Prepared in cooperation with the
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION,
DIVISION OF SUPERFUND

Volatile Organic Compound Data from Three Karst Springs in Middle Tennessee, February 2000 to May 2001

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Cover photograph: Rutledge Falls with Big Spring shown at right of photo.

Volatile Organic Compound Data from Three Karst Springs in Middle Tennessee, February 2000 to May 2001

By SHANNON D. WILLIAMS and JAMES J. FARMER

U.S. GEOLOGICAL SURVEY

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Denver, Colorado 80225

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CONVERSION FACTORS AND WATER-QUALITY UNITS

Multiply	By	To obtain
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
gallon (gal)	3.785	liter (L)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
pound per square inch (lb/in^2)	6.895	kilopascal (kPa)

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C), and temperature in °C to °F, as follows:

°F = (1.8 x °C) + 32

°C = 5/9(°F – 32)

Gage datum—Each site is referenced to its own local datum.

Water-Quality Units

µg/L	micrograms per liter
µg/mL	micrograms per milliliter
µL	microliter
µS/cm	microsiemens per centimeter
mg/L	milligrams per liter
mL	milliliter

Volatile Organic Compound Data from Three Karst Springs in Middle Tennessee, February 2000 to May 2001

By Shannon D. Williams *and* James J. Farmer

ABSTRACT

The U.S. Geological Survey (USGS), in cooperation with the Tennessee Department of Environment and Conservation, Division of Superfund, collected discharge, rainfall, continuous water-quality (temperature, dissolved oxygen, specific conductance, and pH), and volatile organic compound (VOC) data from three karst springs in Middle Tennessee from February 2000 to May 2001. Continuous monitoring data indicated that each spring responds differently to storms. Water quality and discharge at Wilson Spring, which is located in the Central Basin karst region of Tennessee, changed rapidly after rainfall. Water quality and discharge also varied at Cascade Spring; however, changes did not occur as frequently or as quickly as changes at Wilson Spring. Water quality and discharge at Big Spring at Rutledge Falls changed little in response to storms. Cascade Spring and Big Spring at Rutledge Falls are located in similar hydrogeologic settings on the escarpment of the Highland Rim.

Nonisokinetic dip-sampling methods were used to collect VOC samples from the springs during base-flow conditions. During selected storms, automatic samplers were used to collect water samples at Cascade Spring and Wilson Spring. Water samples were collected as frequently as every 15 minutes at the beginning of a storm, and sampling intervals were gradually increased following a storm. VOC samples were analyzed using a portable gas chromatograph (GC). VOC samples were collected from Wilson, Cascade, and Big Springs during 600, 199, and 55 sampling times, respectively, from February 2000 to May 2001.

Chloroform concentrations detected at Wilson Spring ranged from 0.073 to 34 mg/L (milligrams per liter). Chloroform concentrations changed during most storms; the greatest change detected was during the first storm in fall 2000, when chloroform concentrations increased from about 0.5 to about 34 mg/L. Concentrations of cis-1,2-dichloroethylene (cis-1,2-DCE) detected at Cascade Spring ranged from 0.30 to 1.8 μg/L (micrograms per liter) and gradually decreased between November 2000 and May 2001. In addition to the gradual decrease in cis-1,2-DCE concentrations, some additional decreases were detected during storms. VOC samples collected at weekly intervals from Big Spring indicated a gradual decrease in trichloroethylene (TCE) concentrations from approximately 9 to 6 μg/L between November 2000 and May 2001. Significant changes in TCE concentrations were not detected during individual storms at Big Spring.

Quality-control samples included trip blanks, equipment blanks, replicates, and field-matrix spike samples. VOC concentrations measured using the portable GC were similar to concentrations in replicate samples analyzed by the USGS National Water Quality Laboratory (NWQL) with the exception of chloroform and TCE concentrations. Chloroform and TCE concentrations detected by the portable GC were consistently lower (median percent differences of –19.2 and –17.4, respectively) than NWQL results. High correlations, however, were observed between concentrations detected by the

portable GC and concentrations detected by the NWQL (Pearson's r > 0.96). VOC concentrations in automatically collected samples were similar to concentrations in replicates collected using dip-sampling methods. More than 80 percent of the VOC concentrations measured in automatically collected samples were within 12 percent of concentrations in dip samples.

INTRODUCTION

Approximately 40 percent of the United States east of the Mississippi River is underlain by various types of karst aquifers (Quinlan, 1989), and more than two-thirds of the State of Tennessee is underlain by carbonate rocks and can be classified as karst (Wolfe and others, 1997). In karst settings, ground-water levels, discharge, and water-quality conditions can fluctuate widely and rapidly (Hess and White, 1988; Dreiss, 1989; Brown and Ewers, 1991; Ryan and Meiman, 1996). These fluctuations create a potential for temporal variability in contaminant concentrations that may not be discerned by periodic sampling. Yet for investigations of chlorinated solvents and other volatile organic compounds (VOCs) in ground water, periodic sampling generally remains the accepted approach for monitoring contaminant concentrations.

Passive sorption samplers may be effective in evaluating the presence or absence of chlorinated solvents, are simple to deploy and retrieve, and are economical to analyze (Einfeld and Koglin, 2000); however, the basic information needed to quantitatively interpret the response of passive samplers to systems with fluctuating flow and concentrations has not been collected and published. Closely spaced storm samples are an effective means to characterize variable concentrations (Quinlan and Alexander, 1987), but few detailed data sets have been collected and published that adequately document VOC concentrations in karst springs because of analytical costs.

The U.S. Geological Survey (USGS), in cooperation with the Tennessee Department of Environment and Conservation, Division of Superfund, is studying the occurrence, fate, and transport of chlorinated solvents in karst regions of Tennessee. One objective of this study is to evaluate several monitoring strategies for karst springs. To accomplish this objective, (1) monitoring techniques incorporating the use of continuous water-quality monitors, automatic VOC samplers, portable gas chromatographs (GCs), and passive adsorption samplers were evaluated; (2) VOC data were collected by using these monitoring techniques at three karst springs in Middle Tennessee; and (3) the effect of various sampling intervals on the characterization of VOC concentrations and loads were examined.

Purpose and Scope

This report presents VOC, water-quality, discharge, and rainfall data collected at three karst springs in Middle Tennessee from February 2000 to May 2001. Many of the VOC samples were collected by using automatic samplers and were analyzed by using a portable GC. Water-quality monitors were used to continuously measure temperature, dissolved oxygen, specific conductance, and pH. Detailed descriptions of the automatic sampler and portable GC methods and quality-control data also are presented.

Study Sites

Wilson Spring is located about 4 miles north-northeast of Lewisburg in the Central Basin karst region of Tennessee (fig. 1) as described by Wolfe and others (1997). The geology of the Central Basin is characterized by thick-bedded limestones that alternate with thin-bedded shaly limestones, both of Ordovician age (Farmer and Hollyday, 1999). Uplift of the Nashville Dome resulted in the development of extensive fracturing in this region. Dissolution of the limestone has enlarged these fractures, resulting in the development of karst features; and ground-water flow is predominantly in these solution openings. The thin-bedded shaly formations generally act as confining units. The thin-bedded Lebanon Limestone of Ordovician age caps the hills of this region and retards the downward movement of water. Surface streams that run off the Lebanon Limestone onto the Ridley Limestone can move into the upper Ridley aquifer as described by Crawford and Ulmer (1994). A 10-foot-thick thin-bedded unit is present within the Ridley Limestone approximately 100 feet below the stratigraphic top of the Ridley Limestone (Wilson, 1990). The thin-bedded unit restricts downward flow, and cave streams are developed on the top of this unit. Wilson Spring is the surface discharge point for one of these cave streams (Crawford and Ulmer, 1994) and

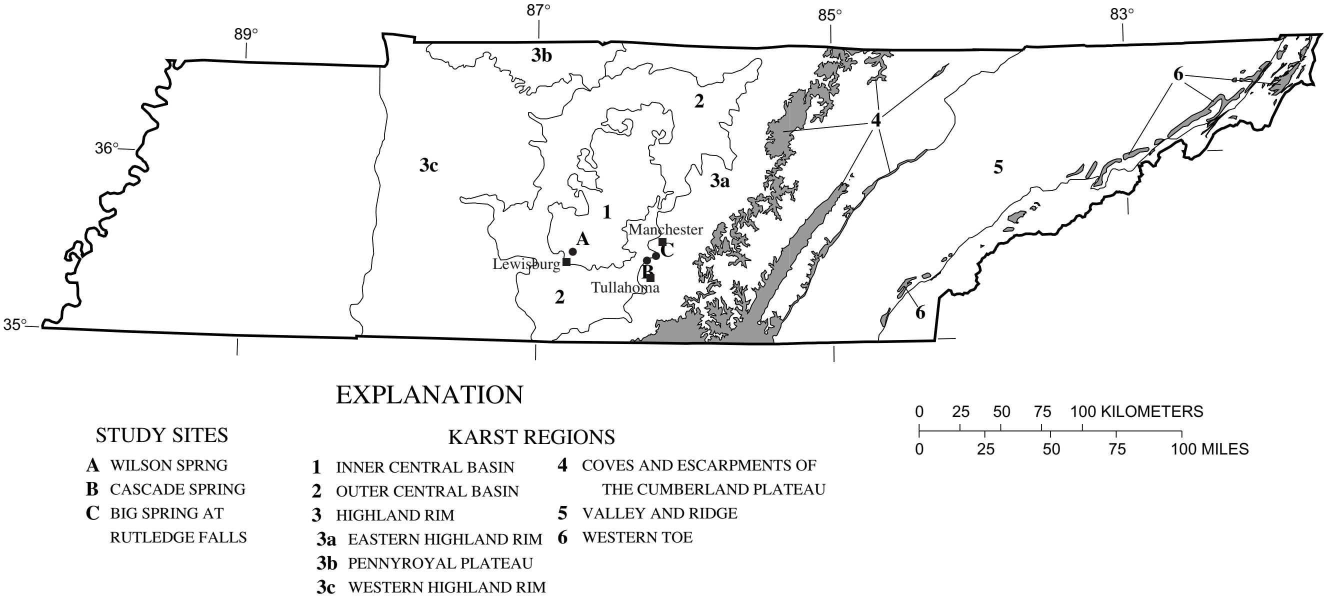

Figure 1. Location of study sites and karst regions of Tennessee. (Modified from Wolfe and others, 1997.)

discharges from about 0 to 10 ft^3/s (Thomas Hensel, AMEC, written commun., 2000).

In October 1990, a train derailment near Wilson Spring released more than 15,000 gallons of chloroform. Chloroform pooled on top of the thin-bedded unit of the Ridley Limestone, and then moved southwest downdip along weathered bedding planes until the chloroform was trapped by less weathered rock of low permeability (Crawford and Ulmer, 1994). Water containing chloroform was transported southeast, along the strike of the bedding planes, to Wilson Spring. Since 1992, a private consulting company has been collecting continuous discharge and rainfall data and monthly VOC data at Wilson Spring. Data from this monitoring indicate that chloroform concentrations range from 1 to 5 mg/L seasonally (Thomas Hensel, AMEC, written commun., 2000). Water from the spring is impounded and treated before being released into Big Rock Creek.

Big Spring at Rutledge Falls is located about 5 miles southwest of Manchester, Tenn., and 5 miles northeast of Tullahoma, Tenn., on the escarpment of the Highland Rim karst region (fig. 1). The spring discharges approximately 3.5 ft^3/s from the Manchester aquifer into Crumpton Creek (Keith Dobson, Aerospace Center Support, written commun., 2000). Spring discharge emerges near the contact between the Chattanooga Shale of late Devonian and early Mississippian age and the overlying Fort Payne Formation of Mississippian age. The Chattanooga Shale ranges from 20 to 30 feet thick and is considered to be a regional confining unit in Tennessee (Burchett, 1977). The Fort Payne Formation ranges from 20 to 230 feet thick and is predominantly cherty limestone. The Manchester aquifer is a regional aquifer composed of gravel in the residuum of the upper part of the Fort Payne Formation and solution openings in the bedrock of the Fort Payne Formation (Burchett and Hollyday, 1974). Numerous springs and seeps are present along the escarpment of the Highland Rim where the contact between the Fort Payne Formation and the Chattanooga Shale crops out. Tetrachloroethylene (PCE) and trichloroethylene (TCE) have been detected in water samples collected from the spring at concentrations of about 2 and 7 µg/L, respectively (Keith Dobson, Aerospace Center Support, written commun., 2000).

Left and right Cascade Springs are located 3.5 miles north of Tullahoma, Tenn. The springs are located on the escarpment of the Highland Rim karst region and discharge from the Manchester aquifer in a hydrogeologic setting similar to the setting described for Big Spring at Rutledge Falls. The combined flow of the Cascade Springs is approximately 5.5 ft^3/s (Johnson, 1995). Left Cascade Spring is the sole source of water for the Wartrace Water System, which supplied 0.52 million gallons of water per day in 1989 to the Town of Wartrace, 14 miles northwest of Tullahoma (Johnson, 1995). Johnson (1995) reported that approximately 1 µg/L of trans-1,2-dichloroethylene has been detected in water samples collected from left

Cascade Spring. Henceforth in this report, the name Cascade Spring refers to left Cascade Spring.

METHODS

Gaging stations were established during February 2000 at Wilson Spring, Big Spring at Rutledge Falls, and Cascade Spring (USGS station numbers 03599102, 03596485, and 03596110, respectively). Water-quality monitors were used to measure temperature, dissolved oxygen, specific conductance, and pH at 10- or 15-minute intervals in the springs. Automatic samplers were used to collect VOC samples during selected storms, and VOC samples were analyzed by using a portable GC.

Discharge and Rainfall Measurement

Spring discharge was measured using procedures described by Carter and Davidian (1968). Continuous stage recorders described by Buchanan and Somers (1968) were used to collect stage data in 0.01-foot increments. Stage data were collected at 15-minute intervals at Cascade Spring and Big Spring at Rutledge Falls, and at 10- or 15-minute intervals at Wilson Spring. Discharge was measured by using methods described by Buchanan and Somers (1969). Discharge ratings were developed by using methods described by Kennedy (1984) and were applied to the continuous stage data to produce discharge records (Kennedy, 1983). A tipping-bucket rain gage was used to collect rainfall data (15-minute intervals) at Cascade Spring. Rainfall data (10-minute intervals) at Wilson Spring were obtained from AMEC (formerly Ogden Environmental and Energy Services).

The USGS gage at Wilson Spring could not accurately measure gage heights below 0.08 foot because of the placement of the water-level sensor in the flume. Discharge data were obtained from AMEC for gage heights below 0.08 foot and for periods of missing record. Discharge data collected from February 10, 2000, to October 10, 2000, by the USGS were collected at 15-minute intervals, whereas, data obtained from AMEC were collected at 10-minute intervals. AMEC discharge data collected at 10 and 20 minutes after the hour were averaged and reported as 15 minutes after the hour. Likewise, discharge data collected at 40 and 50 minutes after the hour were averaged and reported as 45 minutes after the hour. AMEC rainfall data collected at 10 and 20 minutes after the hour were added together and reported as 15 minutes after the hour. Likewise, rainfall data collected at 40 and 50 minutes after the hour were added together and reported as 45 minutes after the hour.

Continuous Water-Quality Monitoring

General procedures described by Wood (1976), Wilde and Radtke (1998), and Wagner and others (2000) were used for field measurements of temperature, dissolved oxygen, specific conductance, and pH. Water-quality monitors were enclosed in perforated polyvinyl chloride (PVC) pipe and placed directly in Cascade Spring (fig. 2) and Big Spring at Rutledge Falls. At Wilson Spring, the monitor was placed in a tub just below the lip of the flume (fig. 3) because of the shallow water depth inside the flume; dissolved-oxygen data were not collected at this spring. During field visits, specific conductance and temperature were checked with a hand-held meter to compare the water-quality conditions in the tub and the spring.

Field measurements were made at 15-minute intervals at Cascade Spring and Big Spring at Rutledge Falls and at 10- or 15-minute intervals at Wilson Spring. The water-quality monitors were calibrated before deployment by using standard reference solutions following the manufacturer's instructions (Hydrolab Corporation, 1999). At approximately 3-week intervals, data were downloaded from the monitors, calibration of the monitors was checked, and monitors were recalibrated as needed.

Portable Gas Chromatograph Analyses

The portable GC method described in this report is suitable for the measurement of microgram per liter concentrations of selected VOCs in water samples. VOCs measured during this study are listed in table 1. The U.S. Environmental Protection Agency (EPA) Environmental Technology Verification Program has evaluated the portable GC used during this study. The EPA performance verification documented high linear relations between portable GC and laboratory results, with correlation coefficients greater than 0.96 for low concentrations (less than 100 µg/L) of 16 VOCs including PCE, TCE, and chloroform (Einfeld, 1998).

Figure 2. Stream gaging, water-quality monitoring, and volatile organic compound sampling equipment at Cascade Spring.

Figure 3. Water-quality monitoring and volatile organic compound sampling equipment at Wilson Spring.

Summary of Method

An internal pump in the purge unit and polytetrafluoroethylene (PTFE) tubing were used to transfer water samples from sample containers to the sample cell in the purge unit (cell fill). An inert gas was then vigorously passed through the water in the sample cell, transferring VOCs from the water phase into the gas phase. The gas flow was initially diverted to the vent (purge/cell exhaust) then passed through an adsorbent trap (located in the main GC unit) that retained and concentrated the VOCs (purge/sampling). The flow of gas was then diverted from the column through the trap to the vent to remove water vapor (dry purge). The flow of gas was then reverted back through the trap to the column and allowed to resume its normal flow (delay). The trap was then quickly heated, and VOCs released from the trap were carried into the stainless-steel capillary column (desportion). Between each water sample, the sample cell in the purge unit was automatically rinsed with volatile blank water (VBW).

Compounds eluting from the GC column were tentatively identified by comparing their retention times to retention times obtained by the measurement of control samples under the same conditions used for the water samples. The identification of compounds was verified by the analysis of selected duplicate samples by the USGS National Water Quality Laboratory (NWQL). The concentrations of identified compounds in water samples were measured by relating the detector response (peak area) to the detector response for known concentrations of control samples analyzed under the same conditions used for the water samples.

Apparatus and Instrumentation

- *Portable purge unit* – Sentex (Fairfield, N.J.) on-line portable model purge unit with a 30-milliliter sample cell, internal pump (150 milliliter per minute pumping rate), and electricity and purge gas provided by the portable GC.
- *Portable GC* – Sentex Sentograph Plus II with an internal carrier gas cylinder and rechargeable batteries; direct on-column, sampling loop, and carboxen trap injection systems; an oven with operating temperature up to 179 °C; and microargon ionization (MAID) and electron capture detectors (ECD).
- *Data system* – Laptop computer and Sentex software (version 1.56, Aquascan mode) were used to operate the portable purge unit and GC and to obtain retention time and peak area data.
- *Capillary column* – Restek Corporation (Bellefonte, Pa.) MXT-volatiles capillary column, treated stainless steel (30-meter length, 0.53-millimeter inside diameter), diphenyl/dimethyl polysiloxane stationary phase (3-micrometer film thickness).
- *GC conditions* – Oven, 70 °C (isothermal); column pressure, 10 pounds per square inch; cell fill, 60 seconds; purge/cell exhaust, 10 seconds; purge/sampling, 60 seconds; dry purge, 60 seconds; delay, 60 seconds; desportion, 4 seconds; detector, MAID; peak integration, constant baseline.
- *Syringes* – Gas-tight glass syringes (ranging in size from 10 to 500 µL) equipped with PTFE plungers.

Reagents and Consumable Materials

- *Carrier gas* – Ultra high purity (greater than 99.995 percent) argon.
- *Sample bottles* – Baked 40-, 125-, and 250-mL glass amber bottles; caps with PTFE-faced silicone septa.
- *2-mL vials* – Amber glass, screw-top vials.
- *Caps for 2-mL vials* – Solid caps with PTFE liner and caps with PTFE-faced silicone septa.
- *Volatile blank water (VBW)* – Generated by purification of tap water through activated charcoal filtration and de-ionization with a high-purity, mixed-bed resin (Nanopure, Barnstead, Dubuque, Iowa, D4802 Organic-free cartridge kit).
- *Analytical standards* – Single component standards containing 100 µg/mL of selected VOCs (table 1) dissolved in methanol (ULTRA Scientific, North Kingstown, R.I.). Custom standard containing 100 µg/mL each of PCE, TCE, 1,1-dichloroethylene (1,1-DCE), cis-1,2-DCE, and 1,1,1-trichloroethane (1,1,1-TCA) in methanol (ULTRA Scientific).
- *Pasteur pipettes*
- *Hydrochlorous acid (HCl)* – 1:1 solution of HCl and water in 30-mL PTFE squeeze bottles.

Sample Analysis

- *Sample preparation* – If chilled, a sample was allowed to warm to room temperature. If a compound was known to be present at a high concentration (greater than 20 µg/L), the sample was diluted prior to analysis. During dilutions, a gas-tight syringe was used to remove the sample from the septum-capped sample vial and to transfer the sample to a septum-capped vial containing the appropriate amount of VBW. Syringes were rinsed with VBW between each dilution.

- *Sample injections* – A sample was quickly uncapped, the PTFE tubing from the purge unit was placed in the bottom of the sample container, and pumping of the sample to the internal cell of the purge unit was initiated using the GC software.

Preparation of Standards and Controls

- *Laboratory blanks* – Blanks were prepared using acidified VBW. One drop of HCl added to 40 mL of VBW was sufficient to achieve a pH of about 2. Laboratory blanks included test blanks, continuing set blanks, carryover blanks, and equipment blanks.
- *Stock standard solutions* – Analytical standards were opened, transferred to 2-mL vials using Pasteur pipettes, capped (with solid caps), and stored in a freezer. New stock standard solutions were prepared approximately every 2 months. Upon creation of a new stock solution, two sets of standards were prepared and analyzed (one from the new stock solution and one from the previously used stock solution) to verify the integrity of the previously used stock solution.
- *Working standard solutions* – Solid caps on stock solution containers were quickly removed and replaced with septum caps. Gas-tight syringes (10 or 25 µL) were used to transfer stock solution to capped sample bottles containing acidified VBW. One drop of HCl added to 40 mL of solution was sufficient to achieve a pH of about 2. Fresh working standard solutions were prepared daily and included detector conditioning, calibration, and continuing calibration verification standards.

Calculation and Reporting of Results

- *Qualitative identification* – Historical data from each of the study sites were obtained to identify the VOCs typically detected in each spring. Single component standards were then used to determine retention times for each of these compounds (table 2). Replicate samples were collected during storms and analyzed by the NWQL to verify the continued presence of previously identified VOCs at each spring.
- *Calibrations* – The calibration range for the method is equivalent to concentrations from 0.25 to 20 mg/L without dilution of samples. Initial calibration data were entered into a computer spreadsheet (Microsoft Excel, Microsoft, Inc., Seattle, Wash.). Graphs were made from the GC data by plotting peak areas on the x-axis and concentrations of the calibration standards on the y-axis. The spreadsheet was used to determine a trend line for the data points using a quadratic curve fit. The equation of the trend line and the correlation coefficient value (r^2) were included with the graph for each compound. Initial calibration data were accepted if the r^2 values for all curves were greater than or equal to 0.99 for all compounds.
- *Quantitation* – Concentrations were determined by entering peak area data in a computer spreadsheet (Microsoft Excel) containing equations for trend lines from the most recent calibration curves. For diluted samples, the dilution factor was incorporated into the calculation for determining final concentrations of samples.
- *Detection/reporting limits* – The GC software allowed signal fluctuations (noise) to be suppressed. The noise-threshold value was set at a level that filtered out all normal signal fluctuations, preventing false positives. Because false positives were not an issue, the smallest concentration of a compound that could be continuously detected was used as an estimated detection and reporting limit (table 2). For diluted samples, reporting limits were raised according to the dilution factor.

Quality-Control Procedures

- *Test blanks* – Test blanks were analyzed prior to beginning an analytical sequence to ensure that the GC system was free of contaminants.
- *Continuing set blanks (CSBs)* – CSBs were analyzed periodically during the analytical sequence to confirm the continued absence of contaminants in the GC system.
- *Carryover blanks (COBs)* – COBs were analyzed after samples or standards with concentrations (typically greater than 10 µg/L) known to produce detectable carryover. Multiple COBs were sometimes needed after analysis of samples or

standards containing high concentrations of VOCs (20 to 50 µg/L).

- *Laboratory equipment blanks* – Laboratory equipment blanks were used to verify that syringes used for sample dilutions were free of contaminants. Equipment blanks using VBW were processed by using the same procedures used to process samples.
- *Detector conditioning standards* – Several standards were analyzed at the beginning of each day to obtain a stable detector response. Detector response was considered stable when concentrations in two consecutive standards were within 20 percent of the concentrations in the previous standard. Typically, three or four standards (with concentrations of 5 µg/L) were needed.
- *Initial calibration standards* – Solutions containing concentrations ranging from 0.25 to 20 µg/L (0.25, 0.50, 1.0, 2.0, 5.0, 10, and 20 µg/L) were used as calibration standards.
- *Continuing calibration verification standards (CCVs)* – Surrogate solutions were not added to samples; therefore, frequent analysis (after approximately every six samples) of CCVs was performed. The CCV concentration was varied during the analysis to collect quality-control information at different concentrations. If the result for a CCV was not within 20 percent of the expected value, new calibrations were performed.
- *Matrix spike control* – Matrix spike samples were used to evaluate effects of sample-matrix interferences on analyte recovery. Matrix spike samples were prepared by spiking replicates of environmental samples with appropriate amounts of stock solution. Matrix spike samples were prepared using the same stock solution and procedures used to prepare working standards.
- *External laboratory replicates* – Selected concurrent field replicates were sent to the NWQL to confirm the identification and quantitation of VOCs detected using the portable GC. The NWQL used gas chromatography/mass spectrometry methods described by Connor and others (1998) during the determination of selected VOCs (table 3). Quality-assurance and quality-control practices used by the NWQL are described in Pritt and Raese (1995).
- *Laboratory split replicates* – For selected samples, multiple dilutions were prepared and analyzed to quantify the variability resulting from dilution process.
- *Analytical sequence* – Samples were analyzed in a consistent sequence. The sequence always began with a test blank to prove the system was free of contamination before analyzing samples. After the system was shown to be free of contaminants, several detector-conditions standards were analyzed until a stable detector response was obtained. Once a stable detector response was obtained, a CSB was analyzed to verify that the system was still free of contaminants. Then, a CCV or series of calibrants were analyzed. A CCV, a COB, and a CSB bracketed each group of samples (typically no more than six samples per group). Each analytical sequence also was ended with a CCV, a COB (if necessary), and a CSB. Equipment blanks and matrix spike controls were included with samples and were randomly analyzed during the analytical sequence.

Volatile Organic Compound Sample Collection

VOC samples were collected from springs by using dip-sampling methods (immersing hand-held 40-mL vials) and by using automatic samples. Dip samples were collected periodically, mostly during base-flow conditions and were processed by using methods described by Wilde and others (1999a; 1999b). During selected storms, automatic samplers collected samples at Cascade Spring and Wilson Spring. The following method was used to automatically collect VOC samples.

Summary of Method

A bladder pump and PTFE tubing were used to transfer water samples from springs to automatic samplers. The automatic samplers mechanically opened a valve in the sampler container cap, inserted a needle through the cap to the bottom of a vial, and rinsed the vial with three volumes of sample. The sample then was collected as the needle was slowly removed from the vial, and the valve was automatically closed creating an airtight seal with no headspace. The bladder and sampling lines were rinsed with water from the spring just before the collection of each sample. Samples were removed from the automatic sampler, acidified, and chilled until analysis.

Apparatus and Instrumentation

- *Automatic samplers* – ISCO, Inc. (Lincoln, Nebr.) model 6100 automatic VOC samplers were used. The samplers held 25 vials.
- *Automatic sampler pump* – The samplers were equipped with bladder pumps constructed of stainless steel and PTFE. An air compressor (built into the sampler) expanded and contracted the bladder, gently pushing water from the pump to the sampler without applying suction or vacuum to samples. At Cascade Spring, the pump was placed directly in the spring (fig. 2); at Wilson Spring, the pump was placed in a tub along with the continuous water-quality monitor (fig. 3).
- *Tubing* – Polyethylene tubing was used to transfer air from the air compressor in the sampler to the bladder pump. PTFE-lined polyethylene tubing was used to transfer samples from the pump to the sampler. At Wilson Spring, the tubing was enclosed in insulated PVC pipe (fig. 3)
- *Sample containers* – Standard 40-mL VOC vials.
- *Sample container caps* – Valve caps (ISCO, Inc.) were used during the collection of samples. These caps were replaced with standard septum caps for 40-mL VOC vials after collection and preservation of samples.
- *Power supply* – The sampler installed at Cascade Spring was powered by 12-volt batteries (ISCO, Inc.). The sampler at Wilson Spring was powered using an alternating current power converter.
- *Sampler houses* – The automatic samplers were placed in small, insulated houses at the springs to protect the samplers. The sampler house at Cascade Spring contained an open bottom and was placed directly in the spring pool (fig. 2) to moderate temperature changes inside the sampler house. The sampler house at Wilson Spring was placed on a bluff above the spring (fig. 3) and contained a heater to prevent samples from freezing during cooler periods.
- *Thermometers* – Temperature changes inside the sampler houses were monitored using maximum/minimum recording thermometers.
- *Sampler activators* – The automatic samplers were equipped with liquid-level actuators that are used to initiate sampling when a specific water level is reached.
- *Rain gages* – Liquid-level actuators were placed in simple rain gages constructed out of plastic funnels and PVC pipe. The rain gages were attached to the top of the sampler houses (fig. 3) and were used to initiate sample collection during the early stages of a storm before discharge increased significantly.

Sample Collection

- *Sampler activation* – The sampler activators were placed in the rain gages so that the samplers would be activated after about 0.25 inch and 0.5 inch of rainfall at Wilson and Cascade Springs, respectively.
- *Sample preservation* – The valve cap was removed from a sample vial, HCl was added to the sample, and the valve cap was replaced with a septum cap. Four drops of HCl added to 40 mL of sample was typically sufficient to achieve a pH of about 2. Samples were stored at about 2 ^{o}C.
- *Equipment cleaning* – Samplers were programmed to automatically rinse the bladder and sample tubing prior to collecting a sample to reduce carryover from previous samples.
- *Sampling intervals* – Samplers were programmed to collect samples at 15-minute intervals after automatic activation at the beginning of storms. During subsequent manual activations, sampling intervals were gradually increased depending on the intensity and the duration of a storm.

Quality-Control Procedures

- *Trip blanks* – Each set of automatically collected samples included a trip blank to verify that samples were not contaminated between the time of collection and the time of analysis. The trip blank consisted of VBW in a capped 40-mL VOC vial and occupied 1 of the 25 slots in each sampling carousel.
- *Equipment blanks* – Equipment blanks were used to quantify the amount of carryover between samples collected using the automatic samplers. Equipment blanks using VBW were processed using the same procedures used to process samples.
- *Replicates* – Concurrent replicates were collected from the springs by using dip-sampling methods to quantify the variability introduced from the collection, processing, shipping, and analysis of samples. Additional replicates were collected to determine the variability associated with specific aspects of sample collection and included

sampling location replicates and sampling method replicates.

- *Sampling location replicates* – Replicate samples were collected from different sampling locations (tub and flume) at Wilson Spring. These replicates were used to determine whether volatilization resulted in significant differences between chloroform concentrations in water from the flume and water from the tub where samples were collected by using the automatic sampler.
- *Sampling method replicates* – Replicate samples also were collected using different sampling methods (automatic samplers and dip) at Wilson Spring and Cascade Spring. Samples collected using the automatic samplers often remained in the field for several days before retrieval and preservation. When the automatic samplers were manually activated, replicate samples were collected by using dip methods and were immediately preserved. Results from these replicates were used to determine if volatilization, biodegradation, or other processes resulted in significant loss of VOCs from the automatically collected samples (between the time of collection and preservation).

QUALITY-CONTROL DATA

Quality-control samples associated with the use of the portable GC included external laboratory (NWQL) replicates, laboratory split replicates, and matrix spike samples. Quality-control data associated with the use of the portable GC are presented in tables 4 through 9 (at the end of the report). Field replicates were collected during 64 of the 600 sampling times at Wilson Spring, during 36 of the 199 sampling times at Cascade Spring, and during 28 of the 55 sampling times at Big Spring. Quality-control data for field replicates and trip blanks are presented for Wilson Spring (tables 10 through 13), Cascade Spring (tables 14 through 16), and Big Spring (tables 16 and 17) at the end of the report.

External Laboratory Replicates

Water samples analyzed by the NWQL included 25 replicates collected from Wilson Spring, 16 replicates collected from Cascade Spring, and 13 replicates collected from Big Spring. Concentrations of cis-1,2-DCE measured in replicates analyzed using the portable GC and in replicates analyzed by the NWQL were similar (fig. 4). Concentrations of cis-1,2-DCE in Cascade Spring replicate samples analyzed by using the portable GC ranged from –11.8 to 33.3 percent different from concentrations in replicates analyzed by the NWQL (table 6). Chloroform concentrations in Wilson Spring replicates analyzed by using the portable GC were typically less than concentrations in replicates analyzed by the NWQL (fig. 4). In 17 of the 25 sets of replicates, chloroform concentrations were less

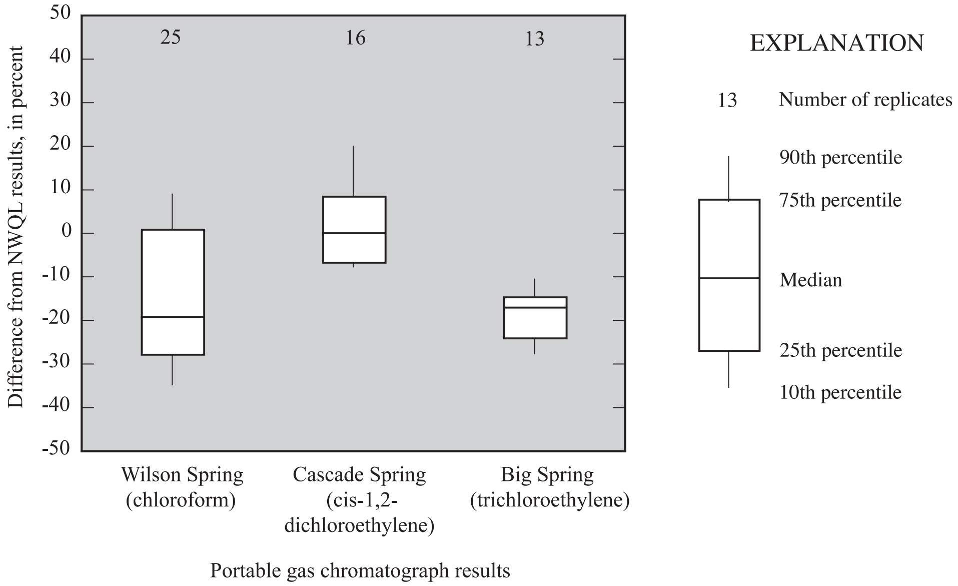

Figure 4. Volatile organic compound results for replicate samples analyzed using the portable gas chromatograph as compared to results for replicate samples analyzed by the USGS National Water Quality Laboratory (NWQL).

in samples analyzed by using the portable GC than in samples analyzed by the NWQL (table 4). The median difference for chloroform concentrations in Wilson Spring replicates analyzed by using the portable GC samples when compared to replicates analyzed by the NWQL was –19.2 percent (fig. 4). TCE concentrations in Big Spring replicates analyzed using the portable GC were consistently less than concentrations in replicates analyzed by the NWQL (fig. 4). TCE concentrations in Big Spring replicates analyzed using the portable GC ranged from –32.6 to 0.0 percent different from concentrations in replicates analyzed by the NWQL (table 8), with a median percentage difference of –17.4 (fig. 4). Although chloroform and TCE concentrations in portable GC replicates were typically less than concentrations detected in NWQL replicates, the concentrations detected by the different methods were highly correlated (Pearson's r>0.96) (figs. 5 and 6).

Laboratory Split Replicates

One concern during the analysis of samples from Wilson Spring was that the dilution of samples might affect the accuracy of the portable GC results. Split replicates were created during the dilution process for 33 samples collected from Wilson Spring and were analyzed using the portable GC (table 5).

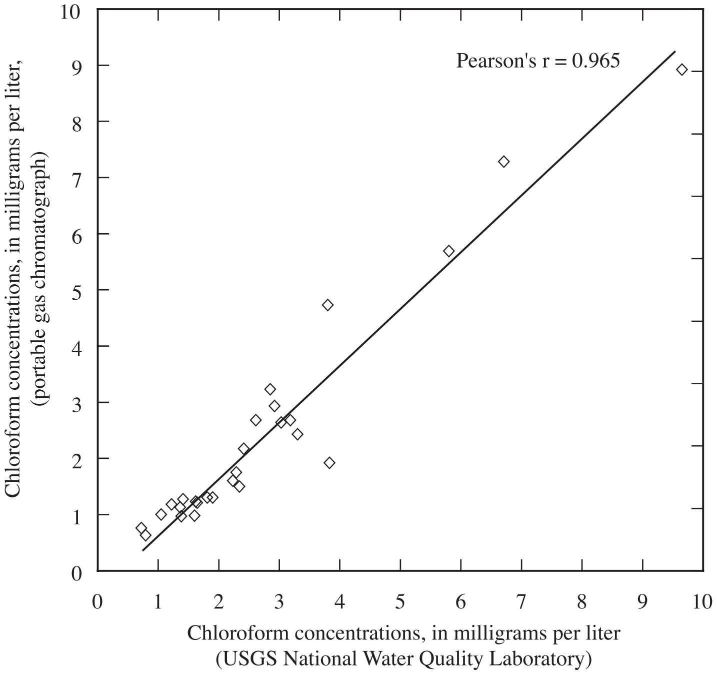

Figure 5. Chloroform results for replicate samples analyzed using different methods (includes results for volatile blank water spike samples from table 4).

Although the dilutions used during the analysis of these split replicates ranged from 1:100 to 1:1,000, chloroform concentrations in split replicates were similar (fig. 7); 82 percent of the relative differences between split replicates were within about 15 percent (table 5) of each other.

Field-Matrix Spikes

Field-matrix spikes were created using three samples collected from Cascade Spring and two samples collected from Big Spring. Field-matrix spikes were not created for samples collected from Wilson Spring because of the high concentrations (greater than 1 mg/L) of chloroform present in the samples. Recoveries for VOCs in the Cascade Spring field-matrix spikes ranged from 85.6 to 101.4 percent (table 7). Recoveries for VOCs in the Big Spring field-matrix spikes ranged from 80.0 to 134.0 percent (table 9). Most of the recoveries for VOCs were between 80 and 120 percent (fig. 8).

Concurrent Replicates

Concurrent replicates were collected using dip-sampling methods to provide a measure of the variability inherent in the entire process of sample collection, processing, and analysis. These concurrent replicates were collected during 24, 24, and 19 sampling times at Wilson, Cascade, and Big Springs, respectively. The relative difference between concentrations in concurrent replicate samples collected using dip-sampling methods was consistently (95 percent or more of the time) less than 15 percent and frequently (75 percent or more of the time) within 10 percent for the primary contaminant at each of the karst springs (fig. 9; tables 10, 14, and 17).

Sampling Location Replicates

One concern during the sampling at Wilson Spring was that chloroform might have been volatilized as water flowed out of the flume and into the tub. Sampling location replicates (replicates from tub and flume) were collected during 27 sampling times at Wilson Spring. If significant volatilization had occurred, chloroform concentrations in samples from the tub would have been consistently less than concentrations in replicate samples from the

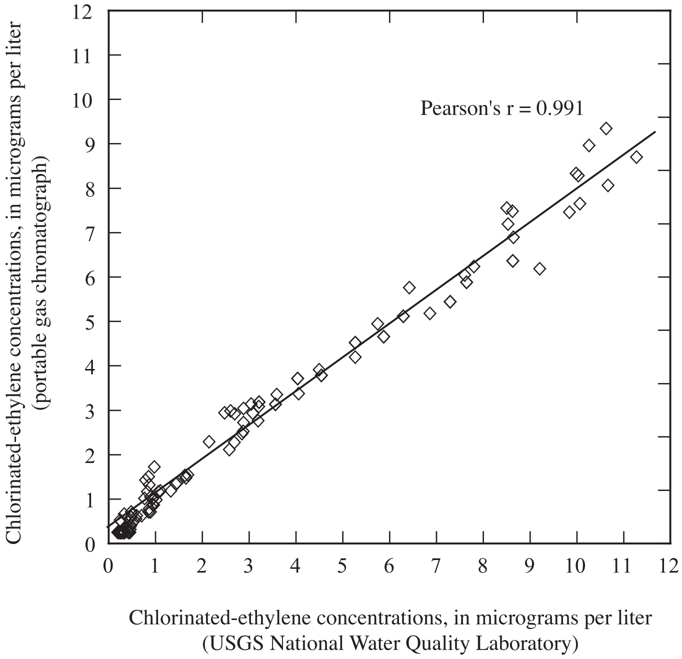

Figure 6. Chlorinated-ethylene results for replicate samples analyzed using different methods (includes results for volatile blank water spike samples from tables 6 and 8).

flume. Chloroform concentrations in samples collected from the tub at Wilson Spring using dip-sampling methods were similar to concentrations in replicates collected from the flume using dip-sampling methods (fig. 10). Chloroform concentrations in dip samples collected from the tub ranged from -23.3 to 13.3 percent different from concentrations in dip samples collected from the flume (table 11). About 80 percent of the chloroform concentrations in dip samples from the tub were within 6.2 percent of chloroform concentrations in dip samples from the flume (fig. 10, table 11).

Sampling Method Replicates

Another concern during the sampling at Wilson and Cascade Springs was that volatilization and biodegradation could result in losses of VOCs from automatically collected samples. Many of the automatically collected samples remained in the field for several days before retrieval and preservation (tables 12 and 15). Maximum temperatures inside the sampler houses were as high as 40 ^{o}C at Wilson Spring (table 12). Sampling method replicates (automatic sampler and dip) were collected during 32 sampling times at Wilson Spring and during 9 sampling times at Cascade Spring. If volatilization or biodegradation was occurring, VOC concentrations detected in automatically collected samples would have been consistently less than concentrations detected in replicate dip samples that were immediately preserved upon collection from the flume at Wilson Spring. VOC concentrations in automatically collected samples were similar to concentrations in replicates collected using dip-sampling methods (fig. 11). Chloroform concentrations in automatically collected samples ranged from –21.4 to 26.8 percent different from concentrations in dip samples collected from the tub at Wilson Spring (table 12). Concentrations of cis-1,2-DCE in automatically collected samples from Cascade Spring ranged from –4.7 to 34.1 percent different from concentrations in dip samples (table 15). More than 80 percent of the chloroform concentrations detected in automatically collected samples at Wilson Spring were within 12 percent of concentrations in dip samples, and more than 80 percent of the cis-1,2-DCE concentrations in automatically collected samples at Cascade Spring were within 10 percent of concentrations in dip samples (fig. 11, tables 12 and 15).

Field Equipment and Trip Blanks

Before the collection of equipment blanks at Wilson Spring, samples were collected from the flume and the tub using dip methods and from the tub using the automatic samplers. The chloroform concentration in these replicates was about 2,700 µg/L (table 18). The automatic sampler pump then was removed from the tub, rinsed with VBW, and placed in a 5-gallon container of VBW. Sequential equipment blanks then were collected using the automatic sampler. A chloroform concentration of 25.0 µg/L was detected in the first equipment blank (table 18), representing a carry-over of less than 1 percent from the previous samples. About 7 and 6 µg/L of chloroform were detected in additional blanks collected using the automatic sampler. Much of the chloroform detected in the additional equipment blanks was probably from contamination of the VBW by the pump during the collection of the equipment blanks. Chloroform was not detected in a dip sample collected from the VBW container before the pump was placed in the container; however, about 4 µg/L of chloroform was detected in a dip sample from the 5-gallon VBW container after the equipment blanks were collected (table 18). Equipment blanks collected at Cascade Spring using similar procedures

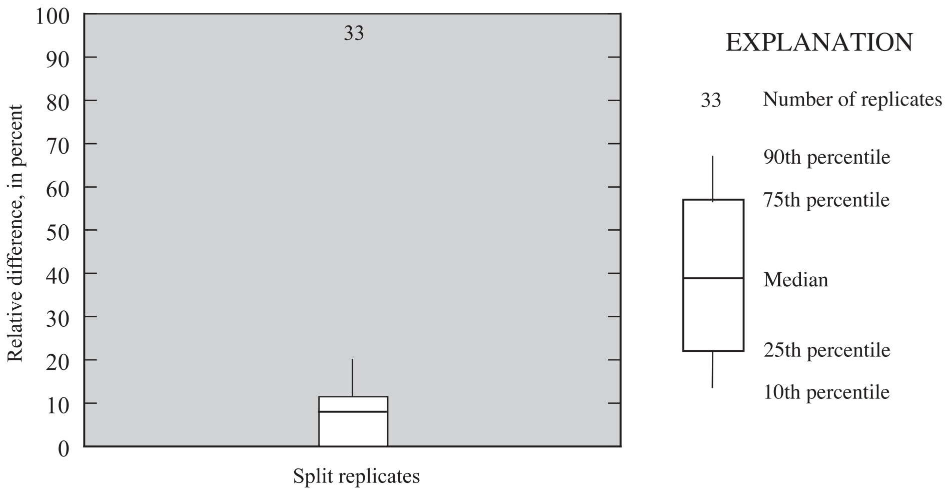

Figure 7. Chloroform results for split replicate samples collected at Wilson Spring.

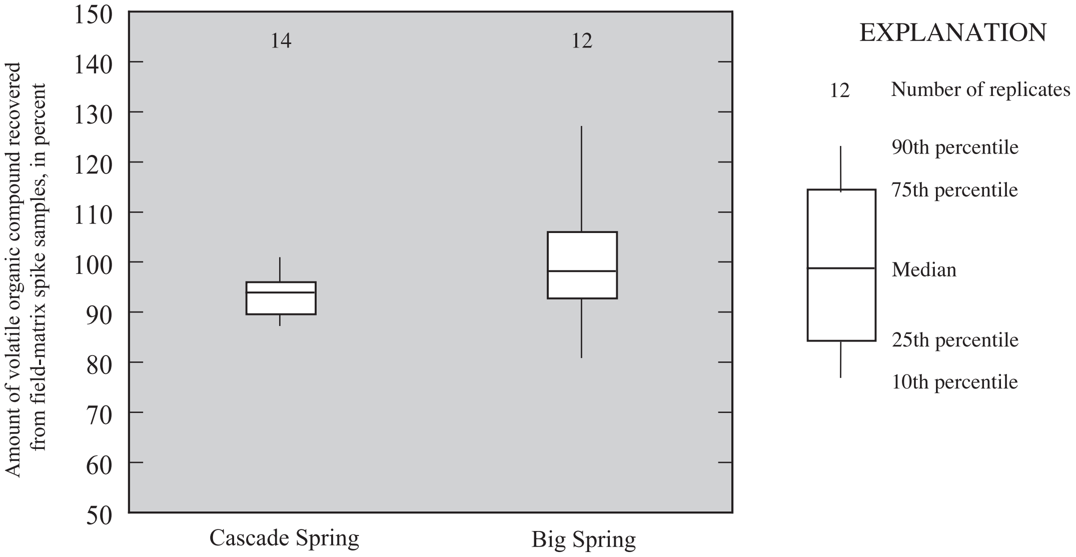

Figure 8. Volatile organic compound results for field-matrix spike samples collected at Cascade and Big Springs.

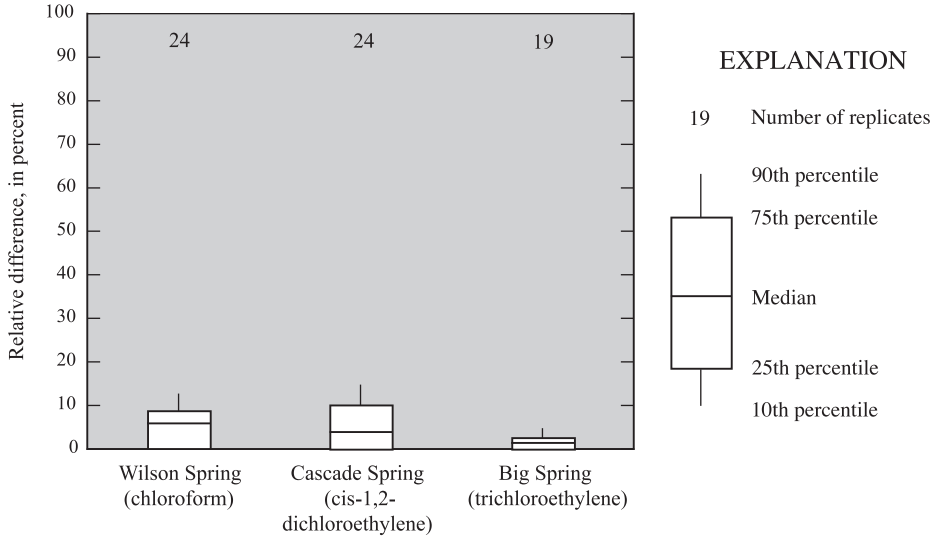

Figure 9. Volatile organic compound results for concurrent replicate samples collected at Wilson, Cascade, and Big Springs.

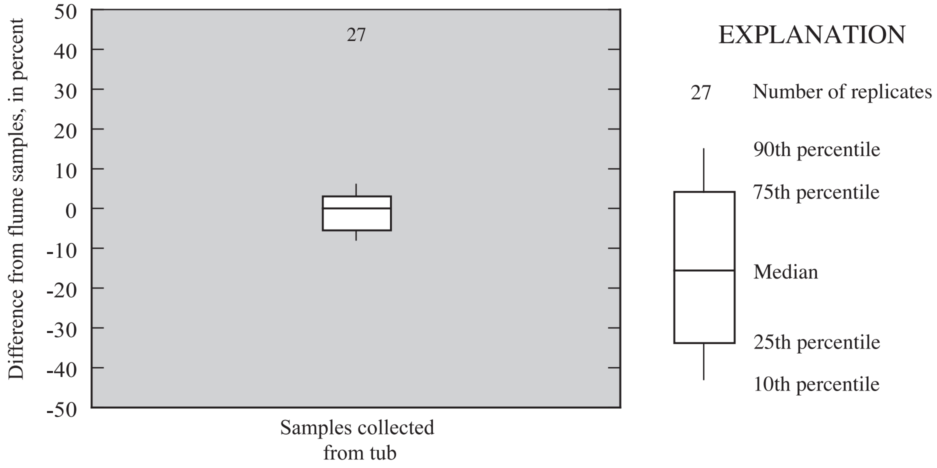

Figure 10. Chloroform results for replicate samples collected from the tub as compared to results for replicate samples collected from the flume at Wilson Spring (all samples were collected using dip methods).

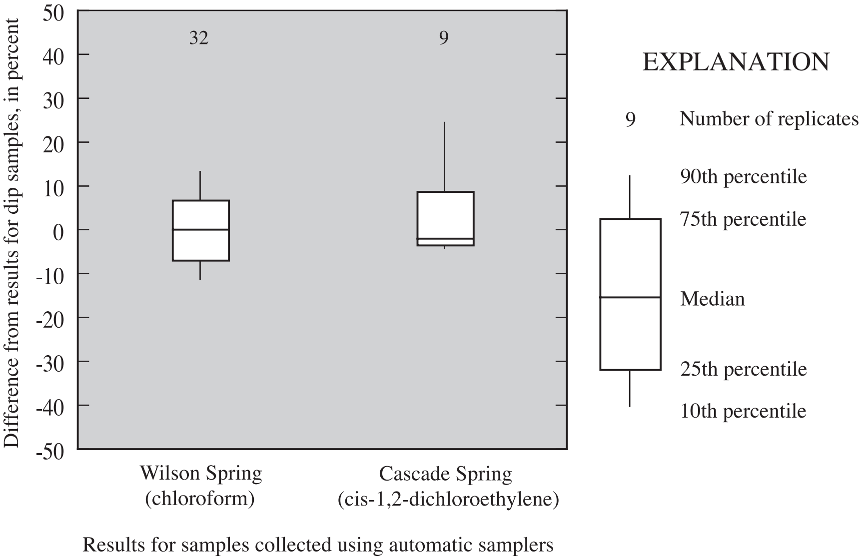

Figure 11. Volatile organic compound results for replicate samples collected using automatic samplers as compared to results for dip samples at Wilson and Cascade Springs.

did not detect any carryover between samples (table 19). VOCs were not detected in any trip blanks during this study (tables 13 and 16). Trip blanks collected for Cascade Spring also served as trip blanks for Big Spring.

RESULTS AND DISCUSSION

Continuous monitoring data collected from February 2000 through October 2000 were examined to determine the water-quality responses of the three springs to rainfall events. During this period, VOC samples were collected periodically at each site by using dip-sampling methods and were analyzed by using the portable GC or by the NWQL. The primary objectives of this initial phase of VOC sampling were to evaluate analytical methods and to obtain background information on VOC concentrations in the springs.

In November 2000, a more intensive phase of VOC sampling began in which the primary objectives were to evaluate sample collection methods and to document changes in VOC concentrations in the springs. During this more intensive sampling, VOC samples were collected weekly during base-flow conditions by using dip-sampling methods and as frequently as every 15 minutes during selected storms at Wilson and Cascade Springs by using automatic samplers.

Continuous Water-Quality Monitoring

Continuous monitoring data indicated that the three springs respond differently to rainfall. At Wilson Spring, water quality and discharge changed rapidly after rainfall. Discharge ranged from less than 0.001 ft^3/s to greater than 8.7 ft^3/s (fig. 12). Specific conductance ranged from 81 to 663 µS/cm, and pH ranged from 6.9 to 9.3. Rapid changes were recorded during many storms; for example, on March 11, 2000, specific conductance decreased from 492 to 81 µS/cm, and pH increased from 7.3 to 8.4 within a 3-hour period (fig. 12).

Significant water-quality changes were detected during most of the storms between November 2000 and May 2001 at Wilson Spring. During the first large storm of fall 2000, about 3 inches of rain fell, and discharge increased from about 0.005 ft^3/s to a peak flow of about 0.5 ft^3/s on November 9. As discharge increased, specific conductance increased from about 430 µS/cm on November 8 to a maximum value of 633 µS/cm on November 13, 2000 (fig. 12). The characteristics of the water-quality responses during storms at Wilson Spring varied. About 2 inches of rain fell on January 18 and January 19, 2001 at Wilson

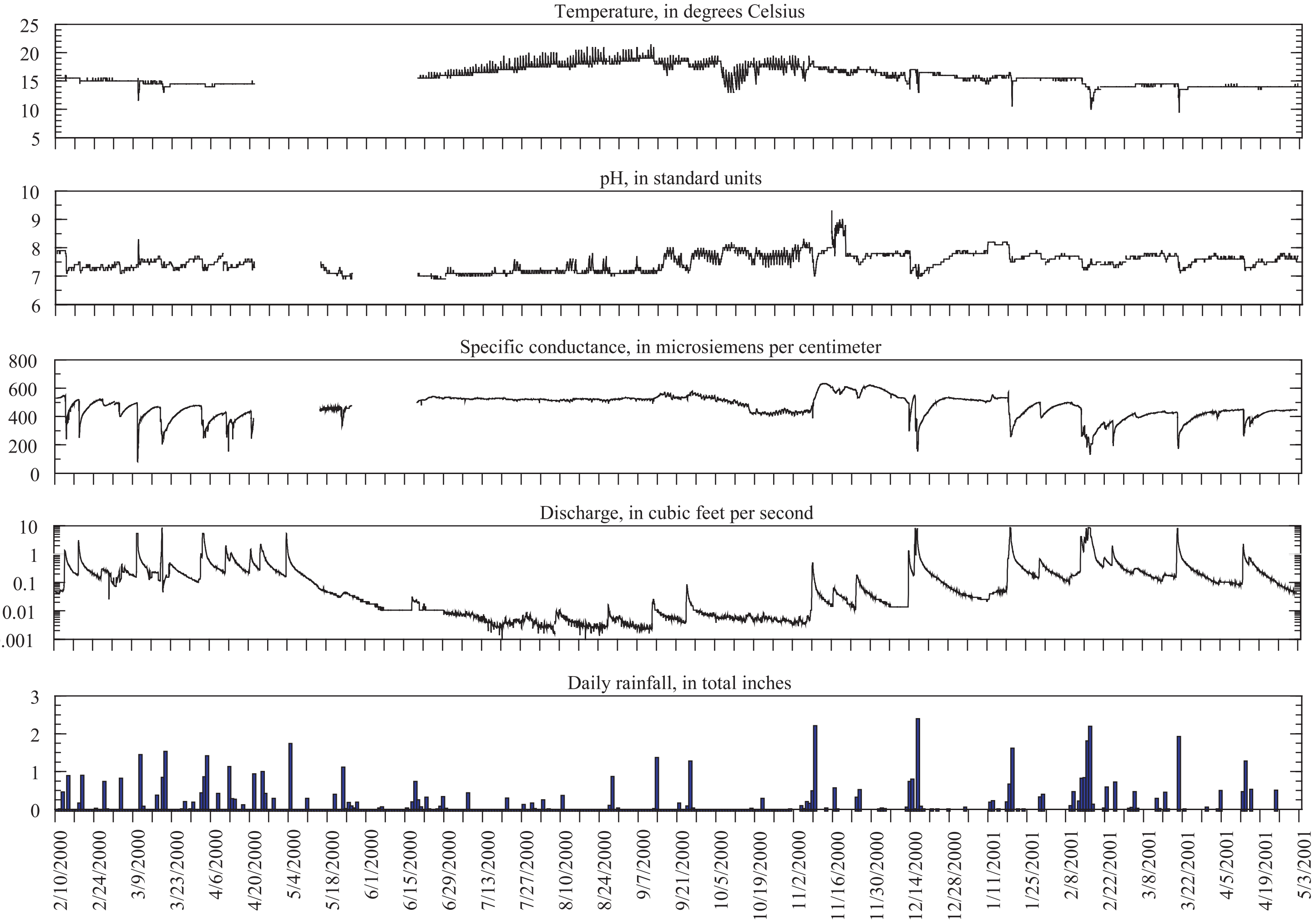

Figure 12. Continuous monitoring data collected at Wilson Spring from February 2000 to May 2001. (Line gaps indicate missing data.)

Spring. During this storm, specific conductance briefly increased from approximately 530 to 574 µS/cm on January 18; however, specific conductance quickly decreased to less than 260 µS/cm. Specific conductance eventually increased to 503 µS/cm on January 30, 2001 at which time another storm began. Between Feburary 1, 2001 and May 2001, the specific conductance typically decreased shortly after storms with no initial increase in response to rainfall (fig. 12).

At Cascade Spring, some variation in water quality and discharge also was detected. Specific conductance ranged from 43 to 96 µS/cm, and pH ranged from 5.6 to 6.9 (fig. 13). These changes were not as frequent and did not occur as quickly after rainfall as the changes at Wilson Spring. For example, about 7 inches of rain fell between November 4 and November 9, 2000; about 1.5 inches fell on November 16, 2000; and about 2 inches fell between November 24 and November 25, 2000, without any significant changes in specific conductance being recorded (fig. 13). The first change in specific conductance because of a storm was after approximately 9 inches of rain fell between December 13 and December 16, 2000. During this storm, specific conductance decreased from about 90 µS/cm on December 13, 2000, to about 60 µS/cm on December 17, 2000 (fig. 13). During other storms between January 1, 2001 and May 2001, similar decreases in specific conductance were observed (fig. 13).

At Big Spring, water quality and discharge varied little. Specific conductance ranged from 144 to 166 µS/cm, and pH ranged from 6.4 to 7.2 (fig. 14). Gage height ranged from 1.91 to 2.08 feet above datum, and no significant changes in gage height were observed during storms (fig. 14). Even during a large

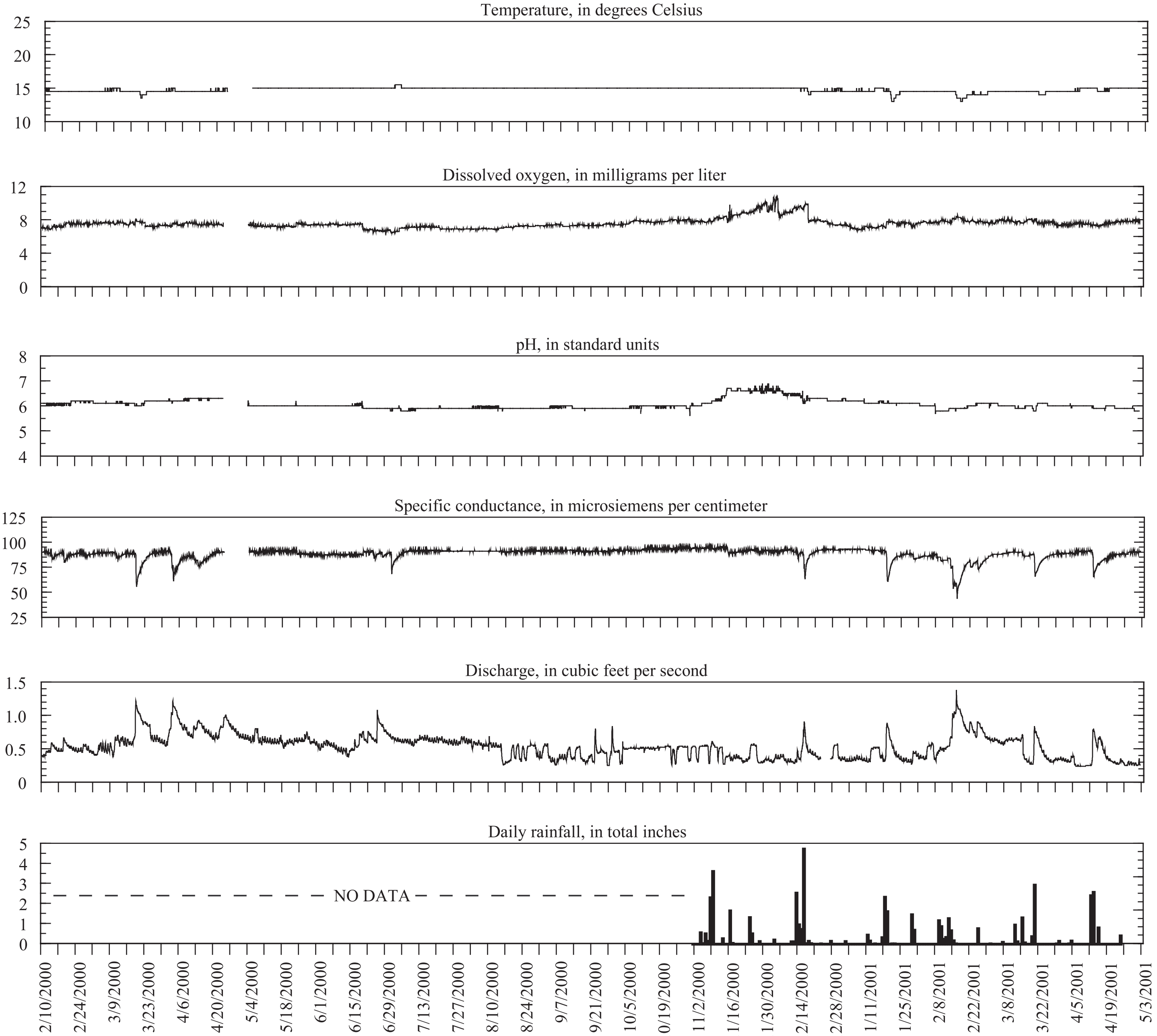

Figure 13. Continuous monitoring data collected at Cascade Spring from February 2000 to May 2001. (Line gaps indicate missing data. Discharge data do not include water captured by Wartrace Water System.)

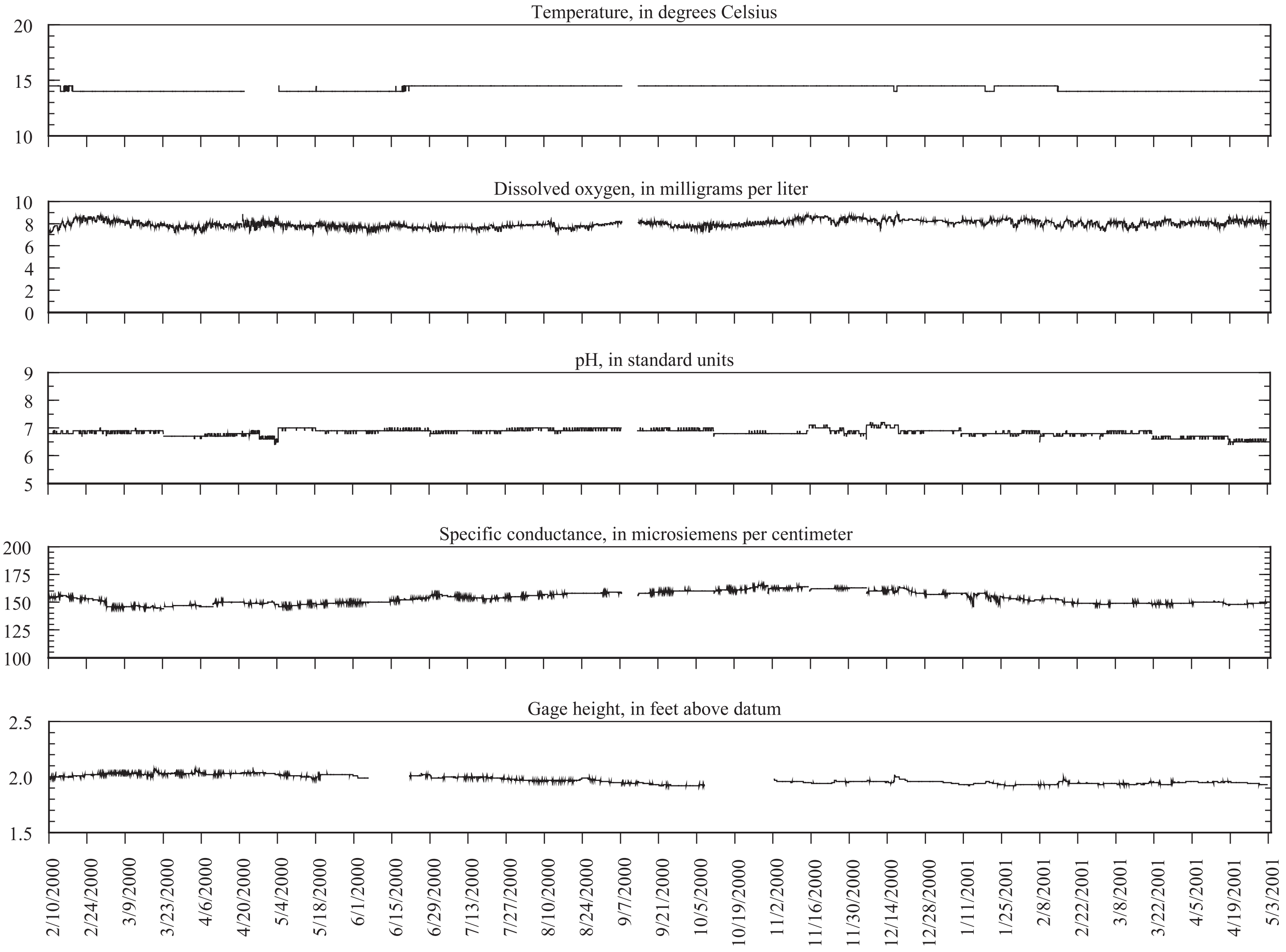

Figure 14. Continuous monitoring data collected at Big Spring at Rutledge Falls from February 2000 to May 2001. (Line gaps indicate missing data.)

storm between December 13 and December 16, 2000, in which approximately 9 inches of rain fell at nearby Cascade Spring, no significant changes in water quality were detected at Big Spring. Gage height increased slightly from 1.95 to 2.02 feet above datum between December 13 and December 17, 2000, and specific conductance decreased slightly from 162 to 158 µS/cm on December 17, before increasing to 164 µS/cm on December 18.

Three discharge measurements were made at Big Spring during the study. The measured discharges were 3.37, 3.52, and 3.12 ft^3/s at gage heights of 2.00, 2.00, and 2.04 feet above datum, respectively. These discharge measurements were comparable to five measurements made from May 1999 through October 1999 during which the discharge ranged from 3.33 to 3.70 ft^3/s (Keith Dobson, Aerospace Center Support, written commun., 2000). Continuous monitoring results from the initial phase of sampling were used to assist with the design of the second phase of monitoring which focused on more intensive VOC sampling at the springs.

Volatile Organic Compounds

From February 2000 through October 2000, dip samples were collected at 34, 26, and 27 different times from Wilson, Cascade, and Big Springs, respectively. The continuous monitoring data collected during this period indicated that water quality at Wilson and Cascade Springs was affected by storms. Automatic VOC samplers were installed at these two springs for more intensive sampling during the second phase of monitoring (November 2000 to May 2001). During the second phase of monitoring, VOC samples were collected during 566, 172, and 28 sampling times at Wilson, Cascade, and Big Springs, respectively, with most of the VOC samples (495 from Wilson Spring and 131 from Cascade Spring) collected using automatic samplers.

The continuous monitoring data indicated that water quality at Big Spring at Rutledge Falls did not change significantly during storms. VOC dip samples were collected at approximately 1-week intervals at Big Spring during the second phase of monitoring. VOC data for the entire study period (March 2000 to May 2001) are presented in tables 20 through 22 (at the end of the report). Samples were collected during a total of 600, 198, and 55 sampling times at Wilson, Cascade, and Big Springs, respectively.

At Wilson Spring, chloroform concentrations ranging from 0.76 to 4.7 mg/L were detected during the VOC sampling conducted from March 2000 through September 2000 (table 20). During the more intensive sampling from November 2000 to May 2001, chloroform concentrations ranged from 0.073 mg/L to approximately 34 mg/L (fig. 15 and table 20). The greatest change in chloroform concentrations was detected during the first storm of fall 2000. During this storm, chloroform concentrations quickly (within 6 hours) increased from about 0.5 to 34 mg/L before quickly decreasing (within 6 hours) to about 5 mg/L (fig. 16). Chloroform concentrations eventually decreased to about 3 mg/L within a day.

The characteristics of the responses during storms at Wilson Spring varied (figs. 16-18). During a storm beginning on January 18, 2001, chloroform concentrations increased from 1.8 to 3.2 mg/L during about a 10-hour period, then decreased to a low of 0.5 mg/L within the next 24 hours before returning to about 1.5 mg/L within a few days (fig. 17). The lowest chloroform concentration detected (0.07 mg/L) was on February 16, 2001, after approximately 6 inches of rain fell during the previous 4 days (fig. 18).

At Cascade Spring, cis-1,2-DCE concentrations ranging from 0.48 to 1.8 µg/L were detected from March 2000 through October 2000 (table 21). From November 2000 to May 2001, cis-1,2-DCE concentrations ranged from 0.30 µg/L to 1.4 µg/L, as concentrations appeared to be gradually decreasing (fig. 19). During November 2000, the average cis-1,2-DCE concentration detected was approximately 1.4 µg/L; however, by April 2001, concentrations were consistently less than 1.0 µg/L. In addition to the gradual decrease in cis-1,2-DCE concentrations, some short-term decreases in concentration were recorded during storms. For example, cis-1,2-DCE concentrations decreased from 1 µg/L on February 8, 2001, to 0.30 µg/L on February 16, 2001, after approximately 3 inches of rain fell during this period (fig. 20).

At Big Spring at Rutledge Falls, TCE concentrations ranging from 7.0 to 11 µg/L were detected during periodic sampling from March 2000 through October 2000 (table 22). VOC samples collected at approximately 1-week intervals from November 2000 to May 2001 indicated a gradual decrease in TCE concentrations (fig. 21). During this period, TCE concentrations ranged from 5.6 to 11 µg/L. Monthly averages for TCE concentrations detected by using the portable GC

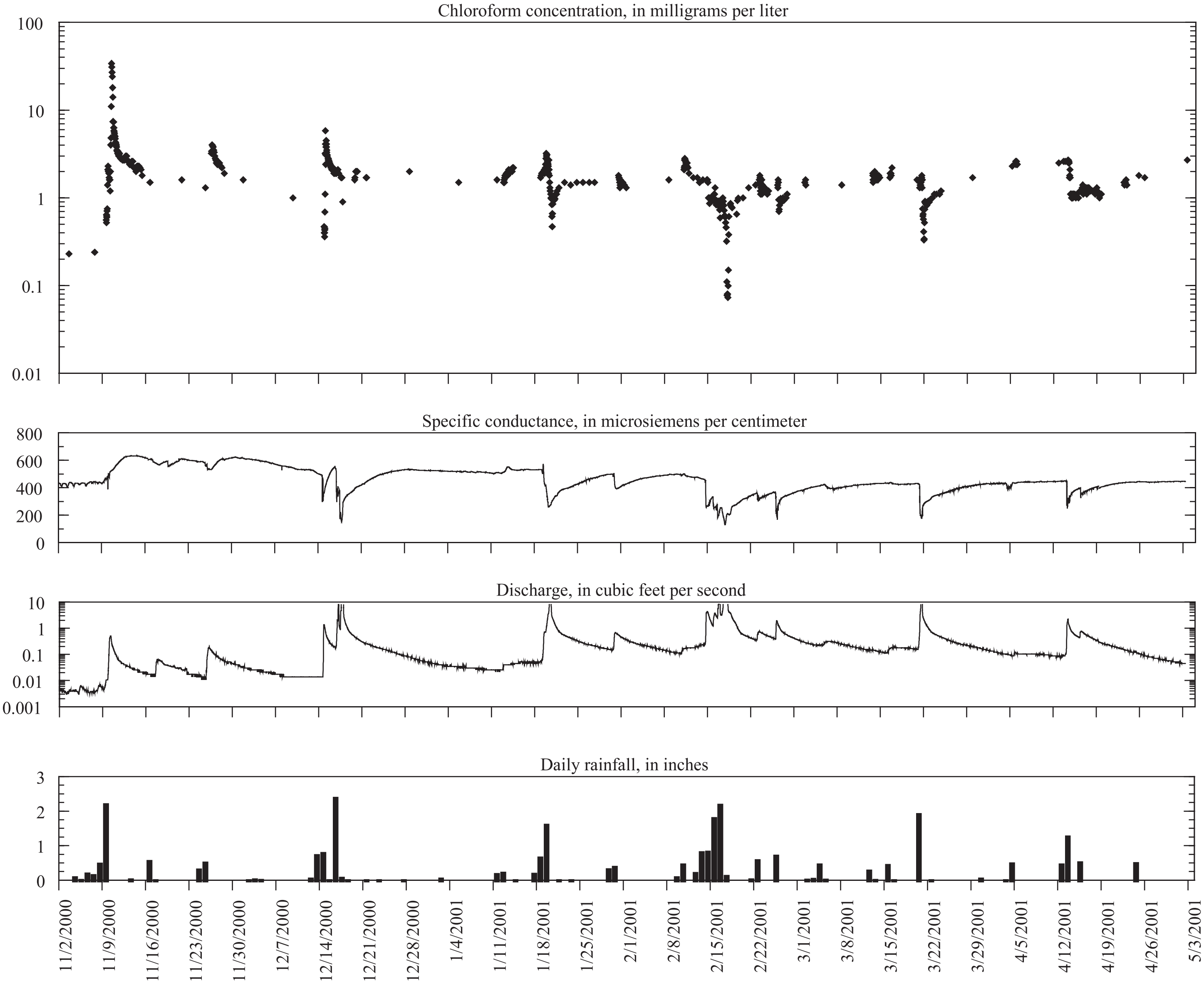

Figure 15. Chloroform concentrations and selected continuous monitoring data at Wilson Spring, November 2000 to May 2001.

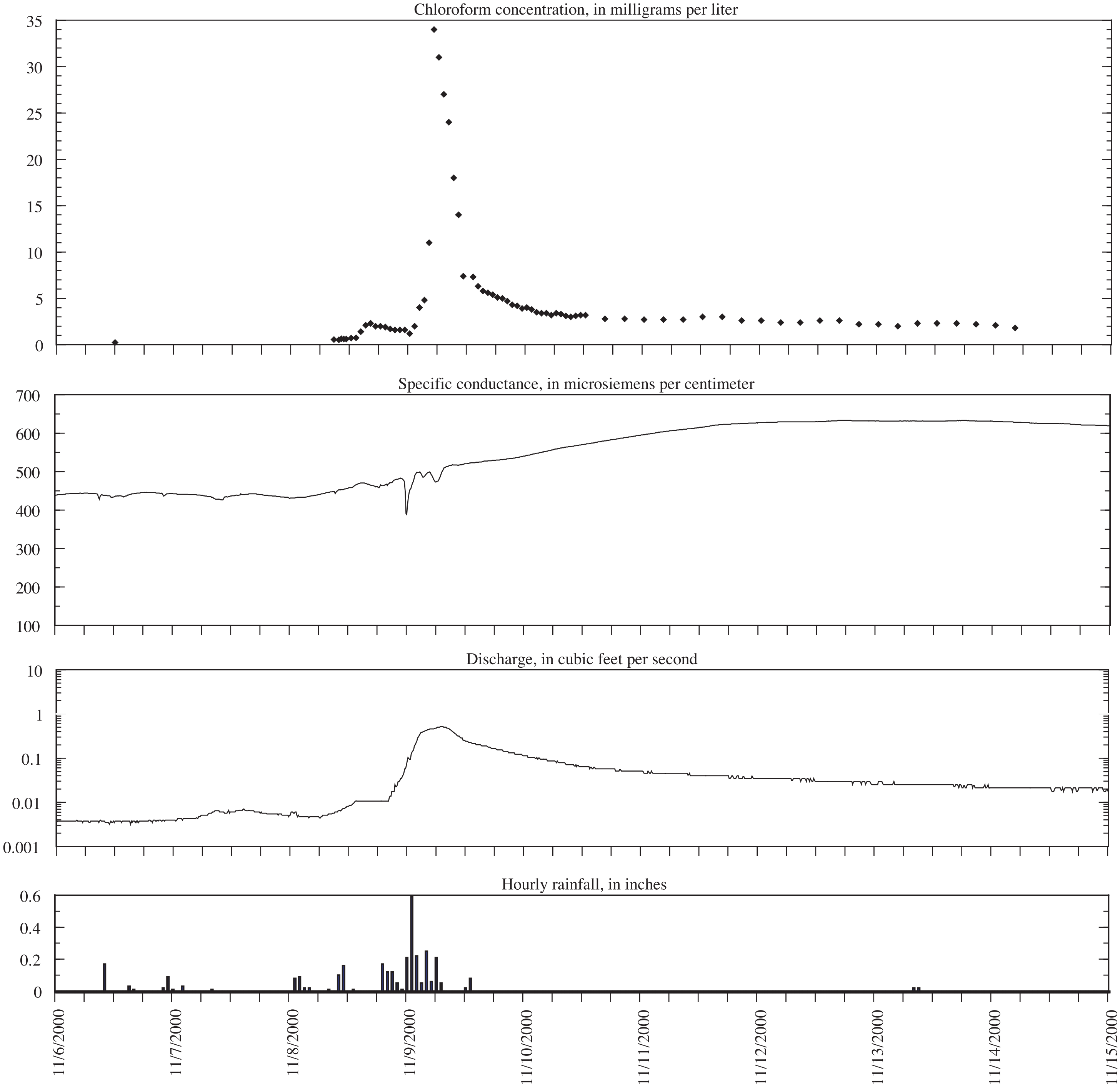

Figure 16. Chloroform concentrations and selected continuous monitoring data during a November 2000 storm at Wilson Spring.

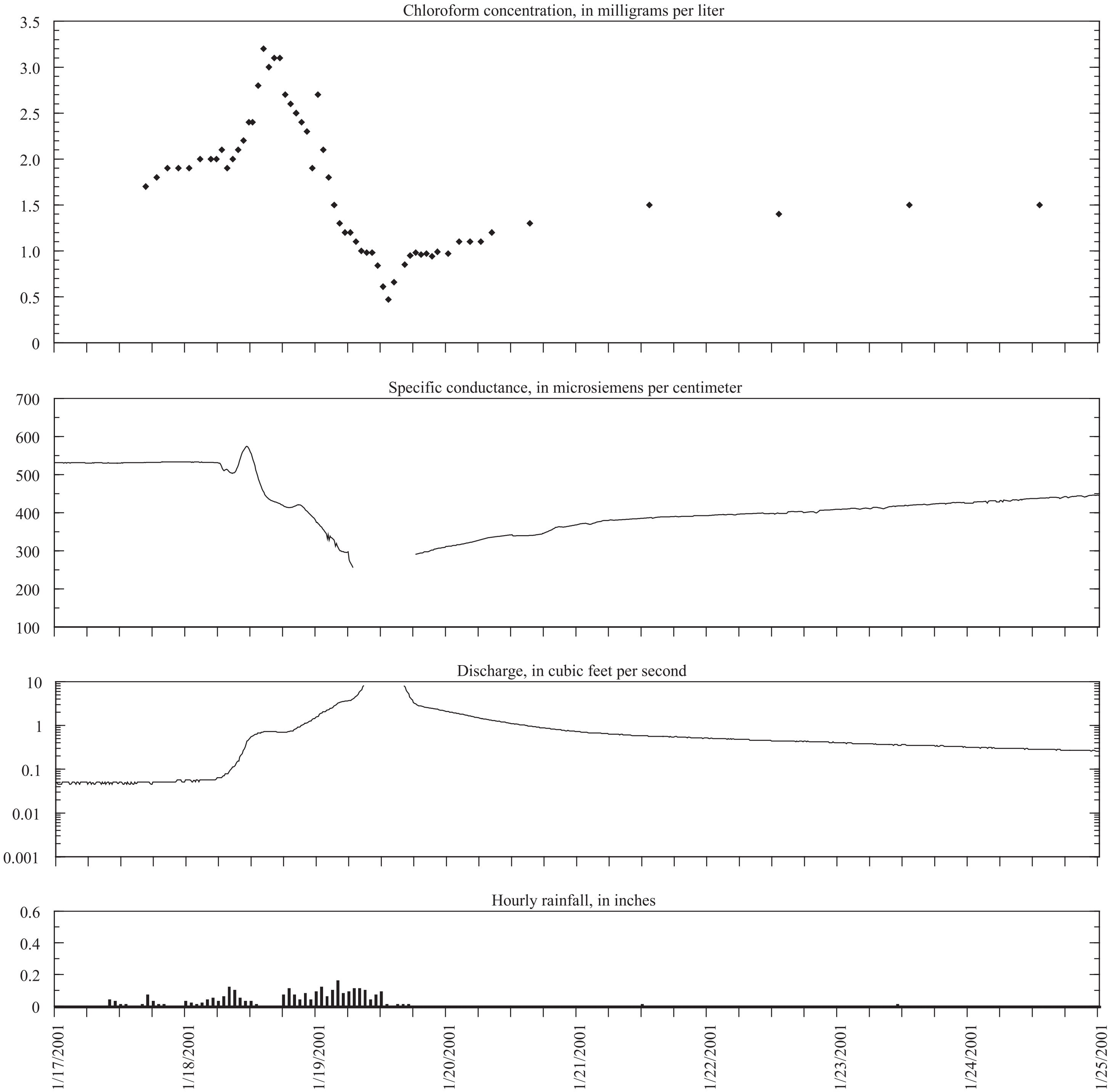

Figure 17. Chloroform concentrations and selected continuous monitoring data during a January 2001 storm at Wilson Spring. (Line gaps indicate missing data.)

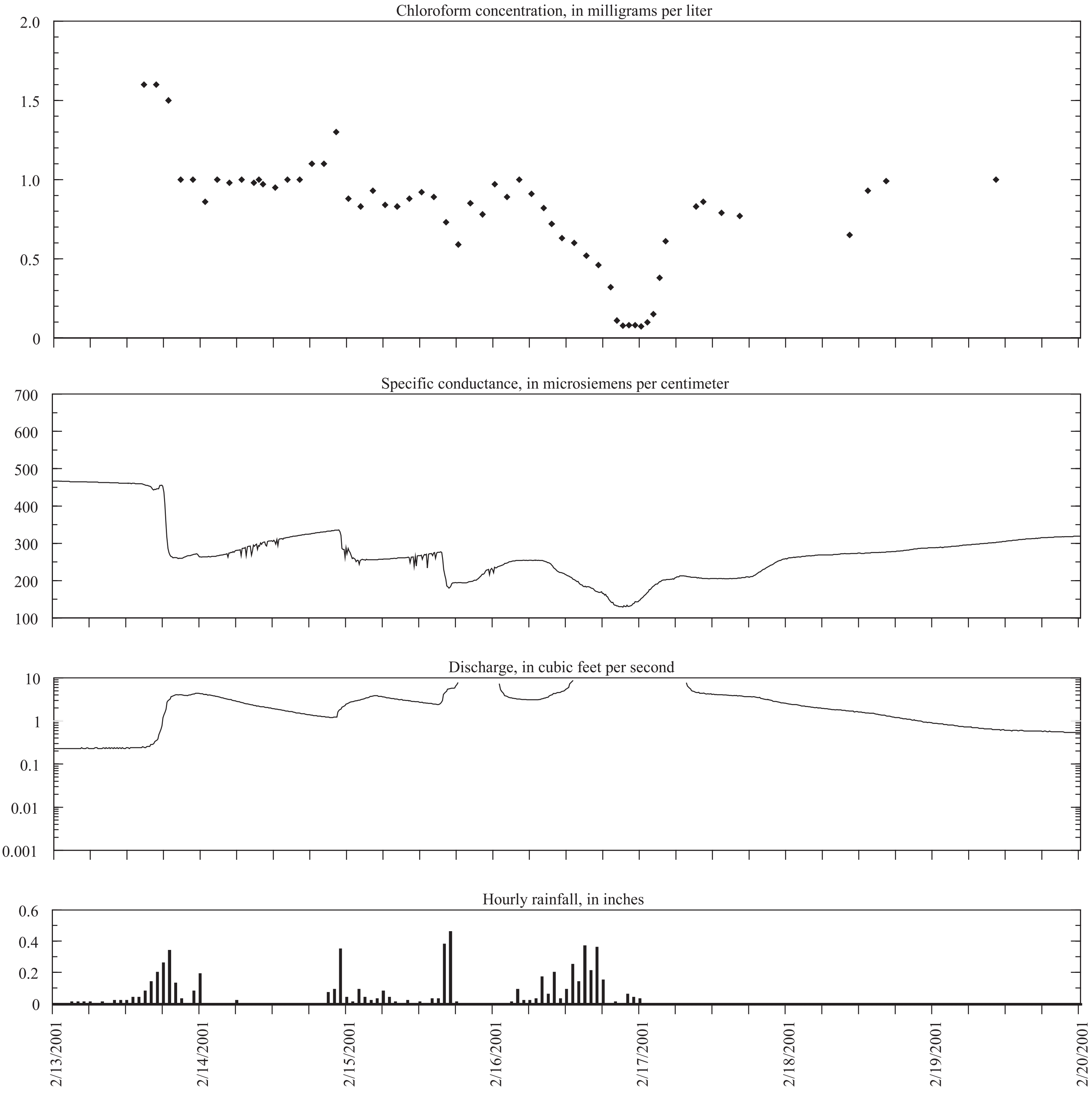

Figure 18. Chloroform concentrations and selected continuous monitoring data during a February 2001 storm at Wilson Spring. (Line gaps indicate missing data.)

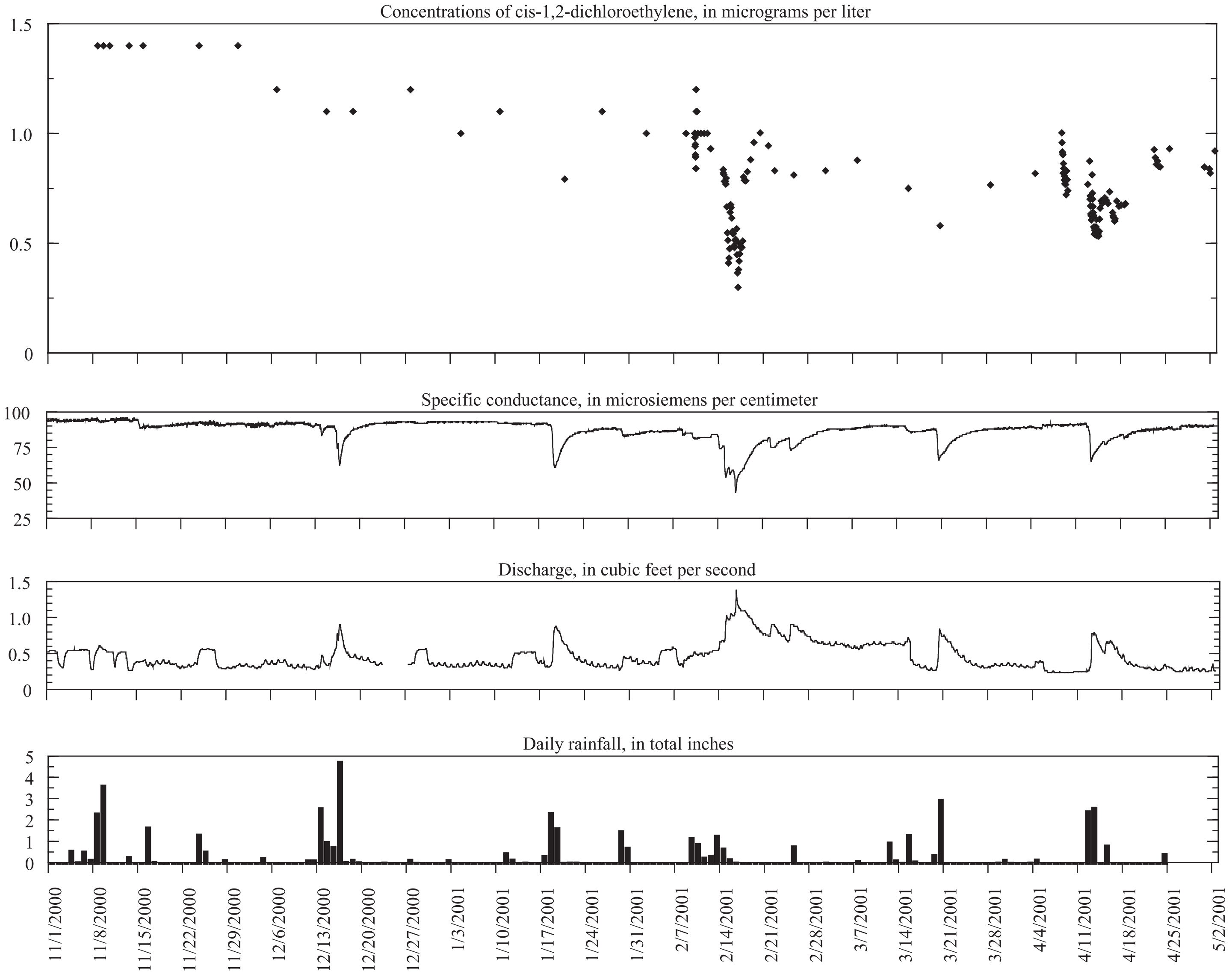

Figure 19. Concentrations of cis-1,2-dichloroethylene and selected continuous monitoring data at Cascade Spring, November 2000 to May 2001. (Line gaps indicate missing data. Discharge data do not include water captured by Wartrace Water System.)

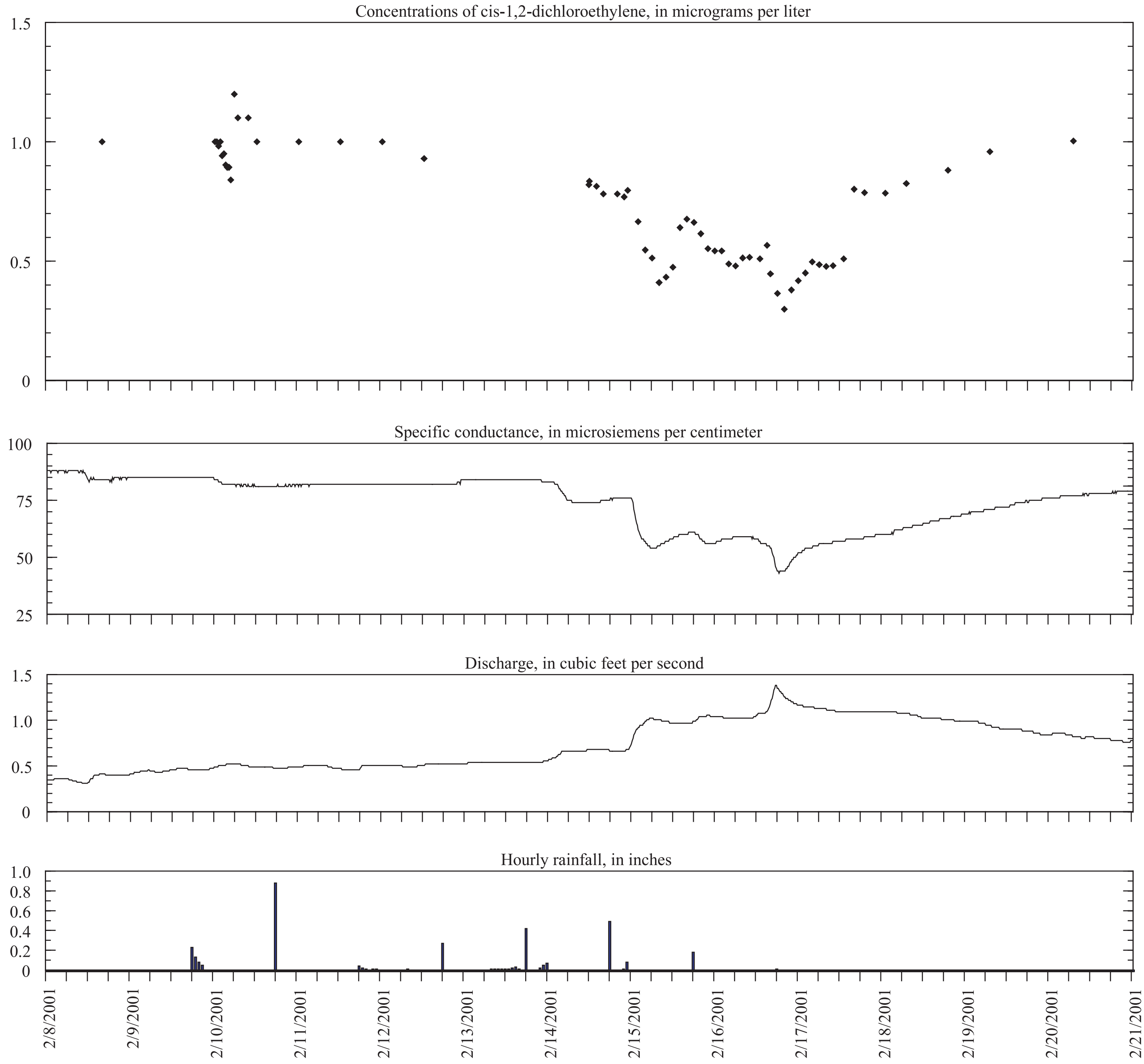

Figure 20. Concentrations of cis-1,2-dichloroethylene and selected continuous monitoring data during a February 2001 storm at Cascade Spring. (Discharge data do not include water captured by Wartrace Water System.)

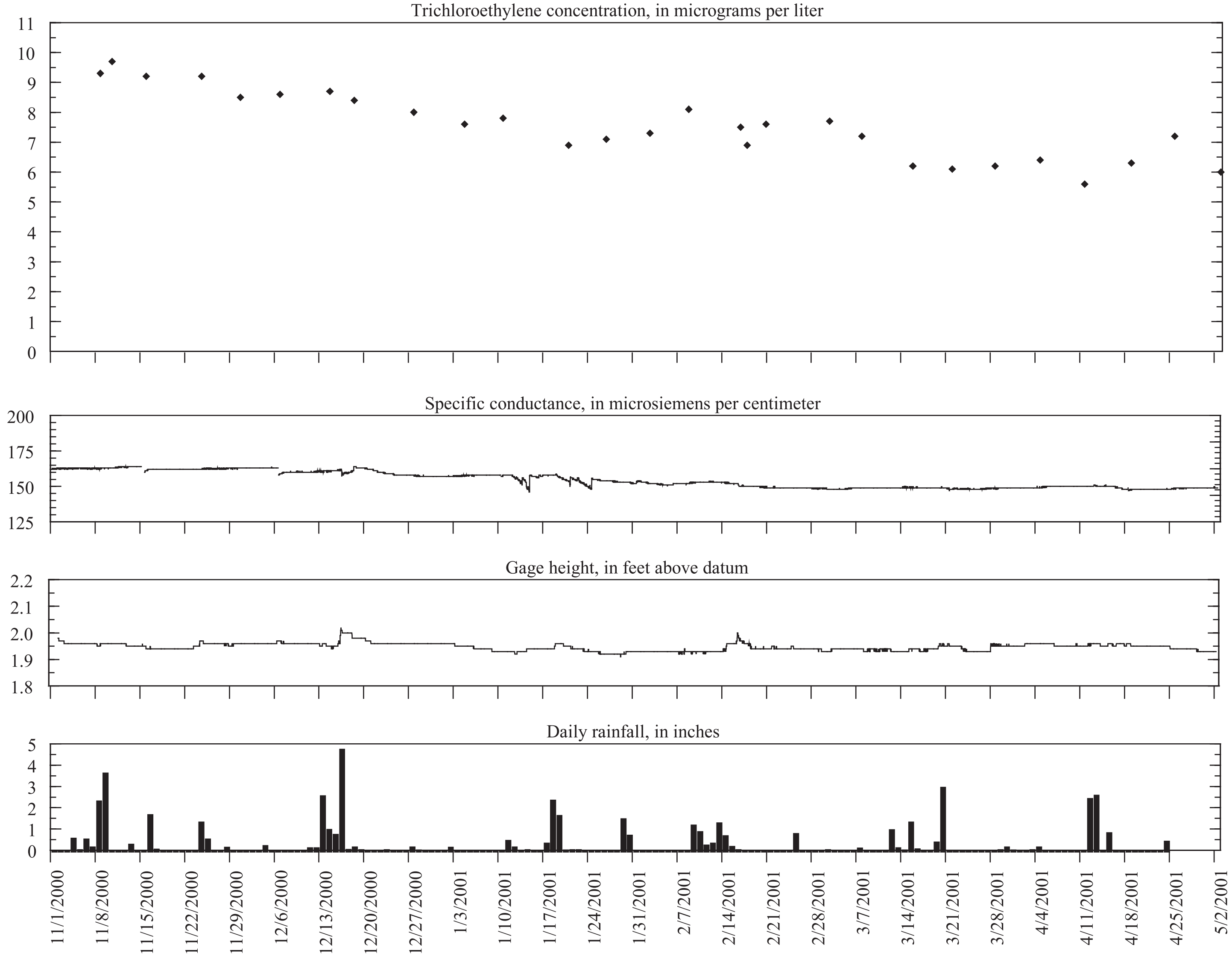

Figure 21. Trichloroethylene concentrations and selected continuous monitoring data at Big Spring, November 2000 to May 2001. (Rainfall data were collected at Cascade Spring.)

were 9.2 , 8.3, 7.3, 7.3, 6.8, and 6.1 µg/L , respectively, from November 2000 through April 2001.

A few additional samples were collected from Big Spring during a February 2001 storm when 3 inches of rain fell from February 9 through February 16 and when the greatest changes in water quality were detected at nearby Cascade Spring. A sample collected from Big Spring on February 8 (before the storm) and analyzed using the portable GC contained 8.1 µg/L of TCE (fig. 21). Samples collected on February 16 and February 17 during the storm and analyzed using the portable GC contained 7.5 and 6.9 µg/L of TCE, respectively (fig. 21). A sample collected on February 20 and analyzed using the portable GC contained 7.6 µg/L of TCE (fig. 21).

SUMMARY

In karst settings, ground-water levels, discharge, and water-quality conditions can fluctuate widely and rapidly. Yet, for most investigations of chlorinated solvents and other volatile organic compounds (VOCs) in ground water, periodic sampling generally remains the accepted approach for monitoring contaminant concentrations. Few detailed data sets have been collected and published that adequately document VOC concentrations in karst springs. The U.S. Geological Survey, in cooperation with the Tennessee Department of Environment and Conservation, Division of Superfund, collected discharge, rainfall, continuous water-quality (temperature, dissolved oxygen, specific conductance, and pH), and VOC data from three karst springs (Wilson, Cascade, and Big Springs) in Middle Tennessee from February 2000 to May 2001. Wilson Spring is located in the Central Basin karst region of Tennessee; Cascade Spring and Big Spring at Rutledge Falls are located on the escarpment of the Highland Rim in similar hydrogeologic settings.

Discharge and rainfall were measured at 10- or 15-minute intervals at the three springs. Water-quality monitors were used to measure temperature, pH, specific conductance, and dissolved oxygen at 10- or 15-minute intervals in the springs. Nonisokinetic dip-sampling methods were used to periodically (mostly during base-flow conditions) collect VOC samples from the springs. During selected storms, automatic samplers were used to collect samples at Cascade Spring and Wilson Spring. VOC samples were analyzed using a portable GC. Quality-control samples included trip blanks, equipment blanks, replicates, and field-matrix spike samples.

Quality-control samples were collected during 64, 36, and 28 different sampling times at Wilson Spring, Cascade Spring, and Big Spring, respectively. These samples included 25, 16, and 13 replicates from Wilson Spring, Cascade Spring, and Big Spring, respectively, which were analyzed by the USGS NWQL. VOC concentrations detected using the portable GC were similar to concentrations reported by NWQL with the exception of chloroform and TCE concentrations. Chloroform and TCE concentrations detected by the portable GC were consistently lower (median percentage differences of -19.2 and -17.4, respectively) than the concentrations detected by the NWQL. High correlations, however, were observed between concentrations detected by the portable GC and concentrations detected by the NWQL (Pearson's $r > 0.96$). VOC concentrations in automatically collected samples were similar to concentrations in replicates collected using dip-sampling methods. More than 80 percent of the VOC concentrations measured in automatically collected samples were within 12 percent of concentrations in dip samples.

Continuous monitoring data collected from February 2000 through October 2000 were used to characterize the water-quality responses of the three springs to rainfall events. During this period, VOC samples were collected periodically at each site using dip-sampling methods and were analyzed using a portable GC or by the NWQL. The primary objectives of this initial phase of VOC sampling were to evaluate analytical methods and to obtain background information on VOC concentrations in the springs. In November 2000, a more intensive phase of VOC sampling began in which the primary objectives were to evaluate sample-collection methods and to document changes in VOC concentrations in the springs. During this more intensive sampling, VOC samples were collected weekly during base-flow conditions using dip-sampling methods and as frequently as every 15 minutes during selected storms at Wilson and Cascade Springs using automatic samplers.

The continuous monitoring data indicated that the three springs each have different water-quality responses to rainfall events. At Wilson Spring, significant changes in water quality and discharge were detected (specific conductance ranged from 81 to 663 μS/cm) with rapid changes observed during storms. Some changes in water quality and discharge also were detected at Cascade Spring. Changes in water quality at Cascade Spring were not as frequent and did not occur as quickly during storms as at Wilson Spring. Minimal changes in water quality and discharge were recorded at Big Spring at Rutledge Falls (specific conductance ranged from 144 to 166 μS/cm).

From February 2000 through October 2000, dip samples were collected during 34, 26, and 27 different times from Wilson, Cascade, and Big Springs, respectively. During the second, more intensive, phase of monitoring (November 2000 to May 2001), VOC samples were collected during 566, 172, and 28 sampling times at Wilson, Cascade, and Big Springs, respectively. Most of the VOC samples from Wilson and Cascade Springs were collected using automatic samplers. Chloroform concentrations detected at Wilson Spring ranged from 0.073 to about 34 mg/L, and significant changes in concentrations were detected during individual storms. The greatest change was observed during the first storm during fall 2000, when chloroform concentrations increased from about 0.5 to about 34 mg/L. Concentrations of cis-1,2-DCE concentrations detected at Cascade Spring ranged from 0.30 to 1.8 μg/L and gradually decreased between November 2000 and May 2001. In addition to the gradual decrease in cis-1,2-DCE concentrations, some additional short-term decreases were recorded during storms. VOC samples collected at approximately

1-week intervals indicated a gradual decrease in TCE concentrations at Big Spring at Rutledge Falls; average concentrations measured in samples analyzed using the portable GC decreased from about 9 µg/L in November 2000 to about 6 µg/L in April 2001.

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Table 1. Registry number and properties of volatile organic compounds measured using the portable gas chromatograph

[Values are at 20 degrees Celsius; CAS, Chemical Abstracts Service; mg/L, milligrams per liter; mm HG, millimeters of mercury; data from Cohen and Mercer (1993) and Lucius and others (1992)]

Volatile organic compound	CAS registry number	Molecular weight (grams)	Solubility in water (mg/L)	Vapor pressure (mm Hg)
Tetrachloroethylene (PCE)	127-18-4	165.8	200	14
Trichloroethylene (TCE)	79-01-6	131.4	1,000	58
1,1-Dichloroethylene (1,1-DCE)	75-35-4	96.9	400	490
cis-1,2-Dichloroethylene (cis-1,2-DCE)	156-59-2	96.9	3,500	160
1,1,1-Trichloroethane (1,1,1-TCA)	71-55-6	133.4	1,300	100
Chloroform	67-66-3	119.4	8,000	160

Table 2. Retention times and estimated detection limits for volatile organic compounds measured using the portable gas chromatograph

[µg/L, micrograms per liter]

Compound	Retention time (seconds)	Estimated detection limit (µg/L)
Tetrachloroethylene (PCE)	236	0.25
Trichloroethylene (TCE)	126	0.25
1,1-Dichloroethylene (1,1-DCE)	105	0.25
cis-1,2-Dichloroethylene (cis-1,2-DCE)	86	0.25
1,1,1-Trichloroethane (1,1,1-TCA)	98	0.25
Chloroform	90	0.25

Table 3. Volatile organic compounds in the U.S. Geological Survey National Water Quality Laboratory analyte list

[CAS, Chemical Abstracts Service; µg/L, micrograms per liter]

CAS number	Volatile organic compound	Reporting limit (µg/L)
71-55-6	1,1,1-Trichloroethane	0.1
76-13-1	1,1,2-Trichlorotrifluoroethane	0.1
75-34-3	1,1-Dichloroethane	0.1
75-35-4	1,1-Dichloroethylene	0.1
95-50-1	1,2-Dichlorobenzene	0.2
107-06-2	1,2-Dichloroethane	0.1
17060-07-0	1,2-Dichloroethane-d4 (surrogate)	0.1
78-87-5	1,2-Dichloropropane	0.1
541-73-1	1,3-Dichlorobenzene	0.1
460-00-4	1,4-Bromofluorobenzene (surrogate)	0.1
106-46-7	1,4-Dichlorobenzene	0.1
71-43-2	Benzene	0.1
75-27-4	Bromodichloromethane	0.2
75-25-2	Bromoform	0.1
108-90-7	Chlorobenzene	0.1
67-66-3	Chloroform	0.2
124-48-1	Dibromochloromethane	0.2
75-71-8	Dichlorodifluoromethane	0.2
75-09-2	Dichloromethane	0.2
60-29-7	Diethyl ether	0.2
108-20-3	Diisopropyl ether	0.1
637-92-3	Ethyl tert-butyl ether	0.1
100-41-4	Ethylbenzene	0.1
100-42-5	Styrene	0.1
127-18-4	Tetrachloroethylene	0.2
56-23-5	Tetrachloromethane	0.1
108-88-3	Toluene	0.1
2037-26-5	Toluene-d8 (surrogate)	0.1
79-01-6	Trichloroethylene	0.2
75-69-4	Trichlorofluoromethane	0.2
75-01-4	Vinyl chloride	0.1
156-59-2	cis-1,2-Dichloroethylene	0.2
	m- and p-Xylene	0.1
95-47-6	o-Xylene	0.2
1634-04-4	tert-Butyl methyl ether	0.2

Table 4. Chloroform results for replicate samples analyzed by different laboratories

[VBW, volatile blank water; USGS, U.S. Geological Survey; all replicates were collected from the flume using dip-sampling methods; for sampling times with multiple replicates from the flume analyzed using the portable gas chromatograph, the average concentration from table 10 is listed]

Type of sample	Sample date and time	Chloroform concentration (milligrams per liter)		Percent difference
		Replicate analyzed by the USGS National Water Quality Laboratory	Replicate(s) analyzed using the portable gas chromatograph	
Wilson Spring	03/22/2000 1200	1.6	1.2	-25.0
Wilson Spring	05/22/2000 1000	3.8	4.7	23.7
Wilson Spring	06/13/2000 0930	2.9	3.0	3.4
Wilson Spring	06/13/2000 1530	3.8	1.9	-50.0
Wilson Spring	09/12/2000 0900	0.71	0.76	7.0
Wilson Spring	09/12/2000 1100	1.0	1.0	0.0
Wilson Spring	09/12/2000 1300	1.2	1.2	0.0
Wilson Spring	09/12/2000 1530	1.4	1.3	-7.1
Wilson Spring	11/09/2000 1300	6.7	7.3	9.0
Wilson Spring	11/10/2000 1100	2.8	3.2	14.3
Wilson Spring	12/14/2000 0800	2.6	2.7	3.8
Wilson Spring	01/18/2001 1210	3.3	2.4	-27.3
Wilson Spring	01/19/2001 1010	1.6	1.0	-37.5
Wilson Spring	01/30/2001 0720	2.3	1.8	-21.7
Wilson Spring	01/31/2001 1300	1.8	1.3	-27.8
Wilson Spring	02/07/2001 1040	2.2	1.6	-27.3
Wilson Spring	02/12/2001 1030	2.3	1.5	-34.8
Wilson Spring	02/14/2001 1000	1.4	1.0	-28.6
Wilson Spring	02/16/2001 1100	0.78	0.63	-19.2
Wilson Spring	03/15/2001 1300	2.4	2.3	-4.2
Wilson Spring	03/20/2001 1000	1.9	1.3	-31.6
Wilson Spring	03/23/2001 1200	1.6	1.2	-25.0
Wilson Spring	04/12/2001 1400	3.0	2.6	-13.3
Wilson Spring	04/13/2001 1159	1.4	1.1	-21.4
Wilson Spring	05/02/2001 0850	3.2	2.7	-15.6
VBW spike	06/28/2001 0950	5.8	5.7	-1.7
VBW spike	06/28/2001 0940	9.6	8.9	-7.3

Table 5. Chloroform results for split replicate samples analyzed using the portable gas chromatograph at Wilson Spring

				Chloroform concentration (milligrams per liter)			
Sample date and time	Sampling location	Sample collection method	Dilution used during analysis	Split replicate 1	Split replicate 2	Average	Relative percent difference
03/22/2000 1200	Flume	Dip	1:200	1.2	1.3	1.3	8.0
04/03/2000 1215	Flume	Dip	1:200	1.2	1.3	1.3	8.0
04/03/2000 1300	Flume	Dip	1:200	1.3	1.4	1.4	7.4
05/15/2000 1300	Flume	Dip	1:850	2.7	2.6	2.7	3.8
06/13/2000 1530	Flume	Dip	1:200	1.7	2.1	1.9	21.1
06/13/2000 1615	Flume	Dip	1:200	2.4	2.2	2.3	8.7
06/19/2000 1130	Flume	Dip	1:200	2.3	2.3	2.3	0.0
06/19/2000 1230	Flume	Dip	1:200	2.7	2.7	2.7	0.0
07/21/2000 1230	Flume	Dip	1:200	1.4	1.4	1.4	0.0
09/12/2000 0900	Flume	Dip	1:200	0.76	0.76	0.76	0.0
09/12/2000 1000	Flume	Dip	1:200	1.1	1.0	1.1	9.5
09/12/2000 1100	Flume	Dip	1:200	1.0	1.0	1.0	0.0
09/12/2000 1400	Flume	Dip	1:200	1.2	1.2	1.2	0.0
11/09/2000 0400	Tub	Automatic sampler	1:1,000	11	11	11	0.0
12/13/2000 1630	Tub	Automatic sampler	1:100	0.50	0.30	0.40	50.0
12/13/2000 1700	Tub	Automatic sampler	1:100	0.38	0.33	0.36	14.1
12/13/2000 1930	Tub	Automatic sampler	1:100	3.2	3.2	3.2	0.0
01/18/2001 2310	Tub	Automatic sampler	1:125	2.0	1.8	1.9	10.5
01/19/2001 0810	Tub	Automatic sampler	1:125	0.93	1.0	1.0	7.3
02/16/2001 0200	Tub	Automatic sampler	1:125	0.94	0.85	0.9	10.1
02/16/2001 1459	Tub	Automatic sampler	1:125	0.53	0.51	0.52	3.8
02/25/2001 0220	Tub	Automatic sampler	1:125	1.3	1.2	1.3	8.0
02/25/2001 0619	Tub	Automatic sampler	1:125	0.73	0.67	0.70	8.6
02/25/2001 1419	Tub	Automatic sampler	1:125	1.0	0.82	0.91	19.8
02/26/2001 0940	Tub	Automatic sampler	1:125	1.0	1.1	1.1	9.5
03/15/2001 1300	Flume	Dip	1:250	2.3	2.1	2.2	9.1
03/20/2001 0120	Tub	Automatic sampler	1:250	1.3	1.4	1.4	7.4
03/20/2001 1700	Tub	Automatic sampler	1:100	0.35	0.30	0.33	15.4
03/20/2001 2359	Tub	Automatic sampler	1:100	0.90	0.81	0.86	10.5
04/15/2001 1600	Tub	Automatic sampler	1:175	1.3	1.0	1.2	26.1
04/16/2001 0200	Tub	Automatic sampler	1:175	1.2	1.0	1.1	18.2
04/17/2001 1109	Tub	Automatic sampler	1:175	1.2	1.0	1.1	18.2
04/18/2001 0310	Tub	Automatic sampler	1:175	1.0	1.0	1.0	0.0

Table 6. Chlorinated-ethylene results for replicate samples analyzed by different laboratories

[µg/L, micrograms per liter; USGS, U.S. Geological Survey; <, less than; --, no data; VBW, volatile blank water. All replicates were collected using dip-sampling methods. For sampling times with multiple dip replicates analyzed using the portable gas chromatograph, the average concentration from table 14 is listed]

		Tetrachloroethylene			**Trichloroethylene**			**cis-1,2-Dichloroethylene**		
		Concentration (µg/L)			**Concentration (µg/L)**			**Concentration (µg/L)**		
Type of sample	**Sample date and time**	**Replicate analyzed by the USGS National Water Quality Laboratory**	**Replicate(s) analyzed using the portable gas chromatograph**	**Percent difference**	**Replicate analyzed by the USGS National Water Quality Laboratory**	**Replicate(s) analyzed using the portable gas chromatograph**	**Percent difference**	**Replicate analyzed by the USGS National Water Quality Laboratory**	**Replicate(s) analyzed using the portable gas chromatograph**	**Percent difference**
Cascade Spring	06/20/2000 1130	0.45	0.31	-31.1	0.25	<0.20	--	1.3	1.2	-7.7
Cascade Spring	09/13/2000 0730	0.47	0.59	25.5	0.24	<0.25	--	1.6	1.5	-6.3
Cascade Spring	09/13/2000 0930	0.46	0.59	28.3	0.24	<0.25	--	1.6	--	--
Cascade Spring	09/13/2000 1130	0.49	0.66	34.7	0.25	0.49	96.0	1.7	1.5	-11.8
Cascade Spring	09/13/2000 1330	0.47	0.71	51.1	0.23	0.52	126.1	1.6	1.5	-6.3
Cascade Spring	11/09/2000 1000	0.44	0.37	-15.9	0.22	<0.25	--	1.4	1.3	-7.1
Cascade Spring	11/13/2000 1045	0.46	0.40	-13.0	0.23	<0.25	--	1.4	1.4	0.0
Cascade Spring	12/14/2000 0900	0.41	<0.25	--	0.21	<0.25	--	1.1	1.2	9.1
Cascade Spring	01/04/2001 0945	0.39	0.27	-30.1	0.22	<0.25	--	1.0	1.2	20.0
Cascade Spring	02/08/2001 1545	0.42	<0.25	--	0.30	<0.25	--	1.0	1.0	0.0
Cascade Spring	02/12/2001 1215	0.44	<0.25	--	0.28	<0.25	--	0.93	1.0	7.5
Cascade Spring	02/16/2001 1245	0.28	<0.25	--	0.18	<0.25	--	0.51	0.48	-5.9
Cascade Spring	03/15/2001 1130	0.33	<0.25	--	0.23	<0.25	--	0.75	1.0	33.3
Cascade Spring	03/20/2001 1100	0.31	<0.25	--	0.22	<0.25	--	0.58	0.62	6.9
Cascade Spring	04/13/2001 1359	0.27	<0.25	--	0.19	<0.25	--	0.57	0.55	-3.5
Cascade Spring	05/02/2001 1200	0.32	<0.25	--	0.25	<0.25	--	0.92	1.0	8.7
VBW spike	05/30/2001 1200	0.33	0.34	3.0	0.35	0.35	0.0	0.29	<0.25	--
VBW spike	05/30/2001 1210	3.2	3.2	0.0	3.6	3.1	-13.9	3.2	2.8	-12.5
VBW spike	05/30/2001 1220	4.0	3.7	-7.5	4.5	3.8	-15.6	4.0	3.4	-15.0
VBW spike	05/30/2001 1230	5.3	4.5	-15.1	5.9	4.6	-22.0	5.2	4.2	-19.2
VBW spike	05/30/2001 1240	7.6	5.9	-22.4	8.6	6.4	-25.6	7.8	6.2	-20.5
VBW spike	05/30/2001 1300	6.3	5.1	-19.0	7.3	5.4	-26.0	6.8	5.2	-23.5

Table 7. Chlorinated-ethylene results for field-matrix spike samples collected at Cascade Spring

[µg/L, micrograms per liter; <, less than; >, greater than. All samples were analyzed using the portable gas chromatograph. For sampling times with multiple dip replicates, the average concentration from table 14 is listed]

Sample date and time	Description	Spike concentration (µg/L)	Tetrachloroethylene			Trichloroethylene			cis-1,2-Dichloroethylene		
			Before spike (µg/L)	After spike (µg/L)	Percentage recovered	Before spike (µg/L)	After spike (µg/L)	Percentage recovered	Before spike (µg/L)	After spike (µg/L)	Percentage recovered
09/13/2000 1130	Matrix spike	5.0	0.66	5.4	94.8	0.49	4.9	88.2	1.5	6.0	90.0
09/13/2000 1130	Matrix spike duplicate	5.0	0.66	5.7	100.8	0.49	5.0	90.2	1.5	6.2	94.0
09/13/2000 1330	Matrix spike	5.0	0.71	5.5	95.8	0.52	4.8	85.6	1.5	6.1	92.0
09/13/2000 1330	Matrix spike duplicate	5.0	0.71	5.4	93.8	0.52	4.9	87.6	1.5	6.3	96.0
03/02/2001 1230	Matrix spike	5.0	<0.25	4.7	>89.0	<0.25	4.9	>93.0	0.83	5.9	101.4
03/02/2001 1230	Matrix spike duplicate	5.0	<0.25	4.7	>89.0	<0.25	4.9	>93.0	0.83	5.8	99.4

Table 8. Volatile organic compound results for replicate samples analyzed by different laboratories

[µg/L, micrograms per liter; USGS, U.S. Geological Survey; NWQL, National Water Quality Laboratory; GC, gas chromatograph; --, no data; <, less than; VBW, volatile blank water; All replicates were collected from the spring using dip-sampling methods and analyzed using the portable GC. For sampling times with multiple replicates analyzed using the portable GC, the average concentration from table 17 is listed]

		Tetrachloroethylene			Trichloroethylene			1,1-Dichloroethylene			1,1,1-Trichloroethane		
		Concentration (µg/L)			Concentration (µg/L)			Concentration (µg/L)			Concentration (µg/L)		
Type of sample	Sample date and time	Replicate analyzed by the USGS NWQL	Replicate(s) analyzed using the portable GC	Percent difference	Replicate analyzed by the USGS NWQL	Replicate(s) analyzed using the portable GC	Percent difference	Replicate analyzed by the USGS NWQL	Replicate(s) analyzed using the portable GC	Percent difference	Replicate analyzed by the USGS NWQL	Replicate(s) analyzed using the portable GC	Percent difference
Big Spring	03/23/2000 0950	2.7	3.0	11.1	8.5	7.6	-10.6	0.95	--	--	0.59	--	--
Big Spring	06/20/2000 1000	2.6	2.1	-19.2	8.6	7.5	-12.8	0.77	1.4	81.8	0.52	0.40	-23.1
Big Spring	09/13/2000 0800	3.0	2.9	-3.3	11	9.3	-15.5	0.96	1.7	77.1	0.64	0.61	-4.7
Big Spring	09/13/2000 1000	2.9	2.7	-6.9	10	9.0	-10.0	0.88	1.0	13.6	0.61	0.52	-14.8
Big Spring	09/13/2000 1200	2.9	2.5	-13.8	10	8.3	-17.0	0.85	1.3	52.9	0.59	0.48	-18.6
Big Spring	09/13/2000 1400	2.8	2.5	-10.7	10	8.3	-17.0	0.84	1.5	78.6	0.59	0.48	-18.6
Big Spring	12/14/2000 0945	3.0	3.1	3.3	11	8.7	-20.9	0.93	0.87	-6.5	0.56	0.52	-7.1
Big Spring	01/04/2001 1030	2.6	3.0	15.4	10	7.6	-24.0	0.84	0.71	-15.5	0.47	0.36	-23.4
Big Spring	02/08/2001 1030	3.2	3.1	-3.1	11	8.1	-26.4	0.95	0.86	-9.5	0.57	0.39	-31.6
Big Spring	02/16/2001 1330	2.9	3.0	3.4	9.8	7.5	-23.5	0.81	1.2	48.1	0.51	<0.30	--
Big Spring	03/15/2001 1030	2.7	2.3	-14.8	9.2	6.2	-32.6	0.88	0.71	-19.3	0.46	<0.25	--
Big Spring	04/25/2001 0800	2.5	3.0	20.0	8.5	7.2	-15.3	0.85	0.78	-8.2	0.48	<0.25	--
Big Spring	05/02/2001 1330	2.1	2.3	9.5	7.6	6.0	-21.1	0.69	0.63	-8.7	0.41	<0.25	--
VBW spike	05/30/2001 1200	0.33	0.34	3.0	0.35	0.35	0.0	0.32	0.66	106.3	0.34	0.60	76.5
VBW spike	05/30/2001 1210	3.2	3.2	0.0	3.6	3.1	-13.9	3.6	3.4	-5.6	3.7	2.3	-37.8
VBW spike	05/30/2001 1220	4.0	3.7	-7.5	4.5	3.8	-15.6	4.5	3.9	-13.3	4.7	2.9	-38.3
VBW spike	05/30/2001 1230	5.2	4.5	-13.5	5.9	4.6	-22.0	5.7	4.9	-14.0	6.1	3.6	-41.0
VBW spike	05/30/2001 1240	7.6	5.9	-22.4	8.6	6.4	-25.6	8.6	6.9	-19.8	9.0	5.2	-42.2
VBW spike	05/30/2001 1300	6.3	5.1	-19.0	7.3	5.4	-26.0	6.4	5.8	-9.4	7.4	4.2	-43.2

Table 9. Volatile organic compound results for field-matrix spike samples collected at Big Spring

[µg/L, micrograms per liter; <, less than; >, greater than; All samples were analyzed using the portable gas chromatograph. For sampling times with multiple dip replicates, the average concentration from table 17 is listed]

			Tetrachloroethylene			Trichloroethylene			1,1-Dichloroethylene			1,1,1-Trichloroethane		
Sample date and time	**Description**	**Spike concentration (µg/L)**	**Before spike (µg/L)**	**After spike (µg/L)**	**Percentage recovered**	**Before spike (µg/L)**	**After spike (µg/L)**	**Percentage recovered**	**Before spike (µg/L)**	**After spike (µg/L)**	**Percentage recovered**	**Before spike (µg/L)**	**After spike (µg/L)**	**Percentage recovered**
09/13/2000 1200	Matrix spike	5.0	2.5	8.5	120.0	8.3	15.0	134.0	1.3	6.3	100.0	0.48	5.3	96.4
03/02/2001 1045	Matrix spike	5.0	3.0	7.1	82.0	7.7	13.0	106.0	0.84	5.6	95.2	<0.25	5.4	>103.0
03/02/2001 1045	Matrix spike duplicate.	5.0	3.0	7.0	80.0	7.7	13.0	106.0	0.84	5.5	93.2	<0.25	5.5	>105.0

Table 10. Chloroform results for concurrent replicate samples collected at Wilson Spring

[All replicates were collected from the flume using dip-sampling methods and were analyzed using the portable gas chromatograph]

Sample date and time	Chloroform concentration (milligrams per liter)			Relative percent difference
	Replicate 1	Replicate 2	Average	
03/22/2000 1200	1.2	1.3	1.2	8.0
06/13/2000 0930	2.8	3.1	3.0	10.2
11/15/2000 1040	1.6	1.4	1.5	13.3
12/18/2000 1400	1.6	1.7	1.6	6.1
12/20/2000 1050	1.7	1.7	1.7	0.0
01/10/2001 1420	1.6	1.5	1.6	6.5
01/18/2001 1210	2.5	2.4	2.4	4.1
01/22/2001 1300	1.4	1.4	1.4	0.0
01/26/2001 0930	1.4	1.5	1.4	6.9
02/07/2001 1040	1.5	1.7	1.6	12.5
02/10/2001 1000	2.5	2.5	2.5	0.0
02/14/2001 1000	1.0	0.91	1.0	9.4
02/16/2001 0920	0.72	0.73	0.73	1.4
02/21/2001 1100	1.5	1.3	1.4	14.3
03/12/2001 1500	1.9	1.7	1.8	11.1
03/19/2001 1410	1.6	1.5	1.6	6.5
03/28/2001 1410	1.7	1.6	1.6	6.1
04/04/2001 1340	2.7	2.6	2.6	3.8
04/11/2001 1330	2.5	2.5	2.5	0.0
04/14/2001 1200	1.1	1.1	1.1	0.0
04/16/2001 1310	1.2	1.2	1.2	0.0
04/18/2001 1100	1.1	1.1	1.1	0.0
04/24/2001 1240	1.7	1.8	1.8	5.7
04/25/2001 1100	1.7	1.7	1.7	0.0

Table 11. Chloroform results for replicate samples collected from different locations at Wilson Spring

[All replicates were collected using dip-sampling methods and were analyzed using the portable gas chromatograph. For sampling times with multiple replicates from the flume, the average concentration from table 10 is listed]

Sample date and time	Chloroform concentration (milligrams per liter)		Percent difference
	Replicate(s) collected from the flume	Replicate collected from the tub	
06/13/2000 1130	3.3	3.2	-3.0
06/13/2000 1500	2.0	2.1	5.0
11/09/2000 1100	7.4	7.7	4.1
11/09/2000 1300	7.3	5.6	-23.3
11/10/2000 1100	3.2	3.2	0.0
11/10/2000 1200	3.2	2.8	-12.5
11/25/2000 1020	3.4	3.4	0.0
11/27/2000 1150	1.9	1.8	-5.3
11/30/2000 1230	1.6	1.5	-6.2
12/08/2000 1430	1.0	0.94	-6.0
12/14/2000 0700	2.8	2.8	0.0
12/14/2000 0800	2.7	2.7	0.0
12/15/2000 1200	1.9	1.9	0.0
12/27/2000 1030	2.0	2.1	5.0
01/12/2001 0810	1.8	1.9	5.6
02/07/2001 1040	1.6	1.7	6.2
02/12/2001 1030	1.5	1.7	13.3
02/14/2001 0920	1.0	0.92	-8.0
02/14/2001 1000	1.0	1.0	0.0
02/23/2001 1410	1.3	1.2	-7.7
02/25/2001 1419	1.0	1.0	0.0
03/20/2001 1000	1.3	1.3	0.0
03/21/2001 1000	0.92	0.88	-4.3
03/23/2001 1200	1.2	1.2	0.0
04/12/2001 1400	2.6	2.6	0.0
04/13/2001 1159	1.1	1.2	9.1
05/02/2001 0850	2.7	2.7	0.0

Table 12. Chloroform results for replicate samples collected using different methods at Wilson Spring

[^{o}C, degrees Celsius; --, no data; All samples were analyzed using the portable gas chromatograph. Dip samples were collected from either the tub or the flume. For sampling times with multiple dip replicates collected from the flume, the average concentration from table 10 is listed]

		Air temperature in sampler house		Chloroform concentration (milligrams per liter)		
Sample date and time	**Number of hours until sample was preserved**	**Minimum (^{O}C)**	**Maximum (^{O}C)**	**Replicate(s) collected using dip-sampling methods**	**Replicate collected using automatic sampler**	**Percent difference**
11/08/2000 1100	24	--	--	0.60	0.69	15.0
11/09/2000 1300	22	--	--	5.6	7.1	26.8
11/10/2000 1100	0	--	--	3.2	3.2	0.0
11/10/2000 1200	95	--	--	2.8	2.2	-21.4
11/25/2000 1020	49	--	--	3.4	3.8	11.8
12/14/2000 0800	28	--	--	2.7	2.8	3.7
12/15/2000 1200	21	--	--	1.9	1.9	0.0
12/27/2000 1030	0	--	--	2.1	2.0	-4.8
01/12/2001 0810	25	--	--	1.8	1.9	5.6
01/18/2001 1210	21	--	--	2.4	2.5	4.2
01/19/2001 1010	29	--	--	1.0	1.1	10.0
01/22/2001 1300	94	--	--	1.4	1.4	0.0
01/30/2001 0720	28	--	--	1.8	1.7	-5.6
01/31/2001 1300	0	--	--	1.3	1.4	7.7
02/12/2001 1030	47	--	--	1.7	1.5	-11.8
02/14/2001 1000	47	--	--	1.0	1.0	0.0
02/16/2001 1100	23	--	--	0.63	0.63	0.0
02/17/2001 1010	70	--	--	0.86	0.81	-5.8
02/22/2001 1220	26	--	--	1.1	1.3	18.2
02/25/2001 1419	0	--	--	1.0	0.91	-9.0
02/25/2001 1440	23	--	--	1.0	0.91	-9.0
03/12/2001 1500	23	10.0	30.0	1.8	1.6	-11.1
03/15/2001 1300	97	6.5	24.5	2.3	2.0	-13.0
03/20/2001 0919	0	8.0	11.5	1.6	1.8	12.5
03/20/2001 1000	24	8.0	11.5	1.3	1.3	0.0
03/21/2001 1000	50	6.5	23.5	0.88	0.87	-1.1
04/04/2001 1340	168	20.0	40.0	2.7	2.5	-7.4
04/11/2001 1330	25	23.0	36.0	2.5	2.6	4.0
04/13/2001 1159	24	15.5	26.5	1.2	1.1	-8.3
04/14/2001 1200	49	15.5	26.5	1.1	1.1	0.0
04/16/2001 1310	44	6.5	25.0	1.2	1.3	8.3
05/02/2001 0850	0	--	--	2.7	2.7	0.0

Table 13. Chloroform results for trip blanks associated with samples collected at Wilson Spring

[<, less than; All trip blanks were analyzed using the portable gas chromatograph]

Date and time			
Blank was placed in automatic sampler	**Blank was removed from automatic sampler**	**Date analyzed**	**Chloroform concentration (milligrams per liter)**
11/08/2000 1100	11/09/2000 1100	11/15/00	<0.25
11/09/2000 1300	11/10/2000 1100	11/15/00	<0.25
11/10/2000 1200	11/14/2000 1050	11/15/00	<0.25
11/25/2000 1020	11/27/2000 1140	12/04/00	<0.25
12/08/2000 1430	12/14/2000 0700	01/02/01	<0.25
12/14/2000 0800	12/15/2000 1200	01/02/01	<0.25
12/15/2000 1200	12/16/2000 0900	01/02/01	<0.25
12/18/2000 1500	12/20/2000 1000	01/12/01	<0.25
01/10/2001 1430	01/12/2001 0730	01/12/01	<0.25
01/12/2001 0810	01/13/2001 0930	02/02/01	<0.25
01/13/2001 0930	01/18/2001 1130	02/02/01	<0.25
01/18/2001 1210	01/19/2001 0910	02/02/01	<0.25
01/19/2001 1010	01/20/2001 1515	02/06/01	<0.25
02/10/2001 1000	02/12/2001 1030	02/22/01	<0.25
02/12/2001 1030	02/14/2001 0920	02/22/01	<0.25
02/14/2001 1000	02/16/2001 0920	02/26/01	<0.25
02/16/2001 1100	02/17/2001 1010	02/26/01	<0.25
02/17/2001 1010	02/20/2001 0820	02/26/01	<0.25
02/22/2001 1410	02/23/2001 1410	02/27/01	<0.25
02/23/2001 1410	02/25/2001 1419	02/27/01	<0.25
03/13/2001 1330	03/15/2001 1300	03/22/01	<0.25
03/19/2001 1410	03/20/2001 0940	03/22/01	<0.25
03/20/2001 1000	03/21/2001 1000	03/28/01	<0.25
03/21/2001 1000	03/23/2001 1210	03/28/01	<0.25
04/04/2001 1000	04/11/2001 1330	04/25/01	<0.25
04/12/2001 1400	04/13/2001 1200	04/25/01	<0.25
04/16/2001 1310	04/18/2001 0900	04/26/01	<0.25
04/18/2001 1100	04/24/2001 1240	04/26/01	<0.25

Table 14. Chlorinated-ethylene results for concurrent replicate samples collected at Cascade Spring

[µg/L, micrograms per liter; <, less than; --, no data; All replicates were collected using dip-sampling methods and were analyzed using the portable gas chromatograph]

Sample date and time	Tetrachloroethylene				Trichloroethylene				cis-1,2-Dichloroethylene			
	Concentration (µg/L)			Relative percent difference	Concentration (µg/L)			Relative percent difference	Concentration (µg/L)			Relative percent difference
	Replicate				Replicate				Replicate			
	1	2	Average		1	2	Average		1	2	Average	
03/23/2000 0945	0.39	0.31	0.35	22.9	<0.25	<0.25	<0.25	--	--	--	--	--
07/05/2000 1500	0.61	0.65	0.63	6.3	<0.25	0.54	--	--	1.4	1.3	1.4	7.4
08/03/2000 1130	0.51	0.52	0.52	1.9	<0.25	0.33	--	--	1.8	1.7	1.8	5.7
11/08/2000 1230	0.37	0.41	0.39	10.3	<0.25	<0.25	<0.25	--	1.4	1.4	1.4	0.0
11/13/2000 1045	--	0.40	--	--	<0.25	<0.25	<0.25	--	1.4	1.4	1.4	0.0
11/15/2000 1500	0.69	0.30	0.50	78.8	<0.25	<0.25	<0.25	--	1.5	1.3	1.4	14.3
11/30/2000 1130	0.25	0.25	0.25	0.0	<0.25	<0.25	<0.25	--	1.4	1.3	1.4	7.4
12/06/2000 1330	0.27	<0.25	--	--	<0.25	<0.25	<0.25	--	1.3	1.2	1.2	8.0
12/14/2000 0900	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	1.2	1.1	1.2	8.7
12/18/2000 1200	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	1.1	1.1	1.1	0.0
12/27/2000 1215	0.50	0.33	0.42	41.0	<0.25	<0.25	<0.25	--	1.2	1.2	1.2	0.0
02/02/2001 1045	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	1.0	1.0	1.0	0.0
02/16/2001 1245	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.51	0.44	0.48	14.7
02/17/2001 1245	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.52	0.50	0.51	3.9
02/22/2001 1330	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.84	0.81	0.83	3.6
03/02/2001 1230	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.83	0.82	0.83	1.2
03/20/2001 1100	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.66	0.57	0.62	14.6
04/12/2001 1400	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.77	0.76	0.77	1.3
04/13/2001 1359	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.58	0.52	0.55	10.9
04/14/2001 1000	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.68	0.54	0.61	23.0
04/16/2001 1100	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.63	0.65	0.64	3.1
04/18/2001 1200	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	0.67	0.69	0.68	2.9
04/25/2001 0900	<0.25	<0.25	<0.25	--	<0.25	<0.25	<0.25	--	1.0	0.90	1.0	10.5
05/02/2001 1200	0.29	<0.25	--	--	<0.25	<0.25	<0.25	--	1.0	1.0	1.0	0.0

Table 15. Chlorinated-ethylene results for replicate samples collected using different methods at Cascade Spring

[°C, degrees Celsius; µg/L, micrograms per liter; --, no data; <, less than; All replicates were analyzed using the portable gas chromatograph. For sampling times with multiple replicates collected using dip-sampling methods, the average concentration from table 14 is listed]

Sample date and time	Number of hours until sample was preserved	Air temperature in sampler house		Tetrachloroethylene			Trichloroethylene			cis-1,2-Dichloroethylene		
				Concentration (µg/L)			Concentration (µg/L)			Concentration (µg/L)		
		Minimum (°C)	Maximum (°C)	Replicate(s) collected using dip-sampling methods	Replicate collected using automatic sampler	Percent difference	Replicate(s) collected using dip-sampling methods	Replicate collected using automatic sampler	Percent difference	Replicate(s) collected using dip-sampling methods	Replicate collected using automatic sampler	Percent difference
02/10/2001 1215	48	--	--	0.27	<0.25	--	<0.25	<0.25	--	1.0	1.1	10.0
02/12/2001 1215	47	--	--	<0.25	<0.25	--	<0.25	<0.25	--	1.0	1.0	0.0
02/14/2001 1130	47	--	--	<0.25	<0.25	--	<0.25	<0.25	--	0.82	1.1	34.1
02/16/2001 1245	24	--	--	<0.25	<0.25	--	<0.25	<0.25	--	0.48	0.47	-2.1
02/17/2001 1245	71	--	--	<0.25	<0.25	--	<0.25	<0.25	--	0.51	0.50	-2.0
04/13/2001 1359	0	16.0	21.0	<0.25	<0.25	--	<0.25	<0.25	--	0.55	0.53	-3.6
04/14/2001 1000	48	15.0	23.0	<0.25	<0.25	--	<0.25	<0.25	--	0.61	0.66	8.2
04/16/2001 1100	49	12.0	24.5	<0.25	<0.25	--	<0.25	<0.25	--	0.64	0.61	-4.7
05/02/2001 1200	0	--	--	<0.25	<0.25	--	<0.25	<0.25	--	1.0	0.97	-3.0

Table 16. Volatile organic compound results for trip blanks associated with samples collected at Cascade and Big Springs

[<, less than; All trip blanks were analyzed using the portable gas chromatograph]

Date and time			Concentration (micrograms per liter)				
Blank placed in automatic sampler	Blank removed from automatic sampler	Date analyzed	Tetrachloroethylene	Trichloroethylene	cis-1,2-Dichloroethylene	1,1-Dichloroethylene	1,1,1-Trichloroethane
02/08/2001 1545	02/10/2001 1215	2/21/01	<0.25	<0.25	<0.25	<0.25	<0.25
02/10/2001 1215	02/12/2001 1215	2/28/01	<0.25	<0.25	<0.25	<0.25	<0.25
02/12/2001 1215	02/14/2001 1130	2/28/01	<0.25	<0.25	<0.25	<0.25	<0.25
02/14/2001 1130	02/16/2001 1215	2/28/01	<0.25	<0.25	<0.25	<0.25	<0.25
02/16/2001 1245	02/17/2001 1245	2/28/01	<0.25	<0.25	<0.25	<0.25	<0.25
02/17/2001 1245	02/21/2001 1315	2/28/01	<0.25	<0.25	<0.25	<0.25	<0.25
04/04/2001 0830	04/12/2001 1400	4/20/01	<0.25	<0.25	<0.25	<0.25	<0.25
04/12/2001 1400	04/13/2001 1500	4/20/01	<0.25	<0.25	<0.25	<0.25	<0.25
04/13/2001 1500	04/14/2001 1000	4/20/01	<0.25	<0.25	<0.25	<0.25	<0.25
04/14/2001 1000	04/16/2001 1100	4/20/01	<0.25	<0.25	<0.25	<0.25	<0.25
04/16/2001 1100	04/18/2001 1200	4/20/01	<0.25	<0.25	<0.25	<0.25	<0.25

Table 17. Volatile organic compound results for concurrent replicate samples collected at Big Spring

[µg/L, micrograms per liter; --, no data; <, less than; All replicates were collected using dip-sampling methods and were analyzed using the portable gas chromatograph]

Sample date and time	Tetrachloroethylene				Trichloroethylene				1,1-Dichloroethylene				1,1,1-Trichloroethane			
	Concentration (µg/L)			Relative percent difference	Concentration (µg/L)			Relative percent difference	Concentration (µg/L)			Relative percent difference	Concentration (µg/L)			Relative percent difference
	Replicate				Replicate				Replicate				Replicate			
	1	2	Average		1	2	Average		1	2	Average		1	2	Average	
03/23/2000 0950	2.9	3.0	3.0	3.4	7.5	7.6	7.6	1.3	--	--	--	--	--	--	--	--
04/10/2000 1320	3.0	3.1	3.0	3.3	8.7	8.9	8.8	2.3	--	--	--	--	--	--	--	--
06/20/2000 0840	2.3	2.2	2.2	4.4	7.3	7.4	7.4	1.4	1.9	0.98	1.4	64.9	0.42	0.38	0.40	10.0
07/05/2000 1430	2.3	2.3	2.3	0.0	7.5	7.4	7.4	1.3	1.2	1.0	1.1	18.2	0.34	0.36	0.35	5.7
07/24/2000 1030	2.8	2.9	2.8	3.5	7.6	7.8	7.7	2.6	2.2	1.8	2.0	20.0	0.32	0.34	0.33	6.1
07/31/2000 0930	2.3	2.4	2.4	4.3	7.0	7.4	7.2	5.6	1.0	0.97	0.99	3.0	0.55	0.56	0.56	1.8
10/31/2000 1045	3.6	3.5	3.6	2.8	9.2	9.2	9.2	0.0	0.97	1.1	1.0	12.6	0.83	0.73	0.78	12.8
11/24/2000 0930	3.5	3.5	3.5	0.0	9.3	9.2	9.2	1.1	0.99	0.93	0.96	6.2	0.77	0.66	0.72	15.4
12/06/2000 1515	3.1	3.0	3.0	3.3	8.6	8.6	8.6	0.0	0.86	0.84	0.85	2.4	0.57	0.55	0.56	3.6
12/27/2000 1230	3.1	3.1	3.1	0.0	8.0	8.0	8.0	0.0	0.75	0.76	0.76	1.3	0.45	0.42	0.44	6.9
01/26/2001 1330	2.7	2.6	2.6	3.8	7.1	7.0	7.0	1.4	0.71	0.71	0.71	0.0	0.27	0.27	0.27	0.0
02/16/2001 1330	3.1	3.0	3.0	3.3	7.7	7.3	7.5	5.3	1.2	1.1	1.2	8.7	0.35	<0.25	<0.30	--
02/17/2001 1330	2.7	2.7	2.7	0.0	6.9	6.9	6.9	0.0	0.73	0.71	0.72	2.8	<0.25	<0.25	<0.25	--
03/02/2001 1045	3.0	3.0	3.0	0.0	7.7	7.7	7.7	0.0	0.86	0.82	0.84	4.8	0.25	<0.25	<0.25	--
03/21/2001 1430	2.3	2.3	2.3	0.0	6.0	6.2	6.1	3.3	0.65	0.66	0.66	1.5	<0.25	<0.25	<0.25	--
04/11/2001 1700	2.2	2.1	2.2	4.6	5.7	5.5	5.6	3.6	0.53	0.54	0.54	1.9	<0.25	<0.25	<0.25	--
04/18/2001 1345	2.5	2.5	2.5	0.0	6.3	6.4	6.4	1.6	0.66	0.67	0.67	1.5	<0.25	<0.25	<0.25	--
04/25/2001 0800	3.0	2.9	3.0	3.4	7.2	7.1	7.2	1.4	0.80	0.76	0.78	5.1	<0.25	<0.25	<0.25	--
05/02/2001 1330	2.3	2.3	2.3	0.0	6.1	6.0	6.0	1.6	0.64	0.61	0.63	4.8	<0.25	<0.25	<0.25	--

Table 18. Chloroform results for equipment blanks collected at Wilson Spring

[<, less than; VBW, volatile blank water; all samples were analyzed using the portable gas chromatograph]

Sample date and time	Source of water	Sample collection method	Sample description	Chloroform concentration, in micrograms per liter
05/02/2001 0750	Flume at Wilson Spring	Dip	Wilson Spring replicate 1	2,700
05/02/2001 0750	Tub at Wilson Spring	Dip	Wilson Spring replicate 2	2,700
05/02/2001 0750	Tub at Wilson Spring	Automatic sampler	Wilson Spring replicate 3	2,700
05/02/2001 0755	VBW container	Dip	VBW before equipment blanks	<0.25
Automatic sampler pump removed from tub, rinsed with VBW, and placed in VBW container				
05/02/2001 0800	VBW container	Automatic sampler	Equipment blank 1	25
05/02/2001 0805	VBW container	Automatic sampler	Equipment blank 2	7.1
05/02/2001 0810	VBW container	Automatic sampler	Equipment blank 3	5.6
05/02/2001 0815	VBW container	Dip	VBW after equipment blanks	4.4

Table 19. Chlorinated-ethylene results for equipment blanks collected at Cascade Spring

[PCE, tetrachloroethylene; TCE, trichloroethylene; cis-1,2-DCE, cis-1,2-dichloroethylene; <, less than; VBW, volatile blank water; All samples were analyzed using the portable gas chromatograph]

Sample date and time	Source of water	Sample collection method	Sample description	Concentration, in micrograms per liter		
				PCE	TCE	cis-1,2-DCE
05/02/2001 1100	Cascade Spring	Dip	Cascade Spring replicate 1	0.29	<0.25	0.98
05/02/2001 1100	Cascade Spring	Dip	Cascade Spring replicate 2	<0.25	<0.25	1.0
05/02/2001 1100	Cascade Spring	Automatic sampler	Cascade Spring replicate 3	<0.25	<0.25	0.97
05/02/2001 1105	VBW container	Dip	VBW before equipment blanks	<0.25	<0.25	<0.25
Automatic sampler pump removed from tub, rinsed with VBW, and placed in VBW container						
05/02/2001 1110	VBW container	Automatic sampler	Equipment blank 1	<0.25	<0.25	<0.25
05/02/2001 1115	VBW container	Automatic sampler	Equipment blank 2	<0.25	<0.25	<0.25
05/02/2001 1120	VBW container	Automatic sampler	Equipment blank 3	<0.25	<0.25	<0.25
05/02/2001 1125	VBW container	Dip	VBW after equipment blanks	<0.25	<0.25	<0.25

Table 20. Chloroform data collected at Wilson Spring

[ft^3/s, cubic feet per second; ^{o}C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; GC, gas chromatograph; *, discharge data obtained from AMEC; --, no data]

Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Water-quality characteristic			Volatile organic compound data		
			Temperature (^{o}C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
03/22/2000 1200	0.45	0.384	14.5	357	7.5	Dip	Portable GC	1.2
04/03/2000 1215	1.17*	3.016*	14.5	376	7.3	Dip	Portable GC	1.2
04/03/2000 1230	1.24*	3.475*	14.5	377	7.3	Dip	Portable GC	1.3
04/03/2000 1245	1.30*	3.872*	14.5	377	7.3	Dip	Portable GC	1.2
04/03/2000 1300	1.35*	4.235*	14.5	371	7.2	Dip	Portable GC	1.3
04/03/2000 1330	1.42*	4.782*	14.5	303	7.2	Dip	Portable GC	1.3
04/10/2000 0959	0.38	0.270	14.5	409	7.2	Dip	Portable GC	1.3
05/15/2000 1314	0.19	0.062	--	451	7.5	Dip	Portable GC	2.7
05/22/2000 0959	0.14	0.035	--	457	7.3	Dip	Portable GC	4.7
06/13/2000 0929	0.08	0.011	--	--	--	Dip	Portable GC	2.9
06/13/2000 1030	0.08	0.011	--	--	--	Dip	Portable GC	3.2
06/13/2000 1130	0.08	0.011	--	--	--	Dip	Portable GC	3.3
06/13/2000 1230	0.08	0.011	--	--	--	Dip	Portable GC	3.2
06/13/2000 1330	0.08	0.011	--	--	--	Dip	Portable GC	3.1
06/13/2000 1430	0.08	0.011	--	--	--	Dip	Portable GC	2.1
06/13/2000 1500	0.08	0.011	--	--	--	Dip	Portable GC	2.0
06/13/2000 1530	0.08	0.011	--	--	--	Dip	Portable GC	1.9
06/13/2000 1615	0.08	0.011	--	--	--	Dip	Portable GC	2.3
06/14/2000 1300	0.08	0.011	--	--	--	Dip	Portable GC	2.5
06/19/2000 1130	0.11*	0.024*	--	--	--	Dip	Portable GC	2.3
06/19/2000 1230	0.11*	0.024*	17.0	500	7.0	Dip	Portable GC	2.7
07/21/2000 1329	0.05*	0.006*	18.0	523	7.0	Dip	Portable GC	1.4
08/14/2000 1014	0.03*	0.003*	19.5	508	7.6	Dip	Portable GC	0.86
09/12/2000 0900	0.04*	0.003*	19.5	490	7.3	Dip	Portable GC	0.76
09/12/2000 1000	0.04*	0.003*	19.5	521	7.2	Dip	Portable GC	1.0
09/12/2000 1100	0.03*	0.002*	20.0	521	7.2	Dip	Portable GC	1.0
09/12/2000 1130	0.04*	0.003*	21.0	520	7.2	Dip	Portable GC	0.98
09/12/2000 1200	0.07*	0.010*	20.0	517	7.2	Dip	Portable GC	1.1
09/12/2000 1230	0.09	0.014	19.0	522	7.1	Dip	Portable GC	1.2
09/12/2000 1300	0.10	0.018	19.0	520	7.1	Dip	Portable GC	1.2
09/12/2000 1330	0.10	0.018	18.5	520	7.1	Dip	Portable GC	1.2
09/12/2000 1400	0.10	0.018	18.5	519	7.1	Dip	Portable GC	1.2
09/12/2000 1500	0.11	0.021	18.5	519	7.1	Dip	Portable GC	1.3
09/12/2000 1530	0.10	0.018	--	--	--	Dip	Portable GC	1.3
11/02/2000 0800	0.04*	0.003*	16.5	418	8.1	Dip	Portable GC	0.23
11/06/2000 1140	0.04*	0.004*	17.0	433	8.2	Dip	Portable GC	0.24
11/08/2000 0830	0.05*	0.005*	18.0	447	8.0	Dip	Portable GC	0.56
11/08/2000 0930	0.05*	0.006*	18.0	446	8.0	Dip	Portable GC	0.52
11/08/2000 1000	0.05*	0.006*	18.0	452	8.0	Dip	Portable GC	0.64
11/08/2000 1030	0.06*	0.007*	18.0	453	8.0	Dip	Portable GC	0.62

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (^oC)	Specific conductance ($\mu S/cm$)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
11/08/2000 1100	0.06*	0.007*	18.0	453	8.0	Dip	Portable GC	0.60
11/08/2000 1200	0.06*	0.008*	18.0	457	8.0	Automatic sampler	Portable GC	0.71
11/08/2000 1300	0.07*	0.010*	18.0	460	7.9	Automatic sampler	Portable GC	0.75
11/08/2000 1400	0.08	0.011	18.5	468	7.7	Automatic sampler	Portable GC	1.4
11/08/2000 1500	0.08	0.011	18.5	470	7.6	Automatic sampler	Portable GC	2.1
11/08/2000 1600	0.08	0.011	18.5	467	7.5	Automatic sampler	Portable GC	2.3
11/08/2000 1700	0.08	0.011	18.5	463	7.5	Automatic sampler	Portable GC	2.0
11/08/2000 1800	0.08	0.011	18.5	461	7.5	Automatic sampler	Portable GC	2.0
11/08/2000 1900	0.08	0.011	18.5	463	7.5	Automatic sampler	Portable GC	1.9
11/08/2000 2000	0.08	0.011	18.5	464	7.6	Automatic sampler	Portable GC	1.7
11/08/2000 2100	0.10	0.018	18.5	472	7.5	Automatic sampler	Portable GC	1.6
11/08/2000 2200	0.12	0.025	18.5	480	7.5	Automatic sampler	Portable GC	1.6
11/08/2000 2300	0.15	0.038	18.5	482	7.5	Automatic sampler	Portable GC	1.6
11/09/2000 0000	0.22	0.086	18.5	388	7.3	Automatic sampler	Portable GC	1.2
11/09/2000 0100	0.27	0.136	18.0	463	7.3	Automatic sampler	Portable GC	2
11/09/2000 0200	0.36	0.241	18.0	498	7.3	Automatic sampler	Portable GC	4
11/09/2000 0300	0.45	0.384	17.5	492	7.2	Automatic sampler	Portable GC	4.8
11/09/2000 0400	0.47	0.421	17.5	494	7.2	Automatic sampler	Portable GC	11
11/09/2000 0500	0.49	0.460	17.5	493	7.1	Automatic sampler	Portable GC	34
11/09/2000 0600	0.50	0.480	17.5	473	7.1	Automatic sampler	Portable GC	31
11/09/2000 0700	0.52	0.521	17.5	492	7.0	Automatic sampler	Portable GC	27
11/09/2000 0800	0.51	0.500	17.5	512	7.0	Automatic sampler	Portable GC	24
11/09/2000 0900	0.47	0.428	17.5	516	7.0	Automatic sampler	Portable GC	18
11/09/2000 1000	0.43	0.349	17.5	517	7.0	Automatic sampler	Portable GC	14
11/09/2000 1100	0.39	0.290	17.5	518	7.0	Dip	Portable GC	7.4
11/09/2000 1300	0.35	0.227	17.5	522	7.1	Dip	Portable GC	7.3
11/09/2000 1400	0.34	0.214	17.5	523	7.1	Automatic sampler	Portable GC	6.3
11/09/2000 1500	0.33	0.201	17.5	525	7.1	Automatic sampler	Portable GC	5.8
11/09/2000 1600	0.32	0.189	17.5	527	7.2	Automatic sampler	Portable GC	5.6
11/09/2000 1700	0.31	0.177	17.5	528	7.2	Automatic sampler	Portable GC	5.4
11/09/2000 1800	0.30	0.165	17.5	529	7.2	Automatic sampler	Portable GC	5.1
11/09/2000 1900	0.29	0.154	17.5	530	7.3	Automatic sampler	Portable GC	5.0
11/09/2000 2000	0.28	0.143	17.5	532	7.3	Automatic sampler	Portable GC	4.7
11/09/2000 2100	0.27	0.133	17.5	534	7.3	Automatic sampler	Portable GC	4.3
11/09/2000 2200	0.27	0.133	17.5	535	7.4	Automatic sampler	Portable GC	4.2
11/09/2000 2300	0.26	0.123	17.5	537	7.4	Automatic sampler	Portable GC	3.9
11/10/2000 0000	0.25	0.113	17.5	540	7.4	Automatic sampler	Portable GC	4.0
11/10/2000 0100	0.24	0.104	17.5	543	7.5	Automatic sampler	Portable GC	3.8
11/10/2000 0200	0.24	0.104	17.5	546	7.5	Automatic sampler	Portable GC	3.5
11/10/2000 0300	0.24	0.101	17.5	548	7.5	Automatic sampler	Portable GC	3.4
11/10/2000 0400	0.23	0.095	17.5	551	7.6	Automatic sampler	Portable GC	3.4

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	**Gage height (feet above datum)**	**Discharge (ft^3/s)**	**Temperature (°C)**	**Specific conductance (μS/cm)**	**pH (standard units)**	**Sample collection**	**Sample analysis**	**Chloroform (mg/L)**
11/10/2000 0500	0.22	0.087	17.5	554	7.6	Automatic sampler	Portable GC	3.2
11/10/2000 0600	0.22	0.087	17.5	557	7.6	Automatic sampler	Portable GC	3.4
11/10/2000 0700	0.21	0.081	17.5	560	7.6	Automatic sampler	Portable GC	3.3
11/10/2000 0800	0.21	0.079	17.5	562	7.6	Automatic sampler	Portable GC	3.1
11/10/2000 0900	0.20	0.071	17.5	564	7.6	Automatic sampler	Portable GC	3.0
11/10/2000 1000	0.20	0.071	17.5	566	7.7	Automatic sampler	Portable GC	3.1
11/10/2000 1100	0.20	0.069	17.5	568	7.7	Dip	Portable GC	3.2
11/10/2000 1200	0.19	0.064	17.5	570	7.7	Dip	Portable GC	3.2
11/10/2000 1600	0.18	0.057	17.5	579	7.7	Automatic sampler	Portable GC	2.8
11/10/2000 2000	0.17	0.051	17.5	587	7.8	Automatic sampler	Portable GC	2.8
11/11/2000 0000	0.17	0.051	17.0	595	7.8	Automatic sampler	Portable GC	2.7
11/11/2000 0400	0.16	0.045	17.0	603	7.8	Automatic sampler	Portable GC	2.7
11/11/2000 0800	0.16	0.045	17.0	609	7.8	Automatic sampler	Portable GC	2.7
11/11/2000 1200	0.15	0.040	17.5	615	7.8	Automatic sampler	Portable GC	3.0
11/11/2000 1600	0.15	0.040	17.5	622	7.8	Automatic sampler	Portable GC	3.0
11/11/2000 2000	0.15	0.040	17.0	625	7.8	Automatic sampler	Portable GC	2.6
11/12/2000 0000	0.14	0.035	17.0	627	7.9	Automatic sampler	Portable GC	2.6
11/12/2000 0400	0.14	0.035	17.0	629	7.9	Automatic sampler	Portable GC	2.4
11/12/2000 0800	0.14	0.035	17.0	629	7.9	Automatic sampler	Portable GC	2.4
11/12/2000 1200	0.13	0.030	17.5	630	7.9	Automatic sampler	Portable GC	2.6
11/12/2000 1600	0.13	0.030	17.5	632	7.8	Automatic sampler	Portable GC	2.6
11/12/2000 2000	0.13	0.030	17.5	632	7.9	Automatic sampler	Portable GC	2.2
11/13/2000 0000	0.12	0.025	17.0	631	7.9	Automatic sampler	Portable GC	2.2
11/13/2000 0400	0.13	0.030	17.5	631	7.9	Automatic sampler	Portable GC	2.0
11/13/2000 0800	0.12	0.025	17.5	632	7.9	Automatic sampler	Portable GC	2.3
11/13/2000 1200	0.12	0.025	17.5	631	7.9	Automatic sampler	Portable GC	2.3
11/13/2000 1600	0.12	0.025	17.5	632	7.9	Automatic sampler	Portable GC	2.3
11/13/2000 2000	0.12	0.025	17.0	632	7.9	Automatic sampler	Portable GC	2.2
11/14/2000 0000	0.11	0.021	17.0	631	8.0	Automatic sampler	Portable GC	2.1
11/14/2000 0400	0.11	0.021	17.0	629	8.0	Automatic sampler	Portable GC	1.8
11/15/2000 1040	0.10	0.018	17.0	613	8.0	Dip	Portable GC	1.5
11/20/2000 1410	0.13*	0.031*	17.0	602	7.7	Dip	Portable GC	1.6
11/24/2000 1020	0.09	0.013	16.5	591	7.7	Dip	Portable GC	1.3
11/25/2000 0920	0.30	0.165	17.0	538	7.4	Dip	Portable GC	3.2
11/25/2000 1020	0.30	0.165	17.0	536	7.4	Dip	Portable GC	3.4
11/25/2000 1220	0.29	0.154	17.0	532	7.4	Automatic sampler	Portable GC	4.0
11/25/2000 1420	0.28	0.143	17.0	532	7.4	Automatic sampler	Portable GC	3.9
11/25/2000 1620	0.28	0.143	17.0	532	7.4	Automatic sampler	Portable GC	3.8
11/25/2000 1820	0.26	0.126	17.0	533	7.4	Automatic sampler	Portable GC	3.5
11/25/2000 2020	0.26	0.123	17.0	537	7.4	Automatic sampler	Portable GC	3.3
11/25/2000 2220	0.25	0.113	17.0	542	7.4	Automatic sampler	Portable GC	3.0

Table 20. Chloroform data collected at Wilson Spring—Continued

Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Water-quality characteristic Temperature (°C)	Specific conductance (μS/cm)	pH (standard units)	Volatile organic compound data Sample collection	Sample analysis	Chloroform (mg/L)
11/26/2000 0020	0.24	0.104	17.0	547	7.5	Automatic sampler	Portable GC	2.8
11/26/2000 0220	0.24	0.104	17.0	552	7.5	Automatic sampler	Portable GC	2.7
11/26/2000 0420	0.23	0.098	17.0	557	7.5	Automatic sampler	Portable GC	2.5
11/26/2000 0620	0.23	0.095	17.0	561	7.5	Automatic sampler	Portable GC	2.6
11/26/2000 0820	0.22	0.089	17.0	566	7.5	Automatic sampler	Portable GC	2.4
11/26/2000 1020	0.23	0.095	17.0	570	7.5	Automatic sampler	Portable GC	2.6
11/26/2000 1220	0.22	0.087	17.0	574	7.5	Automatic sampler	Portable GC	2.5
11/26/2000 1420	0.22	0.084	17.0	579	7.5	Automatic sampler	Portable GC	2.4
11/26/2000 1620	0.21	0.079	17.0	582	7.5	Automatic sampler	Portable GC	2.5
11/26/2000 2020	0.21	0.076	17.0	592	7.6	Automatic sampler	Portable GC	2.3
11/26/2000 2220	0.20	0.071	17.0	595	7.6	Automatic sampler	Portable GC	2.3
11/27/2000 0220	0.20	0.069	17.0	601	7.6	Automatic sampler	Portable GC	2.2
11/27/2000 1140	0.18	0.057	17.0	610	7.6	Dip	Portable GC	1.9
11/30/2000 1230	0.14	0.035	17.0	617	7.8	Dip	Portable GC	1.6
12/08/2000 1430	0.09	0.014	16.0	551	7.9	Dip	Portable GC	1.0
12/13/2000 1530	0.09	0.014	15.0	492	7.9	Automatic sampler	Portable GC	0.47
12/13/2000 1600	0.09	0.014	15.0	486	7.8	Automatic sampler	Portable GC	0.40
12/13/2000 1630	0.09	0.014	15.0	484	7.9	Automatic sampler	Portable GC	0.40
12/13/2000 1700	0.10	0.017	14.5	376	7.8	Automatic sampler	Portable GC	0.36
12/13/2000 1730	0.15	0.038	14.0	300	7.7	Automatic sampler	Portable GC	0.43
12/13/2000 1800	0.16	0.045	13.5	299	7.6	Automatic sampler	Portable GC	0.45
12/13/2000 1830	0.26	0.122	15.5	364	7.6	Automatic sampler	Portable GC	0.69
12/13/2000 1900	0.43	0.348	17.0	456	7.7	Automatic sampler	Portable GC	1.1
12/13/2000 1930	0.77	1.184	16.5	456	7.6	Automatic sampler	Portable GC	3.2
12/13/2000 2000	0.81	1.333	16.5	315	7.3	Automatic sampler	Portable GC	5.8
12/13/2000 2030	0.82	1.366	16.0	307	7.2	Automatic sampler	Portable GC	4.1
12/13/2000 2100	0.82	1.367	15.5	311	7.2	Automatic sampler	Portable GC	2.4
12/13/2000 2130	0.81	1.333	16.0	331	7.1	Automatic sampler	Portable GC	3.1
12/13/2000 2200	0.79	1.277	16.0	349	7.1	Automatic sampler	Portable GC	3.2
12/13/2000 2230	0.78	1.230	16.5	357	7.1	Automatic sampler	Portable GC	3.8
12/13/2000 2300	0.77	1.195	16.5	361	7.1	Automatic sampler	Portable GC	4.5
12/13/2000 2330	0.74	1.096	16.5	361	7.1	Automatic sampler	Portable GC	4.5
12/14/2000 0000	0.72	1.022	17.0	362	7.1	Automatic sampler	Portable GC	4.1
12/14/2000 0030	0.70	0.970	17.0	364	7.1	Automatic sampler	Portable GC	3.8
12/14/2000 0100	0.68	0.912	17.0	366	7.1	Automatic sampler	Portable GC	3.5
12/14/2000 0130	0.66	0.856	17.0	371	7.1	Automatic sampler	Portable GC	3.3
12/14/2000 0200	0.64	0.802	17.0	377	7.1	Automatic sampler	Portable GC	3.1
12/14/2000 0230	0.62	0.751	17.0	382	7.1	Automatic sampler	Portable GC	3.1
12/14/2000 0300	0.61	0.725	17.0	388	7.1	Automatic sampler	Portable GC	3.0
12/14/2000 0700	0.50	0.480	17.0	420	7.1	Dip	Portable GC	2.8
12/14/2000 0730	0.50	0.473	17.0	424	7.2	Dip	Portable GC	2.7

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (°C)	Specific conductance (μS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
12/14/2000 0800	0.49	0.460	17.0	427	7.2	Dip	Portable GC	2.7
12/14/2000 0900	0.48	0.440	17.0	434	7.2	Automatic sampler	Portable GC	2.7
12/14/2000 1000	0.46	0.403	17.0	441	7.2	Automatic sampler	Portable GC	2.6
12/14/2000 1100	0.45	0.385	17.0	448	7.2	Automatic sampler	Portable GC	2.6
12/14/2000 1200	0.45	0.378	17.0	453	7.2	Automatic sampler	Portable GC	2.4
12/14/2000 1300	0.43	0.349	17.0	459	7.2	Automatic sampler	Portable GC	2.5
12/14/2000 1400	0.42	0.338	17.0	462	7.2	Automatic sampler	Portable GC	2.4
12/14/2000 1500	0.42	0.332	17.0	468	7.2	Automatic sampler	Portable GC	2.4
12/14/2000 1600	0.41	0.316	17.0	472	7.2	Automatic sampler	Portable GC	2.4
12/14/2000 1700	0.40	0.300	17.0	477	7.2	Automatic sampler	Portable GC	2.3
12/14/2000 1800	0.40	0.300	17.0	482	7.2	Automatic sampler	Portable GC	2.2
12/14/2000 1900	0.39	0.285	17.0	486	7.3	Automatic sampler	Portable GC	2.3
12/14/2000 2000	0.38	0.270	17.0	491	7.3	Automatic sampler	Portable GC	2.2
12/14/2000 2100	0.38	0.270	17.0	497	7.3	Automatic sampler	Portable GC	2.1
12/14/2000 2200	0.37	0.255	17.0	500	7.3	Automatic sampler	Portable GC	2.2
12/14/2000 2300	0.37	0.255	17.0	505	7.3	Automatic sampler	Portable GC	2.2
12/15/2000 0000	0.36	0.241	17.0	508	7.3	Automatic sampler	Portable GC	2.2
12/15/2000 0100	0.36	0.241	17.0	511	7.3	Automatic sampler	Portable GC	2.2
12/15/2000 0200	0.36	0.241	17.0	516	7.3	Automatic sampler	Portable GC	2.2
12/15/2000 0300	0.35	0.227	17.0	518	7.3	Automatic sampler	Portable GC	2.1
12/15/2000 0400	0.35	0.227	17.0	522	7.3	Automatic sampler	Portable GC	2.1
12/15/2000 0500	0.35	0.227	17.0	525	7.3	Automatic sampler	Portable GC	1.9
12/15/2000 0700	0.34	0.214	17.0	530	7.3	Automatic sampler	Portable GC	1.9
12/15/2000 1200	0.32	0.193	17.0	542	7.3	Dip	Portable GC	1.9
12/15/2000 1500	0.32	0.189	17.0	548	7.3	Automatic sampler	Portable GC	1.9
12/15/2000 1800	0.32	0.185	17.0	550	7.4	Automatic sampler	Portable GC	2.0
12/15/2000 2100	0.35	0.227	16.5	539	7.3	Automatic sampler	Portable GC	2.1
12/16/2000 0000	0.77	1.195	16.5	382	7.0	Automatic sampler	Portable GC	1.9
12/16/2000 0900	0.75	1.128	17.0	362	7.0	Automatic sampler	Portable GC	1.7
12/16/2000 1200	0.68	0.912	17.0	381	7.0	Automatic sampler	Portable GC	1.7
12/16/2000 1500	1.49	4.636	15.5	211	6.9	Automatic sampler	Portable GC	0.9
12/18/2000 1400	0.53	0.534	16.5	374	7.1	Dip	Portable GC	1.6
12/18/2000 1510	0.52	0.521	16.5	375	7.1	Automatic sampler	Portable GC	1.7
12/18/2000 1810	0.51	0.494	16.5	383	7.1	Automatic sampler	Portable GC	2.0
12/18/2000 2110	0.49	0.460	16.5	385	7.1	Automatic sampler	Portable GC	2.0
12/19/2000 0010	0.48	0.440	16.5	395	7.2	Automatic sampler	Portable GC	2.0
12/20/2000 0950	0.38	0.270	16.5	431	7.3	Dip	Portable GC	1.7
12/20/2000 1150	0.38	0.270	16.5	425	7.0	Automatic sampler	Portable GC	1.7
12/27/2000 1030	0.21	0.079	16.0	531	7.6	Dip	Portable GC	2.0
01/04/2001 1000	0.13	0.031	15.5	517	7.8	Dip	Portable GC	1.5
01/10/2001 1420	0.12	0.025	15.5	504	7.8	Dip	Portable GC	1.6

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	**Gage height (feet above datum)**	**Discharge (ft^3/s)**	**Temperature (°C)**	**Specific conductance (µS/cm)**	**pH (standard units)**	**Sample collection**	**Sample analysis**	**Chloroform (mg/L)**
01/11/2001 1700	0.12	0.025	15.0	503	8.2	Automatic sampler	Portable GC	1.5
01/11/2001 1730	0.12	0.025	15.0	504	8.2	Automatic sampler	Portable GC	1.5
01/11/2001 1800	0.12	0.025	15.0	506	8.2	Automatic sampler	Portable GC	1.5
01/11/2001 1900	0.12	0.025	15.5	507	8.2	Automatic sampler	Portable GC	1.6
01/11/2001 2000	0.12	0.025	15.5	510	8.2	Automatic sampler	Portable GC	1.5
01/11/2001 2100	0.13	0.030	15.5	511	8.2	Automatic sampler	Portable GC	1.7
01/11/2001 2200	0.13	0.031	15.5	511	8.2	Automatic sampler	Portable GC	1.8
01/11/2001 2300	0.14	0.035	15.5	512	8.2	Automatic sampler	Portable GC	1.8
01/12/2001 0000	0.15	0.040	15.5	512	8.2	Automatic sampler	Portable GC	1.8
01/12/2001 0100	0.15	0.040	15.5	513	8.2	Automatic sampler	Portable GC	1.8
01/12/2001 0200	0.15	0.040	15.5	513	8.2	Automatic sampler	Portable GC	1.8
01/12/2001 0300	0.15	0.040	15.5	514	8.2	Automatic sampler	Portable GC	1.9
01/12/2001 0430	0.15	0.040	15.5	517	8.2	Automatic sampler	Portable GC	1.8
01/12/2001 0730	0.15	0.040	15.5	521	8.2	Dip	Portable GC	1.8
01/12/2001 0810	0.15	0.040	15.5	522	8.2	Dip	Portable GC	1.8
01/12/2001 0910	0.15	0.040	15.5	526	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1010	0.15	0.040	15.5	530	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1110	0.15	0.040	15.5	535	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1210	0.15	0.040	15.5	540	8.2	Automatic sampler	Portable GC	2.1
01/12/2001 1310	0.15	0.040	15.5	544	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1409	0.15	0.040	15.5	547	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1509	0.15	0.040	15.5	549	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1609	0.15	0.040	15.5	551	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1709	0.15	0.040	15.5	552	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1809	0.15	0.040	15.5	552	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 1909	0.15	0.040	15.5	552	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 2110	0.15	0.040	15.5	551	8.2	Automatic sampler	Portable GC	2.0
01/12/2001 2310	0.15	0.040	15.5	548	8.2	Automatic sampler	Portable GC	2.1
01/13/2001 0110	0.15	0.040	15.5	544	8.2	Automatic sampler	Portable GC	2.0
01/13/2001 0310	0.16	0.045	15.5	541	8.2	Automatic sampler	Portable GC	2.2
01/13/2001 0510	0.15	0.040	15.5	538	8.2	Automatic sampler	Portable GC	2.2
01/13/2001 0710	0.15	0.040	15.5	535	8.1	Automatic sampler	Portable GC	2.2
01/17/2001 1630	0.17	0.051	16.0	532	8.2	Automatic sampler	Portable GC	1.7
01/17/2001 1830	0.17	0.051	16.0	532	8.1	Automatic sampler	Portable GC	1.8
01/17/2001 2030	0.17	0.051	16.0	533	8.1	Automatic sampler	Portable GC	1.9
01/17/2001 2230	0.18	0.057	16.0	533	8.1	Automatic sampler	Portable GC	1.9
01/18/2001 0030	0.18	0.057	16.0	533	8.1	Automatic sampler	Portable GC	1.9
01/18/2001 0230	0.18	0.057	16.0	533	8.1	Automatic sampler	Portable GC	2.0
01/18/2001 0429	0.18	0.057	16.0	532	8.1	Automatic sampler	Portable GC	2.0
01/18/2001 0530	0.18	0.060	16.0	531	8.1	Automatic sampler	Portable GC	2.0
01/18/2001 0630	0.19	0.064	16.0	528	8.1	Automatic sampler	Portable GC	2.1

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (°C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
01/18/2001 0730	0.21	0.079	15.5	513	8.1	Automatic sampler	Portable GC	1.9
01/18/2001 0830	0.25	0.113	15.5	504	8.0	Automatic sampler	Portable GC	2.0
01/18/2001 0930	0.29	0.154	16.0	515	8.0	Automatic sampler	Portable GC	2.1
01/18/2001 1030	0.38	0.269	16.0	558	8.0	Automatic sampler	Portable GC	2.2
01/18/2001 1130	0.50	0.473	16.5	573	7.9	Automatic sampler	Portable GC	2.4
01/18/2001 1210	0.54	0.570	16.5	554	7.9	Dip	Portable GC	2.4
01/18/2001 1310	0.59	0.676	16.5	504	7.7	Automatic sampler	Portable GC	2.8
01/18/2001 1410	0.60	0.708	16.5	462	7.7	Automatic sampler	Portable GC	3.2
01/18/2001 1510	0.61	0.725	16.5	439	7.6	Automatic sampler	Portable GC	3.0
01/18/2001 1610	0.61	0.725	16.5	430	7.6	Automatic sampler	Portable GC	3.1
01/18/2001 1710	0.60	0.700	16.5	425	7.6	Automatic sampler	Portable GC	3.1
01/18/2001 1810	0.60	0.700	16.5	417	7.6	Automatic sampler	Portable GC	2.7
01/18/2001 1910	0.62	0.750	16.0	413	7.6	Automatic sampler	Portable GC	2.6
01/18/2001 2010	0.65	0.838	16.5	417	7.6	Automatic sampler	Portable GC	2.5
01/18/2001 2110	0.71	1.000	16.0	420	7.6	Automatic sampler	Portable GC	2.4
01/18/2001 2210	0.75	1.139	16.0	407	7.6	Automatic sampler	Portable GC	2.3
01/18/2001 2310	0.82	1.366	16.0	393	7.5	Automatic sampler	Portable GC	1.9
01/19/2001 0010	0.88	1.589	16.0	374	7.5	Automatic sampler	Portable GC	2.7
01/19/2001 0110	1.00	2.049	16.0	361	7.5	Automatic sampler	Portable GC	2.1
01/19/2001 0209	1.05	2.284	16.0	331	7.5	Automatic sampler	Portable GC	1.8
01/19/2001 0309	1.16	2.783	16.0	331	7.5	Automatic sampler	Portable GC	1.5
01/19/2001 0409	1.27	3.331	15.5	308	7.5	Automatic sampler	Portable GC	1.3
01/19/2001 0509	1.31	3.567	15.5	297	7.4	Automatic sampler	Portable GC	1.2
01/19/2001 0609	1.34	3.736	15.5	276	7.5	Automatic sampler	Portable GC	1.2
01/19/2001 0709	1.48	4.570	15.5	258	7.5	Automatic sampler	Portable GC	1.1
01/19/2001 0810	1.72	6.267	15.0	259	7.5	Automatic sampler	Portable GC	1.0
01/19/2001 0910	2.12	--	15.0	261	7.5	Automatic sampler	Portable GC	0.98
01/19/2001 1010	2.45	--	15.0	263	7.5	Dip	Portable GC	0.98
01/19/2001 1109	2.75	--	12.0	265	7.6	Automatic sampler	Portable GC	0.84
01/19/2001 1209	2.85	--	11.0	267	7.6	Automatic sampler	Portable GC	0.61
01/19/2001 1309	2.78	--	10.5	269	7.6	Automatic sampler	Portable GC	0.47
01/19/2001 1409	2.60	--	13.5	271	7.5	Automatic sampler	Portable GC	0.66
01/19/2001 1609	1.93	7.965	14.0	274	7.5	Automatic sampler	Portable GC	0.85
01/19/2001 1709	1.46	4.456	14.5	276	7.5	Automatic sampler	Portable GC	0.95
01/19/2001 1809	1.23	3.156	15.0	278	7.5	Automatic sampler	Portable GC	0.98
01/19/2001 1910	1.16	2.785	15.0	294	7.5	Automatic sampler	Portable GC	0.96
01/19/2001 2010	1.12	2.578	15.0	297	7.5	Automatic sampler	Portable GC	0.97
01/19/2001 2110	1.09	2.453	15.0	301	7.5	Automatic sampler	Portable GC	0.94
01/19/2001 2210	1.07	2.360	15.0	305	7.5	Automatic sampler	Portable GC	0.99
01/20/2001 0010	1.01	2.093	15.0	311	7.5	Automatic sampler	Portable GC	0.97
01/20/2001 0210	0.96	1.872	15.0	316	7.5	Automatic sampler	Portable GC	1.1

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (°C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
01/20/2001 0410	0.90	1.650	15.0	321	7.5	Automatic sampler	Portable GC	1.1
01/20/2001 0610	0.85	1.458	15.0	328	7.5	Automatic sampler	Portable GC	1.1
01/20/2001 0810	0.81	1.322	15.0	335	7.5	Automatic sampler	Portable GC	1.2
01/20/2001 1510	0.70	0.970	15.0	340	7.6	Automatic sampler	Portable GC	1.3
01/21/2001 1310	0.54	0.563	15.5	386	7.6	Automatic sampler	Portable GC	1.5
01/22/2001 1300	0.48	0.440	15.5	399	7.6	Dip	Portable GC	1.4
01/23/2001 1300	0.43	0.349	15.5	418	7.6	Automatic sampler	Portable GC	1.5
01/24/2001 1300	0.39	0.285	15.5	438	7.7	Automatic sampler	Portable GC	1.5
01/25/2001 1300	0.36	0.241	15.5	458	7.7	Automatic sampler	Portable GC	1.5
01/26/2001 0930	0.34	0.210	15.5	474	7.8	Dip	Portable GC	1.5
01/30/2001 0720	0.56	0.607	15.5	394	7.6	Dip	Portable GC	1.8
01/30/2001 0820	0.56	0.607	15.5	394	7.6	Automatic sampler	Portable GC	1.7
01/30/2001 0919	0.55	0.585	15.5	394	7.6	Automatic sampler	Portable GC	1.7
01/30/2001 1019	0.55	0.585	15.5	393	7.6	Automatic sampler	Portable GC	1.6
01/30/2001 1119	0.55	0.585	15.5	394	7.6	Automatic sampler	Portable GC	1.5
01/30/2001 1219	0.54	0.563	15.5	394	7.6	Automatic sampler	Portable GC	1.3
01/30/2001 1319	0.54	0.563	15.5	395	7.6	Automatic sampler	Portable GC	1.4
01/30/2001 1419	0.53	0.542	15.5	396	7.6	Automatic sampler	Portable GC	1.6
01/30/2001 1720	0.52	0.521	15.5	400	7.6	Automatic sampler	Portable GC	1.5
01/30/2001 2020	0.51	0.500	15.5	403	7.6	Automatic sampler	Portable GC	1.5
01/30/2001 2320	0.50	0.480	15.5	407	7.6	Automatic sampler	Portable GC	1.5
01/31/2001 0520	0.47	0.421	15.5	415	7.6	Automatic sampler	Portable GC	1.4
01/31/2001 1300	0.45	0.384	15.5	417	7.4	Dip	Portable GC	1.3
02/07/2001 1040	0.28	0.139	15.5	491	7.7	Dip	Portable GC	1.6
02/09/2001 2130	0.28	0.143	15.5	488	7.7	Automatic sampler	Portable GC	2.1
02/09/2001 2200	0.29	0.150	15.5	489	7.7	Automatic sampler	Portable GC	2.2
02/09/2001 2229	0.29	0.154	15.5	492	7.7	Automatic sampler	Portable GC	2.1
02/09/2001 2300	0.29	0.154	15.5	493	7.7	Automatic sampler	Portable GC	2.3
02/09/2001 2330	0.29	0.154	15.5	495	7.7	Automatic sampler	Portable GC	2.7
02/10/2001 0000	0.29	0.154	15.5	496	7.7	Automatic sampler	Portable GC	2.3
02/10/2001 0030	0.30	0.165	15.5	496	7.7	Automatic sampler	Portable GC	2.8
02/10/2001 0130	0.30	0.165	15.5	496	7.7	Automatic sampler	Portable GC	2.7
02/10/2001 0230	0.30	0.165	15.5	497	7.7	Automatic sampler	Portable GC	2.7
02/10/2001 0330	0.30	0.165	15.5	500	7.7	Automatic sampler	Portable GC	2.6
02/10/2001 0430	0.30	0.165	15.5	501	7.7	Automatic sampler	Portable GC	2.5
02/10/2001 0530	0.30	0.165	15.5	502	7.7	Automatic sampler	Portable GC	2.3
02/10/2001 0630	0.30	0.165	15.5	502	7.7	Automatic sampler	Portable GC	2.3
02/10/2001 0730	0.30	0.165	15.5	501	7.7	Automatic sampler	Portable GC	2.3
02/10/2001 0830	0.30	0.165	15.5	497	7.7	Automatic sampler	Portable GC	2.3
02/10/2001 1000	0.30	0.165	15.5	493	7.7	Dip	Portable GC	2.5
02/10/2001 1300	0.31	0.177	15.5	488	7.7	Automatic sampler	Portable GC	2.2

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (°C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
02/10/2001 1700	0.31	0.177	15.5	484	7.7	Automatic sampler	Portable GC	1.9
02/11/2001 0900	0.31	0.177	15.5	479	7.7	Automatic sampler	Portable GC	1.7
02/12/2001 0100	0.31	0.177	15.5	475	7.7	Automatic sampler	Portable GC	1.7
02/12/2001 0900	0.33	0.201	15.5	478	7.7	Automatic sampler	Portable GC	1.5
02/12/2001 1030	0.33	0.201	15.5	477	7.7	Dip	Portable GC	1.5
02/12/2001 2240	0.34	0.219	15.5	468	7.6	Automatic sampler	Portable GC	1.6
02/13/2001 1430	0.37	0.255	15.5	460	7.6	Automatic sampler	Portable GC	1.6
02/13/2001 1630	0.42	0.332	15.0	443	7.6	Automatic sampler	Portable GC	1.6
02/13/2001 1830	1.15	2.728	15.0	359	7.4	Automatic sampler	Portable GC	1.5
02/13/2001 2030	1.40	4.084	14.5	259	7.3	Automatic sampler	Portable GC	1.0
02/13/2001 2230	1.41	4.143	14.5	267	7.3	Automatic sampler	Portable GC	1.0
02/14/2001 0030	1.41	4.145	14.5	264	7.3	Automatic sampler	Portable GC	0.86
02/14/2001 0230	1.34	3.736	14.5	265	7.3	Automatic sampler	Portable GC	1.0
02/14/2001 0430	1.24	3.191	14.5	272	7.3	Automatic sampler	Portable GC	0.98
02/14/2001 0630	1.15	2.737	14.5	282	7.3	Automatic sampler	Portable GC	1.0
02/14/2001 0830	1.07	2.360	14.5	268	7.3	Automatic sampler	Portable GC	0.98
02/14/2001 0920	1.04	2.224	14.5	298	7.3	Dip	Portable GC	1.0
02/14/2001 1000	1.02	2.136	14.5	301	7.3	Dip	Portable GC	0.97
02/14/2001 1200	0.97	1.925	14.5	305	7.3	Automatic sampler	Portable GC	0.95
02/14/2001 1400	0.91	1.701	14.5	314	7.3	Automatic sampler	Portable GC	1.0
02/14/2001 1600	0.87	1.541	14.5	320	7.3	Automatic sampler	Portable GC	1.0
02/14/2001 1800	0.82	1.378	14.5	325	7.3	Automatic sampler	Portable GC	1.1
02/14/2001 2000	0.79	1.265	14.5	330	7.3	Automatic sampler	Portable GC	1.1
02/14/2001 2200	0.78	1.230	14.5	334	7.3	Automatic sampler	Portable GC	1.3
02/15/2001 0000	1.10	2.484	14.5	288	7.3	Automatic sampler	Portable GC	0.88
02/15/2001 0200	1.21	3.035	14.0	254	7.3	Automatic sampler	Portable GC	0.83
02/15/2001 0400	1.34	3.736	14.0	256	7.3	Automatic sampler	Portable GC	0.93
02/15/2001 0600	1.32	3.623	14.0	257	7.3	Automatic sampler	Portable GC	0.84
02/15/2001 0800	1.25	3.243	14.0	260	7.3	Automatic sampler	Portable GC	0.83
02/15/2001 1000	1.20	2.984	14.0	262	7.3	Automatic sampler	Portable GC	0.88
02/15/2001 1200	1.14	2.705	14.0	267	7.2	Automatic sampler	Portable GC	0.92
02/15/2001 1400	1.10	2.485	14.0	273	7.2	Automatic sampler	Portable GC	0.89
02/15/2001 1600	1.46	4.427	14.0	230	7.3	Automatic sampler	Portable GC	0.73
02/15/2001 1800	1.81	6.978	14.0	195	7.4	Automatic sampler	Portable GC	0.59
02/15/2001 2000	4.22	--	14.0	196	7.3	Automatic sampler	Portable GC	0.85
02/15/2001 2200	4.72	--	13.5	211	7.3	Automatic sampler	Portable GC	0.78
02/16/2001 0000	2.89	--	13.5	229	7.4	Automatic sampler	Portable GC	0.97
02/16/2001 0200	1.35	3.812	14.0	246	7.4	Automatic sampler	Portable GC	0.89
02/16/2001 0400	1.25	3.243	14.0	254	7.4	Automatic sampler	Portable GC	1.0
02/16/2001 0600	1.23	3.121	14.0	255	7.4	Automatic sampler	Portable GC	0.91
02/16/2001 0800	1.26	3.278	14.0	254	7.4	Automatic sampler	Portable GC	0.82

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (^{o}C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
02/16/2001 0920	1.37	3.907	13.5	247	7.4	Dip	Portable GC	0.72
02/16/2001 1100	1.49	4.636	13.5	222	7.4	Dip	Portable GC	0.63
02/16/2001 1300	2.00	8.604	13.5	207	7.4	Automatic sampler	Portable GC	0.60
02/16/2001 1459	3.55	--	13.0	184	7.4	Automatic sampler	Portable GC	0.52
02/16/2001 1659	5.79	--	12.5	171	7.4	Automatic sampler	Portable GC	0.46
02/16/2001 1859	7.85	--	11.0	150	7.6	Automatic sampler	Portable GC	0.32
02/16/2001 2000	9.12	--	10.5	134	7.6	Automatic sampler	Portable GC	0.11
02/16/2001 2059	9.83	--	10.0	130	7.6	Automatic sampler	Portable GC	0.077
02/16/2001 2200	10.08	--	10.0	134	7.6	Automatic sampler	Portable GC	0.080
02/16/2001 2300	9.88	--	10.0	138	7.6	Automatic sampler	Portable GC	0.080
02/17/2001 0000	9.30	--	10.0	147	7.6	Automatic sampler	Portable GC	0.073
02/17/2001 0100	8.67	--	10.0	162	7.6	Automatic sampler	Portable GC	0.099
02/17/2001 0200	7.68	--	10.5	180	7.6	Automatic sampler	Portable GC	0.15
02/17/2001 0300	6.76	--	11.0	191	7.5	Automatic sampler	Portable GC	0.38
02/17/2001 0400	5.52	--	11.5	202	7.5	Automatic sampler	Portable GC	0.61
02/17/2001 0900	1.51	4.767	12.0	209	7.4	Automatic sampler	Portable GC	0.83
02/17/2001 1010	1.45	4.387	11.5	207	7.4	Dip	Portable GC	0.86
02/17/2001 1310	1.40	4.084	11.5	206	7.4	Automatic sampler	Portable GC	0.79
02/17/2001 1610	1.35	3.812	11.5	207	7.4	Automatic sampler	Portable GC	0.77
02/18/2001 1010	0.92	1.714	13.5	272	7.4	Automatic sampler	Portable GC	0.65
02/18/2001 1310	0.87	1.541	13.5	274	7.4	Automatic sampler	Portable GC	0.93
02/18/2001 1610	0.82	1.356	13.5	276	7.4	Automatic sampler	Portable GC	0.99
02/19/2001 1010	0.57	0.630	14.0	302	7.5	Automatic sampler	Portable GC	1.0
02/20/2001 0810	0.51	0.500	13.5	325	7.5	Dip	Portable GC	1.3
02/21/2001 1100	0.45	0.384	14.0	350	7.4	Dip	Portable GC	1.4
02/22/2001 0150	0.53	0.541	14.0	359	7.5	Automatic sampler	Portable GC	1.6
02/22/2001 0250	0.55	0.585	14.0	360	7.4	Automatic sampler	Portable GC	1.5
02/22/2001 0320	0.55	0.585	14.0	337	7.4	Automatic sampler	Portable GC	1.6
02/22/2001 0350	0.56	0.607	14.0	326	7.4	Automatic sampler	Portable GC	1.8
02/22/2001 0420	0.56	0.607	14.0	312	7.4	Automatic sampler	Portable GC	1.7
02/22/2001 0450	0.58	0.653	14.0	315	7.4	Automatic sampler	Portable GC	1.6
02/22/2001 0520	0.59	0.668	14.0	329	7.4	Automatic sampler	Portable GC	1.5
02/22/2001 0549	0.59	0.676	14.0	333	7.4	Automatic sampler	Portable GC	1.4
02/22/2001 0619	0.60	0.700	14.0	309	7.4	Automatic sampler	Portable GC	1.2
02/22/2001 0649	0.61	0.725	14.0	333	7.4	Automatic sampler	Portable GC	1.1
02/22/2001 0719	0.61	0.725	14.0	328	7.4	Automatic sampler	Portable GC	1.2
02/22/2001 0749	0.62	0.750	14.0	324	7.4	Automatic sampler	Portable GC	1.3
02/22/2001 0819	0.61	0.725	14.0	334	7.4	Automatic sampler	Portable GC	1.2
02/22/2001 0849	0.62	0.750	14.0	329	7.4	Automatic sampler	Portable GC	1.3
02/22/2001 0919	0.62	0.742	14.0	326	7.4	Automatic sampler	Portable GC	1.3
02/22/2001 0949	0.62	0.750	14.0	321	7.4	Automatic sampler	Portable GC	1.6

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (^oC)	Specific conductance ($\mu S/cm$)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
02/22/2001 1019	0.61	0.725	14.0	323	7.4	Automatic sampler	Portable GC	1.5
02/22/2001 1049	0.61	0.725	14.0	323	7.4	Automatic sampler	Portable GC	1.6
02/22/2001 1119	0.61	0.725	14.0	324	7.4	Automatic sampler	Portable GC	1.6
02/22/2001 1149	0.60	0.700	14.0	321	7.4	Automatic sampler	Portable GC	1.4
02/22/2001 1219	0.60	0.700	14.0	322	7.4	Dip	Portable GC	1.1
02/22/2001 1250	0.60	0.700	14.0	320	7.4	Automatic sampler	Portable GC	1.2
02/22/2001 1320	0.60	0.700	14.0	322	7.4	Automatic sampler	Portable GC	1.2
02/22/2001 1410	0.60	0.692	14.0	324	7.4	Automatic sampler	Portable GC	1.4
02/22/2001 1510	0.59	0.676	14.0	325	7.4	Automatic sampler	Portable GC	1.3
02/22/2001 1710	0.59	0.676	14.0	328	7.4	Automatic sampler	Portable GC	1.3
02/22/2001 1910	0.58	0.653	14.0	330	7.4	Automatic sampler	Portable GC	1.2
02/22/2001 2109	0.57	0.630	14.0	332	7.4	Automatic sampler	Portable GC	1.3
02/22/2001 2309	0.57	0.630	14.0	332	7.4	Automatic sampler	Portable GC	1.3
02/23/2001 0309	0.55	0.585	14.0	333	7.5	Automatic sampler	Portable GC	1.2
02/23/2001 0709	0.54	0.563	14.0	339	7.5	Automatic sampler	Portable GC	1.2
02/23/2001 0909	0.54	0.563	14.0	342	7.5	Automatic sampler	Portable GC	1.1
02/23/2001 1109	0.53	0.542	14.0	342	7.5	Automatic sampler	Portable GC	1.2
02/23/2001 1410	0.52	0.521	14.0	344	7.5	Dip	Portable GC	1.2
02/25/2001 0120	0.45	0.384	14.0	367	7.4	Automatic sampler	Portable GC	1.4
02/25/2001 0220	0.64	0.801	14.0	355	7.4	Automatic sampler	Portable GC	1.3
02/25/2001 0319	0.84	1.435	14.0	226	7.3	Automatic sampler	Portable GC	1.6
02/25/2001 0419	0.92	1.726	14.0	232	7.3	Automatic sampler	Portable GC	1.5
02/25/2001 0519	0.97	1.939	14.0	232	7.3	Automatic sampler	Portable GC	0.95
02/25/2001 0619	0.96	1.885	14.0	217	7.3	Automatic sampler	Portable GC	0.70
02/25/2001 0719	0.92	1.726	14.0	227	7.3	Automatic sampler	Portable GC	0.74
02/25/2001 0819	0.90	1.650	14.0	241	7.3	Automatic sampler	Portable GC	0.82
02/25/2001 0919	0.85	1.470	14.0	256	7.3	Automatic sampler	Portable GC	0.93
02/25/2001 1019	0.82	1.367	14.0	267	7.3	Automatic sampler	Portable GC	0.95
02/25/2001 1119	0.80	1.300	14.0	274	7.3	Automatic sampler	Portable GC	0.94
02/25/2001 1219	0.79	1.265	14.0	277	7.3	Automatic sampler	Portable GC	0.98
02/25/2001 1319	0.78	1.230	14.0	285	7.3	Automatic sampler	Portable GC	0.93
02/25/2001 1419	0.76	1.162	14.0	286	7.3	Dip	Portable GC	0.96
02/25/2001 1440	0.75	1.128	14.0	285	7.3	Dip	Portable GC	0.96
02/25/2001 1540	0.74	1.096	14.0	283	7.3	Automatic sampler	Portable GC	0.93
02/25/2001 1740	0.71	1.001	14.0	300	7.3	Automatic sampler	Portable GC	0.90
02/25/2001 2140	0.65	0.829	14.0	315	7.4	Automatic sampler	Portable GC	1.0
02/26/2001 0140	0.62	0.750	14.0	325	7.4	Automatic sampler	Portable GC	0.94
02/26/2001 0540	0.60	0.700	14.0	330	7.4	Automatic sampler	Portable GC	0.99
02/26/2001 0940	0.58	0.653	14.0	334	7.4	Automatic sampler	Portable GC	1.0
02/26/2001 1340	0.56	0.607	14.0	339	7.4	Dip	Portable GC	1.1
03/01/2001 1030	0.40	0.300	14.0	376	7.7	Dip	Portable GC	1.5

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (°C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
03/01/2001 1320	0.40	0.300	14.0	382	7.7	Automatic sampler	Portable GC	1.6
03/01/2001 1420	0.40	0.300	14.0	383	7.6	Automatic sampler	Portable GC	1.4
03/07/2001 1000	0.37	0.255	14.5	400	7.7	Automatic sampler	Portable GC	1.4
03/12/2001 1050	0.28	0.143	14.5	427	7.8	Automatic sampler	Portable GC	1.9
03/12/2001 1120	0.28	0.143	14.5	427	7.8	Automatic sampler	Portable GC	1.8
03/12/2001 1149	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	1.6
03/12/2001 1219	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	1.5
03/12/2001 1249	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	1.8
03/12/2001 1319	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	1.9
03/12/2001 1349	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	1.9
03/12/2001 1419	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	1.9
03/12/2001 1500	0.28	0.143	14.5	427	7.7	Dip	Portable GC	1.8
03/12/2001 1600	0.28	0.147	14.5	427	7.7	Automatic sampler	Portable GC	1.6
03/12/2001 1659	0.29	0.154	14.5	427	7.7	Automatic sampler	Portable GC	1.6
03/12/2001 1759	0.28	0.143	14.5	427	7.7	Automatic sampler	Portable GC	2.0
03/12/2001 1859	0.28	0.143	14.5	428	7.7	Automatic sampler	Portable GC	1.8
03/12/2001 2100	0.28	0.143	14.5	428	7.7	Automatic sampler	Portable GC	1.9
03/12/2001 2300	0.28	0.143	14.5	429	7.7	Automatic sampler	Portable GC	1.7
03/13/2001 0100	0.28	0.143	14.5	429	7.7	Automatic sampler	Portable GC	1.6
03/13/2001 0400	0.28	0.143	14.5	431	7.7	Automatic sampler	Portable GC	1.7
03/13/2001 0700	0.28	0.143	14.5	432	7.7	Automatic sampler	Portable GC	1.6
03/13/2001 0959	0.27	0.133	14.5	432	7.7	Automatic sampler	Portable GC	1.8
03/13/2001 1330	0.27	0.133	14.5	432	7.7	Dip	Portable GC	1.7
03/15/2001 0500	0.25	0.113	14.5	433	7.7	Automatic sampler	Portable GC	1.7
03/15/2001 0600	0.26	0.123	14.5	433	7.7	Automatic sampler	Portable GC	1.9
03/15/2001 0700	0.26	0.123	14.5	431	7.7	Automatic sampler	Portable GC	1.9
03/15/2001 0800	0.27	0.133	14.5	431	7.7	Automatic sampler	Portable GC	1.9
03/15/2001 0900	0.29	0.154	14.5	431	7.7	Automatic sampler	Portable GC	1.9
03/15/2001 1000	0.29	0.154	14.5	432	7.7	Automatic sampler	Portable GC	1.8
03/15/2001 1300	0.30	0.165	14.5	436	7.7	Dip	Portable GC	2.2
03/19/2001 1410	0.30	0.161	14.5	429	7.8	Dip	Portable GC	1.6
03/20/2001 0120	0.29	0.154	14.5	432	7.7	Automatic sampler	Portable GC	1.3
03/20/2001 0150	0.29	0.154	14.5	432	7.7	Automatic sampler	Portable GC	1.5
03/20/2001 0220	0.29	0.154	14.5	431	7.7	Automatic sampler	Portable GC	1.5
03/20/2001 0250	0.29	0.154	14.5	430	7.7	Automatic sampler	Portable GC	1.4
03/20/2001 0320	0.29	0.154	14.5	430	7.7	Automatic sampler	Portable GC	1.5
03/20/2001 0350	0.31	0.177	14.0	428	7.7	Automatic sampler	Portable GC	1.5
03/20/2001 0420	0.31	0.177	14.0	428	7.7	Automatic sampler	Portable GC	1.4
03/20/2001 0449	0.32	0.189	14.0	427	7.7	Automatic sampler	Portable GC	1.5
03/20/2001 0519	0.34	0.214	14.5	426	7.7	Automatic sampler	Portable GC	1.4
03/20/2001 0550	0.36	0.241	14.5	427	7.7	Automatic sampler	Portable GC	1.5

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (^oC)	Specific conductance ($\mu S/cm$)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
03/20/2001 0619	0.38	0.270	14.5	428	7.6	Automatic sampler	Portable GC	1.6
03/20/2001 0649	0.42	0.338	14.5	429	7.6	Automatic sampler	Portable GC	1.7
03/20/2001 0719	0.47	0.428	14.5	426	7.6	Automatic sampler	Portable GC	1.7
03/20/2001 0750	0.51	0.500	14.5	426	7.5	Automatic sampler	Portable GC	1.7
03/20/2001 0820	0.54	0.563	14.5	424	7.5	Automatic sampler	Portable GC	1.7
03/20/2001 0849	0.59	0.668	14.5	415	7.5	Automatic sampler	Portable GC	1.8
03/20/2001 0919	0.69	0.931	14.5	405	7.4	Dip	Portable GC	1.6
03/20/2001 1000	0.97	1.914	14.0	340	7.3	Dip	Portable GC	1.3
03/20/2001 1100	1.29	3.456	12.0	225	7.3	Automatic sampler	Portable GC	1.6
03/20/2001 1200	1.47	4.510	12.5	194	7.3	Automatic sampler	Portable GC	0.75
03/20/2001 1300	1.66	5.814	12.5	199	7.3	Automatic sampler	Portable GC	0.62
03/20/2001 1400	2.73	--	12.0	198	7.3	Automatic sampler	Portable GC	0.65
03/20/2001 1500	3.44	--	11.0	189	7.3	Automatic sampler	Portable GC	0.57
03/20/2001 1600	3.93	--	9.5	181	7.4	Automatic sampler	Portable GC	0.41
03/20/2001 1700	3.92	--	9.5	177	7.4	Automatic sampler	Portable GC	0.33
03/20/2001 1800	3.32	--	9.5	180	7.4	Automatic sampler	Portable GC	0.34
03/20/2001 1900	2.47	--	10.5	202	7.3	Automatic sampler	Portable GC	0.52
03/20/2001 1959	1.47	4.521	12.5	243	7.2	Automatic sampler	Portable GC	0.74
03/20/2001 2059	1.20	2.985	13.5	257	7.2	Automatic sampler	Portable GC	0.89
03/20/2001 2159	1.13	2.657	13.5	262	7.2	Automatic sampler	Portable GC	0.91
03/20/2001 2259	1.10	2.500	13.5	271	7.2	Automatic sampler	Portable GC	0.90
03/20/2001 2359	1.06	2.314	13.5	276	7.2	Automatic sampler	Portable GC	0.86
03/21/2001 0059	1.04	2.224	13.5	280	7.2	Automatic sampler	Portable GC	0.86
03/21/2001 0300	0.98	1.967	13.5	283	7.2	Automatic sampler	Portable GC	0.84
03/21/2001 0500	0.93	1.766	13.5	288	7.2	Automatic sampler	Portable GC	0.82
03/21/2001 0700	0.88	1.577	13.5	292	7.2	Automatic sampler	Portable GC	0.86
03/21/2001 1000	0.82	1.378	13.5	296	7.2	Dip	Portable GC	0.92
03/21/2001 1400	0.77	1.195	13.5	301	7.2	Automatic sampler	Portable GC	0.89
03/21/2001 2000	0.70	0.970	13.5	307	7.2	Automatic sampler	Portable GC	0.97
03/22/2001 0200	0.64	0.802	13.5	315	7.3	Automatic sampler	Portable GC	1.0
03/22/2001 1000	0.59	0.676	13.5	332	7.3	Automatic sampler	Portable GC	1.1
03/22/2001 1759	0.56	0.607	13.5	341	7.2	Automatic sampler	Portable GC	1.1
03/23/2001 0600	0.52	0.528	13.5	347	7.3	Automatic sampler	Portable GC	1.1
03/23/2001 1200	0.51	0.500	13.5	346	7.3	Dip	Portable GC	1.2
03/28/2001 1410	0.34	0.210	14.0	413	7.6	Dip	Portable GC	1.7
04/04/2001 0010	0.23	0.095	14.0	402	7.6	Automatic sampler	Portable GC	2.3
04/04/2001 1340	0.22	0.087	14.0	435	7.6	Dip	Portable GC	2.6
04/04/2001 1410	0.22	0.087	14.0	435	7.6	Automatic sampler	Portable GC	2.5
04/04/2001 1509	0.22	0.087	14.0	435	7.7	Automatic sampler	Portable GC	2.4
04/04/2001 1709	0.24	0.107	14.0	435	7.6	Automatic sampler	Portable GC	2.6
04/04/2001 2010	0.26	0.123	14.0	433	7.6	Automatic sampler	Portable GC	2.4

Table 20. Chloroform data collected at Wilson Spring—Continued

			Water-quality characteristic			Volatile organic compound data		
Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Temperature (°C)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Chloroform (mg/L)
04/11/2001 1330	0.22	0.087	14.0	445	7.6	Dip	Portable GC	2.5
04/12/2001 0810	0.22	0.087	14.0	449	7.7	Automatic sampler	Portable GC	2.6
04/12/2001 1400	0.23	0.095	14.0	447	7.6	Dip	Portable GC	2.6
04/12/2001 2000	0.22	0.087	14.0	449	7.6	Automatic sampler	Portable GC	2.6
04/13/2001 0200	0.24	0.104	14.0	446	7.6	Automatic sampler	Portable GC	2.7
04/13/2001 0300	0.27	0.129	14.0	444	7.5	Automatic sampler	Portable GC	2.6
04/13/2001 0400	0.31	0.177	14.0	443	7.5	Automatic sampler	Portable GC	2.5
04/13/2001 0500	0.57	0.630	14.0	449	7.5	Automatic sampler	Portable GC	2.6
04/13/2001 0559	0.83	1.400	14.0	335	7.3	Automatic sampler	Portable GC	2.5
04/13/2001 0659	0.90	1.663	14.0	263	7.3	Automatic sampler	Portable GC	1.7
04/13/2001 0759	0.94	1.804	14.0	294	7.2	Automatic sampler	Portable GC	1.8
04/13/2001 0859	1.02	2.150	14.0	325	7.3	Automatic sampler	Portable GC	2.1
04/13/2001 0959	1.04	2.225	14.0	319	7.3	Automatic sampler	Portable GC	1.7
04/13/2001 1059	0.91	1.676	14.0	305	7.2	Automatic sampler	Portable GC	1.1
04/13/2001 1159	0.86	1.505	14.0	315	7.2	Dip	Portable GC	1.1
04/13/2001 1259	0.82	1.378	14.0	319	7.3	Automatic sampler	Portable GC	1.1
04/13/2001 1359	0.80	1.300	14.0	323	7.3	Automatic sampler	Portable GC	1.1
04/13/2001 1459	0.77	1.207	14.0	327	7.3	Automatic sampler	Portable GC	1.0
04/13/2001 1559	0.76	1.162	14.0	325	7.3	Automatic sampler	Portable GC	1.0
04/13/2001 1659	0.73	1.064	14.0	333	7.3	Automatic sampler	Portable GC	1.0
04/13/2001 1759	0.71	1.001	14.0	337	7.3	Automatic sampler	Portable GC	1.1
04/13/2001 1859	0.69	0.941	14.0	333	7.3	Automatic sampler	Portable GC	1.0
04/13/2001 2000	0.67	0.884	14.0	336	7.3	Automatic sampler	Portable GC	1.0
04/13/2001 2100	0.66	0.856	14.0	349	7.3	Automatic sampler	Portable GC	1.1
04/13/2001 2200	0.65	0.829	14.0	351	7.3	Automatic sampler	Portable GC	1.1
04/13/2001 2300	0.63	0.776	14.0	355	7.3	Automatic sampler	Portable GC	1.1
04/14/2001 0300	0.60	0.700	14.0	366	7.3	Automatic sampler	Portable GC	1.1
04/14/2001 0700	0.57	0.630	14.0	373	7.3	Automatic sampler	Portable GC	1.0
04/14/2001 1200	0.54	0.563	14.0	381	7.3	Dip	Portable GC	1.1
04/14/2001 1800	0.52	0.521	14.0	386	7.3	Automatic sampler	Portable GC	1.0
04/15/2001 0000	0.50	0.480	14.0	392	7.3	Automatic sampler	Portable GC	1.2
04/15/2001 0600	0.49	0.460	14.0	397	7.3	Automatic sampler	Portable GC	1.2
04/15/2001 0800	0.48	0.440	14.0	394	7.3	Automatic sampler	Portable GC	1.3
04/15/2001 1000	0.60	0.700	14.0	397	7.3	Automatic sampler	Portable GC	1.4
04/15/2001 1200	0.63	0.776	14.0	350	7.3	Automatic sampler	Portable GC	1.1
04/15/2001 1400	0.62	0.750	14.0	355	7.3	Automatic sampler	Portable GC	1.2
04/15/2001 1600	0.62	0.750	14.0	355	7.3	Automatic sampler	Portable GC	1.2
04/15/2001 1800	0.60	0.700	14.0	360	7.3	Automatic sampler	Portable GC	1.3
04/15/2001 2000	0.60	0.700	14.0	347	7.3	Automatic sampler	Portable GC	1.3
04/15/2001 2200	0.58	0.653	14.0	366	7.3	Automatic sampler	Portable GC	1.3
04/16/2001 0000	0.57	0.630	14.0	369	7.3	Automatic sampler	Portable GC	1.3

Table 20. Chloroform data collected at Wilson Spring—Continued

Date and time	Gage height (feet above datum)	Discharge (ft^3/s)	Water-quality characteristic: Temperature (°C)	Water-quality characteristic: Specific conductance (μS/cm)	Water-quality characteristic: pH (standard units)	Volatile organic compound data: Sample collection	Volatile organic compound data: Sample analysis	Volatile organic compound data: Chloroform (mg/L)
04/16/2001 0200	0.56	0.607	14.0	372	7.3	Automatic sampler	Portable GC	1.1
04/16/2001 0400	0.56	0.607	14.0	373	7.3	Automatic sampler	Portable GC	1.2
04/16/2001 0600	0.55	0.585	14.0	376	7.4	Automatic sampler	Portable GC	1.3
04/16/2001 0800	0.54	0.563	14.0	368	7.4	Automatic sampler	Portable GC	1.2
04/16/2001 1000	0.53	0.542	14.0	379	7.4	Automatic sampler	Portable GC	1.3
04/16/2001 1310	0.52	0.521	14.0	381	7.3	Dip	Portable GC	1.2
04/16/2001 1710	0.51	0.500	14.0	384	7.3	Automatic sampler	Portable GC	1.2
04/16/2001 2310	0.49	0.460	14.0	390	7.3	Automatic sampler	Portable GC	1.2
04/17/2001 0510	0.47	0.421	14.0	394	7.4	Automatic sampler	Portable GC	1.2
04/17/2001 1109	0.45	0.390	14.0	398	7.5	Automatic sampler	Portable GC	1.1
04/17/2001 1709	0.44	0.367	14.0	402	7.5	Automatic sampler	Portable GC	1.3
04/17/2001 1910	0.44	0.367	14.0	404	7.5	Automatic sampler	Portable GC	1.2
04/17/2001 2110	0.43	0.355	14.0	405	7.5	Automatic sampler	Portable GC	1.1
04/17/2001 2310	0.43	0.349	14.0	405	7.5	Automatic sampler	Portable GC	1.1
04/18/2001 0110	0.43	0.349	14.0	405	7.5	Automatic sampler	Portable GC	1.1
04/18/2001 0310	0.42	0.332	14.0	403	7.5	Automatic sampler	Portable GC	1.0
04/18/2001 0510	0.42	0.332	14.0	410	7.5	Automatic sampler	Portable GC	1.1
04/18/2001 0710	0.41	0.321	14.0	411	7.6	Automatic sampler	Portable GC	1.1
04/18/2001 1100	0.40	0.300	14.0	397	7.5	Dip	Portable GC	1.1
04/22/2001 0220	0.30	0.165	14.0	436	7.5	Automatic sampler	Portable GC	1.5
04/22/2001 0450	0.30	0.165	14.0	436	7.5	Automatic sampler	Portable GC	1.4
04/22/2001 0750	0.29	0.154	14.0	437	7.5	Automatic sampler	Portable GC	1.5
04/22/2001 1050	0.29	0.154	14.0	438	7.5	Automatic sampler	Portable GC	1.6
04/22/2001 1349	0.29	0.154	14.0	438	7.5	Automatic sampler	Portable GC	1.4
04/24/2001 1240	0.25	0.113	14.0	442	7.5	Dip	Portable GC	1.8
04/25/2001 1100	0.23	0.095	14.0	443	7.7	Dip	Portable GC	1.7
05/02/2001 0850	0.16	0.045	14.0	445	7.7	Dip	Portable GC	2.7

Table 21. Volatile organic compound data collected at Cascade Spring

[ft^3/s, cubic feet per second; ^oC, degrees Celsius; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; GC, gas chromatograph; --, no data; <, less than; NWQL, U.S. Geological Survey National Water Quality Laboratory; auto, automatic sampler; Discharge values do not include water captured by Wartrace Water System]

		Water-quality characteristic				Volatile organic compound data					
Date and time	**Discharge (ft^3/s)**	**Temperature (^oC)**	**Dissolved oxygen (mg/L)**	**Specific conductance (µS/cm)**	**pH (standard units)**	**Sample collection**	**Sample analysis**	**Tetrachloroethylene (µg/L)**	**Trichloroethylene (µg/L)**	**cis-1,2-Dichloroethylene (µg/L)**	**Chloroform (µg/L)**
03/23/2000 0945	0.88	14.5	7.7	83	6.1	Dip	Portable GC	0.35	<0.25	--	--
03/23/2000 1110	0.88	--	--	--	--	Dip	NWQL	0.40	0.18	1.2	--
04/10/2000 1044	0.70	14.5	7.7	87	6.2	Dip	Portable GC	0.26	<0.25	0.48	--
05/16/2000 1130	0.61	15.0	7.3	91	6.0	Dip	NWQL	0.36	0.19	0.88	<0.20
05/17/2000 0730	0.63	15.0	7.1	92	6.0	Dip	NWQL	0.36	0.20	0.89	<0.20
05/22/2000 1115	0.57	15.0	7.1	91	6.0	Dip	NWQL	0.47	0.24	0.93	0.21
06/20/2000 0929	0.70	15.0	6.8	90	6.0	Dip	Portable GC	0.38	<0.25	1.3	--
06/20/2000 1030	0.68	15.0	6.8	90	5.9	Dip	Portable GC	0.38	<0.25	1.2	--
06/20/2000 1130	0.68	15.0	6.8	90	5.9	Dip	NWQL	0.45	0.25	1.3	--
06/20/2000 1230	0.66	15.0	6.8	90	5.9	Dip	Portable GC	0.37	<0.25	1.2	--
06/20/2000 1330	0.64	15.0	6.8	90	5.9	Dip	Portable GC	0.42	0.54	1.4	--
06/20/2000 1430	0.64	15.0	6.8	90	5.9	Dip	Portable GC	0.45	0.30	1.2	--
06/20/2000 1530	0.63	15.0	6.8	91	5.9	Dip	Portable GC	0.45	0.29	1.2	--
06/21/2000 0730	0.63	15.0	6.8	90	5.9	Dip	Portable GC	0.50	0.40	1.3	--
07/05/2000 1500	0.61	15.0	7.0	89	5.9	Dip	Portable GC	0.63	0.20	1.4	--
07/21/2000 1045	0.64	15.0	7.0	92	5.9	Dip	Portable GC	0.51	<0.25	1.7	--
08/03/2000 1130	0.52	15.0	6.9	91	5.9	Dip	Portable GC	0.52	0.33	1.8	--
08/14/2000 0830	0.54	15.0	6.8	91	6.0	Dip	Portable GC	0.43	<0.25	1.7	--
09/13/2000 0730	0.35	15.0	7.3	92	6.0	Dip	NWQL	0.47	0.24	1.6	--
09/13/2000 0830	0.34	15.0	7.3	92	6.0	Dip	Portable GC	0.61	<0.25	1.5	--
09/13/2000 0930	0.34	15.0	7.3	92	6.0	Dip	NWQL	0.46	0.24	1.6	--
09/13/2000 1030	0.34	15.0	7.3	92	6.0	Dip	Portable GC	0.68	0.57	1.5	--
09/13/2000 1130	0.35	15.0	7.3	92	6.0	Dip	NWQL	0.49	0.25	1.7	--
09/13/2000 1230	0.35	15.0	7.3	91	6.0	Dip	Portable GC	0.64	0.48	1.5	--
09/13/2000 1330	0.35	--	--	--	--	Dip	NWQL	0.47	0.23	1.6	--
10/31/2000 1215	0.32	15.0	7.9	93	5.7	Dip	Portable GC	0.42	<0.25	1.4	--
11/08/2000 1230	0.46	15.0	7.9	95	6.1	Dip	NWQL	0.39	<0.25	1.4	--
11/09/2000 1000	0.59	15.0	7.8	93	6.1	Dip	NWQL	0.44	0.22	1.4	--
11/10/2000 0945	0.52	15.0	8.1	94	6.2	Dip	Portable GC	0.37	<0.25	1.4	--
11/13/2000 1045	0.43	15.0	8.2	95	6.3	Dip	NWQL	0.46	0.23	1.4	--
11/15/2000 1500	0.39	15.0	7.8	89	6.7	Dip	Portable GC	0.50	<0.25	1.4	--
11/24/2000 1000	0.35	15.0	8.8	92	6.7	Dip	Portable GC	0.47	<0.25	1.4	--
11/30/2000 1130	0.31	15.0	10.0	92	6.6	Dip	Portable GC	0.25	<0.25	1.4	--
12/06/2000 1330	0.35	15.0	8.9	90	6.6	Dip	Portable GC	0.27	<0.25	1.2	--
12/14/2000 0900	0.37	15.0	9.5	87	6.5	Dip	NWQL	0.41	0.21	1.1	--
12/18/2000 1200	0.44	14.5	9.9	85	6.4	Dip	Portable GC	<0.25	<0.25	1.1	--
12/27/2000 1214	0.35	15.0	7.5	93	6.2	Dip	Portable GC	0.42	<0.25	1.2	--
01/04/2001 0945	0.32	14.5	7.2	93	6.2	Dip	NWQL	0.39	0.22	1.0	--
01/10/2001 1230	0.32	14.5	7.0	93	6.3	Dip	Portable GC	0.23	<0.25	1.1	--

Table 21. Volatile organic compound data collected at Cascade Spring—Continued

		Water-quality characteristic				Volatile organic compound data					
Date and time	Discharge (ft^3/s)	Temperature (^oC)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Tetrachloroethylene (µg/L)	Trichloroethylene (µg/L)	cis-1,2-Dichloroethylene (µg/L)	Chloroform (µg/L)
01/20/2001 1615	0.66	13.0	7.7	74	6.1	Dip	Portable GC	<0.25	<0.25	0.79	--
01/26/2001 1300	0.31	14.5	7.6	88	6.1	Dip	Portable GC	<0.25	<0.25	1.1	--
02/02/2001 1045	0.36	14.5	7.7	85	6.0	Dip	Portable GC	<0.25	<0.25	1.0	--
02/08/2001 1545	0.42	14.5	7.6	84	5.8	Dip	NWQL	0.42	0.30	1.0	--
02/10/2001 0015	0.49	14.5	7.7	84	5.8	Auto	Portable GC	<0.25	<0.25	1.0	--
02/10/2001 0044	0.49	14.5	7.7	84	5.8	Auto	Portable GC	<0.25	<0.25	1.0	--
02/10/2001 0114	0.49	14.5	7.7	84	5.8	Auto	Portable GC	<0.25	<0.25	0.98	--
02/10/2001 0144	0.51	14.5	7.8	83	5.8	Auto	Portable GC	<0.25	<0.25	1.0	--
02/10/2001 0214	0.51	14.5	7.7	83	5.8	Auto	Portable GC	<0.25	<0.25	0.94	--
02/10/2001 0244	0.51	14.5	7.7	82	5.8	Auto	Portable GC	<0.25	<0.25	0.95	--
02/10/2001 0314	0.51	14.5	7.8	82	5.8	Auto	Portable GC	<0.25	<0.25	0.90	--
02/10/2001 0344	0.52	14.5	7.8	82	5.8	Auto	Portable GC	<0.25	<0.25	0.89	--
02/10/2001 0415	0.52	14.5	7.8	82	5.8	Auto	Portable GC	<0.25	<0.25	0.89	--
02/10/2001 0445	0.52	14.5	7.8	82	5.8	Auto	Portable GC	<0.25	<0.25	0.84	--
02/10/2001 0545	0.52	14.5	7.8	82	5.8	Auto	Portable GC	0.53	0.28	1.2	--
02/10/2001 0645	0.52	14.5	7.8	82	5.8	Auto	Portable GC	0.35	<0.25	1.1	--
02/10/2001 0945	0.51	14.5	7.9	81	5.8	Auto	Portable GC	0.29	<0.25	1.1	--
02/10/2001 1215	0.49	14.5	7.9	81	5.8	Dip	Portable GC	0.27	<0.25	1.0	--
02/11/2001 0015	0.49	14.5	7.9	82	5.8	Auto	Portable GC	<0.25	<0.25	1.0	--
02/11/2001 1215	0.48	14.5	8.0	82	5.8	Dip	Portable GC	<0.25	<0.25	1.0	--
02/12/2001 0015	0.51	14.5	7.9	82	5.8	Auto	Portable GC	<0.25	<0.25	1.0	--
02/12/2001 1215	0.51	14.5	7.8	82	5.8	Dip	NWQL	0.44	0.28	0.93	--
02/14/2001 1130	0.68	14.5	7.7	74	5.9	Dip	Portable GC	<0.25	<0.25	0.82	--
02/14/2001 1145	0.68	14.5	7.8	74	5.9	Auto	Portable GC	<0.25	<0.25	0.83	--
02/14/2001 1345	0.68	14.5	7.7	74	5.9	Auto	Portable GC	<0.25	<0.25	0.81	--
02/14/2001 1544	0.68	14.5	7.7	75	5.9	Auto	Portable GC	<0.25	<0.25	0.78	--
02/14/2001 1945	0.66	14.5	7.8	76	5.9	Auto	Portable GC	<0.25	<0.25	0.78	--
02/14/2001 2144	0.66	14.0	7.7	76	5.9	Auto	Portable GC	<0.25	<0.25	0.77	--
02/14/2001 2344	0.70	14.0	7.7	76	5.9	Auto	Portable GC	<0.25	<0.25	0.80	--
02/15/2001 0144	0.90	14.0	7.8	65	5.9	Auto	Portable GC	<0.25	<0.25	0.67	--
02/15/2001 0344	0.97	14.0	8.1	58	5.9	Auto	Portable GC	<0.25	<0.25	0.55	--
02/15/2001 0544	1.02	14.0	8.2	54	5.9	Auto	Portable GC	<0.25	<0.25	0.51	--
02/15/2001 0745	1.01	13.5	8.2	55	5.9	Auto	Portable GC	<0.25	<0.25	0.41	--
02/15/2001 0945	0.99	13.5	8.2	56	5.9	Auto	Portable GC	<0.25	<0.25	0.43	--
02/15/2001 1145	0.97	13.5	8.2	58	5.9	Auto	Portable GC	<0.25	<0.25	0.47	--
02/15/2001 1345	0.97	13.5	8.1	59	5.9	Auto	Portable GC	<0.25	<0.25	0.64	--
02/15/2001 1545	0.97	13.5	8.1	60	5.9	Auto	Portable GC	<0.25	<0.25	0.68	--
02/15/2001 1745	0.97	13.5	8.1	61	5.9	Auto	Portable GC	<0.25	<0.25	0.66	--
02/15/2001 1945	1.04	13.5	8.1	59	5.9	Auto	Portable GC	<0.25	<0.25	0.61	--
02/15/2001 2145	1.04	13.5	8.2	56	5.9	Auto	Portable GC	<0.25	<0.25	0.55	--

Table 21. Volatile organic compound data collected at Cascade Spring—Continued

		Water-quality characteristic				Volatile organic compound data					
Date and time	Discharge (ft^3/s)	Temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Tetrachloroethylene (µg/L)	Trichloroethylene (µg/L)	cis-1,2-Dichloroethylene (µg/L)	Chloroform (µg/L)
02/15/2001 2345	1.04	13.5	8.2	56	5.9	Auto	Portable GC	<0.25	<0.25	0.54	--
02/16/2001 0145	1.04	13.5	8.2	57	5.9	Auto	Portable GC	<0.25	<0.25	0.54	--
02/16/2001 0345	1.02	13.5	8.1	58	5.9	Auto	Portable GC	<0.25	<0.25	0.49	--
02/16/2001 0545	1.02	13.5	8.1	59	5.9	Auto	Portable GC	<0.25	<0.25	0.48	--
02/16/2001 0744	1.02	13.5	8.1	59	5.9	Auto	Portable GC	<0.25	<0.25	0.51	--
02/16/2001 0944	1.02	13.5	8.1	59	5.9	Auto	Portable GC	<0.25	<0.25	0.52	--
02/16/2001 1245	1.08	13.5	8.0	58	5.9	Dip	NWQL	0.28	0.18	0.51	--
02/16/2001 1445	1.08	13.5	8.1	56	5.9	Auto	Portable GC	<0.25	<0.25	0.57	--
02/16/2001 1545	1.13	13.5	8.1	55	5.9	Auto	Portable GC	<0.25	<0.25	0.45	--
02/16/2001 1745	1.38	13.5	8.2	46	5.8	Auto	Portable GC	<0.25	<0.25	0.37	--
02/16/2001 1945	1.29	13.5	8.4	44	5.8	Auto	Portable GC	<0.25	<0.25	0.30	--
02/16/2001 2145	1.22	13.0	8.4	47	5.9	Auto	Portable GC	<0.25	<0.25	0.38	--
02/16/2001 2345	1.18	13.0	8.4	51	5.9	Auto	Portable GC	<0.25	<0.25	0.42	--
02/17/2001 0145	1.15	13.0	8.4	53	5.9	Auto	Portable GC	<0.25	<0.25	0.45	--
02/17/2001 0345	1.15	13.0	8.3	54	5.9	Auto	Portable GC	<0.25	<0.25	0.50	--
02/17/2001 0545	1.13	13.0	8.3	55	5.9	Auto	Portable GC	<0.25	<0.25	0.49	--
02/17/2001 0745	1.13	13.0	8.3	56	5.9	Auto	Portable GC	<0.25	<0.25	0.48	--
02/17/2001 0945	1.11	13.0	8.4	56	5.9	Auto	Portable GC	<0.25	<0.25	0.48	--
02/17/2001 1245	1.09	13.0	8.3	57	5.9	Dip	Portable GC	<0.25	<0.25	0.51	--
02/17/2001 1545	1.09	13.5	8.3	58	5.9	Auto	Portable GC	<0.25	<0.25	0.80	--
02/17/2001 1845	1.09	13.5	8.3	58	5.9	Auto	Portable GC	<0.25	<0.25	0.79	--
02/18/2001 0045	1.09	13.5	8.3	60	5.9	Auto	Portable GC	<0.25	<0.25	0.78	--
02/18/2001 0645	1.08	13.5	8.3	63	5.9	Auto	Portable GC	<0.25	<0.25	0.83	--
02/18/2001 1845	1.01	13.5	8.1	67	5.9	Auto	Portable GC	<0.25	<0.25	0.88	--
02/19/2001 0645	0.95	13.5	8.1	71	5.9	Auto	Portable GC	<0.25	<0.25	0.96	--
02/20/2001 0645	0.84	14.0	7.9	77	5.9	Auto	Portable GC	<0.25	<0.25	1.0	--
02/21/2001 1315	0.76	14.0	7.8	80	6.0	Dip	Portable GC	<0.25	<0.25	0.94	--
02/22/2001 1330	0.90	14.0	7.8	75	6.0	Dip	Portable GC	<0.25	<0.25	0.83	--
02/25/2001 1315	0.90	14.0	7.7	74	6.0	Dip	Portable GC	<0.25	<0.25	0.81	--
03/02/2001 1230	0.64	14.5	7.7	86	5.9	Dip	Portable GC	<0.25	<0.25	0.83	--
03/07/2001 1115	0.57	14.5	8.1	88	6.0	Dip	Portable GC	<0.25	<0.25	0.88	--
03/15/2001 1130	0.68	14.5	7.6	88	5.9	Dip	NWQL	0.33	0.23	0.75	--
03/20/2001 1100	0.80	14.5	7.9	70	5.8	Dip	NWQL	0.31	0.22	0.58	--
03/28/2001 0800	0.30	14.5	7.8	88	6.0	Dip	Portable GC	<0.25	<0.25	0.77	--
04/04/2001 0830	0.31	14.5	7.5	89	6.0	Dip	Portable GC	<0.25	<0.25	0.82	--
04/08/2001 1230	0.24	15.0	7.6	90	6.0	Auto	Portable GC	<0.25	<0.25	1.0	--
04/08/2001 1329	0.24	15.0	7.7	91	6.0	Auto	Portable GC	<0.25	<0.25	0.96	--
04/08/2001 1429	0.24	15.0	7.6	90	6.0	Auto	Portable GC	<0.25	<0.25	0.92	--
04/08/2001 1529	0.24	15.0	7.6	91	6.0	Auto	Portable GC	<0.25	<0.25	0.91	--
04/08/2001 1629	0.24	15.0	7.6	90	6.0	Auto	Portable GC	<0.25	<0.25	0.90	--

Table 21. Volatile organic compound data collected at Cascade Spring—Continued

		Water-quality characteristic				Volatile organic compound data					
Date and time	Discharge (ft^3/s)	Temperature (^oC)	Dissolved oxygen (mg/L)	Specific conductance (μS/cm)	pH (standard units)	Sample collection	Sample analysis	Tetrachloroethylene (μg/L)	Trichloroethylene (μg/L)	cis-1,2-Dichloroethylene (μg/L)	Chloroform (μg/L)
04/08/2001 1729	0.24	15.0	7.5	90	6.0	Auto	Portable GC	<0.25	<0.25	0.82	--
04/08/2001 1829	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.86	--
04/08/2001 1929	0.24	15.0	7.6	91	6.0	Auto	Portable GC	<0.25	<0.25	0.84	--
04/08/2001 2029	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.82	--
04/08/2001 2129	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.79	--
04/08/2001 2229	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.81	--
04/08/2001 2329	0.24	15.0	7.5	90	6.0	Auto	Portable GC	<0.25	<0.25	0.77	--
04/09/2001 0029	0.24	15.0	7.4	91	6.0	Auto	Portable GC	<0.25	<0.25	0.79	--
04/09/2001 0229	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.77	--
04/09/2001 0429	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.72	--
04/09/2001 0629	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.83	--
04/09/2001 0829	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.79	--
04/09/2001 1029	0.24	15.0	7.5	91	6.0	Auto	Portable GC	<0.25	<0.25	0.74	--
04/12/2001 1400	0.25	15.0	7.6	92	6.0	Dip	Portable GC	<0.25	<0.25	0.77	--
04/12/2001 2100	0.28	15.0	7.4	90	6.0	Auto	Portable GC	<0.25	<0.25	0.87	--
04/12/2001 2200	0.29	15.0	7.4	89	6.0	Auto	Portable GC	<0.25	<0.25	0.70	--
04/12/2001 2300	0.30	15.0	7.4	89	6.0	Auto	Portable GC	<0.25	<0.25	0.72	--
04/12/2001 2359	0.31	15.0	7.4	89	6.0	Auto	Portable GC	<0.25	<0.25	0.67	--
04/13/2001 0059	0.32	15.0	7.3	87	6.0	Auto	Portable GC	<0.25	<0.25	0.63	--
04/13/2001 0159	0.34	15.0	7.3	87	6.0	Auto	Portable GC	<0.25	<0.25	0.62	--
04/13/2001 0259	0.36	15.0	7.3	86	6.0	Auto	Portable GC	<0.25	<0.25	0.61	--
04/13/2001 0359	0.39	15.0	7.3	85	6.0	Auto	Portable GC	<0.25	<0.25	0.64	--
04/13/2001 0459	0.51	15.0	7.2	84	6.0	Auto	Portable GC	<0.25	<0.25	0.63	--
04/13/2001 0600	0.68	15.0	7.3	77	6.0	Auto	Portable GC	<0.25	<0.25	0.81	--
04/13/2001 0700	0.76	15.0	7.3	70	6.0	Auto	Portable GC	<0.25	<0.25	0.73	--
04/13/2001 0800	0.78	15.0	7.3	67	5.9	Auto	Portable GC	<0.25	<0.25	0.70	--
04/13/2001 0900	0.78	15.0	7.4	66	5.9	Auto	Portable GC	<0.25	<0.25	0.67	--
04/13/2001 1000	0.78	15.0	7.4	65	5.9	Auto	Portable GC	<0.25	<0.25	0.64	--
04/13/2001 1100	0.78	15.0	7.5	66	6.0	Auto	Portable GC	<0.25	<0.25	0.63	--
04/13/2001 1159	0.76	15.0	7.4	67	6.0	Auto	Portable GC	<0.25	<0.25	0.62	--
04/13/2001 1259	0.76	14.5	7.5	67	6.0	Auto	Portable GC	<0.25	<0.25	0.57	--
04/13/2001 1359	0.78	14.5	7.5	67	6.0	Dip	Portable GC	0.27	0.19	0.57	--
04/13/2001 1459	0.80	14.5	7.4	68	6.0	Auto	Portable GC	<0.25	<0.25	0.54	--
04/13/2001 1559	0.78	14.5	7.4	69	6.0	Auto	Portable GC	<0.25	<0.25	0.56	--
04/13/2001 1659	0.78	14.5	7.4	69	6.0	Auto	Portable GC	<0.25	<0.25	0.57	--
04/13/2001 1759	0.78	14.5	7.4	70	6.0	Auto	Portable GC	<0.25	<0.25	0.54	--
04/13/2001 1859	0.76	14.5	7.4	70	6.0	Auto	Portable GC	<0.25	<0.25	0.55	--
04/13/2001 2000	0.76	14.5	7.4	70	6.0	Auto	Portable GC	<0.25	<0.25	0.54	--
04/13/2001 2100	0.76	14.5	7.4	71	5.9	Auto	Portable GC	<0.25	<0.25	0.58	--
04/13/2001 2200	0.76	14.5	7.4	71	5.9	Auto	Portable GC	<0.25	<0.25	0.61	--

Table 21. Volatile organic compound data collected at Cascade Spring—Continued

		Water-quality characteristic				Volatile organic compound data					
Date and time	Discharge (ft^3/s)	Temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	pH (standard units)	Sample collection	Sample analysis	Tetrachloroethylene (µg/L)	Trichloroethylene (µg/L)	cis-1,2-Dichloroethylene (µg/L)	Chloroform (µg/L)
04/13/2001 2300	0.76	14.5	7.4	71	5.9	Auto	Portable GC	<0.25	<0.25	0.54	--
04/14/2001 0000	0.74	14.5	7.3	71	5.9	Auto	Portable GC	<0.25	<0.25	0.54	--
04/14/2001 0100	0.72	14.5	7.4	72	5.9	Auto	Portable GC	<0.25	<0.25	0.53	--
04/14/2001 0200	0.70	14.5	7.3	72	5.9	Auto	Portable GC	<0.25	<0.25	0.55	--
04/14/2001 0300	0.70	14.5	7.3	72	5.9	Auto	Portable GC	<0.25	<0.25	0.55	--
04/14/2001 0400	0.68	14.5	7.3	72	5.9	Auto	Portable GC	<0.25	<0.25	0.54	--
04/14/2001 0500	0.68	14.5	7.3	72	5.9	Auto	Portable GC	<0.25	<0.25	0.54	--
04/14/2001 0700	0.66	14.5	7.3	73	5.9	Auto	Portable GC	<0.25	<0.25	0.53	--
04/14/2001 0859	0.64	14.5	7.4	74	5.9	Auto	Portable GC	<0.25	<0.25	0.55	--
04/14/2001 1000	0.64	14.5	7.4	74	5.9	Dip	Portable GC	<0.25	<0.25	0.61	--
04/14/2001 1200	0.63	14.5	7.4	74	5.9	Auto	Portable GC	<0.25	<0.25	0.66	--
04/14/2001 1600	0.59	14.5	7.4	76	5.9	Auto	Portable GC	<0.25	<0.25	0.69	--
04/14/2001 2000	0.56	14.5	7.3	76	5.9	Auto	Portable GC	<0.25	<0.25	0.68	--
04/14/2001 2359	0.52	14.5	7.3	77	5.9	Auto	Portable GC	<0.25	<0.25	0.69	--
04/15/2001 0600	0.51	14.5	7.2	79	5.9	Auto	Portable GC	<0.25	<0.25	0.71	--
04/15/2001 1200	0.64	14.5	7.2	78	5.9	Auto	Portable GC	<0.25	<0.25	0.70	--
04/15/2001 1800	0.66	14.5	7.3	78	5.9	Auto	Portable GC	<0.25	<0.25	0.68	--
04/16/2001 0000	0.66	14.5	7.3	79	5.9	Auto	Portable GC	<0.25	<0.25	0.73	--
04/16/2001 1100	0.66	15.0	7.4	81	5.9	Dip	Portable GC	<0.25	<0.25	0.64	--
04/16/2001 1300	0.64	15.0	7.4	81	5.9	Auto	Portable GC	<0.25	<0.25	0.62	--
04/16/2001 1500	0.63	15.0	7.4	81	5.9	Auto	Portable GC	<0.25	<0.25	0.62	--
04/16/2001 1900	0.59	14.5	7.3	81	5.9	Auto	Portable GC	<0.25	<0.25	0.60	--
04/16/2001 2100	0.56	15.0	7.3	81	5.9	Auto	Portable GC	<0.25	<0.25	0.61	--
04/17/2001 0300	0.57	14.5	7.3	82	5.9	Auto	Portable GC	<0.25	<0.25	0.69	--
04/17/2001 1100	0.49	15.0	7.5	82	5.9	Auto	Portable GC	<0.25	<0.25	0.67	--
04/17/2001 1900	0.46	15.0	7.5	83	5.9	Auto	Portable GC	<0.25	<0.25	0.67	--
04/18/2001 0700	0.46	14.5	7.6	84	5.9	Auto	Portable GC	<0.25	<0.25	0.67	--
04/18/2001 1200	0.39	15.0	7.7	83	5.9	Dip	Portable GC	<0.25	<0.25	0.68	--
04/22/2001 2344	0.27	15.0	7.7	88	5.9	Auto	Portable GC	<0.25	<0.25	0.93	--
04/23/2001 0344	0.29	15.0	7.7	88	5.9	Auto	Portable GC	<0.25	<0.25	0.89	--
04/23/2001 0744	0.29	15.0	7.7	88	5.9	Auto	Portable GC	<0.25	<0.25	0.86	--
04/23/2001 1144	0.28	15.0	7.9	88	5.9	Auto	Portable GC	<0.25	<0.25	0.87	--
04/23/2001 1544	0.27	15.0	7.8	88	5.9	Auto	Portable GC	<0.25	<0.25	0.85	--
04/23/2001 2144	0.27	15.0	7.8	88	5.9	Auto	Portable GC	<0.25	<0.25	0.85	--
04/25/2001 0859	0.31	15.0	7.8	89	5.9	Dip	Portable GC	<0.25	<0.25	0.93	--
04/30/2001 2014	0.28	15.0	7.9	90	5.8	Auto	Portable GC	<0.25	<0.25	0.85	--
05/01/2001 1514	0.26	15.0	7.9	90	5.8	Auto	Portable GC	<0.25	<0.25	0.84	--
05/01/2001 1814	0.26	15.0	7.8	90	5.8	Auto	Portable GC	<0.25	<0.25	0.82	--
05/02/2001 1159	0.26	15.0	7.8	90	5.8	Dip	NWQL	0.32	0.25	0.92	--

Table 22. Volatile organic compound data collected at Big Spring

[°C, degrees Celsius; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; µg/L, micrograms per liter; NWQL, U.S. Geological Survey National Water Quality Laboratory; GC, gas chromatograph; <, less than; --, no data; All samples were collected using dip-sampling methods]

		Water-quality characteristic				Volatile organic compound data							
Date and time	Gage height (feet above datum)	Temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	pH (standard units)	Sample analysis	Tetrachloroethylene (µg/L)	Trichloroethylene (µg/L)	cis-1,2-Dichloroethylene (µg/L)	1,1-Dichloroethylene (µg/L)	1,1,1-Trichloroethane (µg/L)	Trichlorofluoromethane (µg/L)	1,1,2-Trichlorotrifluoroethane (µg/L)
03/23/2000 0945	2.04	14.0	7.8	144	6.8	NWQL	2.7	8.5	0.20	0.95	0.59	1.3	0.16
04/10/2000 1330	2.02	14.0	8.0	148	6.7	Portable GC	3.1	8.8	<0.25	--	--	--	--
05/16/2000 1145	2.00	14.0	7.7	148	7.0	NWQL	2.1	7.3	<0.20	0.64	0.41	0.82	<0.20
05/17/2000 0700	1.99	14.0	7.2	149	6.9	NWQL	2.3	7.8	<0.20	0.78	0.44	1.1	<0.20
05/22/2000 1200	2.02	14.0	7.8	148	6.9	NWQL	2.8	10.0	0.15	0.80	0.57	1.5	0.20
06/20/2000 0845	--	14.5	7.8	152	6.9	Portable GC	2.2	7.3	<0.25	0.40	--	--	--
06/20/2000 1000	--	14.5	7.8	152	6.9	NWQL	2.6	8.6	0.15	0.77	0.52	1.1	0.16
06/20/2000 1130	--	14.5	7.7	152	7.0	Portable GC	2.2	7.2	<0.25	1.1	0.48	--	--
06/20/2000 1230	--	14.5	7.8	152	7.0	Portable GC	2.1	7.1	<0.25	1.1	0.43	--	--
06/20/2000 1330	--	14.5	7.7	152	7.0	Portable GC	2.0	7.0	<0.25	1.0	0.44	--	--
06/20/2000 1430	--	14.5	7.7	152	7.0	Portable GC	2.2	7.0	<0.25	--	0.40	--	--
06/21/2000 0815	--	14.5	7.6	152	6.9	Portable GC	2.3	7.7	<0.25	1.4	0.40	--	--
07/05/2000 1430	2.00	14.5	7.7	156	6.9	Portable GC	2.3	7.4	<0.25	1.1	0.35	--	--
07/24/2000 1030	1.99	14.5	7.6	153	6.9	Portable GC	2.9	7.7	<0.25	2.0	0.33	--	--
07/31/2000 0930	1.97	14.5	7.8	155	6.9	Portable GC	2.4	7.2	<0.25	0.99	0.56	--	--
08/03/2000 1000	1.97	14.5	7.9	155	7.0	Portable GC	2.5	7.9	<0.25	0.81	0.34	--	--
08/07/2000 1630	1.96	14.5	7.9	156	7.0	Portable GC	2.9	8.4	<0.25	2.2	0.47	--	--
08/11/2000 1029	1.96	14.5	8.0	157	7.0	Portable GC	2.3	8.0	<0.25	0.94	0.59	--	--
08/14/2000 0830	1.97	14.5	7.3	157	6.8	Portable GC	2.7	8.4	<0.25	1.0	0.65	--	--
09/13/2000 0800	1.96	--	--	--	--	NWQL	3.1	11.0	0.17	0.96	0.64	1.6	0.16
09/13/2000 0900	1.96	--	--	--	--	Portable GC	2.9	9.4	<0.25	1.4	0.60	--	--
09/13/2000 1000	1.96	--	--	--	--	NWQL	2.9	10.0	0.17	0.88	0.61	1.3	0.15
09/13/2000 1100	1.96	--	--	--	--	Portable GC	2.8	8.9	<0.25	1.2	0.54	--	--
09/13/2000 1200	1.96	--	--	--	--	NWQL	2.9	10.0	0.17	0.85	0.59	1.3	0.15
09/13/2000 1300	1.96	--	--	--	--	Portable GC	2.5	8.3	<0.25	1.2	0.46	--	--

Table 22. Volatile organic compound data collected at Big Spring—Continued

		Water-quality characteristic				Volatile organic compound data							
Date and time	Gage height (feet above datum)	Temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	pH (standard units)	Sample analysis	Tetrachloroethylene (µg/L)	Trichloroethylene (µg/L)	cis-1,2-Dichloroethylene (µg/L)	1,1-Dichloroethylene (µg/L)	1,1,1-Trichloroethane (µg/L)	Trichlorofluoromethane (µg/L)	1,1,2-Trichlorotrifluoroethane (µg/L)
09/13/2000 1400	1.96	--	--	--	--	NWQL	2.8	10.0	0.19	0.84	0.59	1.4	0.15
10/31/2000 1045	--	14.5	8.1	159	6.8	Portable GC	3.6	9.2	<0.25	1.0	0.78	--	--
11/08/2000 1315	1.96	14.5	8.3	163	6.8	Portable GC	3.6	9.3	<0.25	1.0	0.66	--	--
11/10/2000 0915	1.96	14.5	8.4	163	6.8	Portable GC	3.8	9.7	<0.25	1.2	0.79	--	--
11/15/2000 1714	1.95	14.5	8.5	160	7.0	Portable GC	3.5	9.2	<0.25	1.1	0.74	--	--
11/24/2000 0930	1.95	14.5	8.2	162	6.9	Portable GC	3.5	9.2	<0.25	0.96	0.72	--	--
11/30/2000 1100	1.96	14.5	8.6	163	6.9	Portable GC	3.2	8.5	<0.25	0.90	0.81	--	--
12/06/2000 1515	1.96	14.5	8.4	163	6.8	Portable GC	3.1	8.6	<0.25	0.85	0.56	--	--
12/14/2000 0945	1.96	14.5	8.4	161	7.1	NWQL	3.0	11.0	0.22	0.93	0.56	1.3	0.17
12/18/2000 0500	2.00	14.5	8.8	160	7.1	Portable GC	3.0	8.4	<0.25	0.85	0.51	--	--
12/27/2000 1230	1.96	14.5	8.2	158	6.9	Portable GC	3.1	8.0	<0.25	0.76	0.44	--	--
01/04/2001 1030	1.95	14.5	8.2	157	6.9	NWQL	2.6	10.0	0.19	0.84	0.47	1.2	0.12
01/10/2001 1045	1.93	14.5	8.1	158	6.9	Portable GC	3.0	7.8	<0.25	0.73	0.37	--	--
01/20/2001 1645	1.95	14.0	8.2	155	6.8	Portable GC	2.8	6.9	<0.25	0.65	<0.25	--	--
01/26/2001 1330	1.92	14.5	8.3	154	6.8	Portable GC	2.7	7.1	<0.25	0.71	0.27	--	--
02/02/2001 1000	1.93	14.5	8.4	152	6.9	Portable GC	2.8	7.3	<0.25	0.72	0.31	--	--
02/08/2001 1030	1.93	14.5	7.7	151	6.5	NWQL	3.2	11.0	0.20	0.95	0.57	1.6	0.22
02/16/2001 1330	1.96	14.0	7.6	152	6.7	NWQL	2.9	9.8	0.15	0.81	0.51	1.5	0.20
02/17/2001 1330	1.97	14.0	8.2	150	6.8	Portable GC	2.7	6.9	<0.25	0.72	<0.25	--	--
02/20/2001 1215	1.94	14.0	7.7	150	6.7	Portable GC	2.9	7.6	<0.25	0.80	<0.25	--	--
03/02/2001 1100	1.93	14.0	7.4	148	6.6	Portable GC	3.0	7.7	<0.25	0.81	<0.25	--	--
03/07/2001 1200	1.94	14.0	8.1	149	6.8	Portable GC	2.9	7.2	<0.25	0.87	<0.25	--	--
03/15/2001 1030	1.93	14.0	7.6	149	6.8	NWQL	2.7	9.2	0.17	0.88	0.46	1.4	0.15
03/21/2001 1445	1.96	14.0	7.7	147	6.5	Portable GC	2.3	6.1	<0.25	0.66	<0.25	--	--
03/28/2001 0700	1.93	14.0	8.4	149	6.7	Portable GC	2.3	6.2	<0.25	0.62	<0.25	--	--
04/04/2001 0800	1.96	14.0	8.1	150	6.6	Portable GC	2.5	6.4	<0.25	0.67	<0.25	--	--
04/11/2001 1700	1.95	14.0	8.2	150	6.7	Portable GC	2.1	5.6	<0.25	0.54	<0.25	--	--
04/18/2001 1345	1.96	14.0	8.1	149	6.5	Portable GC	2.5	6.3	<0.25	0.67	<0.25	--	--
04/25/2001 0800	1.95	14.0	8.3	148	6.5	NWQL	2.5	8.5	0.18	0.85	0.48	1.2	0.14
05/02/2001 1330	1.93	14.0	8.3	149	6.6	NWQL	2.1	7.6	0.17	0.69	0.41	0.89	0.12