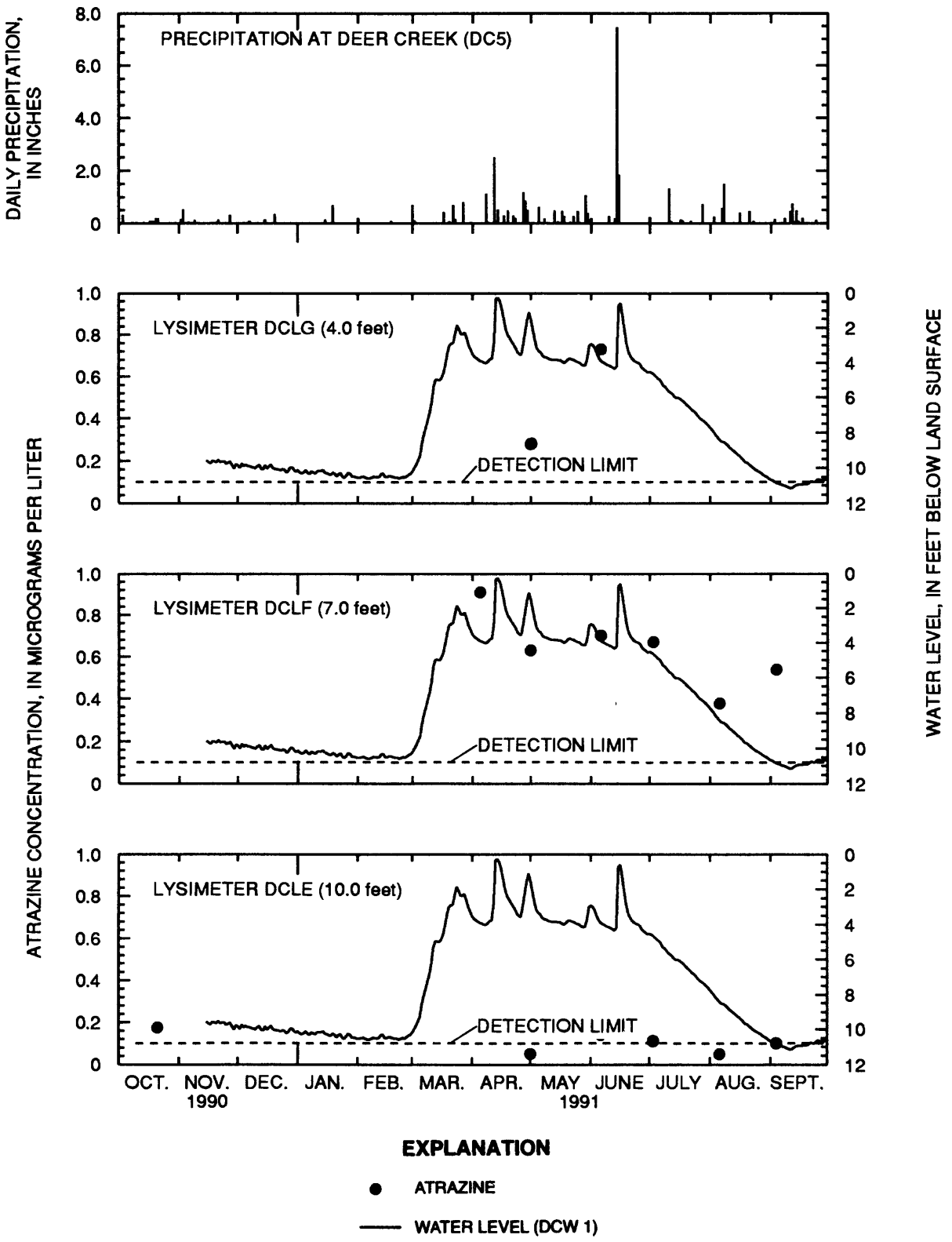


Figure 13. Daily precipitation, total-recoverable atrazine, and the water level in the loess at a site in the Deer Creek watershed, water year 1991.

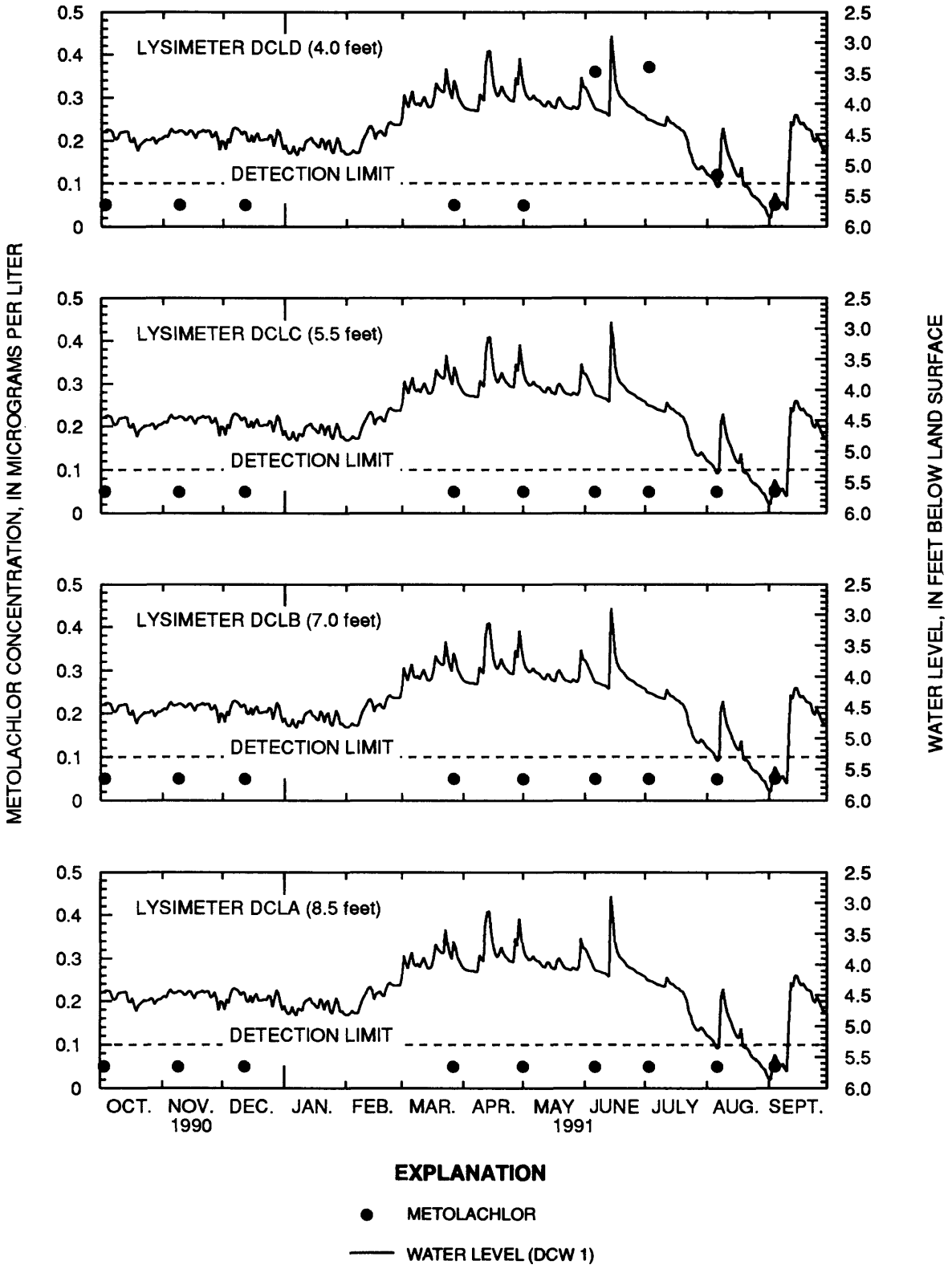


Figure 14. Total-recoverable metolachlor and the water level in alluvium in the Deer Creek watershed, water year 1991.

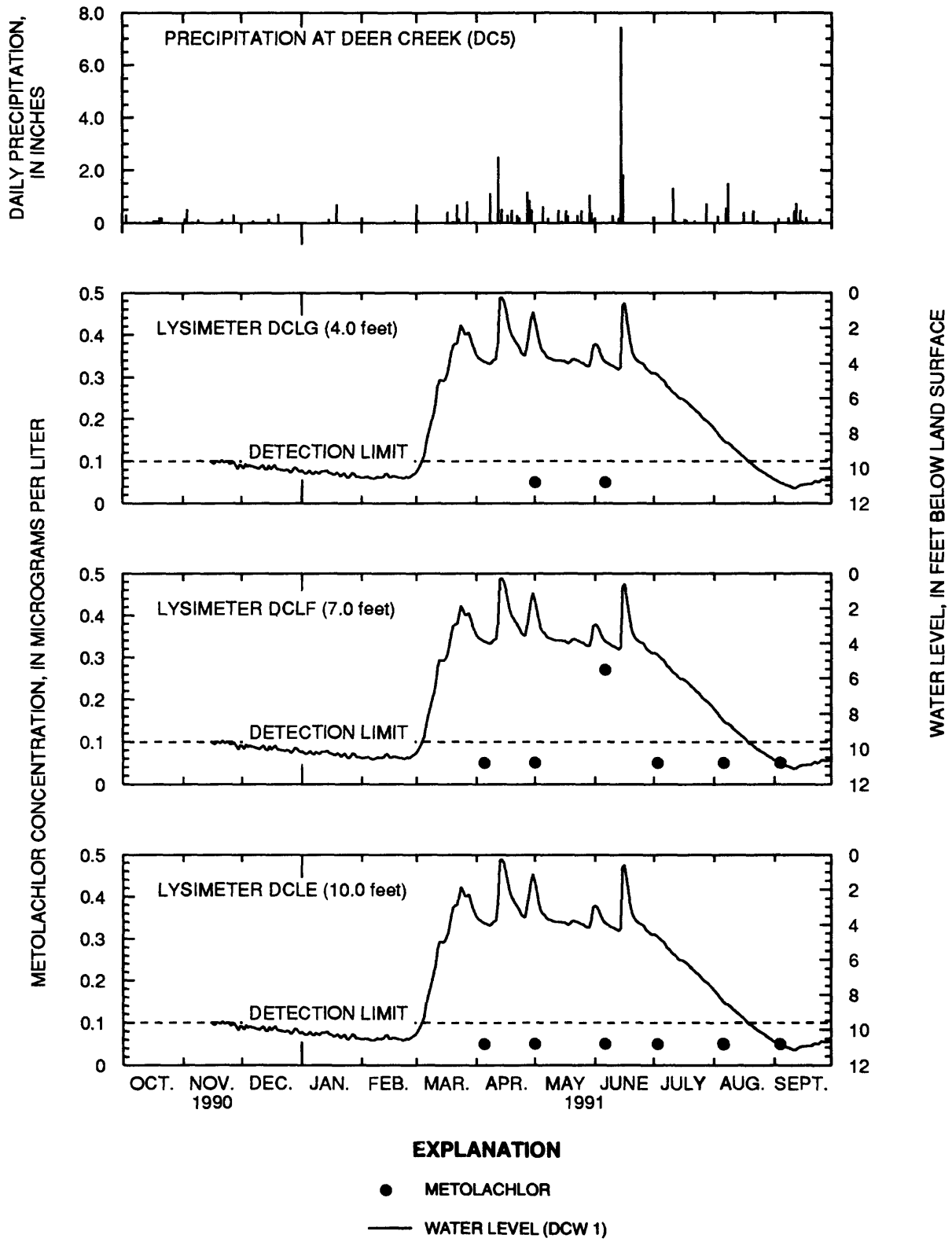


Figure 15. Daily precipitation, total-recoverable metolachlor, and the water level in the loess at a site in the Deer Creek watershed, water year 1991.

species and seven selected herbicides. Nitrate-N concentrations ranged from 0.60 to 43 mg/L, ammonia-N concentrations ranged from less than the detection limit (0.10 mg/L) to 0.50 mg/L, and organic-N concentrations ranged from 0.70 to 3.3 mg/L. Orthophosphorus concentrations ranged from less than the detection limit (0.10 mg/L) to 0.20 mg/L. Two of the seven herbicides were detected. Atrazine concentrations were greater than the detection limit in 9 of the 12 samples. Atrazine concentrations ranged from less than the detection limit (0.10) to 0.54 µg/L. Metolachlor was detected in 2 of 12 samples in concentrations ranging from less than the detection limit (0.10) to 0.34 µg/L.

Galena Aquifer

Water Levels

The highest water levels in the Galena aquifer generally were measured in April or June 1991 (table 21 and fig. 16). The highest daily mean water level in well BS1-B was 2.50 ft above land surface on June 15 just before the recorder was damaged by flooding from the Turkey River. Water-level data for this well were lost from June 16 through June 30 due to damaged equipment. The highest daily mean water level in well BS2-E was 133.06 ft below land surface, 160.44 ft below land surface in well BS3-A, and 200.13 ft below land surface in well BS4-A. The lowest water level in well BS1-B was 8.64 ft below land surface on January 29, 1991, 154.52 ft below land surface on December 25-26, 1991, in well BS2-E, 168.11 ft below land surface on February 6, 1991, in well BS3-A, and 218.96 ft below land surface on February 20, 1991, in well BS4-A.

Big Spring

Discharge from Big Spring was continuously recorded and is shown in figure 17 and listed in table 22. The discharge values are the sum of discharge from the main spring and from a secondary spring (Back Spring) located about 500 ft east of the main spring. The maximum daily mean discharge was 369 ft^3/s on June 15, 1991, and the minimum daily mean discharge was 9.5 ft^3/s on January 30, 1991. Mean daily discharge equaled or exceeded 10 ft^3/s more than 99 percent of the year, equaled or exceeded 20 ft^3/s about 66 percent of the year, and equaled or exceeded 30 ft^3/s about 56 percent of the year (fig. 6). Median discharge during water year 1991 was 43 ft^3/s.

Continuous water-quality data collected at Big Spring are shown as daily mean and median values in figure 17 and are listed in tables 22 and 23. Daily mean specific-conductance values ranged from 414 µS/cm on June 15, 1991, to 788 µS/cm on October 31, 1990. The maximum daily median pH was 7.1 from February 20 through March 2, 1991, and the minimum daily median pH was 6.7 on June 15 and September 15 and 16, 1991. Daily mean water temperatures ranged from 8.5 °C on 17 days in March and 1 day in April to 13.0 °C on June 15, 1991. Daily mean suspended-sediment concentrations ranged from 4 mg/L in January and February to 10,400 mg/L on June 15, 1991 (table 24). The suspended-sediment load ranged from less than 0.11 ton/d on January 25, 1991, to 10,800 ton/d on June 15, 1991, following the largest rainfall during the water year (fig. 7 and table 24). The maximum monthly sediment load was greater than 14, 000 tons in June 1991. The total measured suspended-sediment load discharged from Big Spring was about 17,000 tons.

Twenty-three samples were collected from Big Spring during water year 1991 for the analyses of nitrogen, phosphorus, and carbon species. Nitrate-N generally was the predominant nitrogen species in solution (table 19). Nitrate-N concentrations ranged from 4.2 to 17 mg/L. Ammonia-N concentrations equaled or exceeded the detection limits in about 30 percent of the samples. The maximum ammonia-N concentration was 0.90 mg/L. Organic-N concentrations ranged from less than 0.10 to 28 mg/L, orthophosphorus concentrations ranged from 0.10 to 4.4 mg/L, and organic carbon concentrations ranged from less than 1.0 to 4.9 mg/L.

Six of seven herbicides analyzed were detected in 23 samples from Big Spring (table 20). Alachlor was detected in 26 percent of the samples, atrazine in 100 percent; cyanazine in 26 percent; and metolachlor in 9 percent. Butylate and trifluralin were detected in one sample. Metribuzin was not detected. Alachlor concentrations ranged from less than 0.10 to 4.0 µg/L; atrazine concentrations from 0.14 to 16 µg/L; cyanazine concentrations from

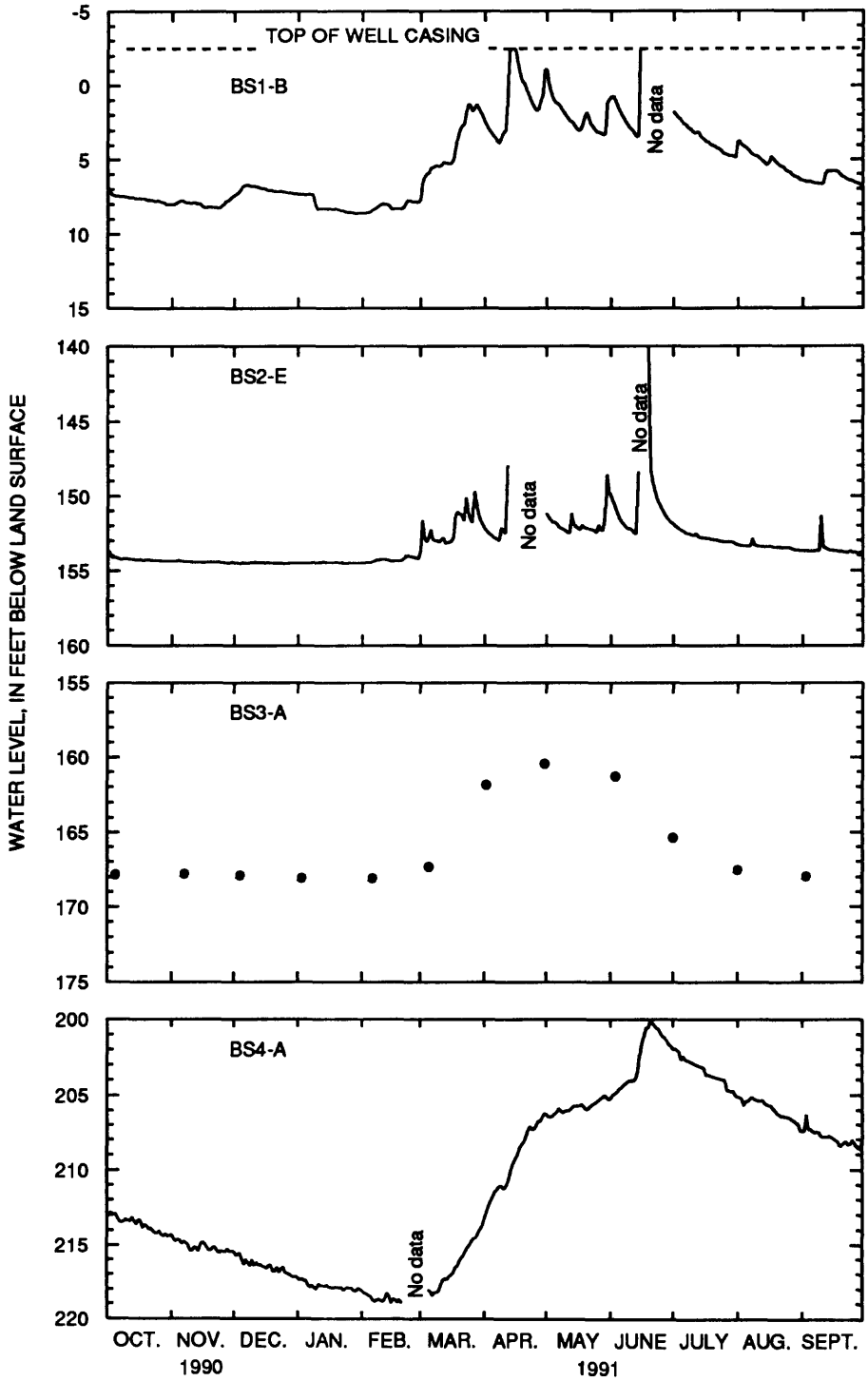


Figure 16. Water levels in the Galena aquifer in the Big Spring Basin, water year 1991.

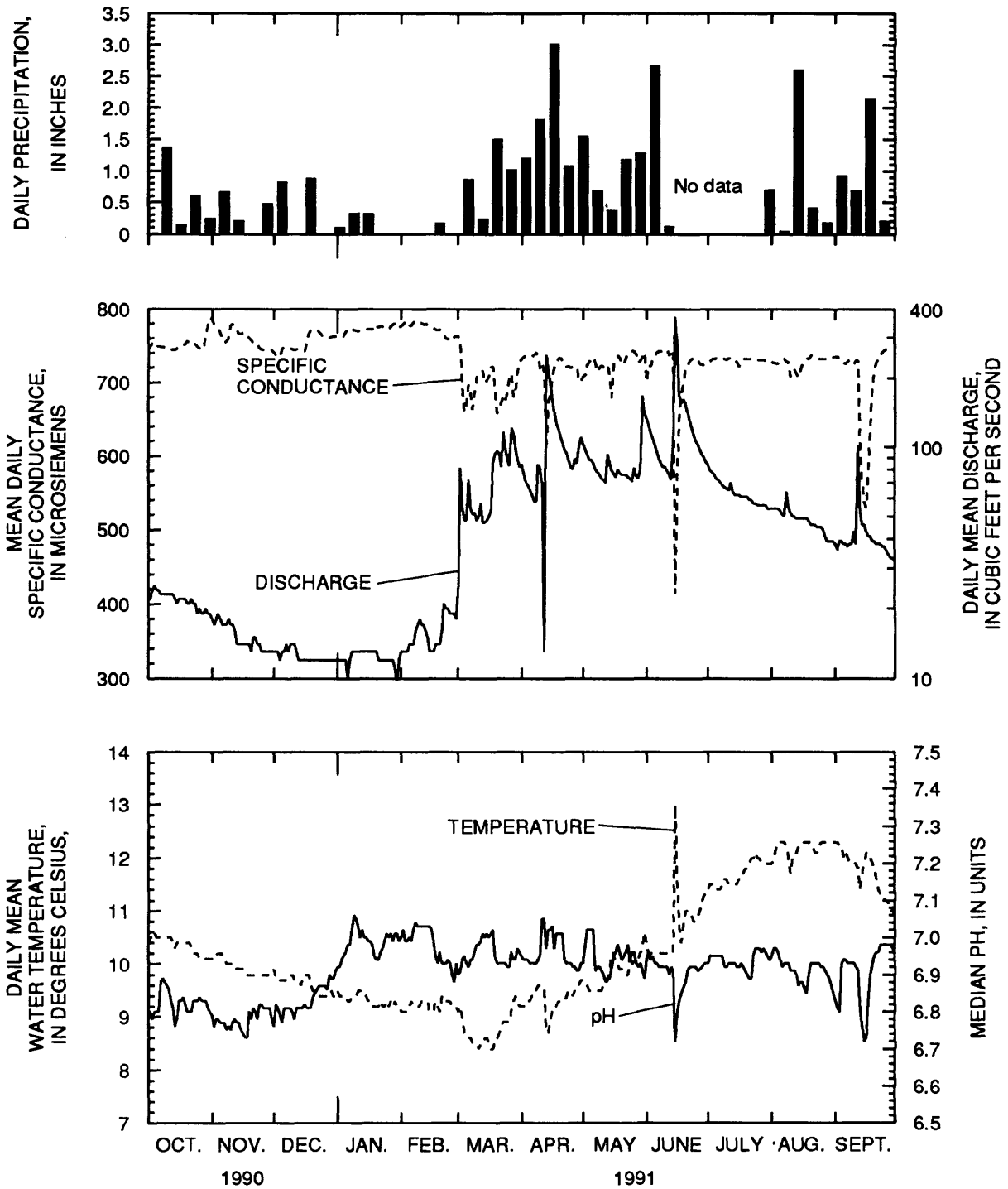


Figure 17. Weekly precipitation, daily mean specific conductance, discharge, water temperature, and daily median pH at Big Spring, water year 1991.

less than 0.10 to 1.6 µg/L; and metolachlor concentrations from less than 0.10 to 2.2 µg/L.

Saint Peter Aquifer

The highest measured water level in BS1-D was 7.57 ft above land surface on July 1, 1991, and 300.01 ft below land surface in well BS3 on April 30, 1991. The highest water level in well BS2-G was 183.28 ft below land surface from July 2 to July 8 and in well BS4, 368.43 ft below land surface on April 29, 1991. The lowest measured water level in well BS1-D was 4.33 ft above land surface on November 2, 1990, and February 19, 1991. The lowest measured water level in well BS3 was 301.35 ft below land surface on January 7, 1991. The lowest water level in well BS 2-G was 186. 44 ft below land surface on January 25 and in well BS4, 372.45 ft below land surface on November 13, 1990. Water levels are shown in figure 18 and are listed in table 25.

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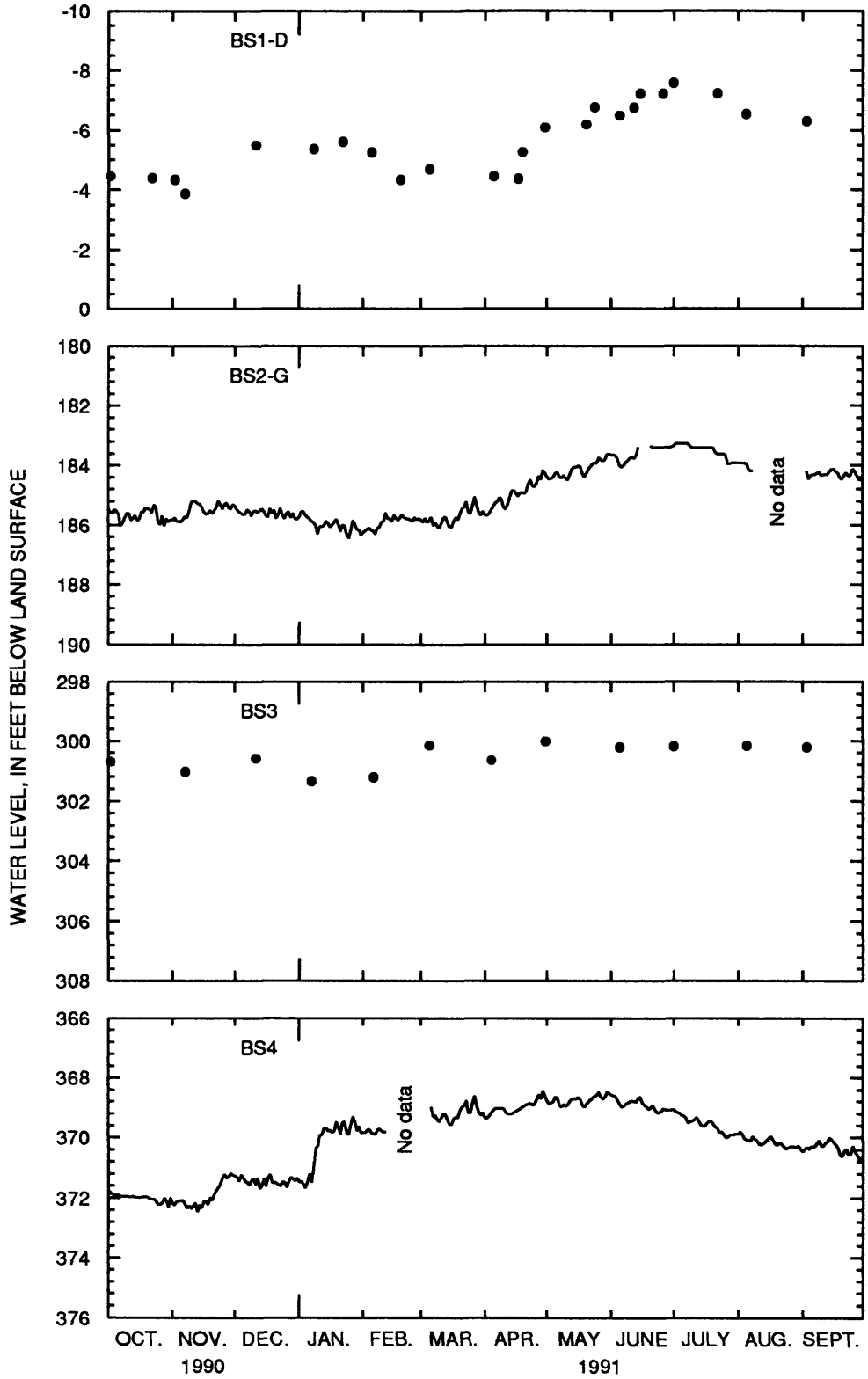

Figure 18. Water levels in the Saint Peter aquifer in the Big Spring Basin, water year 1991.

HYDROLOGIC DATA

Table 1. Records of monitoring sites in the Big Spring study area, Clayton County, Iowa

[mi^2, square miles]

Site (fig. 2)	Site identification number	Station name	Location		Drainage area (mi^2)	Type of record[1]
			Latitude	Longitude		
DC5	430040091325401	Deer Creek near Postville	430400	0913254	1.1	S, QW
L23S	05412060	Silver Creek near Luana	430119	0912921	4.39	S
BOOGD	05412070	Unnamed Creek near Luana	430224	0912807	1.15	S, P, QW
RC2	05412100	Roberts Creek above Saint Olaf	425549	0912303	70.7	S, P, QW
Big Spring	05411950	Big Spring near Elkader	425433	0912801	[2]103	G, P, QW

[1] S, surface water; G, ground water; P, precipitation; QW, water quality.
[2] Ground-water drainage.

Table 2. Records of selected ground-water monitoring wells, lysimeters, and tile lines in the Big Spring Basin, Clayton County, Iowa

[Sec., section; T., township; R., range; --, not applicable; well-construction data from Iowa Department of Natural Resources, Geological Survey Bureau]

Site (fig. 2 or 3)	Site identification number	Location			Altitude (feet)	Well depth (feet)	Open interval (feet)	Aquifer
		Sec.	T.	R.				
Well nest BS1								
BS1-A	425433091285001	NWSE31	94N	05W	855	36	33 - 36	Unconsolidated
BS1-B	425433091285002	NWSE31	94N	05W	855	85	61 - 85	Galena
BS1-D	425433091285004	NWSE31	94N	05W	855	215	173 - 215	Saint Peter
Well nest BS2								
BS2-A	--	SENW16	94N	05W	950	57	47 - 57	Galena
BS2-B	--	SENW16	94N	05W	950	127	122 - 127	Galena
BS2-C	--	SENW16	94N	05W	950	128	118 - 128	Galena
BS2-D	--	SENW16	94N	05W	950	151	137 - 151	Galena
BS2-E	425736091260302	SENW16	94N	05W	950	180	165 - 180	Galena
BS2-F	--	SENW16	94N	05W	950	286	272 - 286	Galena
BS2-G	425736091260303	SENW16	94N	05W	950	335	300 - 335	Saint Peter
Well nest BS3								
BS3	430145091253001	SWNW22	95N	05W	1,080	397	351 - 397	Saint Peter
BS3-A	430145091253002	SWNW22	95N	05W	1,080	185	165 - 185	Galena
BS3-B	430145091253003	SWNW22	95N	05W	1,080	60		Galena
BS3-C	430145091253004	SWNW22	95N	05W	1,080	26	11 - 26	Unconsolidated
Well nest BS4								
BS4	430133091344801	NWSE20	95N	06W	1,160	580	550 - 580	Saint Peter
BS4-A	430133091344802	NWSE20	95N	06W	1,160	361	261 - 361	Galena
BS4-B	430133091344803	NWSE20	95N	06W	1,160	139	130 - 139	Unconsolidated
BS4-C	430133091344804	NWSE20	95N	06W	1,160	61	50 - 61	Unconsolidated
Single wells								
DCW1	430040091325402	SESE28	95N	06W	1,070	13	11 - 13	Unconsolidated
DCW2	430040091325403	SESE28	95N	06W	1,070	11	8 - 11	Unconsolidated
DCW3	430040091325410	SESE28	95N	06W	1,083	15	13 - 15	Unconsolidated
DCW7	430040091325414	SESE28	95N	06W	1,078	15	13 - 15	Unconsolidated
DCW8	430040091325415	SESE28	95N	06W	1,100	15	10 - 15	Unconsolidated
DCW10	430040091325417	SESE28	95N	06W	1,083	15	11 - 15	Unconsolidated
DCW11	430040091325418	SESE28	95N	06W	1,083	23	18 - 23	Unconsolidated

Table 2. Records of selected ground-water monitoring wells, lysimeters, and tile lines in the Big Spring Basin, Clayton County, Iowa--Continued

Site (fig. 2 or 3)	Site identification number	Location			Altitude (feet)	Well depth (feet)	Open interval (feet)	Aquifer
		Sec.	T.	R.				
				Lysimeters				
DCLA	430040091325404	SESE28	95N	06W	1,069	8.5	--	Unconsolidated
DCLB	430040091325405	SESE28	95N	06W	1,069	7.0	--	Unconsolidated
DCLC	430040091325406	SESE28	95N	06W	1,069	5.5	--	Unconsolidated
DCLD	430040091325407	SESE28	95N	06W	1,069	4.0	--	Unconsolidated
DCLE	430040091325419	SESE28	95N	06W	1,084	10.0	--	Unconsolidated
DCLF	430040091325420	SESE28	95N	06W	1,084	7.0	--	Unconsolidated
DCLG	430040091325421	SESE28	95N	06W	1,084	4.0	--	Unconsolidated
				Tile lines				
DCT1	430040091325409	SESE28	95N	06W	1,065	--	--	Unconsolidated
DCT2	430040091325408	SESE28	95N	06W	1,070	--	--	Unconsolidated

Table 3. Sample preparation and chemical analysis procedures

[EPA methods from U.S. Environmental Protection Agency, 1983; µm, micrometer; c, carbon; N, nitrogen; P, phosphorus, mg/L, milligrams per liter; µg/L, microgram per liter; --, not applicable]

Sample preparation	Chemical constituent
Chill	Organic carbon, nitrite plus nitrate, ammonia, organic nitrogen, orthophosphorus, atrazine, cyanazine, metolachlor, alachlor, metribuzin, butylate, trifluralin
Acidification with sulfuric acid	Nitrite plus nitrate, ammonia, orthophosphate

Constituent	Analytical procedure	Quantitation or detection limit
Field measurements		
Stream discharge	Buchanan and Somers, 1969	--
Specific conductance	Wood, 1976	--
pH	Wood, 1976	--
Water temperature	Wood, 1976	--
Oxygen, dissolved	Wood, 1976	--
Nutrients, total and dissolved		
Nitrite plus nitrate as N	[1]EPA 353.2	0.10 mg/L
Ammonia as N	[1]EPA 350.1	.10 mg/L
Organic nitrogen as N	[1]EPA 415.1	.10 mg/L
Orthophosphorus as P	[1]EPA 365.1	.10 mg/L
Carbon, total organic as C	[1]EPA 415.1	.10 mg/L
Herbicides, total recoverable		
Alachlor	[1]EPA 81.41	.10 µg/L
Atrazine	[1]EPA 81.41	.10 µg/L
Butylate	[1]EPA 81.41	.10 µg/L
Cyanazine	[1]EPA 81.41	.10 µg/L
Metolachlor	[1]EPA 81.41	.10 µg/L
Metribuzin	[1]EPA 81.41	.10 µg/L
Trifluralin	[1]EPA 81.41	.10 µg/L

[1] Modified for use of dual-capillary columns.

Table 4. Statistical summary of precipitation quantity and quality at Big Spring, water year 1991

[Chemical constituents in milligrams per liter, except as noted. µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; <, less than indicated detected limit; --, not applicable]

Constituent	Number of weekly samples	Precipitation weighted	Median	Minimum	Maximum
Precipitation (inches)	46	--	0.44	0	3.02
Specific conductance (µS/cm)	34	16	14	4.4	71
pH (standard units)	34	5.13	5.42	3.99	6.9
Calcium	39	.40	.47	.03	3.9
Magnesium	39	.06	.07	.01	.76
Sodium	39	.06	.04	< .01	.67
Potassium	38	.07	.04	< .01	1.7
Sulfate	38	1.6	1.5	.11	5.6
Chloride	39	.10	.11	.04	.73
Nitrate as N	39	.33	.36	.09	1.2
Ammonia as N	39	.45	.49	.03	1.8

Table 5. Daily precipitation in the Big Spring study area, Clayton County, Iowa, water year 1991

[---, missing data]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sept.
						Site DC5, Deer Creek near Postville (fig. 2)						
1	0	0	0	0	0.19	0.68	0	0.01	0.19	0.22	0	0
2	0	.15	0	0	0	.10	0	0	0	0	0	0
3	.30	.52	0	0	0	0	0	0	0	0	0.24	0.16
4	0	.01	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	.61	0	0	0	.02
6	0	.04	0	0	0	0	0	.01	0	0	.02	0
7	0	0	0	0	0	0	0	0	0	.02	.56	0
8	.04	0	0	0	0	0	1.11	.17	0	0	1.50	.18
9	0	.12	0	0	0	---	.04	0	0	0	0	.02
10	.03	.01	0	0	0	---	0	0	.27	0	0	0
11	0	0	.02	0	0	---	0	0	0	1.33	0	.46
12	0	0	.01	0	0	---	2.50	0	0	.07	0	.73
13	0	0	0	0	0	---	.07	.47	.18	0	0	.06
14	.04	.01	0	0	0	0	.51	0	7.45	0	0	.47
15	.01	0	.14	.14	0	0	0	.05	1.83	0	0	.08
16	0	0	.01	0	0	0	0	0	0	0	.40	.02
17	.08	0	.06	0	0	.41	0	.45	0	.13	0	.18
18	.08	0	0	0	.08	.01	.28	.26	0	.10	0	0
19	0	0	0	.68	0	0	.47	0	0	0	.01	0
20	.18	.04	.34	0	0	.06	0	0	.01	0	0	0
21	.18	.14	0	0	0	.02	0	.04	0	0	.46	0
22	0	0	0	0	0	.68	.23	0	0	.08	0	0
23	0	0	0	0	0	.15	.18	.26	0	0	.07	0
24	0	0	0	0	0	0	0	.01	0	0	0	.12
25	0	0	0	0	0	0	0	.46	0	0	0	.01
26	0	0	0	0	0	0	0	.03	0	0	0	0
27	0	.30	0	0	.01	.80	1.18	0	0	0	0	0
28	0	0	0	0	0	0	.86	0	0	.72	0	0
29	0	0	0	0		0	.49	1.06	0	0	0	0
30	0	0	0	0		0	.02	.38	0	0	0	0
31	0		0	.01		.03		.14		0	0	
Total	.94	1.34	.58	.83	.28	2.94	7.94	4.41	9.93	2.67	3.26	2.51

Table 5. Daily precipitation in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sept.
						Site BOOGD, Unnamed Creek near Luana (fig. 2)						
1	0	0	0	0	0	0	0	0	0.34	0.28	0	0
2	0	0	.01	0	0	.70	0	0	0	0	0	.14
3	.11	.63	0	0	0	0	0	0	0	0	.03	1.83
4	.87	.17	0	0	0	0	.01	0	0	0	0	0
5	0	0	0	.24	.01	0	0	.74	0	0	0	.02
6	0	0	0	0	0	0	0	0	0	0	.01	0
7	0	0	0	.10	0	0	0	.02	0	.01	1.17	0
8	0	0	0	0	0	0	1.35	.17	0	0	3.27	.36
9	0	.09	0	0	0	0	0	---	0	.02	0	.92
10	0	0	0	0	0	0	0	---	.21	0	0	0
11	0	0	0	.01	0	0	0	---	0	1.86	0	.82
12	0	0	0	0	0	.08	2.50	---	.01	.08	0	3.43
13	0	0	0	0	.01	0	0	---	.20	0	0	.21
14	0	0	.09	0	0	0	.70	---	11.98	0	0	.61
15	0	0	.10	0	0	0	0	---	1.98	0	0	.03
16	0	0	0	0	0	0	0	---	0	0	.65	.02
17	0	0	.26	0	0	.28	0	---	0	.16	0	.02
18	.32	0	0	0	.02	0	.19	1.10	0	.24	.08	0
19	0	0	0	0	0	0	.43	0	0	0	.01	.01
20	0	0	0	0	0	.09	0	0	0	0	0	.02
21	.62	.17	0	0	0	.08	0	0	0	0	.09	.01
22	0	.18	0	0	0	0	.20	0	0	.16	0	0
23	0	0	0	0	0	.62	.16	0	0	0	.05	0
24	0	0	0	0	0	0	0	0	0	0	0	.12
25	0	0	0	0	0	0	0	.96	0	0	0	.02
26	0	0	0	0	0	0	0	.07	0	0	0	0
27	0	.39	0	0	0	1.45	1.12	0	0	0	0	0
28	0	0	.05	0	0	0	.50	.04	0	.95	0	0
29	0	0	0	0		0	1.00	2.29	0	0	0	0
30	0	0	0	0		0	.02	.61	0	0	0	0
31	0		0	0		.02		.31		0	0	
Total	1.92	1.63	.51	.35	.04	3.32	8.18	6.31	14.72	3.76	5.36	8.59

Table 5. Daily precipitation in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July.	Aug.	Sept.
						Site RC2, Roberts Creek above Saint Olaf (fig. 2)						
1	0	0	0	0	0	0.62	0	0.01	0.42	0.22	0	0
2	0	.06	0	0	0	.05	0	0	.03	0	0	.06
3	1.13	.42	.01	0	0	0	0	0	.01	0	.04	1.15
4	0	0	0	0	0	0	.05	.02	.01	0	0	0
5	0	.01	0	.26	.01	0	.04	.75	0	0	0	.01
6	0	0	0	0	0	0	0	.02	0	0	.16	0
7	0	0	0	.08	0	0	.62	0	0	.23	.42	0
8	.09	.03	0	0	0	.01	1.58	.20	.01	0	2.44	.42
9	0	.12	0	0	0	0	.14	.01	.04	.01	0	.06
10	.08	0	0	.03	0	0	0	.01	.16	0	0	0
11	0	0	0	.06	0	0	.02	.01	.01	.96	0	.16
12	0	0	0	0	0	.32	2.67	0	0	.14	.17	1.25
13	0	0	0	0	.02	0	.05	2.04	.21	0	0	.14
14	.08	0	.08	0	.02	0	.31	.02	1.03	0	0	.31
15	0	.03	.17	0	0	0	.01	.12	---	0	0	.09
16	.08	.02	0	0	0	0	0	.03	---	0	.51	0
17	.11	0	.27	0	0	.30	0	.88	---	0	0	.26
18	.02	0	0	0	.03	0	.17	.53	---	.08	.02	0
19	0	0	0	0	0	0	.24	.01	---	0	0	0
20	.29	.18	0	0	0	.02	0	.01	0	0	0	0
21	.11	.07	.01	0	0	.05	0	.35	.43	0	.20	.01
22	0	0	0	0	0	.95	.23	.14	0	.06	0	0
23	0	0	0	0	0	.18	.28	.28	0	0	.02	0
24	0	0	0	0	0	0	.01	0	0	0	0	.09
25	0	0	0	0	0	.04	.01	.39	0	0	0	.01
26	0	0	0	0	0	.01	.01	.01	0	0	0	0
27	0	.27	0	0	0	2.05	1.12	.01	0	0	0	0
28	0	.01	.02	0	0	0	.77	.14	0	.70	0	0
29	.07	0	0	0		.02	1.05	2.03	0	0	0	0
30	.09	.04	0	0		0	.01	.58	0	0	.02	0
31	0		0	0		.04		.46		0	0	
Total	2.15	1.26	.56	.43	.08	4.66	9.39	9.06	2.36	2.40	4.00	4.02

Table 6. Daily mean discharge at site DC5, Deer Creek near Postville, Iowa, water year 1991

[Discharge in cubic feet per second]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.13	0.23	0.21	0.18	0.13	0.38	0.48	1.4	0.60	0.28	0.30	0.18
2	.15	.23	.21	.18	.12	1.8	.44	1.1	.41	.33	.31	.18
3	.41	.31	.21	.18	.11	.59	.43	.82	.36	.34	.32	.48
4	.25	.24	.21	.18	.12	.41	.38	.66	.31	.34	.33	.22
5	.22	.23	.21	.18	.11	.97	.32	1.2	.27	.33	.32	.20
6	.20	.22	.22	.18	.12	1.0	.27	.73	.26	.32	.30	.20
7	.17	.23	.22	.18	.13	.40	.23	.57	.26	.32	.32	.20
8	.19	.23	.22	.19	.14	.31	.63	.60	.23	.32	.85	.23
9	.22	.23	.23	.18	.16	---	.79	.52	.16	.30	.41	.26
10	.22	.23	.22	.18	.16	---	.44	.44	.20	.28	.35	.25
11	.22	.20	.22	.18	.14	---	.42	.42	.18	.36	.34	.28
12	.22	.20	.21	.18	.13	---	2.0	.37	.17	.40	.34	.24
13	.21	.19	.17	.18	.13	.90	2.9	.92	.19	.34	.34	.29
14	.21	.18	.16	.18	.10	.70	2.8	.44	---	.34	.32	.36
15	.19	.18	.16	.18	.10	.46	3.1	.38	---	.33	.24	.39
16	.16	.16	.16	.18	.11	.47	1.7	.32	---	.31	.20	.29
17	.17	.16	.16	.18	.11	.94	1.2	.50	---	.30	.20	.22
18	.18	.17	.16	.18	.11	2.3	1.1	.82	---	.30	.19	.27
19	.17	.17	.17	.18	.11	2.4	2.0	.50	---	.31	.18	.23
20	.17	.18	.18	.18	.12	2.1	1.3	.41	.88	.31	.18	.23
21	.23	.24	.18	.18	.20	1.7	1.0	.37	.58	.31	.19	.20
22	.18	.23	.18	.16	.24	2.4	1.0	.36	.57	.29	.20	.20
23	.17	.20	.18	.16	.21	3.8	1.0	.39	.55	.27	.20	.22
24	.17	.21	.18	.16	.18	1.7	.62	.33	.50	.27	.20	.25
25	.17	.20	.18	.16	.16	1.2	.54	.35	.47	.27	.20	.25
26	.17	.19	.38	.26	.14	.96	.49	.41	.41	.27	.19	.24
27	.20	.27	.42	.16	.13	2.7	2.5	.29	.34	.26	.18	.23
28	.23	.22	.20	.16	.12	1.1	.90	.24	.30	.28	.19	.23
29	.23	.19	.20	.16		.73	2.8	.84	.29	.32	.18	.23
30	.23	.21	.19	.15		.60	2.4	.95	.27	.30	.18	.22
31	.23		.18	.14		.55		.59		.30	.18	

Table 7. Onsite determinations of selected water-quality constituents at surface-water sites in the Big Spring study area, Clayton County, Iowa, water year 1991

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, degrees Celsius; mg/L, milligrams per liter; --, missing data]

Date	Time (24-hour)	Instantaneous discharge (ft^3/s)	Specific conductance (µS/cm)	pH (units)	Water temperature (°C)	Dissolved oxygen (mg/L)
Site DC5, Deer Creek near Postville (fig. 2)						
10-03-90	0830	0.34	585	7.6	15.0	6.2
11-08-90	1015	.19	588	7.8	2.5	12.0
12-05-90	1300	--	660	7.5	0	--
01-08-91	1030	.18	569	7.8	1.0	14.1
02-06-91	1300	.13	570	7.8	1.0	12.2
03-05-91	1630	1.7	350	7.8	1.0	--
03-06-91	0945	1.0	472	7.7	.5	12.2
03-18-91	1300	1.9	420	7.2	4.0	--
03-19-91	1530	4.5	383	7.4	6.0	--
03-26-91	1600	.83	561	8.2	18.0	8.5
03-27-91	0930	3.6	467	--	12.0	10.0
04-04-91	1030	.34	569	--	10.0	12.6
04-22-91	1650	.91	590	--	15.0	--
05-01-91	0840	1.4	532	7.5	7.0	11.8
05-30-91	1230	1.4	548	7.3	19.0	--
06-06-91	0830	.35	576	7.8	11.0	8.4
06-15-91	0130	--	--	--	--	--
06-20-91	1155	.88	650	7.7	20.0	--
07-02-91	0850	.42	582	7.7	17.0	7.0
08-06-91	0900	.29	573	7.6	14.5	7.2
09-03-91	0920	.49	523	7.3	18.0	--
09-04-91	0900	.20	554	7.3	14.0	9.9
Site BOOGD, Unnamed Creek near Luana (fig. 2)						
10-03-90	1220	.20	595	8.1	17.0	7.9
03-06-91	1330	.03	265	7.6	.5	--
03-18-91	1140	.45	645	7.6	1.0	--
03-19-91	1330	.95	505	7.9	1.0	--

Table 7. Onsite determinations of selected water-quality constituents at surface-water sites in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Instantaneous discharge (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (units)	Water temperature (°C)	Dissolved oxygen (mg/L)
Site BOOGD, Unnamed Creek near Luana (fig. 2)--Continued						
03-21-91	1230	1.1	614	7.6	9.5	--
04-04-91	1300	.91	694	--	14.0	11.8
04-23-91	1130	2.3	765	--	8.0	--
05-02-91	1200	3.0	715	7.6	11.0	11.3
05-20-91	1045	.44	793	7.4	13.5	--
06-06-91	1430	1.5	792	7.9	15.5	9.0
06-15-91	1135	50	350	7.1	20.5	--
06-16-91	1410	15	599	7.3	19.0	--
06-20-91	1430	3.2	773	7.5	19.0	--
07-01-91	1330	.97	760	7.6	20.0	9.7
08-06-91	1300	.11	741	7.8	18.0	7.5
09-23-91	1200	.35	756	7.5	14.0	--
Site RC2, Roberts Creek above Saint Olaf (fig. 2)						
10-03-90	1410	6.2	600	8.1	17.0	9.0
10-13-90	1930	3.3	636	8.8	13.0	--
11-08-90	1500	3.1	688	7.9	2.0	15.1
12-05-90	1215	.96	815	7.6	0	--
01-07-91	1145	.12	625	7.4	0	6.4
02-05-91	1000	.01	700	7.4	1.0	4.8
03-06-91	1500	39	512	8.1	.5	13.2
03-18-91	1100	83	578	8.7	1.0	--
03-19-91	1000	114	528	7.6	1.0	--
03-21-91	1115	108	546	8.0	1.0	--
03-27-91	1315	162	--	--	--	--
04-04-91	0900	33	--	--	15.0	--
04-23-91	1445	73	680	7.4	9.0	--
05-01-91	1415	99	650	7.2	10.0	10.6
05-14-91	1400	52	630	8.0	22.0	--

Table 7. Onsite determinations of selected water-quality constituents at surface-water sites in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Instantaneous discharge (ft^3/s)	Specific conductance ($\mu S/cm$)	pH (units)	Water temperature (°C)	Dissolved oxygen (mg/L)
Site RC2, Roberts Creek above Saint Olaf (fig. 2)--Continued						
05-20-91	0945	45	698	8.0	14.5	--
05-20-91	1400	44	--	--	--	--
05-30-91	1445	219	556	8.0	21.0	--
06-06-91	1630	46	733	8.3	21.0	9.5
06-14-91	2245	119	622	8.2	21.5	--
06-15-91	0020	3,790	191	7.6	20.0	--
06-15-91	0910	10,000	125	7.7	18.5	--
06-16-91	0830	458	518	7.8	18.0	--
06-20-91	0955	90	672	7.8	24.0	--
07-02-91	1600	22	713	8.4	28.0	11.1
08-06-91	1700	.26	616	7.8	19.0	10.7
09-04-91	1530	.07	620	7.5	24.0	8.1
09-16-91	1130	20	620	8.0	22.0	--

Table 8. Selected nitrogen, phosphorus, and carbon species at surface-water monitoring sites in the Big Spring study area, Clayton County, Iowa, water year 1991

[Total constituents in milligrams per liter; N, nitrogen; P, phosphorus, C, carbon; --, data not collected; <, less than indicated detection limit]

Date	Time (24-hour)	Nitrite plus nitrate, total (as N)	Ammonia, total (as N)	Organic nitrogen, total (as N)	Orthophos-phorus, total (as P)	Organic carbon, total (as C)
Site DC5, Deer Creek near Postville (fig. 2)						
10-03-90	0830	2.5	<0.10	1.0	0.20	6.3
11-08-90	1015	3.4	<.10	.20	<.10	2.5
12-05-90	1300	3.7	.10	.80	.20	6.0
01-08-91	1030	3.5	<.10	.20	<.10	3.4
02-06-91	1300	3.3	<.10	.30	<.10	2.8
03-05-91	1630	3.9	1.0	3.2	.50	4.5
03-06-91	0945	9.7	.30	.90	.20	8.2
03-18-91	1300	7.3	.20	1.1	.20	7.4
03-19-91	1530	6.9	.20	1.1	.20	6.9
03-26-91	1600	12	<.10	1.0	.10	7.7
03-27-91	0930	8.9	.90	2.2	.50	12
04-04-91	1030	5.2	<.10	.40	<.10	5.0
04-22-91	1650	9.2	<.10	.80	.20	7.1
05-01-91	0840	12	.10	.50	.20	5.4
05-30-91	1230	7.4	.40	2.1	.40	11
06-06-91	0830	4.6	.10	.20	<.10	2.5
06-15-91	0130	.80	<.10	17	.40	16
06-20-91	1155	7.0	.10	.60	.20	3.6
07-02-91	0850	3.2	<.10	.40	.10	2.8
08-06-91	0900	3.0	<.10	.50	<.10	1.7
09-03-91	0920	2.5	.10	.80	.20	5.4
09-04-91	0900	2.2	.10	.50	<.10	3.8
Site BOOGD, Unnamed Creek near Luana (fig. 2)						
10-03-90	1220	9.8	.60	2.7	.40	10
03-06-91	1330	4.2	.30	.70	.30	3.9
03-18-91	1140	18	<.10	.60	.20	2.4
03-19-91	1330	14	<.10	1.0	.10	3.2

Table 8. Selected nitrogen, phosphorus, and carbon species at surface-water monitoring sites in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Nitrite plus nitrate, total (as N)	Ammonia, total (as N)	Organic nitrogen, total (as N)	Orthophos-phorus, total (as P)	Organic carbon, total (as C)
Site BOOGD, Unnamed Creek near Luana (fig. 2)--Continued						
03-21-91	1230	17	< 0.10	0.50	0.10	2.0
04-04-91	1300	22	< .10	.20	< .10	1.9
04-23-91	1130	26	< .10	.20	.10	2.0
05-02-91	1200	27	.10	< .10	< .10	2.0
05-20-91	1045	26	.20	2.1	.20	2.7
06-06-91	1430	26	< .10	1.4	.30	3.4
06-15-91	1135	15	< .10	2.0	.20	7.8
06-16-91	1410	24	< .10	1.6	.10	3.3
06-20-91	1430	24	.10	2.1	.30	1.1
07-01-91	1330	24	< .10	1.1	.20	4.5
08-06-91	1300	13	.10	.80	.10	34
09-23-91	1200	17	.10	.40	< .10	2.1
Site RC2, Roberts Creek above Saint Olaf (fig. 2)						
10-03-90	1410	2.9	< .10	.80	.20	3.6
10-13-90	1930	2.2	< .10	.60	--	--
11-08-90	1500	2.2	< .10	--	.30	3.2
12-05-90	1215	3.4	< .10	.30	.40	3.1
01-07-91	1145	3.0	.20	.30	.10	2.7
02-05-91	1000	3.3	.20	.40	.10	--
03-06-91	1500	11	1.0	1.3	.60	6.0
03-18-91	1100	9.5	1.0	1.6	.40	7.7
03-19-91	1000	12	1.2	2.2	--	11
03-21-91	1115	13	.60	2.2	.40	8.7
03-27-91	1315	16	.20	1.5	.30	8.3
04-04-91	0900	16	< .10	.60	.20	2.8
04-23-91	1445	22	< .10	.50	.20	2.7
05-01-91	1415	19	.20	< .60	.40	4.5
05-14-91	1400	14	.30	.60	.40	--

Table 8. Selected nitrogen, phosphorus, and carbon species at surface-water monitoring sites in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Nitrite plus nitrate, total (as N)	Ammonia, total (as N)	Organic nitrogen, total (as N)	Orthophos-phorus, total (as P)	Organic carbon, total (as C)
Site RC2, Roberts Creek above Saint Olaf (fig. 2)--Continued						
05-20-91	0945	17	0.20	1.1	0.40	5.0
05-20-91	1400	--	--	--	--	--
05-30-91	1445	13	.50	4.3	.60	7.6
06-06-91	1630	18	< .10	.60	.30	1.9
06-14-91	2245	12	< .10	2.0	.30	4.9
06-15-91	0020	1.8	1.4	22	.40	28
06-15-91	0910	2.2	.20	3.8	.50	21
06-16-91	0830	18	< .10	2.2	.20	7.3
06-20-91	0955	16	.20	.30	.30	2.0
07-02-91	1600	14	< .10	1.0	.20	3.3
08-06-91	1700	4.4	.20	1.2	< .10	2.5
09-04-91	1530	3.1	.20	.40	.20	2.5
09-16-91	1130	6.4	< .10	2.1	.80	6.5

Table 9. Selected herbicides at surface-water monitoring sites in the Big Spring study area, Clayton County, Iowa, water year 1991

[Total-recoverable constituents in micrograms per liter; <, less than indicated detection limit]

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
Site DC5, Deer Creek near Postville (fig. 2)								
10-03-90	0830	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
11-08-90	1015	<.10	<.10	<.10	<.10	<.10	<.10	<.10
12-05-90	1300	<.10	<.10	<.10	<.10	<.10	<.10	<.10
01-08-91	1030	<.10	<.10	<.10	<.10	<.10	<.10	<.10
02-06-91	1300	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-05-91	1630	<.10	.23	<.10	<.10	<.10	<.10	<.10
03-06-91	0945	<.10	11	<.10	<.10	<.10	<.10	<.10
03-18-91	1300	<.10	.10	<.10	<.10	<.10	<.10	<.10
03-19-91	1530	<.10	.14	<.10	<.10	<.10	<.10	<.10
03-26-91	1600	<.10	.11	<.10	<.10	<.10	<.10	<.10
03-27-91	0930	<.10	.14	<.10	<.10	<.10	<.10	<.10
04-04-91	1030	<.10	<.10	<.10	<.10	<.10	<.10	<.10
04-22-91	1650	.34	.15	<.10	<.10	<.10	<.10	<.10
05-01-91	0840	<.20	.20	<.10	<.10	<.20	<.10	<.10
05-30-91	1230	<.10	7.7	<.10	<.10	11	<.10	<.10
06-06-91	0830	<.10	.23	<.10	<.10	.10	<.10	<.10
06-15-91	0130	.16	5.8	<.10	<.10	9.2	<.10	<.10
06-20-91	1155	<.10	.99	<.10	<.10	.99	<.10	<.10
07-02-91	0850	<.10	.32	<.10	<.10	.24	<.10	<.10
08-06-91	0900	<.10	<.10	<.10	<.10	<.10	<.10	<.10
09-03-91	0920	<.20	.12	<.10	<.10	<.20	<.10	<.10
09-04-91	0900	<.20	<.10	<.10	<.10	<.20	<.10	<.10
Site BOOGD, Unnamed Creek near Luana (fig. 2)								
10-03-90	1220	<.10	.26	<.10	<.10	<.10	<.10	<.10
03-06-91	1330	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-18-91	1140	<.10	.22	<.10	<.10	<.10	<.10	<.10
03-19-91	1330	<.10	.21	<.10	<.10	<.10	<.10	<.10

Table 9. Selected herbicides at surface-water monitoring sites in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
			Site BOOGD, Unnamed Creek near Luana (fig. 2)--Continued					
03-21-91	1230	<0.10	0.24	<0.10	<0.10	<0.10	<0.10	<0.10
04-04-91	1300	<.10	.21	<.10	<.10	<.10	<.10	<.10
04-23-91	1130	<.10	.28	<.10	<.10	<.10	<.10	<.10
05-02-91	1200	<.20	.47	<.10	.11	<.30	<.10	<.10
05-20-91	1045	<.20	.52	<.10	.21	<.20	<.10	<.10
06-06-91	1430	.26	1.1	<.10	.19	<.10	<.10	<.10
06-15-91	1135	2.4	9.0	<.10	2.6	.20	<.10	<.10
06-16-91	1410	1.2	4.6	<.10	1.1	.15	<.10	<.10
06-20-91	1430	.18	1.7	<.10	.18	<.10	<.10	<.10
07-01-91	1330	<.10	.79	<.10	<.10	<.10	<.10	<.10
08-06-91	1300	<.10	.39	<.10	<.10	<.10	<.10	<.10
09-23-91	1200	<.20	.33	<.10	<.10	<.20	<.10	<.10
			Site RC2, Roberts Creek above Saint Olaf (fig. 2)					
10-03-90	1410	<.10	<.10	<.10	<.10	<.10	<.10	<.10
11-08-90	1500	<.10	<.10	<.10	<.10	<.10	<.10	<.10
12-05-90	1215	<.10	.12	<.10	<.10	<.10	<.10	<.10
01-07-91	1145	<.10	.17	<.10	<.10	<.10	<.10	<.10
02-05-91	1000	<.10	.13	<.10	<.10	<.10	<.10	<.10
03-06-91	1500	<.10	.13	<.10	<.10	<.10	<.10	<.10
03-18-91	1100	<.10	.18	<.10	<.10	<.10	<.10	<.10
03-19-91	1000	.20	.46	<.10	<.10	<.10	<.10	<.10
03-21-91	1115	<.10	.19	<.10	<.10	<.10	<.10	<.10
03-27-91	1315	<.10	.21	<.10	<.10	<.10	<.10	<.10
04-04-91	0900	<.10	.16	<.10	<.10	<.10	<.10	<.10
04-23-91	1445	<.10	.19	<.10	<.10	<.10	<.10	<.10
05-01-91	1415	<.20	.28	<.10	<.10	<.20	<.10	<.10
05-14-91	1400	1.0	1.6	<.10	.42	<.10	<.10	<.10
05-20-91	0945	.50	1.1	<.10	.17	.28	<.10	<.10
05-30-91	1445	29	43	<.10	6.6	5.9	<.10	<.10
06-06-91	1630	.16	.74	<.10	.11	.11	<.10	<.10
06-14-91	2245	.18	1.3	<.10	.10	.12	<.10	<.10
06-15-91	0020	8.8	20	<.10	3.0	4.3	<.10	<.10

Table 9. Selected herbicides at surface-water monitoring sites in the Big Spring study area, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
Site RC2, Roberts Creek above Saint Olaf (fig. 2)--Continued								
06-15-91	0910	5.6	15	< 0.10	2.4	6.7	< 0.10	<0 .10
06-16-91	0830	3.2	6.8	< .10	2.1	4.0	< .10	< .10
06-20-91	0955	.35	2.7	< .10	.25	.50	< .10	< .10
07-02-91	1600	< .10	.71	< .10	< .10	< .10	< .10	< .10
08-06-91	1700	< .10	.30	< .10	< .10	< .10	< .10	< .10
09-04-91	1530	< .20	.34	< .10	< .10	< .20	< .10	< .10
09-16-91	1130	.18	.94	< .10	< .10	.15	< .10	< .10

Table 10. Daily mean discharge at site L23S, Silver Creek near Luana, Iowa, water year 1991

[Discharge in cubic feet per second]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.69	0.56	0.52	0.52	0.41	0.80	4.7	6.9	7.1	4.2	1.4	1.2
2	.69	.53	.49	.52	.41	1.5	4.1	6.0	6.4	3.5	1.5	1.2
3	.85	.52	.45	.52	.39	1.0	3.0	5.4	5.7	2.9	1.6	2.5
4	.88	.52	.30	.52	.38	.80	2.4	5.1	5.5	2.3	1.8	1.6
5	.76	.52	.22	.52	.38	2.0	2.4	5.4	5.2	1.5	1.7	1.2
6	.71	.52	.27	.52	.38	3.0	2.1	5.3	4.8	1.4	2.0	1.2
7	.69	.52	.40	.53	.38	1.4	1.6	4.9	4.2	1.4	2.5	1.1
8	.65	.52	.50	.56	.38	.97	2.1	4.4	3.3	1.4	6.6	1.2
9	.64	.52	.53	.56	.38	1.0	5.7	3.8	2.7	1.3	3.1	2.4
10	.64	.52	.56	.56	.36	1.0	3.9	3.2	2.4	1.2	2.1	2.5
11	.64	.52	.57	.55	.35	2.0	2.5	2.5	1.8	2.1	2.0	1.3
12	.64	.52	.60	.52	.36	2.2	21	1.9	1.5	2.6	2.0	50
13	.64	.52	.60	.52	.38	6.0	21	6.9	1.4	1.3	1.7	4.9
14	.64	.52	.60	.52	.33	7.0	27	5.0	350	1.2	1.6	4.1
15	.64	.52	.60	.52	.32	1.9	14	3.9	431	1.2	1.6	4.5
16	.64	.52	.60	.49	.33	2.1	10	3.1	22	1.3	1.7	3.3
17	.64	.52	.60	.48	.35	3.7	8.9	2.4	15	1.1	2.2	2.9
18	.64	.52	.60	.48	.36	7.6	8.0	4.7	12	1.3	2.0	2.4
19	.60	.55	.60	.48	.35	7.9	9.5	5.0	11	1.3	1.8	2.0
20	.58	.52	.60	.45	.31	6.9	9.2	4.4	10	1.3	1.6	2.0
21	.56	.52	.60	.41	.33	6.6	8.0	3.5	9.1	1.1	1.7	2.0
22	.56	.52	.60	.41	.38	6.6	7.6	3.0	8.2	1.1	1.6	2.0
23	.56	.52	.60	.41	.38	12	7.3	3.8	7.7	1.2	1.5	2.0
24	.56	.52	.60	.41	.38	7.6	6.1	4.7	7.1	1.2	1.4	1.9
25	.56	.53	.56	.39	.38	6.2	5.8	5.3	6.6	1.2	1.3	1.6
26	.56	.56	.53	.38	.38	5.7	5.3	7.5	6.2	1.2	1.3	1.5
27	.56	.56	.48	.38	.39	11	12	6.0	5.7	1.1	1.3	1.5
28	.56	.51	.48	.38	.38	7.1	7.1	5.3	5.4	1.5	1.3	1.6
29	.56	.52	.48	.38		6.2	13	8.2	5.2	1.9	1.3	1.6
30	.56	.52	.51	.35		5.5	10	17	5.0	1.5	1.2	1.6
31	.56		.52	.39		5.3		8.3		1.6	1.2	

Table 11. Daily mean discharge at site BOOGD, Unnamed Creek near Luana, Iowa, water year 1991

[Discharge, in cubic feet per second]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.07	0	0	0	0	0.18	1.3	3.9	4.1	1.0	0.16	0.03
2	.07	0	0	0	0	1.4	1.2	3.1	3.3	1.0	.15	.01
3	.11	.01	0	0	0	.03	1.0	2.6	2.7	.89	.18	.36
4	.06	.02	0	0	0	0	.95	2.2	2.1	.76	.16	.01
5	.12	0	0	0	0	1.2	.83	2.5	1.8	.75	.11	0
6	.18	0	0	0	0	.03	.75	2.1	1.4	.73	.11	0
7	.15	0	0	0	0	.02	.65	1.5	1.2	.74	.14	0
8	.15	.33	0	0	0	.02	.67	1.4	.98	.69	1.6	0
9	.15	0	0	0	0	.02	1.5	1.3	.91	.61	.27	2.1
10	.15	0	0	0	0	.03	.80	1.0	.90	.71	.14	.04
11	.18	0	0	0	0	.36	.59	.86	.74	1.6	.11	.01
12	.18	0	0	0	0	.13	6.1	.76	.66	1.5	.08	21
13	.13	0	0	0	0	.03	12	3.4	1.1	1.3	.07	2.6
14	.05	0	0	0	0	.02	12	1.4	60	.94	.06	2.1
15	.05	0	0	0	0	.04	9.7	1.2	100	.59	.05	1.7
16	.03	0	0	0	0	.04	6.8	1.1	17	.59	.05	1.2
17	.03	.06	0	0	0	.16	5.4	1.0	9.2	.54	.04	.89
18	.04	0	0	0	0	.67	4.9	1.8	6.0	.49	.03	.78
19	.04	0	0	0	0	1.9	5.7	1.1	4.2	.38	.01	.64
20	.03	0	0	0	0	1.3	3.7	.93	3.1	.33	0	.48
21	.02	.07	0	0	0	1.4	2.9	.82	2.3	.26	.03	.48
22	.02	.01	0	0	0	.77	2.4	1.9	1.9	.26	.03	.44
23	.02	0	0	0	0	4.2	2.2	1.9	1.5	.23	.03	.37
24	.02	0	0	0	0	2.7	1.6	.83	1.3	.21	.03	.32
25	.03	0	0	0	0	2.0	1.5	2.7	1.2	.20	.04	.32
26	.01	0	0	0	0	1.8	1.3	4.1	1.2	.18	.05	.27
27	.04	0	0	0	0	5.2	4.2	1.6	1.2	.21	.05	.22
28	.05	0	0	0	0	3.5	2.2	1.5	1.1	.33	.06	.21
29	.02	0	0	0		2.4	7.6	7.3	1.1	.27	.05	.21
30	0	0	0	0		1.9	5.7	11	1.0	.20	.05	.21
31	0		0	0		1.7		5.3		.18	.03	

Table 12. Daily mean suspended-sediment concentration and daily suspended-sediment load at site BOOGD, Unnamed Creek near Luana, Iowa, water year 1991

[Total sediment load rounded to three significant figures; ---, data not available to calculate values]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily mean suspended-sediment concentration, in milligrams per liter						
1	---	---	---	---	---	---	26	50	598	122	147	76
2	---	---	---	---	---	---	29	30	512	141	146	73
3	---	---	---	---	---	---	31	15	423	156	143	126
4	---	---	---	---	---	---	26	12	304	137	141	10
5	---	---	---	---	---	---	33	26	188	114	134	---
6	---	---	---	---	---	---	42	16	150	103	132	---
7	---	---	---	---	---	---	48	13	336	108	143	---
8	---	---	---	---	---	---	92	15	325	107	190	---
9	---	---	---	---	---	---	48	17	300	126	122	1,660
10	---	---	---	---	---	---	25	17	274	121	113	202
11	---	---	---	---	---	---	36	16	257	430	114	207
12	---	---	---	---	---	25	409	320	472	214	116	1,910
13	---	---	---	---	---	21	73	993	697	207	115	42
14	---	---	---	---	---	17	461	71	2,170	230	113	124
15	---	---	---	---	---	12	34	59	1,340	222	112	50
16	---	---	---	---	---	9	30	82	156	200	126	92
17	---	---	---	---	---	30	27	164	95	172	122	96
18	---	---	---	---	---	56	22	2,040	57	146	110	103
19	---	---	---	---	---	189	26	171	77	139	107	93
20	---	---	---	---	---	66	14	226	60	140	---	67
21	---	---	---	---	---	28	14	250	62	147	126	42
22	---	---	---	---	---	707	14	290	58	158	117	48
23	---	---	---	---	---	213	19	384	---	166	105	57
24	---	---	---	---	---	39	13	292	---	184	96	63
25	---	---	---	---	---	30	8	1,000	---	207	93	67
26	---	---	---	---	---	26	7	708	---	222	94	72
27	---	---	---	---	---	251	324	347	---	216	93	71
28	---	---	---	---	---	61	54	821	---	222	89	66
29	---	---	---	---		65	1,070	1,890	---	154	84	57
30	---	---	---	---		31	68	1,210	---	145	80	48
31	---	---	---			25		625		146	79	

Table 12. Daily mean suspended-sediment concentration and daily suspended-sediment load at site BOOGD, Unnamed Creek near Luana, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily suspended-sediment load, in tons						
1	---	0	0	0	0	---	0.09	0.53	6.6	0.34	0.06	0.01
2	---	0	0	0	0	---	.09	.26	4.6	.39	.06	0
3	---	---	0	0	0	---	.09	.11	3.1	.37	.07	.19
4	---	---	0	0	0	---	.07	.07	1.7	.28	.06	0
5	---	0	0	0	0	---	.07	.19	.89	.23	.04	0
6	---	0	0	0	0	---	.08	.09	.57	.20	.04	0
7	---	---	0	0	0	---	.08	.05	1.1	.22	.05	0
8	---	0	0	0	0	---	.18	.06	.86	.20	.97	0
9	---	0	0	0	0	---	.19	.06	.74	.21	.09	31
10	---	0	0	0	0	---	.05	.05	.66	.24	.04	.06
11	---	0	0	0	0	---	.06	.04	.51	3.3	.03	.01
12	---	0	0	0	0	0	12	.61	.85	.95	.03	254
13	---	0	0	0	0	0	2.3	9.0	2.6	.70	.02	.29
14	---	0	0	0	0	0	15	.27	1,060	.58	.02	.82
15	---	0	0	0	0	0	.93	.20	1,030	.35	.02	.24
16	---	0	0	0	0	0	.55	.24	7.5	.32	.02	.30
17	---	---	0	0	0	.03	.39	.47	2.4	.25	.02	.23
18	---	0	0	0	0	.14	.30	11	.92	.19	.01	.22
19	---	0	0	0	0	1.3	.42	.54	.88	.14	0	.16
20	---	0	0	0	0	.26	.15	.57	.51	.12	0	.09
21	---	---	0	0	0	.10	.11	.55	.39	.10	.01	.05
22	---	---	0	0	0	1.4	.09	1.5	.29	.11	.01	.06
23	---	0	0	0	0	1.4	.11	2.1	---	.10	.01	.06
24	---	0	0	0	0	.28	.06	.63	---	.10	.01	.05
25	---	0	0	0	0	.16	.03	13	---	.11	.01	.06
26	---	0	0	0	0	.13	.02	9.7	---	.11	.01	.05
27	---	0	0	0	0	3.3	5.6	1.5	---	.12	.01	.04
28	---	0	0	0	0	.56	.33	3.6	---	.21	.02	.04
29	---	0	0	0	---	.42	29	88	---	.11	.01	.03
30	0	0	0	0	---	.16	1.1	43	---	.08	.01	.03
31	0		0	0		.12		8.9		.07	.01	
Total measured	0	0	0	0	0	9.76	70	197	2,130	10.8	1.77	288

Table 13. Daily mean discharge and specific conductance at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991

[---, data not available to calculate mean values; water-quality instrumentation was removed from November 27, 1990, to March 20, 1991, and instrument shelter destroyed by flood on June 15, 1991]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily mean discharge, in cubic feet per second						
1	3.6	2.9	1.9	0.20	0	0.70	45	102	116	33	1.4	0
2	3.0	2.9	1.7	.23	0	1.5	40	84	96	27	.85	0
3	4.8	3.3	1.5	.17	.01	10	35	71	78	20	.72	.89
4	7.6	3.5	1.0	.14	.01	18	33	66	63	18	.90	.18
5	5.7	3.5	.80	.12	.01	15	30	65	52	18	.56	.01
6	3.8	3.4	.58	.14	.02	33	26	75	46	16	.20	0
7	3.2	3.2	.70	.12	.03	29	23	58	42	15	.28	0
8	2.8	3.2	.75	.14	.04	19	26	52	38	13	22	.03
9	2.7	3.3	.80	.14	.05	13	83	51	35	12	17	.07
10	3.1	3.8	.83	.13	.05	13	56	44	39	11	4.5	0
11	3.2	3.8	.85	.17	.04	15	43	41	43	12	2.2	0
12	3.0	3.5	.85	.15	.04	32	187	37	34	23	1.4	105
13	3.0	3.1	.80	.15	.03	20	342	85	28	15	.87	59
14	3.6	3.2	.70	.14	.02	10	272	58	111	11	.55	35
15	2.9	3.6	.60	.15	.02	20	196	44	7,090	9.4	.40	41
16	2.7	3.2	.62	.16	.03	21	141	40	435	9.0	.22	24
17	2.7	2.9	.64	.13	.04	19	108	38	204	7.7	.51	14
18	2.8	2.9	.56	.14	.06	70	92	61	143	7.5	1.4	12
19	2.8	3.0	.45	.15	.08	96	103	56	110	7.3	.23	11
20	2.9	2.8	.50	.10	.15	103	108	45	90	6.4	.13	8.6
21	3.6	3.1	.30	.08	.40	100	84	41	78	5.6	.26	8.2
22	3.4	3.2	.21	.06	.50	71	74	40	69	4.9	.22	8.0
23	2.9	3.0	.17	.04	.50	171	70	37	63	3.6	.16	6.8
24	2.8	2.7	.17	.03	.45	117	63	39	55	2.8	.15	6.3
25	2.7	2.5	.21	.02	.43	80	52	32	50	2.1	.11	6.8
26	2.7	2.7	.25	.02	.40	65	49	77	47	1.7	.08	6.5
27	2.7	2.6	.22	.03	.40	137	117	56	42	1.4	.06	5.5
28	2.6	2.3	.24	.03	.50	112	91	46	38	1.8	.06	5.1
29	2.6	2.2	.27	.03		76	168	72	36	3.8	.05	5.0
30	2.5	2.5	.30	.02		60	150	225	33	3.4	.05	3.9
31	2.6		.23	.01		53		136		1.8	.03	

Table 13. Daily mean discharge and specific conductance at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
	Daily mean specific conductance, in microsiemens per centimeter at 25 degrees Celsius											
1	627	---	719	---	---	---	738	630	674	---	---	---
2	625	771	734	---	---	---	745	661	702	---	---	---
3	634	765	722	---	---	---	749	673	717	---	---	---
4	632	708	---	---	---	---	748	684	692	---	---	---
5	645	680	---	---	---	---	753	682	675	---	---	---
6	654	674	---	---	---	---	754	674	686	---	---	---
7	676	673	---	---	---	---	741	683	727	---	---	---
8	686	693	---	---	---	---	711	684	722	---	---	---
9	691	754	---	---	---	---	674	675	711	---	---	---
10	708	788	---	---	---	---	696	671	697	---	---	---
11	701	788	---	---	---	---	755	671	629	---	---	---
12	689	781	---	---	---	---	717	665	705	---	---	---
13	675	767	---	---	---	---	587	637	729	---	---	---
14	677	747	---	---	---	---	635	625	---	---	---	---
15	684	739	---	---	---	---	695	693	---	---	---	---
16	684	734	---	---	---	---	689	721	---	---	---	---
17	685	727	---	---	---	---	670	723	---	---	---	---
18	676	717	---	---	---	---	714	694	---	---	---	---
19	700	711	---	---	---	---	695	680	---	---	---	---
20	707	716	---	---	---	---	691	707	---	---	---	---
21	670	703	---	---	---	---	696	740	---	---	---	---
22	---	698	---	---	---	580	696	726	---	---	---	---
23	---	719	---	---	---	589	682	720	---	---	---	---
24	---	---	---	---	---	617	656	683	---	---	---	---
25	---	---	---	---	---	668	652	697	---	---	---	---
26	---	---	---	---	---	719	654	665	---	---	---	---
27	---	719	---	---	---	626	620	672	---	---	---	---
28	---	711	---	---	---	621	565	713	---	---	---	---
29	---	715	---	---		718	609	730	---	---	---	---
30	---	713	---	---		738	589	631	---	---	---	---
31	---		---	---		738		621		---	---	

Table 14. Daily median pH and mean water temperature at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991

[pH rounded to near one-tenth unit, and water temperature rounded to nearest one-half degree; ---, data not available to calculate mean or median values; water-quality instrumentation was removed from November 27, 1990, to March 20, 1991, and instrument shelter destroyed by flood on June 15, 1991]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily median pH, in standard units						
1	8.0	---	7.9	---	---	---	8.3	8.3	8.4	---	---	---
2	8.0	7.5	7.9	---	---	---	8.3	8.3	8.3	---	---	---
3	8.1	7.5	7.7	---	---	---	8.3	8.4	8.2	---	---	---
4	8.1	7.4	---	---	---	---	8.4	8.3	8.2	---	---	--
5	8.1	7.4	---	---	---	---	8.4	8.3	8.2	---	---	---
6	7.9	7.3	---	---	---	---	8.5	8.2	8.2	---	---	---
7	7.9	7.2	---	---	---	---	8.5	8.2	8.3	---	---	---
8	7.7	7.1	---	---	---	---	8.4	8.4	8.3	---	---	---
9	7.7	7.2	---	---	---	---	8.2	8.5	8.3	---	---	---
10	7.8	7.4	---	---	---	---	8.0	8.4	8.3	---	---	---
11	7.9	7.3	---	---	---	---	8.1	8.4	8.3	---	---	---
12	8.0	7.3	---	---	---	---	8.1	8.5	8.3	---	---	---
13	8.0	7.3	---	---	---	---	8.2	8.5	8.3	---	---	---
14	8.0	7.3	---	---	---	---	8.1	8.4	---	---	---	---
15	8.0	7.8	---	---	---	---	8.4	8.3	---	---	---	---
16	7.9	7.8	---	---	---	---	8.4	8.1	---	---	---	---
17	7.8	7.8	---	---	---	---	8.2	8.2	---	---	---	---
18	7.7	7.8	---	---	---	---	8.2	8.2	---	---	---	---
19	7.7	7.8	---	---	---	---	8.3	8.3	---	---	---	---
20	7.7	7.6	---	---	---	---	8.3	8.3	---	---	---	---
21	7.7	7.8	---	---	---	---	8.2	8.3	---	---	---	---
22	---	7.7	---	---	---	7.6	8.3	8.3	---	---	---	---
23	---	7.6	---	---	---	7.6	8.4	8.4	---	---	---	---
24	---	---	---	---	---	7.6	8.3	8.3	---	---	---	---
25	---	---	---	---	---	7.8	8.2	8.3	---	---	---	---
26	---	---	---	---	---	7.9	8.2	8.3	---	---	---	---
27	---	7.6	---	---	---	8.1	8.4	8.3	---	---	---	---
28	---	8.0	---	---	---	8.1	8.4	8.2	---	---	---	---
29	---	8.0	---	---		8.3	8.4	8.1	---	---	---	---
30	---	7.9	---	---		8.3	8.3	8.2	---	---	---	---
31	---		---	---		8.3		8.4		---	---	

Table 14. Daily median pH and mean water temperature at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily mean water temperature, in degrees Celsius						
1	16.0	---	2.0	---	---	---	7.0	9.0	21.0	---	---	---
2	15.0	8.5	.5	---	---	---	8.5	9.5	22.5	---	---	---
3	16.5	10.5	.5	---	---	---	10.0	10.0	21.5	---	---	---
4	13.5	7.5	---	---	---	---	10.5	10.0	19.5	---	---	---
5	12.5	6.5	---	---	---	---	10.5	11.0	19.0	---	---	---
6	19.0	4.5	---	---	---	---	11.0	8.0	19.5	---	---	---
7	16.5	3.5	---	---	---	---	11.5	9.0	20.5	---	---	---
8	12.0	1.0	---	---	---	---	11.5	12.5	21.0	---	---	---
9	10.5	2.5	---	---	---	---	11.0	15.5	21.5	---	---	---
10	9.5	3.0	---	---	---	---	10.0	17.5	21.0	---	---	---
11	9.5	3.0	---	---	---	---	9.0	19.0	21.5	---	---	---
12	10.5	3.5	---	---	---	---	4.5	22.0	23.0	---	---	---
13	10.5	3.5	---	---	---	---	3.5	23.0	22.5	---	---	---
14	12.0	5.0	---	---	---	---	7.5	22.0	---	---	---	---
15	10.5	8.5	---	---	---	---	10.5	20.5	---	---	---	---
16	12.0	8.5	---	---	---	---	10.0	22.0	---	---	---	---
17	14.5	5.5	---	---	---	---	8.0	20.5	---	---	---	---
18	10.0	6.0	---	---	---	---	10.5	15.0	---	---	---	---
19	8.0	5.5	---	---	---	---	11.5	14.0	---	---	---	---
20	7.5	6.0	---	---	---	---	10.5	17.0	---	---	---	---
21	9.5	11.0	---	---	---	---	11.0	20.5	---	---	---	---
22	---	7.5	---	---	---	6.5	11.5	23.0	---	---	---	---
23	---	6.0	---	---	---	5.5	11.0	24.0	---	---	---	---
24	---	---	---	---	---	5.0	10.5	24.5	---	---	---	---
25	---	---	---	---	---	8.0	11.5	24.5	---	---	---	---
26	---	---	---	---	---	11.5	11.5	24.5	---	---	---	---
27	---	5.5	---	---	---	13.5	13.0	27.0	---	---	---	---
28	---	2.5	---	---	---	7.0	14.5	30.0	---	---	---	---
29	---	1.0	---	---		4.5	15.0	31.5	---	---	---	---
30	---	1.5	---	---		4.5	12.0	25.0	---	---	---	---
31	---		---	---		6.0		22.0		---	---	

Table 15. Daily mean suspended-sediment concentration and daily suspended-sediment load at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991

[---, data not available to calculate median values; total sediment load rounded to three significant figures]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily mean suspended-sediment concentration, in milligrams per liter						
1	15	24	9	9	---	32	52	134	131	50	34	---
2	15	24	8	9	---	30	51	75	141	63	46	---
3	15	23	8	10	30	28	54	56	157	107	109	55
4	17	23	8	13	34	27	52	63	139	80	166	39
5	18	23	8	12	36	26	53	71	119	63	70	57
6	17	23	9	11	19	24	54	72	103	67	22	---
7	14	22	9	11	21	23	56	36	99	76	29	---
8	10	22	9	14	22	24	93	44	78	78	41	55
9	21	22	9	16	23	27	134	51	83	78	37	54
10	28	22	9	16	24	36	54	76	70	76	31	---
11	15	22	9	16	26	31	63	100	73	72	26	---
12	10	21	9	17	28	151	1,390	117	67	69	23	---
13	7	21	8	17	30	322	2,210	594	309	70	20	---
14	8	21	8	17	32	142	368	627	1,530	73	20	---
15	12	20	7	18	34	87	172	222	5,340	76	22	---
16	18	20	7	18	36	83	193	171	778	73	29	---
17	23	21	6	18	38	102	334	199	309	44	39	---
18	24	22	6	19	41	252	113	204	205	104	55	---
19	25	23	6	19	43	426	86	187	119	161	69	---
20	26	23	6	20	42	497	76	100	66	173	57	---
21	26	24	6	20	38	563	76	128	62	130	39	---
22	26	25	6	21	36	164	83	160	58	55	29	---
23	26	24	7	21	34	1,130	90	139	56	22	23	---
24	25	22	7	21	32	203	87	132	46	30	18	---
25	25	19	7	21	32	189	87	145	49	39	28	---
26	25	18	7	21	30	133	76	249	50	55	36	---
27	25	16	8	21	32	542	663	217	49	89	35	---
28	24	14	8	21	31	211	396	204	93	85	32	---
29	25	12	9	22		49	759	231	120	78	30	---
30	24	10	9	22		36	598	2,340	55	47	31	---
31	24		9	22		41		463		33	32	---

Table 15. Daily mean suspended-sediment concentration and daily suspended-sediment load at site RC2, Roberts Creek above Saint Olaf, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily suspended-sediment load, in tons						
1	0.15	0.19	0.05	0	0	0.06	6.3	38	41	4.5	0.13	0
2	.12	.19	.04	.01	0	.12	5.4	17	36	4.5	.11	0
3	.21	.21	.03	0	0	.77	5.1	11	33	5.8	.22	.14
4	.36	.22	.02	0	0	1.3	4.6	11	24	4.0	.40	.02
5	.28	.22	.02	0	0	1.1	4.2	12	17	3.0	.11	0
6	.17	.21	.01	0	0	2.1	3.8	15	13	2.9	.01	0
7	.12	.20	.02	0	0	1.8	3.4	5.7	11	3.1	.02	0
8	.08	.19	.02	.01	0	1.2	7.2	6.2	8.1	2.7	2.5	.01
9	.16	.20	.02	.01	0	.92	29	7.0	7.8	2.5	1.7	.01
10	.23	.22	.02	.01	0	1.2	7.8	8.9	7.6	2.2	.37	0
11	.13	.22	.02	.01	0	1.2	7.2	11	8.5	2.3	.15	0
12	.08	.20	.02	.01	0	15	1,870	12	6.0	4.3	.09	0
13	.06	.18	.02	.01	0	18	2,590	145	23	2.8	.05	---
14	.08	.18	.01	.01	0	3.5	262	112	4,220	2.2	.03	---
15	.09	.20	.01	.01	0	4.7	93	26	144,000	1.9	.02	---
16	.13	.18	.01	.01	0	4.7	71	18	982	1.8	.02	---
17	.17	.17	.01	.01	0	5.5	98	20	172	.91	.05	---
18	.18	.18	.01	.01	.01	51	28	33	79	2.1	.20	---
19	.19	.18	.01	.01	.01	111	24	29	36	3.2	.04	---
20	.20	.18	.01	.01	.02	138	22	12	16	3.0	.02	---
21	.25	.20	0	0	.04	156	17	14	13	2.0	.03	---
22	.24	.21	0	0	.05	32	17	17	11	.73	.02	---
23	.20	.19	0	0	.05	587	17	14	9.5	.22	.01	---
24	.19	.16	0	0	.04	71	15	14	6.9	.23	.01	---
25	.18	.13	0	0	.04	41	12	13	6.6	.22	.01	---
26	.18	.13	.01	0	.03	23	10	53	6.3	.25	.01	---
27	.18	.11	0	0	.03	230	295	33	5.6	.34	.01	---
28	.17	.09	.01	0	.04	69	104	25	9.5	.42	.01	---
29	.18	.07	.01	0		10	425	84	12	.79	0	---
30	.16	.07	.01	0		5.7	275	1,360	5.0	.45	0	---
31	.17		.01	0		5.9		184		.16	0	
Total measured	5.29	5.28	.43	.14	.36	1,590	6,329	2,360	150,000	65.5	6.35	.18

Table 16. Miscellaneous water-level measurements in the Big Spring Basin, Clayton County, Iowa, water year 1991

[Water levels in feet below land surface; negative values indicate that the water level is above land surface; --, data not collected]

Date	Water level	Date	Water level
	Well BS1-D (fig. 2)		
10-02-90	-4.45	4-19-91	-5.26
10-22-90	-4.38	4-30-91	-6.09
11-02-90	-4.33	5-20-91	-6.18
11-07-90	-3.87	5-24-91	-6.76
12-11-90	-5.49	6-05-91	-6.48
1-08-91	-5.39	6-12-91	-6.76
1-22-91	-5.60	6-15-91	-7.22
2-05-91	-5.26	6-26-91	-7.22
2-19-91	-4.33	7-01-91	-7.57
3-05-91	-4.68	7-22-91	-7.22
4-05-91	-4.45	8-05-91	-6.53
4-17-91	-4.36	9-03-91	-6.30
	Well BS2-A (fig. 2)		
10-02-90	55.35	4-04-91	54.97
11-07-90	55.59	4-30-91	54.88
12-11-90	55.57	6-05-91	54.25
1-09-91	55.58	7-01-91	52.64
2-06-91	55.60	8-05-91	51.14
3-05-91	55.42	9-03-91	50.93
		10-08-91	52.27
	Well BS2-B (fig. 2)		
10-02-90	126.10	4-04-91	124.66
11-07-90	--	4-30-91	124.59
12-11-90	124.46	6-05-91	124.68
1-09-91	124.64	7-01-91	124.49
2-06-91	124.81	8-05-91	124.56
3-05-91	124.63	9-03-91	124.71
		10-08-91	124.58

Table 16. Miscellaneous water-level measurements in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Water level	Date	Water level
	Well BS2-C (fig. 2)		
10-02-90	123.61	4-04-91	122.70
11-07-90	--	4-30-91	122.62
12-11-90	122.50	6-05-91	122.64
1-09-91	122.04	7-01-91	122.58
2-06-91	122.28	8-05-91	123.98
3-05-91	122.70	9-03-91	124.02
		10-08-91	124.03
	Well BS2-D (fig. 2)		
10-02-90	134.64	4-04-91	134.57
11-07-90	--	4-30-91	134.76
12-11-90	134.09	6-05-91	134.64
1-09-91	134.29	7-01-91	134.58
2-06-91	134.02	8-05-91	134.09
3-05-91	134.47	9-03-91	134.49
		10-08-91	133.53
	Well BS2-F (fig. 2)		
10-02-90	281.60	4-04-91	279.75
11-07-90	--	4-30-91	279.29
12-11-90	280.53	6-05-91	278.83
1-09-91	279.74	7-01-91	260.78
2-06-91	280.37	8-05-91	260.59
3-05-91	280.19	9-03-91	260.66
		10-08-91	260.05
	Well BS3 (fig. 2)		
10-01-90	300.70	4-04-91	300.65
11-07-90	301.03	4-30-91	300.01
12-11-90	300.59	6-05-91	300.22
1-07-91	301.35	7-01-91	300.18
2-06-91	301.22	8-05-91	300.16
3-05-91	300.15	9-03-91	300.21

Table 16. Miscellaneous water-level measurements in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Water level	Date	Water level
Well BS3-A (fig. 2)			
10-02-90	167.84	4-04-91	161.81
11-07-90	167.76	4-30-91	160.44
12-11-90	167.87	6-05-91	161.25
1-07-91	168.07	7-01-91	165.34
2-06-91	168.11	8-05-91	167.54
3-05-91	167.32	9-03-91	167.96
Well BS3-C (fig. 2)			
10-02-90	14.17	4-04-91	9.58
11-07-90	15.36	4-30-91	7.77
12-11-90	15.27	6-05-91	9.01
1-07-91	14.25	7-01-91	10.27
2-06-91	14.93	8-05-91	13.99
3-06-91	12.10	9-05-91	14.68

Table 17. Daily mean water levels in unconsolidated aquifers, Clayton County, Iowa, water year 1991

[Water levels in feet below land surface; ---, data not available to calculate mean values]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS1-A (fig. 2)						
1	12.70	13.17	13.38	13.48	13.53	13.29	11.15	6.25	10.12	11.37	12.51	13.06
2	12.78	13.18	13.40	13.48	13.53	13.05	11.30	8.07	10.06	11.50	12.51	13.03
3	12.83	13.19	13.41	13.48	13.53	12.77	11.45	9.30	10.47	11.57	12.53	13.05
4	12.76	13.18	13.41	13.48	13.51	12.39	11.58	9.88	10.80	11.60	12.56	13.07
5	12.66	13.16	13.48	13.48	13.48	12.35	11.68	10.16	11.05	11.62	12.57	13.08
6	12.59	13.17	13.53	13.48	13.45	12.25	11.79	10.09	11.25	11.69	12.59	13.08
7	12.62	13.20	13.52	13.48	13.44	12.02	11.88	9.98	11.41	11.73	12.63	13.08
8	12.68	13.22	13.44	13.48	13.40	11.85	11.96	10.10	11.56	11.78	12.66	13.08
9	12.72	13.22	13.39	13.47	13.38	11.82	11.78	10.38	11.68	11.84	12.66	13.08
10	12.75	13.22	13.40	13.45	13.37	11.89	11.67	10.57	11.77	11.89	12.69	13.08
11	12.78	13.22	13.40	13.44	13.36	11.89	11.68	10.71	11.79	11.91	12.72	13.08
12	12.76	13.24	13.42	13.44	13.39	11.84	11.11	10.87	11.90	11.93	12.72	13.08
13	12.73	13.25	13.41	13.43	13.34	11.74	7.14	11.00	12.02	11.99	12.70	13.08
14	12.80	13.25	13.41	13.42	13.34	11.73	6.66	11.12	11.97	12.02	12.69	13.08
15	12.88	13.25	13.42	13.42	13.45	11.78	6.42	11.26	---	12.06	12.76	13.08
16	12.92	13.27	13.46	13.42	13.46	11.84	7.40	11.34	---	12.10	12.80	13.08
17	12.94	13.27	13.43	13.42	13.42	11.75	8.70	11.08	---	12.14	12.84	13.08
18	12.97	13.28	13.41	13.42	13.43	11.47	9.47	10.39	---	12.17	12.83	13.09
19	13.00	13.29	13.40	13.42	13.43	11.03	9.82	9.33	---	12.19	12.91	13.09
20	13.00	13.31	13.40	13.42	13.43	10.76	9.78	8.76	---	12.23	12.95	13.10
21	12.99	13.32	13.42	13.47	13.41	10.70	9.83	9.37	---	12.30	12.98	13.10
22	12.94	13.33	13.43	13.49	13.35	10.66	10.12	10.15	---	12.33	12.98	13.10
23	12.91	13.33	13.54	13.49	13.34	10.12	10.36	10.28	---	12.36	12.98	13.10
24	12.91	13.33	13.67	13.49	13.31	9.11	10.53	10.59	---	12.38	13.00	13.10
25	12.95	13.33	13.71	13.51	13.38	9.14	10.72	10.82	---	12.41	13.03	13.10
26	13.04	13.35	13.62	13.51	13.35	9.80	10.90	10.90	10.82	12.44	13.02	13.11
27	13.07	13.37	13.43	13.51	13.35	10.14	10.60	11.01	10.91	12.44	13.04	13.11
28	13.11	13.37	13.41	13.52	13.31	10.17	9.48	11.08	11.04	12.44	13.04	13.11
29	13.12	13.37	13.44	13.53		10.39	8.18	11.09	11.15	12.45	13.05	13.11
30	13.14	13.37	13.47	13.53		10.69	6.22	10.11	11.24	12.47	13.06	13.11
31	13.16		13.48	13.53		10.95		10.28		12.49	13.06	

Table 17. Daily mean water levels in unconsolidated aquifers, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS4-B (fig. 2)						
1	73.11	73.33	73.49	73.61	73.69	73.61	72.24	71.04	71.44	70.90	71.68	72.17
2	73.13	73.34	73.55	73.66	73.69	73.50	72.26	71.06	71.42	70.97	71.67	72.16
3	73.04	73.36	73.39	73.67	73.68	73.48	72.28	71.08	71.42	71.03	71.69	72.13
4	73.07	73.35	73.46	73.66	73.68	73.42	72.30	71.07	71.45	71.07	71.73	72.15
5	73.09	73.30	73.45	73.61	73.69	73.31	72.28	71.08	71.49	71.09	71.77	72.15
6	73.09	73.36	73.47	73.66	73.74	73.25	72.31	71.14	71.53	71.13	71.79	72.17
7	73.18	73.39	73.47	73.67	73.76	73.28	72.34	71.20	71.55	71.17	71.78	72.18
8	73.22	73.38	73.49	73.59	73.75	73.25	72.32	71.20	71.55	71.22	71.66	72.17
9	73.20	73.34	73.50	73.58	73.74	73.25	72.38	71.24	71.56	71.26	71.68	72.15
10	73.17	73.36	73.52	73.61	73.75	73.23	72.38	71.29	71.56	71.29	71.71	72.19
11	73.16	73.40	73.47	73.55	73.75	73.13	71.95	71.29	71.56	71.30	71.75	72.19
12	73.19	73.44	73.46	73.53	73.71	73.03	71.51	71.29	71.59	71.27	71.78	72.04
13	73.16	73.43	73.53	73.52	73.64	73.01	71.25	71.30	71.63	71.31	71.78	72.01
14	73.14	73.40	73.53	73.58	73.65	73.05	71.21	71.34	71.53	71.37	71.78	71.95
15	73.24	73.39	73.45	73.58	73.72	73.07	71.27	71.38	70.79	71.41	71.79	71.93
16	73.23	73.44	73.52	73.59	73.70	73.04	71.30	71.40	70.41	71.43	71.79	71.92
17	73.16	73.47	73.47	73.60	73.71	72.96	71.30	71.44	70.32	71.43	71.78	71.94
18	73.23	73.43	73.44	73.56	73.72	72.86	71.30	71.48	70.30	71.43	71.83	71.95
19	73.28	73.43	73.51	73.57	73.75	72.76	71.30	71.49	70.34	71.44	71.87	72.00
20	73.24	73.44	73.52	73.63	73.77	72.61	71.27	71.49	70.36	71.47	71.88	72.02
21	73.26	73.38	73.53	73.61	73.76	72.56	71.21	71.49	70.38	71.50	71.88	71.97
22	73.28	73.43	73.54	73.54	73.76	72.50	71.27	71.50	70.43	71.51	71.90	71.95
23	73.27	73.41	73.56	73.64	73.70	72.29	71.38	71.50	70.52	71.57	71.94	72.01
24	73.31	73.42	73.54	73.69	73.68	72.29	71.41	71.52	70.58	71.58	71.97	72.01
25	73.33	73.46	73.57	73.66	73.72	72.24	71.39	71.52	70.62	71.62	71.97	71.94
26	73.30	73.45	73.63	73.59	73.69	72.14	71.27	71.52	70.64	71.66	71.98	71.98
27	73.30	73.43	73.60	73.57	73.67	72.04	71.21	71.58	70.69	71.67	71.99	72.03
28	73.37	73.47	73.54	73.66	73.66	72.11	70.97	71.63	70.77	71.65	72.02	72.06
29	73.34	73.55	73.54	73.68		72.16	70.88	71.62	70.82	71.62	72.05	72.08
30	73.33	73.47	73.61	73.65		72.20	70.94	71.51	70.87	71.64	72.07	72.08
31	73.36		73.63	73.69		72.18		71.45		71.65	72.12	

Table 17. Daily mean water levels in unconsolidated aquifers, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS4-C (fig. 2)						
1	56.00	56.25	56.66	56.68	56.90	56.88	56.47	56.06	55.64	54.04	54.97	54.83
2	55.98	56.35	56.64	56.87	56.93	57.18	56.32	56.05	55.59	54.41	54.93	54.77
3	55.90	56.45	56.42	56.79	56.89	57.18	56.19	55.87	55.56	54.42	55.02	54.80
4	56.14	56.39	56.73	56.70	56.92	56.93	56.05	55.80	55.64	54.43	55.10	54.89
5	56.06	56.25	56.46	56.67	56.96	56.95	56.05	55.55	54.89	54.47	54.74	54.86
6	56.08	56.50	56.70	56.88	56.95	57.50	55.97	55.68	54.15	54.46	54.44	54.90
7	56.29	56.50	56.56	56.80	56.97	57.63	56.04	55.93	54.04	54.54	54.44	54.89
8	56.25	56.34	56.66	56.65	56.87	57.38	56.04	55.79	53.97	54.69	54.37	54.84
9	56.17	56.31	56.63	56.87	56.92	57.49	56.12	55.62	53.98	54.59	54.48	54.87
10	56.03	56.43	56.66	56.75	56.97	57.39	56.26	55.65	53.98	54.53	54.52	55.03
11	56.13	56.49	56.49	56.65	56.98	57.22	56.19	55.57	54.00	54.55	54.55	54.93
12	56.18	56.55	56.57	56.81	56.82	57.19	55.93	55.46	54.07	54.54	54.53	54.89
13	56.07	56.47	56.79	56.67	56.80	57.29	55.60	55.46	54.13	54.71	54.49	54.92
14	56.11	56.32	56.55	56.84	57.03	57.36	55.38	55.52	54.03	54.79	54.47	54.89
15	56.33	56.38	56.55	56.86	57.14	57.34	55.51	55.57	53.78	54.73	54.48	54.97
16	56.16	56.54	56.72	56.85	56.85	57.24	55.70	55.51	53.80	54.68	54.48	55.02
17	56.04	56.49	56.47	56.88	57.02	57.01	55.68	55.61	53.77	54.64	54.55	55.04
18	56.38	56.36	56.56	56.82	56.95	57.04	55.53	55.82	53.73	54.59	54.64	55.10
19	56.26	56.49	56.79	56.71	57.09	57.06	55.53	55.72	53.80	54.68	54.68	55.19
20	56.13	56.47	56.64	56.91	56.98	56.78	53.93	55.53	53.66	54.77	54.63	55.06
21	56.33	56.38	56.65	56.94	57.00	56.89	54.78	55.45	53.58	54.82	54.58	54.91
22	56.27	56.52	56.72	56.67	57.13	56.84	54.94	55.46	53.72	54.78	54.70	54.99
23	56.24	56.48	56.69	56.93	56.93	56.76	55.07	55.47	53.80	54.93	54.73	55.18
24	56.34	56.47	56.63	57.01	57.11	57.15	55.39	55.47	53.74	54.83	54.72	55.06
25	56.32	56.66	56.76	56.93	57.06	56.82	55.05	55.49	53.65	54.87	54.69	54.91
26	56.21	56.43	56.81	56.73	56.93	56.46	54.98	55.46	53.56	54.97	54.66	55.18
27	56.30	56.52	56.58	56.74	56.94	56.37	54.85	55.67	53.67	54.95	54.67	55.22
28	56.41	56.76	56.54	56.96	56.93	56.79	54.99	55.67	53.76	54.85	54.72	55.20
29	56.23	56.72	56.74	56.97		56.78	54.58	55.59	53.70	54.91	54.74	55.15
30	56.30	56.42	56.80	56.86		56.60	55.38	55.48	53.70	54.95	54.73	55.12
31	56.33		56.74	56.99		56.37		55.56		54.94	54.81	

Table 17. Daily mean water levels in unconsolidated aquifers, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well DCW1 (fig. 3)						
1	---	4.54	4.62	4.67	4.82	4.21	4.06	3.73	3.74	4.19	5.15	5.85
2	---	4.52	4.74	4.77	4.82	3.86	4.08	3.84	3.80	4.25	5.17	5.86
3	4.45	4.54	4.57	4.81	4.80	3.98	4.09	3.89	3.88	4.26	5.20	5.56
4	4.42	4.46	4.63	4.79	4.76	4.06	4.10	3.93	3.95	4.27	5.23	5.47
5	4.43	4.41	4.48	4.69	4.79	3.92	4.10	3.91	4.03	4.28	5.29	5.54
6	4.44	4.46	4.40	4.79	4.80	3.80	4.10	3.86	4.09	4.30	5.36	5.60
7	4.54	4.47	4.39	4.83	4.79	3.99	4.12	3.92	4.10	4.32	5.34	5.64
8	4.58	4.46	4.41	4.72	4.68	4.02	4.12	3.94	4.11	4.33	4.53	5.61
9	4.55	4.44	4.44	4.73	4.58	3.99	3.85	3.95	4.12	4.34	4.40	5.69
10	4.46	4.44	4.50	4.76	4.52	4.04	3.90	4.00	4.14	4.35	4.62	5.73
11	4.45	4.46	4.46	4.62	4.46	3.96	3.95	4.03	4.14	4.36	4.77	4.94
12	4.47	4.50	4.46	4.59	4.39	3.89	3.35	4.04	4.17	4.21	4.86	4.30
13	4.45	4.49	4.60	4.57	4.36	3.98	3.15	3.96	4.20	4.27	4.93	4.36
14	4.45	4.44	4.61	4.55	4.42	4.06	3.14	3.97	2.90	4.31	5.03	4.19
15	4.60	4.44	4.51	4.63	4.57	4.06	3.47	4.04	3.23	4.32	5.11	4.18
16	4.62	4.50	4.62	4.64	4.48	4.03	3.71	4.06	3.63	4.35	5.17	4.28
17	4.55	4.56	4.52	4.69	4.46	3.89	3.83	4.08	3.78	4.38	5.19	4.34
18	4.67	4.47	4.48	4.71	4.44	3.67	3.88	3.94	3.86	4.39	5.04	4.31
19	4.76	4.46	4.59	4.56	4.50	3.74	3.81	3.90	3.90	4.43	5.32	4.36
20	4.67	4.45	4.59	4.60	4.52	3.78	3.72	3.96	3.93	4.44	5.35	4.41
21	4.64	4.43	4.58	4.74	4.40	3.81	3.81	4.02	3.97	4.51	5.35	4.42
22	4.61	4.46	4.57	4.62	4.32	3.81	3.87	4.06	4.02	4.59	5.40	4.44
23	4.58	4.44	4.58	4.59	4.30	3.44	3.90	4.07	4.04	4.77	5.47	4.58
24	4.59	4.44	4.51	4.76	4.33	3.66	3.94	4.08	4.06	4.84	5.51	4.62
25	4.59	4.54	4.52	4.80	4.34	3.82	3.95	4.09	4.07	4.96	5.53	4.53
26	4.56	4.52	4.69	4.68	4.34	3.91	3.96	4.05	4.10	5.02	5.56	4.59
27	4.56	4.46	4.57	4.55	4.34	3.63	3.58	4.07	4.13	5.07	5.59	4.68
28	4.65	4.56	4.42	4.62	4.34	3.73	3.69	4.09	4.14	5.07	5.64	4.75
29	4.60	4.75	4.47	4.77		3.88	3.26	4.02	4.16	5.02	5.68	4.77
30	4.57	4.60	4.62	4.76		3.95	3.53	3.58	4.18	5.05	5.70	4.77
31	4.57		4.74	4.81		4.01		3.73		5.10	5.79	

Table 17. Daily mean water levels in unconsolidated aquifers, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well DCW10 (fig. 3)						
1	---	---	9.85	10.13	10.55	10.21	3.54	1.53	2.94	4.54	7.73	10.67
2	---	---	10.00	10.25	10.53	10.02	3.68	2.13	3.00	4.58	7.86	10.71
3	---	---	9.75	10.30	10.51	9.83	3.75	2.70	3.21	4.65	7.99	10.78
4	---	---	9.90	10.25	10.49	9.57	3.84	3.15	3.52	4.78	8.17	10.86
5	---	---	9.81	10.13	10.55	9.31	3.91	3.35	3.76	4.89	8.30	10.88
6	---	---	9.89	10.26	10.59	8.61	3.94	3.41	3.90	4.96	8.42	10.93
7	---	---	9.90	10.33	10.59	8.10	4.01	3.61	3.98	5.10	8.53	10.97
8	---	---	9.95	10.19	10.55	7.71	4.04	3.69	4.04	5.32	8.55	11.00
9	---	---	9.98	10.24	10.49	7.27	3.93	3.72	4.12	5.38	8.63	11.04
10	---	---	10.02	10.31	10.51	6.85	3.81	3.78	4.16	5.53	8.73	11.10
11	---	---	9.91	10.17	10.53	6.25	3.76	3.82	4.21	5.67	8.86	11.15
12	---	---	9.83	10.18	10.49	5.36	2.88	3.84	4.28	5.73	8.94	11.13
13	---	---	10.05	10.16	10.33	4.97	.33	3.85	4.35	5.85	9.04	11.05
14	---	---	10.07	10.13	10.32	4.98	.29	3.85	4.23	5.99	9.14	10.98
15	---	9.59	9.85	10.26	10.51	5.02	.48	3.86	.74	6.03	9.24	10.95
16	---	9.67	10.03	10.29	10.51	4.89	.92	3.86	.60	6.04	9.33	10.95
17	---	9.74	9.92	10.35	10.45	4.61	1.49	3.93	1.30	6.11	9.43	10.94
18	---	9.59	9.81	10.38	10.47	4.09	2.07	4.01	2.13	6.20	9.56	10.90
19	---	9.62	10.01	10.26	10.50	3.48	2.41	3.94	2.87	6.31	9.68	10.92
20	---	9.66	10.05	10.32	10.54	3.01	2.58	3.82	3.36	6.43	9.72	10.90
21	---	9.54	10.07	10.46	10.53	2.91	2.78	3.77	3.62	6.53	9.81	10.80
22	---	9.67	10.09	10.35	10.59	2.89	2.95	3.81	3.78	6.63	9.91	10.76
23	---	9.62	10.13	10.29	10.56	2.36	3.14	3.85	3.89	6.76	10.00	10.81
24	---	9.62	10.07	10.49	10.49	1.86	3.39	3.91	3.96	6.82	10.09	10.77
25	---	9.75	10.09	10.55	10.54	2.06	3.53	3.97	4.00	6.95	10.15	10.64
26	---	9.70	10.25	10.42	10.47	2.37	3.57	4.00	4.08	7.10	10.22	10.66
27	---	9.64	10.15	10.27	10.38	2.37	2.95	4.11	4.30	7.21	10.28	10.68
28	---	9.84	9.98	10.33	10.32	2.28	2.25	4.15	4.39	7.29	10.38	10.68
29	---	10.02	9.97	10.49		2.61	1.54	4.15	4.48	7.37	10.45	10.65
30	---	9.79	10.12	10.48		3.01	1.12	3.75	4.57	7.49	10.51	10.61
31	---		10.20	10.52		3.27		3.02		7.59	10.60	

Table 18. Onsite determinations of selected water-quality constituents at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; °C, degrees Celsius; mg/L, milligrams per liter; --, missing data]

Date	Time (24-hour)	Water level (feet below land surface)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Dissolved oxygen (mg/L)
			Well DCW2 (fig. 3)			
10-03-90	1050	6.81	795	6.9	14.0	0.8
11-08-90	1120	6.05	880	7.1	10.5	1.0
12-12-90	1115	6.05	792	7.1	7.0	1.0
01-08-91	1145	6.21	753	7.0	8.0	1.5
02-06-91	1330	6.39	780	7.1	6.0	1.2
03-06-91	1145	5.37	808	7.1	4.0	2.1
03-26-91	1430	--	873	7.4	10.0	1.5
05-01-91	1000	5.31	830	7.1	7.5	1.7
06-06-91	0930	5.61	860	7.0	10.0	0.8
07-02-91	0950	5.72	763	7.3	10.0	--
08-06-91	1000	6.98	772	6.9	13.0	--
09-04-91	0955	7.19	761	6.9	14.0	--
			Well DCW3 (fig. 3)			
10-03-90	1130	6.46	598	7.1	14.0	1.2
11-08-90	0930	7.99	621	6.9	10.0	1.6
12-12-90	0915	7.96	635	7.3	8.0	2.1
01-08-91	1215	8.15	608	7.3	7.0	2.5
02-06-91	1415	8.14	644	7.3	6.0	1.5
03-06-91	1240	6.49	640	7.2	5.0	1.7
03-27-91	1125	--	630	--	8.5	--
05-01-91	1300	3.07	656	7.4	8.0	2.3
06-06-91	1200	3.76	673	7.3	12.0	1.2
07-02-91	1145	4.49	647	7.3	10.0	--
08-06-91	1130	6.29	620	7.1	14.0	--
09-04-91	1045	7.87	586	7.0	14.0	--

Table 18. Onsite determinations of selected water-quality constituents at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Water level (feet below land surface)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Dissolved oxygen (mg/L)
			Well DCW7 (fig. 3)			
12-12-90	1200	--	668	7.5	8.5	--
05-01-91	1100	2.60	718	7.5	8.5	--
07-02-91	1100	4.44	710	7.4	10.0	--
08-06-91	1100	8.67	738	7.3	14.0	--
09-04-91	1010	10.99	639	7.1	14.0	--
			Well DCW8 (fig. 3)			
12-12-90	0830	13.49	802	7.3	8.0	7.0
03-27-91	1040	5.96	745	--	8.0	--
05-01-91	1400	6.15	662	7.6	8.0	--
06-06-91	1315	6.64	759	7.4	11.5	--
07-02-91	1310	7.16	767	7.4	10.0	--
08-06-91	1300	8.95	820	7.3	14.0	--
			Deer Creek well (DCW11, fig. 3)			
12-12-90	0945	11.57	667	7.3	7.0	2.4
03-27-91	1150	4.80	688	--	9.0	--
05-01-91	1330	5.29	646	7.5	8.0	--
06-06-91	1240	6.64	700	7.4	13.0	1.4
07-02-91	1230	8.16	633	7.5	10.0	--
08-06-91	1200	11.43	635	7.4	11.5	--
09-04-91	1115	13.44	609	7.2	13.0	--
			Tile DCT1 (fig. 3)			
04-04-91	1015	--	638	--	5.0	--
			Tile DCT2 (fig. 3)			
10-03-90	0750	--	667	6.7	14.0	--
11-08-90	0950	--	600	6.5	9.0	--
12-12-90	1230	--	575	6.9	8.0	--
02-06-91	1200	--	600	6.8	5.0	--
03-06-91	0920	--	705	6.3	3.0	--
04-04-91	0940	--	--	--	--	--

Table 18. Onsite determinations of selected water-quality constituents at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Water level (feet below land surface)	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Dissolved oxygen (mg/L)
			Tile DCT2 (fig. 3)--Continued			
05-01-91	0800	--	527	6.3	8.0	--
06-06-91	0810	--	566	6.3	12.0	--
07-02-91	0800	--	593	6.6	16.0	--
08-06-91	0815	--	598	6.8	15.0	--
09-04-91	0830	--	604	6.8	15.0	--
			Big Spring (fig. 2)			
10-02-90	1330	--	750	6.6	10.5	8.9
11-07-90	1430	--	758	6.8	10.0	8.1
12-05-90	0945	--	735	6.7	10.0	--
01-08-91	1600	--	807	7.3	9.5	10.0
02-05-91	1200	--	785	7.0	9.0	10.0
03-05-91	1300	--	670	6.8	8.5	9.0
03-18-91	1000	--	723	7.0	8.5	--
03-19-91	1200	--	691	6.8	8.5	10.0
03-21-91	1200	--	664	6.9	8.5	--
03-27-91	0750	--	725	6.9	9.0	--
04-05-91	1000	--	737	6.9	9.5	--
04-22-91	1230	--	720	6.7	9.0	--
05-02-91	0800	--	710	6.9	9.5	9.6
05-20-91	1200	--	725	6.9	10.0	--
05-30-91	1200	--	698	6.9	10.5	--
06-05-91	1340	--	735	6.9	10.0	8.8
06-15-91	1120	--	299	6.7	14.0	--
06-15-91	1230	--	709	6.7	11.0	8.4
06-16-91	0520	--	522	6.8	12.0	--
07-01-91	1430	--	726	6.9	11.5	8.8
08-05-91	1400	--	724	6.9	12.5	8.4
09-03-91	1630	--	732	6.8	12.0	8.4
09-16-91	0930	--	576	6.7	12.0	--

Table 19. Selected nitrogen, phosphorus, and carbon species at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991

[Total constituents in milligrams per liter; N, nitrogen; P, phosphorus; C, carbon; --, data not collected; <, less than indicated detected limit]

Date	Time (24-hour)	Nitrogen, NO_2+NO_3, total (as N)	Nitrogen, ammonia, total (as N)	Nitrogen, organic, total (as N)	Phosphorus, organic, total (as P)	Carbon, organic, total (as C)
			Well DCW2 (fig. 3)			
10-03-90	1050	8.0	0.20	0.40	<0.10	3.1
11-08-90	1120	4.2	.80	.30	.10	3.2
12-12-90	1115	.50	1.0	.10	<.10	2.9
01-08-91	1145	.20	.20	.20	<.10	3.1
02-06-91	1330	.10	.20	.20	<.10	2.5
03-06-91	1145	.40	.20	.20	<.10	2.4
03-26-91	1430	16	<.10	.40	.10	--
05-01-91	1000	28	.20	.40	.20	3.0
06-06-91	0930	18	.10	.20	<.10	1.8
07-02-91	0950	6.6	.50	4.4	3.4	3.4
08-06-91	1000	1.3	1.1	8.8	<.10	49
09-04-91	0955	.50	1.5	1.0	.40	7.1
			Well DCW3 (fig. 3)			
10-03-90	1130	<.10	<.10	.40	<.10	<1.0
11-08-90	0930	<.10	.20	.50	.20	2.0
12-12-90	0915	<.10	.10	.40	<.10	2.6
01-08-91	1215	<.10	<.10	.20	<.10	2.0
02-06-91	1415	<.10	.20	<.10	<.10	1.2
03-06-91	1240	<.10	.20	<.10	<.10	1.3
03-27-91	1125	.10	.20	<.10	<.10	1.3
05-01-91	1300	.60	.30	<.10	.20	1.4
06-06-91	1200	.40	.10	.10	<.10	<1.0
07-02-91	1145	<.10	.30	.90	.10	1.3
08-06-91	1130	<.10	.10	1.0	<.10	2.6
09-04-91	1045	<.10	.20	.30	.20	1.4

Table 19. Selected nitrogen, phosphorus, and carbon species at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Nitrogen, NO_2+NO_3, total (as N)	Nitrogen, ammonia, total (as N)	Nitrogen, organic, total (as N)	Phosphorus, organic, total (as P)	Carbon, organic, total (as C)
			Well DCW7 (fig. 3)			
12-12-90	1200	0.40	<0.10	<0.10	<0.10	--
05-01-91	1100	1.0	.20	.70	.90	--
07-02-91	1100	1.0	<.10	.60	.20	1.1
08-06-91	1100	1.1	<.10	.80	<.10	1.0
09-04-91	1010	.70	.20	1.7	.60	<1.0
			Well DCW8 (fig. 3)			
12-12-90	0830	19	<.10	.50	<.10	2.3
03-27-91	1040	30	<.10	.30	.10	<1.0
05-01-91	1400	29	.50	<.10	.60	3.2
06-06-91	1315	33	.10	.70	.70	2.7
07-02-91	1310	30	.10	1.2	.10	33
08-06-91	1300	29	<.10	.90	<.10	22
			Well DCW11 (fig. 3)			
12-12-90	0945	<.10	.20	<.10	<.10	2.3
03-27-91	1150	1.4	<.10	.10	<.10	1.1
05-01-91	1330	<.10	.30	7.3	4.5	270
06-06-91	1240	.10	.20	.10	.10	<1.0
07-02-91	1230	.10	.60	4.1	.10	99
08-06-91	1200	<.10	.20	1.2	<.10	18
09-04-91	1115	<.10	.20	.40	<.10	1.1
			Lysimeter DCLA (fig. 3)			
10-03-90	0805	<.10	<.10	<.30	<.10	<1.0
11-09-90	0825	<.10	<.10	.20	<.10	--
12-12-90	1145	<.10	<.10	<.10	<.10	--
04-05-91	0830	<.10	<.10	.20	<.10	--
05-01-91	1020	<.10	.20	.20	<.10	3.0
06-06-91	1000	<.10	<.10	.10	--	<1.0
07-03-91	1015	.10	.20	.20	.10	1.3
08-06-91	0910	<.10	<.10	.20	<.10	1.4
09-04-91	0915	<.10	.20	.10	.20	1.4

Table 19. Selected nitrogen, phosphorus, and carbon species at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Nitrogen, NO_2+NO_3, total (as N)	Nitrogen, ammonia, total (as N)	Nitrogen, organic, total (as N)	Phosphorus, organic, total (as P)	Carbon, organic, total (as C)
			Lysimeter DCLB (fig. 3)			
10-03-90	0806	<0.10	<0.10	<0.10	<0.10	<1.0
11-09-90	0826	<.10	<.10	.20	<.10	--
12-12-90	1146	<.10	<.10	.10	<.10	--
04-05-91	0835	<.10	<.10	.10	<.10	--
05-01-91	1021	<.10	.20	.40	<.10	2.7
06-06-91	1005	<.10	<.10	.20	.10	<1.0
07-03-91	1020	<.10	.20	.20	.20	1.7
08-06-91	0915	<.10	<.10	.30	<.10	1.9
09-04-91	0920	<.10	.20	.10	.10	1.8
			Lysimeter DCLC (fig. 3)			
10-03-90	0807	.40	<.10	.60	.10	2.9
11-09-90	0827	.20	<.10	.30	<.10	--
12-12-90	1147	.20	<.10	.20	<.10	--
04-05-91	0840	6.8	<.10	.40	<.10	--
05-01-91	1022	7.9	.10	.50	<.10	4.4
06-06-91	1010	8.3	<.10	.60	<.10	3.3
07-03-91	1025	7.2	.10	.60	.10	<1.0
08-06-91	0920	4.2	<.10	.50	<.10	4.2
09-04-91	0925	1.9	.10	.40	.10	4.1
			Lysimeter DCLD (fig. 3)			
10-03-90	0808	27	<.10	.90	<.10	4.0
11-09-90	0828	16	<.10	.70	<.10	--
12-12-90	1148	22	<.10	.60	<.10	--
04-05-91	0845	63	<.10	.80	<.10	--
05-01-91	1023	63	<.10	1.0	<.10	--
06-06-91	1015	57	<.10	.70	.70	--
07-03-91	1025	49	.20	.70	.10	4.1
08-06-91	0925	38	<.10	.70	<.10	5.5
09-04-91	0930	32	<.10	1.1	<.10	6.2

Table 19. Selected nitrogen, phosphorus, and carbon species at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Nitrogen, NO_2+NO_3, total (as N)	Nitrogen, ammonia, total (as N)	Nitrogen, organic, total (as N)	Phosphorus, organic, total (as P)	Carbon, organic, total (as C)
			Lysimeter DCLE (fig. 3)			
04-05-91	0755	16	<0.10	0.10	<0.10	--
05-01-91	1400	16	<.10	.40	<.10	1.0
06-06-91	1020	14	<.10	<.10	.10	<1.0
07-03-91	1035	14	<.10	.30	<.10	1.0
08-06-91	1215	14	.10	.20	<.10	<1.0
09-04-91	0935	13	<.10	.20	.10	<1.0
			Lysimeter DCLF (fig. 3)			
04-05-91	0757	39	<.10	.20	.10	--
05-01-91	1401	46	.10	.50	<.10	2.1
06-06-91	1025	40	.10	.30	<.10	<1.0
07-03-91	1040	40	<.10	.50	.10	1.6
08-06-91	1220	47	<.10	.20	<.10	1.3
09-04-91	0940	41	<.10	.30	<.10	1.3
			Lysimeter DCLG (fig. 3)			
04-05-91	0800	140	<.10	.50	<.10	--
05-01-91	1402	120	.10	<.10	<.10	2.0
06-06-91	1030	110	<.10	.40	<.10	<1.0
07-03-91	1045	100	<.10	.90	.10	1.8
08-06-91	1225	110	.40	.40	<.10	--
			Tile DCT2 (fig.3)			
10-03-90	0750	6.5	<.10	1.1	<.10	10
11-08-90	0950	4.1	<.10	1.3	<.10	13
12-12-90	1230	3.6	<.10	1.0	<.10	9.8
02-06-91	1200	3.7	<.10	.70	<.10	16
03-06-91	0920	43	.40	3.3	.20	36
04-04-91	0940	26	.50	1.9	.10	25
05-01-91	0800	30	.20	2.8	.20	31
06-06-91	0810	12	.50	2.5	.10	32
07-02-91	0800	1.6	.50	1.5	.20	19
08-06-91	0815	.60	<.10	1.2	<.10	4.8
09-04-91	0830	1.6	.40	2.2	.20	21

Table 19. Selected nitrogen, phosphorus, and carbon species at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Nitrogen, NO_2+NO_3, total (as N)	Nitrogen, ammonia, total (as N)	Nitrogen, organic, total (as N)	Phosphorus, organic, total (as P)	Carbon, organic, total (as C)
			Tile DCT1 (fig. 3)			
04-04-91	1015	27	<0.10	<0.10	0.10	1.4
			Big Spring (fig. 2)			
10-02-90	1330	9.5	<.10	<.10	.40	<1.0
11-07-90	1430	7.7	<.10	--	.30	1.5
12-05-90	0945	7.3	<.10	<.10	.20	3.2
01-08-91	1600	7.2	<.10	.20	.40	2.1
02-05-91	1200	7.0	<.10	.20	.50	1.2
03-05-91	1300	9.7	.20	.90	.50	4.6
03-18-91	1000	11	<.10	.60	.40	2.9
03-19-91	1200	11	.10	.90	.40	4.0
03-21-91	1200	13	<.10	.60	.30	2.5
03-27-91	0750	16	<.10	.30	.20	1.7
04-05-91	1000	15	<.10	.20	.10	1.3
04-22-91	1230	17	<.10	.30	.20	1.4
05-02-91	0800	14	<.10	.10	.20	2.4
05-20-91	1200	16	<.10	.40	.20	1.9
05-30-91	1200	15	.10	1.3	.30	2.6
06-05-91	1340	17	<.10	.20	.10	<1.0
06-15-91	1120	4.2	.90	28	4.4	3.6
06-15-91	1230	13	.10	1.1	.50	2.7
06-16-91	0520	10	.30	2.0	1.2	2.0
07-01-91	1430	16	<.10	.40	.20	1.7
08-05-91	1400	11	<.10	.20	.20	1.8
09-03-91	1630	8.7	.10	.20	.30	1.1
09-16-91	0930	6.9	<.10	1.0	.30	4.9

Table 20. Selected herbicides at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991

[Total-recoverable constituents in micrograms per liter; <, less than indicated detection limit]

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
				Well DCW2 (fig. 3)				
10-03-90	1050	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10
11-08-90	1120	<.10	<.10	<.10	<.10	<.10	<.10	<.10
12-12-90	1115	<.10	.11	<.10	<.10	<.10	<.10	<.10
01-08-91	1145	<.10	<.10	<.10	<.10	<.10	<.10	<.10
02-06-91	1330	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-06-91	1145	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-26-91	1430	<.10	<.10	<.10	<.10	<.10	<.10	<.10
05-01-91	1000	<.20	<.10	<.10	<.10	<.30	<.10	<.10
06-06-91	0930	<.10	<.10	<.10	<.10	<.10	<.10	<.10
07-02-91	0950	<.10	.56	<.10	<.10	.82	<.10	<.10
08-06-91	1000	<.10	<.10	<.10	<.10	<.10	<.10	<.10
09-04-91	0955	<.20	<.10	<.10	<.10	<.20	<.10	<.10
				Well DCW3 (fig. 3)				
10-03-90	1130	<.10	<.10	<.10	<.10	<.10	<.10	<.10
11-08-90	0930	<.10	<.10	<.10	<.10	<.10	<.10	<.10
12-12-90	0915	<.10	<.10	<.10	<.10	<.10	<.10	<.10
01-08-91	1215	<.10	<.10	<.10	<.10	<.10	<.10	<.10
02-06-91	1415	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-06-91	1240	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-27-91	1125	<.10	<.10	<.10	<.10	<.10	<.10	<.10
05-01-91	1300	<.20	<.10	<.10	<.10	<.30	<.10	<.10
06-06-91	1200	.20	.17	<.10	<.10	.15	<.10	<.10
07-02-91	1145	<.10	4.0	<.10	<.10	<.10	<.10	<.10
08-06-91	1130	<.10	.12	<.10	<.10	<.10	<.10	<.10
09-04-91	1045	<.20	<.10	<.10	<.10	<.20	<.10	<.10
				Well DCW7 (fig. 3)				
05-01-91	1100	<.20	<.10	<.10	<.10	<.30	<.10	<.10
07-02-91	1100	<.10	.51	<.10	<.10	.11	<.10	<.10
08-06-91	1100	<.10	<.10	<.10	<.10	<.10	<.10	<.10
09-04-91	1010	<.20	<.10	<.10	<.10	<.20	<.10	<.10

Table 20. Selected herbicides at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
				Well DCW8 (fig. 3)				
03-27-91	1040	<0.10	0.18	<0.10	<0.10	<0.10	<0.10	<0.10
05-01-91	1400	<.20	.33	<.10	<.10	<.20	<.10	<.10
06-06-91	1315	.23	.61	<.10	<.10	.21	<.10	<.10
07-02-91	1310	<.10	8.3	<.10	<.10	4.00	<.10	<.10
08-06-91	1300	<.20	1.2	<.10	<.10	.73	<.10	<.10
				Well DCW11 (fig. 3)				
12-12-90	0945	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-27-91	1150	<.10	<.10	<.10	<.10	<.10	<.10	<.10
05-01-91	1330	<.20	<.10	<.10	<.10	<.20	<.10	<.10
06-06-91	1240	<.10	<.10	<.10	<.10	<.10	<.10	<.10
07-02-91	1230	<.10	.15	<.10	<.10	<.10	<.10	<.10
08-06-91	1200	<.10	<.10	<.10	<.10	<.10	<.10	<.10
09-04-91	1115	<.20	<.10	<.10	<.10	<.20	<.10	<.10
				Lysimeter DCLA (fig. 3)				
10-03-90	0805	<.10	<.10	<.10	<.10	<.10	<.10	<.10
11-09-90	0825	<.10	<.10	<.10	<.10	<.10	<.10	<.10
12-12-90	1145	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-27-91	1230	<.20	<.10	<.10	<.10	<.20	<.10	<.10
05-01-91	1020	<.20	<.10	<.10	<.10	<.30	<.10	<.10
06-06-91	1000	<.10	.17	<.10	<.10	<.10	<.10	<.10
07-03-91	1015	<.10	.25	<.10	<.10	<.10	<.10	<.10
08-06-91	0910	<.10	.22	<.10	<.10	<.10	<.10	<.10
09-04-91	0915	<.20	<.10	<.10	<.10	<.20	<.10	<.10
				Lysimeter DCLB (fig. 3)				
10-03-90	0806	<.10	<.10	<.10	<.10	<.10	<.10	<.10
11-09-90	0826	<.10	<.10	<.10	<.10	<.10	<.10	<.10
12-12-90	1146	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-27-91	1232	<.20	<.10	<.10	<.10	<.20	<.10	<.10
05-01-91	1021	<.20	<.10	<.10	<.10	<.30	<.10	<.10
06-06-91	1005	<.10	<.10	<.10	<.10	<.20	<.10	<.10
07-03-91	1020	<.10	<.10	<.10	<.10	<.10	<.10	<.10
08-06-91	0915	<.10	<.10	<.10	<.10	<.10	<.10	<.10
09-04-91	0920	<.20	<.10	<.10	<.10	<.20	<.10	<.10

Table 20. Selected herbicides at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
				Lysimeter DCLC (fig. 3)				
10-03-90	0807	<0.10	0.15	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
11-09-90	0827	< .10	.12	< .10	< .10	< .10	< .10	< .10
12-12-90	1147	< .10	.12	< .10	< .10	< .10	< .10	< .10
03-27-91	1234	< .20	< .10	< .10	< .10	< .20	< .10	< .10
05-01-91	1022	< .20	< .10	< .10	< .10	< .30	< .10	< .10
06-06-91	1010	< .10	< .10	< .10	< .10	< .10	< .10	< .10
07-03-91	1025	< .10	.11	< .10	< .10	< .10	< .10	< .10
08-06-91	0920	< .10	.11	< .10	< .10	< .10	< .10	< .10
09-04-91	0925	< .20	< .10	< .10	< .10	< .20	< .10	< .10
				Lysimeter DCLD (fig. 3)				
10-03-90	0808	< .10	1.6	< .10	< .10	< .10	< .10	< .10
11-09-90	0828	< .10	1.2	< .10	< .10	< .10	< .10	< .10
12-12-90	1148	< .10	.90	< .10	< .10	< .10	< .10	< .10
03-27-91	1236	< .20	.77	< .10	< .10	< .20	< .10	< .10
05-01-91	1023	< .20	.74	< .10	< .10	< .30	< .10	< .10
06-06-91	1015	< .20	1.1	< .10	< .10	.36	< .10	< .10
07-03-91	1025	< .10	1.1	< .10	< .10	.37	< .10	< .10
08-06-91	0925	< .10	.58	< .10	< .10	.12	< .10	< .10
09-04-91	0930	< .20	.68	< .10	< .10	< .20	< .10	< .10
				Lysimeter DCLE (fig. 3)				
03-27-91	1105	<.10	.19	<.10	<.10	<.10	<.10	<.10
05-01-91	1400	< .20	< .10	< .10	< .10	< .30	< .10	< .10
06-06-91	1020	< .20	.14	< .10	< .10	< .20	< .10	< .10
07-03-91	1035	< .10	.11	< .10	< .10	< .10	< .10	< .10
08-06-91	1215	< .20	< .10	< .10	< .10	< .20	< .10	< .10
09-04-91	0935	< .20	.10	< .10	< .10	< .20	< .10	< .10
				Lysimeter DCLF (fig. 3)				
03-27-91	1108	< .20	.91	< .10	< .10	< .20	< .10	< .10
05-01-91	1401	< .20	.63	< .10	< .10	< .30	< .10	< .10
06-06-91	1025	< .10	.70	< .10	< .10	.27	< .10	< .10
07-03-91	1040	< .10	.67	< .10	< .10	< .10	< .10	< .10
08-06-91	1220	< .10	.38	.10	< .10	< .10	< .10	< .10
09-04-91	0940	< .20	.54	< .10	< .10	< .20	< .10	< .10

Table 20. Selected herbicides at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
				Lysimeter DCLG (fig. 3)				
03-27-91	1111	<0.30	0.40	<0.10	<0.10	<0.30	<0.10	<0.10
05-01-91	1402	<.20	.28	<.10	<.10	<.30	<.10	<.10
06-06-91	1030	<.30	.73	<.10	<.10	<.30	<.10	<.10
				Tile DCT2 (fig. 3)				
10-03-90	0750	<.10	<.10	<.10	<.10	<.10	<.10	<.10
11-08-90	0950	<.10	.27	<.10	<.10	<.10	<.10	<.10
12-12-90	1230	<.10	<.10	<.10	<.10	<.10	<.10	<.10
02-06-91	1200	<.10	<.10	<.10	<.10	<.10	<.10	<.10
03-06-91	0920	<.10	.21	<.10	<.10	<.10	<.10	<.10
04-04-91	0940	<.10	.25	<.10	<.10	<.10	<.10	<.10
05-01-91	0800	<.20	.23	<.10	<.10	<.20	<.10	<.10
06-06-91	0810	<.10	.19	<.10	<.10	<.10	<.10	<.10
07-02-91	0800	<.10	.54	<.10	<.10	.34	<.10	<.10
08-06-91	0815	<.10	.26	<.10	<.10	.10	<.10	<.10
09-04-91	0830	<.20	.38	<.10	<.10	<.20	<.10	<.10
				Tile DCT1 (fig. 3)				
04-04-91	1015	<.10	.23	<.10	<.10	<.10	<.10	<.10
				Big Spring (fig. 2)				
10-02-90	1330	<.10	.16	<.10	<.10	<.10	<.10	<.10
11-07-90	1430	<.10	.25	<.10	<.10	<.10	<.10	<.10
12-05-90	0945	<.10	.19	<.10	<.10	<.10	<.10	<.10
01-08-91	1600	<.10	.21	<.10	<.10	<.10	<.10	<.10
02-05-91	1200	<.10	.14	<.10	<.10	<.10	<.10	<.10
03-05-91	1300	<.10	.28	<.10	<.10	<.10	<.10	<.10
03-18-91	1000	<.10	.17	<.10	<.10	<.10	<.10	<.10
03-19-91	1200	<.10	.21	<.10	<.10	<.10	<.10	<.10
03-21-91	1200	<.10	.19	<.10	<.10	<.10	<.10	<.10
03-27-91	0750	<.10	.15	<.10	<.10	<.10	<.10	<.10
04-05-91	1000	<.10	.16	<.10	<.10	<.10	<.10	<.10
04-22-91	1230	<.10	.19	<.10	<.10	<.10	<.10	<.10
05-02-91	0800	<.20	.37	<.10	<.10	<.20	<.10	<.10
05-20-91	1200	.69	1.1	<.10	.20	<.10	<.10	<.10
05-30-91	1200	2.40	4.9	<.10	1.6	<.10	<.10	<.10

Table 20. Selected herbicides at ground-water monitoring sites in the Big Spring Basin, Clayton County, Iowa, water year 1991--Continued

Date	Time (24-hour)	Alachlor	Atrazine	Butylate	Cyanazine	Metolachlor	Metribuzin	Trifluralin
			Big Spring (fig. 2)--Continued					
06-05-91	1340	0.33	1.0	<0.10	0.14	<0.10	<0.10	<0.10
06-15-91	1120	4.00	16	<.10	1.6	2.20	<.10	<.10
06-15-91	1230	.35	2.3	<.10	.18	<.10	<.10	<.10
06-16-91	0520	2.90	8.9	<.10	1.4	.78	<.10	<.10
07-01-91	1430	<.10	.50	<.10	<.10	<.10	<.10	<.10
08-05-91	1400	<.10	.34	<.10	<.10	<.10	<.10	<.10
09-03-91	1630	<.20	.19	.10	<.10	<.20	<.10	.11
09-16-91	0930	<.10	.75	<.10	<.10	<.10	<.10	<.10

Table 21. Daily mean water levels in the Galena aquifer, Clayton County, Iowa, water year 1991

[Water levels in feet below land surface, negative values indicate that the water level is above land surface; ---, data not available to calculate mean values

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS1-B (fig. 2)						
1	6.81	8.01	7.42	7.34	8.62	7.72	2.46	-1.08	0.77	1.78	3.71	6.40
2	7.11	8.00	7.33	7.35	8.61	6.51	2.73	-.09	.73	1.94	3.81	6.44
3	7.42	7.93	7.21	7.34	8.59	6.16	2.97	.47	1.03	2.14	3.97	6.49
4	7.42	7.85	7.01	7.37	8.56	5.97	3.17	.91	1.39	2.23	4.05	6.45
5	7.44	7.77	6.79	7.36	8.50	5.89	3.37	1.15	1.70	2.42	4.18	6.50
6	7.46	7.77	6.74	7.34	8.35	5.54	3.55	1.22	1.99	2.56	4.29	6.56
7	7.48	7.84	6.69	7.35	8.29	5.50	3.75	1.34	2.24	2.63	4.50	6.59
8	7.49	7.92	6.71	7.38	8.18	5.41	3.88	1.57	2.47	2.83	4.66	6.61
9	7.50	7.90	6.77	7.98	8.09	5.38	3.43	1.80	2.68	2.87	4.74	6.62
10	7.51	7.94	6.78	8.33	8.00	5.44	3.12	2.03	2.87	3.06	4.76	6.62
11	7.56	7.90	6.79	8.28	7.99	5.37	3.01	2.21	3.00	3.19	4.86	6.62
12	7.59	7.91	6.80	8.30	8.03	5.18	.74	2.40	3.22	3.14	5.00	5.98
13	7.57	7.97	6.89	8.27	8.02	5.20	-2.36	2.46	3.43	3.13	5.11	5.75
14	7.60	7.94	6.90	8.29	8.11	5.23	-2.47	2.64	3.36	3.42	5.23	5.78
15	7.64	8.04	6.91	8.32	8.35	5.26	-2.48	2.88	-2.50	3.55	5.35	5.78
16	7.62	8.16	6.96	8.31	8.29	5.21	-2.37	3.01	---	3.66	5.21	5.78
17	7.62	8.21	7.04	8.32	8.30	4.99	-1.51	2.98	---	3.78	4.84	5.76
18	7.62	8.19	7.04	8.33	8.28	4.16	-.78	2.67	---	3.82	4.95	5.81
19	7.65	8.14	7.05	8.30	8.31	3.41	-.29	2.14	---	3.97	5.13	6.01
20	7.73	8.18	7.14	8.35	8.32	2.91	-.16	1.86	---	4.02	5.23	6.14
21	7.71	8.20	7.12	8.43	8.20	2.70	.22	2.18	---	4.08	5.39	6.20
22	7.72	8.20	7.12	8.43	7.91	2.60	.58	2.61	---	4.18	5.44	6.30
23	7.77	8.23	7.13	8.48	7.75	1.75	.93	2.75	---	4.24	5.51	6.39
24	7.81	8.24	7.14	8.55	7.77	1.27	1.26	2.95	---	4.38	5.73	6.43
25	7.76	8.11	7.17	8.57	7.85	1.35	1.51	3.13	---	4.59	5.78	6.45
26	7.81	7.99	7.21	8.56	7.84	1.73	1.68	3.14	---	4.63	5.85	6.56
27	7.87	7.79	7.22	8.57	7.86	1.48	1.57	3.21	---	4.68	6.03	6.60
28	7.89	7.77	7.22	8.63	7.87	1.28	1.05	3.32	---	4.76	6.12	6.64
29	8.02	7.64	7.28	8.64		1.51	.62	3.22	---	4.75	6.18	6.73
30	8.02	7.50	7.31	8.60		1.83	-1.05	1.16	---	4.79	6.24	6.75
31	8.02		7.31	8.63		2.11		.92		4.88	6.37	

Table 21. Daily mean water levels in the Galena aquifer, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS2-E (fig. 2)						
1	153.80	154.33	154.47	154.47	154.47	153.69	152.20	151.19	150.04	151.87	153.29	153.68
2	153.74	154.35	154.46	154.49	154.47	151.62	152.38	151.42	150.41	152.02	153.32	153.69
3	154.08	154.34	154.48	154.48	154.46	152.82	152.53	151.59	150.75	152.14	153.35	153.68
4	154.09	154.31	154.51	154.48	154.46	153.07	152.62	151.77	151.14	152.24	153.36	153.70
5	154.11	154.33	154.45	154.48	154.45	152.76	152.75	151.75	151.45	152.31	153.36	153.71
6	154.15	154.36	154.49	154.50	154.37	152.28	152.85	151.89	151.70	152.38	153.38	153.72
7	154.22	154.37	154.47	154.48	154.33	152.94	152.93	152.12	151.88	152.50	153.37	153.72
8	154.22	154.37	154.49	154.46	154.27	153.00	152.96	152.19	152.06	152.54	152.89	153.66
9	154.21	154.37	154.45	154.47	154.26	153.01	152.14	152.25	152.21	152.55	153.29	153.70
10	154.21	154.39	154.45	154.45	154.23	153.08	152.39	152.36	152.19	152.63	153.36	151.36
11	154.22	154.41	154.43	154.43	154.25	152.92	152.50	152.47	152.31	152.64	153.39	153.42
12	154.23	154.43	154.44	154.44	154.25	152.81	147.97	152.52	152.47	152.54	153.40	153.51
13	154.22	154.43	154.47	154.42	154.27	153.16	---	151.22	152.55	152.73	153.41	153.59
14	154.25	154.41	154.45	154.44	154.32	153.14	---	151.87	148.42	152.79	153.41	153.66
15	154.28	154.42	154.46	154.45	154.37	153.09	---	152.06	---	152.82	153.42	153.68
16	154.26	154.44	154.48	154.44	154.34	153.04	---	152.18	---	152.83	153.42	153.69
17	154.25	154.42	154.46	154.44	154.36	152.74	---	152.28	---	152.84	153.42	153.70
18	154.31	154.42	154.47	154.44	154.33	151.31	---	151.98	---	152.86	153.44	153.73
19	154.28	154.43	154.49	154.43	154.34	151.09	---	152.13	133.06	152.91	153.45	153.76
20	154.27	154.43	154.48	154.46	154.31	151.21	---	152.19	148.26	152.94	153.46	153.75
21	154.29	154.43	154.48	154.48	154.20	151.27	---	152.22	149.09	152.95	153.46	153.78
22	154.29	154.42	154.49	154.45	154.02	151.66	---	152.24	149.71	152.96	153.49	153.80
23	154.30	154.43	154.49	154.50	154.00	150.14	---	152.28	150.18	153.02	153.49	153.80
24	154.32	154.43	154.49	154.51	154.06	151.07	---	152.35	150.52	153.03	153.50	153.72
25	154.32	154.46	154.52	154.50	154.08	151.50	---	152.46	150.78	153.06	153.50	153.82
26	154.32	154.43	154.52	154.47	154.10	151.77	---	151.96	151.03	153.06	153.51	153.78
27	154.34	154.45	154.50	154.47	154.16	149.74	---	152.27	151.28	153.07	153.56	153.83
28	154.35	154.48	154.48	154.50	154.19	150.47	---	152.33	151.47	153.07	153.63	153.84
29	154.34	154.46	154.49	154.48		151.15	---	151.47	151.61	153.08	153.64	153.81
30	154.35	154.43	154.48	154.47		151.60	---	148.57	151.76	153.12	153.65	153.80
31	154.35		154.48	154.49		151.90		149.78		153.23	153.68	

Table 21. Daily mean water levels in the Galena aquifer, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS4-A (fig. 2)						
1	213.11	214.31	215.47	217.29	218.11	---	213.23	206.26	205.24	201.99	205.11	207.38
2	213.10	214.57	215.76	217.41	218.27	---	212.81	206.45	204.99	201.97	205.14	207.38
3	212.82	214.74	215.67	217.33	218.33	---	212.41	206.46	204.89	202.06	205.25	206.33
4	212.99	214.63	215.60	217.45	218.45	---	212.09	206.41	204.79	202.15	205.69	207.27
5	212.90	214.68	216.01	217.44	218.50	218.05	211.83	206.24	204.62	202.66	205.42	207.29
6	213.19	214.92	216.37	217.78	218.76	218.16	211.48	206.13	204.51	202.43	205.43	207.41
7	213.45	214.78	216.03	217.88	218.86	218.44	211.30	205.90	204.37	202.64	205.24	207.49
8	213.50	214.86	216.24	217.73	218.76	218.23	211.13	206.02	204.26	202.74	205.14	207.47
9	213.44	215.00	216.44	217.88	218.71	218.23	211.07	206.18	204.14	202.76	205.27	207.48
10	213.28	215.41	216.06	218.01	218.80	218.14	211.21	206.06	204.06	202.85	205.33	207.76
11	213.39	215.38	216.42	217.66	218.87	217.74	211.21	206.02	204.04	202.91	205.38	207.84
12	213.41	215.17	216.22	217.78	218.69	217.41	210.96	206.03	204.08	202.99	205.38	207.77
13	213.17	215.18	216.40	217.79	218.31	217.32	210.51	205.90	203.92	203.04	205.34	207.84
14	213.43	215.43	216.36	217.82	218.47	217.38	209.97	205.76	203.45	203.11	205.56	207.74
15	213.63	214.97	216.48	217.75	218.95	217.18	209.58	205.71	202.35	203.15	205.66	207.84
16	213.35	214.82	216.52	217.88	218.68	217.06	209.31	205.73	201.58	203.22	205.70	207.94
17	213.39	214.92	216.61	217.89	218.74	216.94	209.03	205.72	201.11	203.66	205.71	208.04
18	213.84	215.15	216.42	217.95	218.90	216.55	208.62	205.65	200.59	203.66	205.89	208.14
19	213.68	215.37	216.40	217.87	218.74	216.46	208.33	205.78	200.60	203.71	206.02	208.40
20	213.71	215.36	216.83	217.89	218.96	216.15	208.17	205.94	200.13	203.77	206.22	208.41
21	213.93	215.18	216.82	217.92	---	215.91	207.82	205.92	---	203.81	206.32	208.21
22	213.88	215.17	216.53	217.88	---	215.74	207.39	205.78	---	203.86	206.45	208.13
23	214.03	215.42	216.90	218.08	---	215.44	207.11	205.66	---	203.89	206.41	208.35
24	214.19	215.56	216.63	217.95	---	215.17	207.27	205.60	---	203.94	206.48	208.31
25	214.20	215.38	216.52	217.89	---	215.01	207.27	205.49	200.97	203.97	206.49	208.04
26	214.04	215.45	216.92	217.92	---	214.74	207.09	205.38	201.14	204.01	206.54	208.25
27	214.33	215.49	216.96	217.94	---	214.55	206.76	205.26	201.25	204.66	206.66	208.42
28	214.40	215.27	217.04	218.09	---	214.52	206.78	205.17	201.45	204.69	206.74	208.57
29	214.24	215.48	217.15	218.14		214.13	206.49	205.01	201.66	204.74	206.88	208.59
30	214.41	215.44	217.22	217.95		213.90	206.23	205.14	201.79	204.70	206.94	208.53
31	214.38		217.15	217.99		213.73		205.30		205.01	207.38	

Table 22. Daily mean discharge and specific conductance at Big Spring, Clayton County, Iowa, water year 1991

[---, data not available to calculate mean values]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily mean discharge, in cubic feet per second						
1	22	18	13	12	13	24	84	103	132	84	54	38
2	22	17	13	12	13	81	77	98	124	79	54	36
3	24	18	13	12	13	55	70	93	115	78	54	39
4	25	19	12	12	13	48	68	88	109	76	54	39
5	24	18	13	12	14	48	65	88	102	73	53	38
6	24	17	13	10	14	72	62	85	96	72	51	38
7	23	17	14	12	14	54	58	80	89	70	50	37
8	23	17	13	13	16	51	58	78	85	68	64	38
9	23	18	14	13	17	52	84	76	82	67	55	38
10	23	17	14	13	18	48	81	73	82	66	52	43
11	23	17	14	13	17	50	68	72	79	65	50	38
12	23	16	13	13	17	57	136	70	76	70	50	101
13	23	14	12	13	16	47	252	93	72	64	49	53
14	22	14	12	13	15	47	216	85	99	62	49	46
15	21	14	12	13	13	48	192	79	369	62	49	46
16	22	14	12	13	13	50	162	77	286	62	49	43
17	22	14	12	13	13	53	141	74	169	61	49	41
18	22	14	12	13	14	86	126	80	156	61	49	41
19	22	14	12	13	14	94	120	77	161	61	48	39
20	21	13	12	13	14	96	111	76	156	61	46	39
21	21	15	12	12	16	94	104	76	142	59	46	38
22	22	15	12	12	21	82	97	76	130	59	46	38
23	21	14	12	12	20	116	94	74	121	57	45	38
24	21	14	12	12	20	99	87	73	113	57	45	37
25	19	13	12	12	19	88	82	71	106	56	45	37
26	20	13	12	12	19	83	80	81	103	56	44	35
27	19	13	12	12	19	121	89	75	98	56	41	34
28	19	13	12	12	18	114	85	73	93	56	39	33
29	20	13	12	11		98	101	80	90	56	39	33
30	19	13	12	9.5		88	110	167	86	54	39	32
31	19		12	12		82		140		54	39	

Table 22. Daily mean discharge and specific conductance at Big Spring, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
	Daily mean specific conductance, in microsiemens per centimeter at 25 degrees Celsius											
1	745	786	741	762	777	764	733	707	701	728	727	735
2	749	779	737	764	779	750	735	710	724	729	727	736
3	753	777	734	764	782	694	735	724	722	732	725	730
4	754	775	737	763	784	660	736	728	732	732	725	728
5	748	768	746	769	778	668	736	733	737	733	727	727
6	749	760	748	772	777	697	735	734	741	732	732	725
7	748	754	748	775	782	686	738	726	743	733	732	729
8	748	755	747	774	783	663	741	715	743	733	729	731
9	747	759	746	771	781	685	736	720	744	732	728	728
10	747	777	745	771	781	708	718	723	745	731	708	725
11	746	779	744	770	781	711	725	721	745	733	712	730
12	744	777	745	770	779	716	714	723	737	733	718	730
13	745	771	745	770	780	716	608	725	742	729	713	618
14	744	766	746	771	778	700	671	708	745	730	707	566
15	746	766	745	772	777	703	684	679	414	728	717	538
16	749	767	743	773	776	709	707	725	562	722	725	530
17	748	768	754	773	774	721	721	730	657	729	730	573
18	750	765	766	772	772	722	729	737	---	732	732	639
19	752	761	771	779	771	690	733	733	---	732	733	693
20	756	757	773	776	772	658	734	725	716	732	737	720
21	754	753	772	775	770	661	729	725	723	732	738	727
22	756	754	771	777	767	672	724	735	729	732	736	733
23	755	751	769	776	759	680	721	739	732	731	734	739
24	751	746	766	775	760	674	722	741	734	731	732	743
25	748	745	762	772	756	686	720	743	735	731	732	744
26	746	744	761	773	757	707	721	742	731	731	732	744
27	744	745	762	776	762	712	722	738	---	731	732	745
28	748	745	761	779	763	680	721	727	724	731	733	745
29	763	745	762	780		687	701	730	725	730	735	745
30	778	744	763	779		715	704	735	727	728	734	745
31	788		763	774		728		741		726	735	

Table 23. Daily median pH and daily mean water temperature at Big Spring, Clayton County, Iowa, water year 1991

[---, data not available to calculate median or mean values]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily median pH, in standard units						
1	6.8	6.8	6.8	6.9	7.0	7.1	7.0	6.9	6.9	6.9	7.0	6.8
2	6.8	6.8	6.8	6.9	7.0	7.1	6.9	7.0	7.0	7.0	7.0	6.8
3	6.8	6.8	6.8	6.9	7.0	7.0	6.9	7.0	7.0	7.0	7.0	6.8
4	6.8	6.8	6.8	7.0	7.0	7.0	6.9	7.0	7.0	7.0	7.0	6.9
5	6.8	6.8	6.8	7.0	7.0	6.9	6.9	7.0	6.9	7.0	6.9	6.9
6	6.8	6.8	6.8	7.0	7.0	6.9	6.9	7.0	6.9	7.0	6.9	6.9
7	6.9	6.8	6.8	7.0	7.0	6.9	6.9	6.9	6.9	7.0	6.9	6.9
8	6.9	6.8	6.8	7.0	7.0	6.9	6.9	6.9	6.9	7.0	6.9	6.9
9	6.9	6.8	6.8	7.1	7.0	7.0	6.9	6.9	6.9	6.9	6.9	6.9
10	6.9	6.8	6.8	7.0	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.9
11	6.9	6.8	6.8	7.0	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.9
12	6.8	6.8	6.8	7.0	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.9
13	6.8	6.8	6.8	7.0	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.8
14	6.8	6.8	6.8	7.0	7.0	7.0	7.0	6.9	6.9	6.9	6.9	6.8
15	6.8	6.8	6.8	7.0	7.0	7.0	7.0	6.9	6.7	6.9	6.9	6.7
16	6.8	6.7	6.8	7.0	7.0	7.0	7.0	7.0	6.8	6.9	6.9	6.7
17	6.8	6.7	6.8	7.0	7.0	7.0	7.0	7.0	6.8	6.9	6.9	6.8
18	6.8	6.7	6.8	7.0	7.0	7.0	7.0	7.0	---	6.9	6.8	6.9
19	6.8	6.8	6.8	7.0	6.9	7.0	7.0	7.0	---	6.9	6.9	6.9
20	6.8	6.8	6.8	6.9	7.1	6.9	7.0	6.9	6.9	6.9	6.9	7.0
21	6.8	6.8	6.8	7.0	7.1	6.9	7.0	7.0	6.9	6.9	6.9	7.0
22	6.8	6.8	6.9	7.0	7.1	6.9	6.9	7.0	6.9	6.9	6.9	7.0
23	6.8	6.8	6.9	7.0	7.1	6.9	6.9	7.0	6.9	7.0	6.9	7.0
24	6.8	6.8	6.9	7.0	7.1	6.9	6.9	6.9	6.9	7.0	6.9	7.0
25	6.8	6.8	6.9	7.0	7.1	6.9	6.9	7.0	6.9	7.0	6.9	7.0
26	6.8	6.8	6.9	7.0	7.1	6.9	6.9	7.0	6.9	7.0	6.9	7.0
27	6.8	6.8	6.9	7.0	7.1	7.0	6.9	6.9	---	7.0	6.9	7.0
28	6.8	6.8	6.9	7.0	7.1	6.9	6.9	6.9	6.9	7.0	6.9	7.0
29	6.8	6.8	6.9	7.0		6.9	6.9	6.9	6.9	7.0	6.9	7.0
30	6.8	6.8	6.9	7.0		7.0	6.9	6.9	6.9	7.0	6.9	7.0
31	6.8		6.9	7.0		7.0		6.9		6.9	6.9	

Table 23. Daily median pH and daily mean water temperature at Big Spring, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Daily mean water temperature, in degrees Celsius						
1	10.5	10.0	10.0	9.5	9.0	9.0	9.0	9.5	10.5	11.5	12.0	12.5
2	10.5	10.0	9.5	9.5	9.0	9.0	9.0	9.5	10.0	11.5	12.0	12.5
3	10.5	10.0	9.5	9.5	9.0	9.0	9.5	9.5	10.0	11.5	12.0	12.0
4	10.5	10.0	9.5	9.5	9.0	8.5	9.5	9.5	10.0	11.5	12.0	12.0
5	10.5	10.0	9.5	9.5	9.0	8.5	9.5	9.5	10.0	11.5	12.5	12.0
6	10.5	10.0	9.5	9.5	9.5	8.6	9.5	9.5	10.0	11.5	12.5	12.0
7	10.5	10.0	9.5	9.5	9.0	8.5	9.5	9.5	10.0	11.5	12.5	12.0
8	10.5	10.0	9.5	9.5	9.0	8.5	9.5	9.5	10.0	11.5	12.0	12.0
9	10.5	10.0	10.0	9.5	9.0	8.5	9.5	9.5	10.0	11.5	12.0	12.0
10	10.5	10.0	10.0	9.5	9.0	8.5	9.5	9.5	10.0	11.5	11.5	12.0
11	10.5	10.0	9.5	9.5	9.5	8.5	9.5	9.5	10.0	11.5	12.0	12.0
12	10.5	10.0	9.5	9.5	9.5	8.5	9.5	9.5	10.0	11.5	12.0	12.0
13	10.5	10.0	9.5	9.5	9.5	8.5	8.5	9.5	10.0	11.5	12.0	11.5
14	10.5	10.0	9.5	9.5	9.5	8.5	8.5	10.0	10.0	11.5	12.0	11.5
15	10.5	10.0	9.5	9.5	9.0	8.5	9.0	10.0	13.0	11.5	12.0	12.0
16	10.5	10.0	10.0	9.5	9.0	8.5	9.0	10.0	11.5	11.5	12.5	12.0
17	10.5	10.0	10.0	9.0	9.0	8.5	9.0	10.0	10.5	11.5	12.5	12.0
18	10.5	10.0	10.0	9.0	9.5	8.5	9.0	10.0	---	11.5	12.5	12.0
19	10.5	10.0	9.5	9.0	9.0	8.5	9.5	10.0	---	12.0	12.5	12.0
20	10.5	10.0	9.5	9.0	9.0	8.5	9.5	10.0	11.0	12.0	12.5	12.0
21	10.5	10.0	9.5	9.0	9.5	8.5	9.5	10.0	11.0	12.0	12.0	11.5
22	10.5	10.0	9.5	9.5	9.5	9.0	9.5	10.0	11.0	12.0	12.0	11.5
23	10.0	10.0	9.5	9.0	9.5	9.0	9.5	10.0	11.0	12.0	12.0	11.5
24	10.0	10.0	9.5	9.0	9.5	9.0	9.5	10.0	11.0	12.0	12.0	11.5
25	10.0	10.0	9.5	9.5	9.5	9.0	9.5	10.0	11.0	12.0	12.5	11.0
26	10.0	10.0	9.5	9.0	9.0	9.0	9.5	10.0	11.0	12.0	12.5	11.0
27	10.0	10.0	9.5	9.5	9.0	9.0	9.5	10.0	---	12.0	12.5	11.0
28	10.0	10.0	9.5	9.0	9.0	9.5	9.5	10.0	11.0	12.0	12.5	11.0
29	10.0	10.0	9.5	9.5		9.5	9.5	10.0	11.5	12.0	12.5	11.0
30	10.0	10.0	9.5	9.0		9.5	9.5	10.5	11.5	12.0	12.5	11.0
31	10.0		9.5	9.0		9.0		10.5		12.0	12.0	

Table 24. Daily mean suspended-sediment concentration and daily suspended-sediment load at Big Spring, water year 1991

[Suspended-sediment load rounded to three significant figures; ---, data not available to calculate values]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.
					Daily mean suspended-sediment concentration, in milligrams per liter							
1	---	---	---	---	6	8	36	46	48	35	16	7
2	---	---	---	---	5	28	28	32	35	45	15	6
3	---	---	---	---	8	20	16	46	25	75	13	10
4	---	---	---	---	12	14	23	53	18	95	13	12
5	---	---	---	---	16	11	29	57	17	100	16	12
6	---	---	---	---	20	28	33	43	18	99	17	11
7	---	---	---	---	18	34	33	39	18	95	10	10
8	---	---	---	---	10	31	29	44	16	91	53	8
9	---	---	---	---	4	23	45	43	14	86	77	8
10	---	---	---	---	4	14	68	32	19	69	65	7
11	---	---	---	---	4	11	52	23	22	47	36	6
12	---	---	---	---	4	13	367	23	22	38	20	206
13	---	---	---	---	4	20	855	37	10	63	14	220
14	---	---	---	---	5	27	162	147	99	64	13	163
15	---	---	---	---	5	31	191	92	10,400	59	11	102
16	---	---	---	---	6	23	97	25	2,200	59	10	66
17	---	---	---	---	7	11	52	23	898	57	9	32
18	---	---	---	9	7	24	50	38	721	48	8	18
19	---	---	---	8	7	41	46	43	534	41	7	13
20	---	---	---	7	7	21	49	50	359	37	7	10
21	---	---	---	6	10	33	63	34	245	32	6	9
22	---	---	---	5	16	54	77	29	201	29	6	8
23	---	---	---	5	17	45	63	23	180	26	7	7
24	---	---	---	5	16	36	51	31	170	26	7	7
25	---	---	---	4	14	40	73	29	166	25	7	7
26	---	---	---	5	12	47	62	37	162	25	7	6
27	---	---	---	5	8	80	73	39	116	24	8	6
28	---	---	---	5	4	122	51	38	68	24	8	6
29	---	---	---	5		40	63	52	52	29	9	6
30	---	---	---	5		33	41	520	43	25	9	6
31	---		---	6		38		212		19	8	

Table 24. Daily mean suspended-sediment concentration and daily suspended-sediment load at Big Spring, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.
						Daily suspended-sediment load, in tons						
1	---	---	---	---	0.20	0.70	7.1	13	17	7.9	2.4	.74
2	---	---	---	---	.19	6.1	5.1	8.4	12	9.7	2.1	.61
3	---	---	---	---	.28	3.0	2.8	12	8.0	16	1.9	1.1
4	---	---	---	---	.44	1.8	3.9	13	5.4	19	1.8	1.5
5	---	---	---	---	.58	1.5	4.6	13	4.6	20	2.3	1.4
6	---	---	---	---	.75	5.1	5.0	10	4.6	19	2.3	1.3
7	---	---	---	---	.68	4.9	4.8	8.4	4.3	18	1.4	1.1
8	---	---	---	---	.41	4.1	4.2	9.4	3.8	17	9.5	.94
9	---	---	---	---	.18	3.2	9.1	8.8	3.2	16	11	.87
10	---	---	---	---	.18	1.8	13	6.3	4.3	12	9.1	.81
11	---	---	---	---	.17	1.5	9.6	4.4	4.7	8.3	5.0	.65
12	---	---	---	---	.18	2.0	258	4.4	4.5	7.1	2.7	79
13	---	---	---	---	.17	2.4	615	9.7	1.9	11	1.9	33
14	---	---	---	---	.18	3.3	93	34	81	11	1.7	21
15	---	---	---	---	.19	4.0	99	20	10,800	9.9	1.5	13
16	---	---	---	---	.21	3.1	43	5.3	1,740	9.9	1.3	8.0
17	---	---	---	---	.24	1.6	20	4.7	410	9.4	1.2	3.8
18	---	---	---	0.30	.27	5.9	17	8.2	304	8.0	1.1	2.1
19	---	---	---	.27	.27	10	15	9.0	232	6.6	.96	1.4
20	---	---	---	.24	.26	5.6	15	10	152	6.0	.88	1.1
21	---	---	---	.21	.43	8.3	17	6.9	95	5.2	.81	.96
22	---	---	---	.18	.90	12	20	5.9	70	4.5	.78	.87
23	---	---	---	.15	.95	14	16	4.7	58	4.0	.80	.76
24	---	---	---	.15	.86	9.7	12	6.0	52	4.0	.82	.71
25	---	---	---	.11	.73	9.6	16	5.5	48	3.8	.90	.68
26	---	---	---	.16	.62	11	13	8.1	45	3.7	.87	.60
27	---	---	---	.16	.38	28	18	7.9	31	3.6	.86	.56
28	---	---	---	.17	.17	38	12	7.5	17	3.6	.90	.53
29	---	---	---	.15		11	17	12	13	4.4	.95	.49
30	---	---	---	.13		7.7	12	233	10	3.6	.98	.52
31	---		---	.21		8.3		81		2.7	.90	
Total measured	---	---	---	2.59	11.1	229	1,400	590	14,200	285	71.6	180

Table 25. Daily mean water levels in the Saint Peter aquifer, Clayton County, Iowa, water year 1991

[Water levels in feet below land surface; ---, data not available to calculate mean values]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS2-G (fig. 2)						
1	185.43	185.83	185.36	185.74	186.25	185.82	185.66	184.39	183.66	183.35	183.93	---
2	185.59	185.76	185.49	185.56	186.20	185.91	185.68	184.47	183.65	183.28	183.93	---
3	185.59	185.88	185.55	185.55	186.14	185.78	185.63	184.44	183.66	183.28	183.93	184.22
4	185.48	185.88	185.60	185.66	186.11	185.90	185.51	184.41	183.80	183.28	183.93	184.47
5	185.53	185.90	185.65	185.74	186.18	185.87	185.38	184.27	184.02	183.28	183.95	184.33
6	185.64	185.81	185.64	185.79	186.20	185.73	185.26	184.23	184.07	183.28	184.14	184.33
7	186.03	185.72	185.49	185.88	186.30	186.02	185.21	184.41	184.00	183.28	184.20	184.32
8	185.94	185.76	185.53	185.90	186.11	185.91	185.08	184.43	183.90	183.28	184.20	184.27
9	185.75	185.54	185.70	186.02	186.08	186.03	185.15	184.35	183.84	183.36	---	184.22
10	185.61	185.24	185.54	186.31	185.90	186.11	185.40	184.44	183.75	183.42	---	184.35
11	185.61	185.18	185.52	186.06	185.87	185.93	185.47	184.49	183.72	183.42	---	184.33
12	185.84	185.20	185.59	186.06	185.60	185.75	185.33	184.32	183.77	183.42	---	184.32
13	185.77	185.28	185.52	186.02	185.77	185.73	185.10	184.13	183.68	183.42	---	184.31
14	185.68	185.29	185.46	185.87	185.80	185.93	184.86	184.07	183.40	183.42	---	184.21
15	185.85	185.38	185.54	185.92	185.88	186.08	184.84	184.07	---	183.42	---	184.14
16	185.81	185.55	185.69	186.08	185.67	186.08	184.93	184.02	---	183.42	---	184.14
17	185.56	185.64	185.73	186.08	185.77	185.85	185.03	184.04	---	183.42	---	184.21
18	185.57	185.63	185.45	186.06	185.84	185.75	184.94	184.26	---	183.42	---	184.26
19	185.42	185.51	185.63	185.81	185.74	185.82	184.91	184.40	---	183.42	---	184.43
20	185.45	185.62	185.50	185.97	185.66	185.64	184.95	184.29	183.35	183.42	---	184.47
21	185.48	185.54	185.77	186.22	185.75	185.45	184.88	184.13	183.39	183.57	---	184.35
22	185.60	185.42	185.65	186.01	185.78	185.40	184.61	184.05	183.39	183.63	---	184.26
23	185.33	185.19	185.44	186.02	185.79	185.22	184.49	183.95	183.39	183.63	---	184.37
24	185.39	185.30	185.66	186.31	185.82	185.58	184.69	183.92	183.39	183.63	---	184.36
25	185.90	185.46	185.78	186.44	185.88	185.63	184.72	183.92	183.39	183.63	---	184.13
26	185.98	185.31	185.62	186.20	185.75	185.37	184.59	183.74	183.39	183.67	---	184.20
27	185.70	185.25	185.55	185.85	185.81	185.06	184.37	183.82	183.39	183.97	---	184.34
28	186.03	185.42	185.75	185.96	185.79	185.32	184.48	183.87	183.39	183.95	---	184.47
29	185.79	185.46	185.61	186.17	185.58	184.17	183.81	183.39	183.93	---	184.49	
30	185.89	185.31	185.78	186.16	185.68	184.26	183.62	183.39	183.93	---	184.42	
31	185.83	185.81	186.33	185.54	183.62	183.93	---					

Table 25. Daily mean water levels in the Saint Peter aquifer, Clayton County, Iowa, water year 1991--Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
						Well BS4 (fig. 2)						
1	371.81	372.19	371.28	371.48	369.83	---	369.35	368.77	368.58	369.05	369.90	370.47
2	371.79	372.23	371.32	371.45	369.84	---	369.36	368.88	368.59	369.14	369.81	370.39
3	371.88	372.12	371.45	371.56	369.75	---	369.29	368.84	368.62	369.16	369.88	370.32
4	371.89	372.11	371.24	371.66	369.74	---	369.18	368.81	368.75	369.19	370.03	370.39
5	371.90	372.09	371.33	371.47	369.85	---	369.10	368.64	368.88	369.26	370.09	370.30
6	371.91	372.08	371.46	371.21	369.88	368.99	369.03	368.67	368.98	369.28	370.11	370.31
7	371.94	372.21	371.49	371.49	369.91	369.31	369.03	368.92	368.95	369.35	370.12	370.29
8	371.95	372.34	371.58	370.97	369.75	369.26	369.03	368.98	368.88	369.52	369.97	370.18
9	371.95	372.25	371.42	370.35	369.72	369.41	369.03	368.90	368.84	369.49	370.05	370.11
10	371.95	372.36	371.37	370.29	369.78	369.48	369.03	368.95	368.80	369.45	370.11	370.29
11	371.96	372.25	371.56	369.93	369.82	369.34	369.15	368.91	368.78	369.42	370.22	370.29
12	371.97	372.17	371.34	369.93	369.83	369.19	369.21	368.79	368.79	369.33	370.25	370.17
13	371.95	372.45	371.68	369.70	---	369.24	369.21	368.71	368.82	369.43	370.21	370.16
14	371.98	372.23	371.59	369.69	---	369.43	369.21	368.70	368.68	369.57	370.14	370.02
15	371.98	372.33	371.36	369.78	---	369.58	369.17	368.71	368.64	369.62	370.09	370.06
16	371.99	372.11	371.61	369.77	---	369.57	369.13	368.66	368.84	369.63	370.00	370.18
17	371.98	372.10	371.33	369.83	---	369.37	369.08	368.70	368.91	369.54	369.97	370.25
18	371.96	372.22	371.23	369.80	---	369.31	369.05	368.90	368.96	369.47	370.10	370.35
19	371.96	371.99	371.51	369.48	---	369.34	368.99	368.98	369.06	369.46	370.24	370.59
20	371.97	372.08	371.49	369.67	---	369.09	368.95	368.90	369.01	369.54	370.25	370.63
21	372.03	371.88	371.51	369.88	---	368.97	368.90	368.80	368.92	369.65	370.16	370.45
22	372.04	371.74	371.57	369.50	---	368.94	368.88	368.75	369.05	369.68	370.23	370.38
23	372.03	371.65	371.60	369.49	---	368.77	368.86	368.67	369.16	369.83	370.31	370.59
24	372.11	371.54	371.47	369.84	---	369.19	368.91	368.62	369.17	369.81	370.38	370.56
25	372.21	371.32	371.49	369.91	---	369.18	368.90	368.58	369.14	369.88	370.35	370.29
26	372.22	371.23	371.65	369.58	---	368.86	368.73	368.48	369.03	369.99	370.31	370.44
27	372.17	371.36	371.46	369.31	---	368.61	368.57	368.64	369.06	370.01	370.29	370.57
28	372.01	371.29	371.32	369.49	---	368.93	368.70	368.71	369.10	369.92	370.32	370.69
29	372.09	371.19	371.36	369.78	369.15	368.43	368.65	369.07	369.90	370.32	370.71	
30	372.30	371.25	371.44	369.64	369.25	368.60	368.47	369.08	369.92	370.28	370.67	
31	372.00	371.35	369.85	369.17	368.50	369.87	370.38					

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