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Ground-Water Hydrology and Water-Quality Data for Wells, Springs, and Surface-Water Sites in the Bradley-Brumalow Creeks Area near Arnold Air Force Base, Tennessee, September to December 1999

Open-File Report 01-40

U.S. Department of the Interior
U.S. Geological Survey

Cover photo: A large unnamed spring (SP-A-06) at Bradley Creek (site 261, figure 4 and table 2).

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By ROBERT A. AYCOCK and CONNOR J. HAUGH

U.S.GEOLOGICAL SURVEY

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Nashville, Tennessee
2001

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

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Denver, Colorado 80225

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CONVERSION FACTORS, VERTICAL DATUM, AND SITE-NUMBERING SYSTEM

Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
acre	4,047	square kilometer
acre	0.4047	hectare
square mile (mi^2)	2.590	square kilometer
gallon per minute (gal/min)	0.06308	liter per second

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

°F = 1.8 °C + 32
°C = 5/9 (°F - 32)

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

Site-numbering system for wells: In addition to the field ID, the U.S. Geological Survey assigns each site listed in this report a local Tennessee well number and a station identification number. The local well number is used as a concise label for a site. The station identification number is used as an identifier for site data stored in the national computer data base of the U.S. Geological Survey.

The local well number in Tennessee consists of three parts: (1) an abbreviation of the name of the county in which the well is located, (2) a letter designating the 7.5-minute topographic quadrangle on which the well is plotted, and (3) a number generally indicating the numerical order in which the well is inventoried. The symbol Cf:G-010, for example, indicates that the well is located in Coffee County on the "G" quadrangle and is identified as well 10 in the numerical sequence. Quadrangles are lettered from left to right, beginning in the southwest corner of the county.

The station identification number is a unique number for each site based on a latitude and longitude grid system. The number consists of 15 digits. The first 6 digits denote the degrees, minutes, and seconds of latitude; the next 7 digits denote degrees, minutes, and seconds of longitude; and the last 2 digits (assigned sequentially) identify the wells within a 1-second grid.

Site numbering system for surface-water sites: Each surface-water station in this report is assigned a unique identification number. The number is assigned when a station is first established and is retained for that station indefinitely. The station numbers indicate downstream-order position. A station on a tributary that enters between two mainstream stations is assigned a number between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries.

Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete number for each station such as 03540500, includes a 2-digit part number "03" plus the multi-digit downstream order number "540500." This downstream numbering system is used in most cases; however, in some cases latitude and longitude numbers are assigned to hydrologic stations as a means of identification.

Ground-Water Hydrology and Water-Quality Data for Wells, Springs, and Surface-Water Sites in the Bradley-Brumalow Creeks Area near Arnold Air Force Base, Tennessee, September to December 1999

By Robert A. Aycock *and* Connor J. Haugh

EXECUTIVE SUMMARY

Arnold Air Force Base (AAFB) occupies about 40,000 acres in Coffee and Franklin Counties, Tennessee. The primary mission of AAFB is to support the development of aerospace systems. This mission is accomplished through test facilities at Arnold Engineering Development Center (AEDC), which occupies about 4,000 acres in the center of AAFB.

Several synthetic volatile organic compounds (VOC's), primarily chlorinated solvents, have been identified in ground-water samples at AEDC. Private ground-water supplies in the Bradley-Brumalow Creeks area are hydraulically downgradient from AEDC and could be affected by transport of VOC's in the ground water at AEDC.

From September to December 1999, a comprehensive investigation of the ground-water resources in the Bradley-Brumalow Creeks area was conducted to determine if VOC's from AEDC have affected local private water supplies and to advance understanding of the ground-water-flow system in this area. The investigation focused on locating and sampling all private water wells and springs located within the Bradley-Brumalow Creeks area that are used as a source of drinking water, though not all of the wells and springs sampled are currently used as a source of drinking water. Ground-water-flow directions were investigated by conducting base-flow stream measurements, measuring water levels in wells, and constructing a potentiometric-surface map of the Manchester aquifer in the study area. Data were collected from a total of 150 private and 88 monitoring wells during the course of the study. Depths to ground water were determined for 103 of the private wells and 86 of the monitoring wells. The wells ranged in depth from 14 to 167 feet deep. Water-level altitudes ranged from 946 to 1,081 feet above sea level. Depths to water ranged from 3 to 93 feet below land surface. Water-quality samples were collected from all 150 private wells that draw water from the Manchester aquifer.

Additionally, a reconnaissance of 8 springs and 33 surface-water sites was conducted in the Bradley-Brumalow Creeks area. Discharge measurements were made at 5 of the 8 springs and all 33 of the surface-water sites as part of the regional base-flow component of the study. Water-quality samples were collected at 8 of the springs and 9 of the surface-water sites.

Water-level-altitude data collected from wells and base-flow data collected from streams and springs were used to construct a regional potentiometric-surface map of the Manchester aquifer in the study area. Several notable features are illustrated on the map, including a ground-water divide that roughly follows the regional surface-water divide, a "saddle" along the ground-water divide lying northeast of AEDC, and two prominent ground-water "troughs" (valleys) extending east and southeast from the divide toward Bradley Creek.

Water-quality samples collected from the 150 private wells, 8 springs, and 9 surface-water sites in the Bradley-Brumalow Creeks area were analyzed for major ions and VOC's. The sampled water is predominantly of the calcium bicarbonate type. Specific conductance for sampled water ranged from 10 to 788 microsiemens per centimeter (μS/cm), with a median of 104 μS/cm. The range and median value for pH in sampled water were 4.5 to 8.0, and 6.3, respectively.

Concentrations of most of the VOC's analyzed for were less than detection limits. None of the sample results exceed drinking water maximum contaminant levels for public water systems. However, some compounds were detected in concentrations exceeding analytical reporting levels. Two wells produced samples containing toluene in concentrations of 1.4 and 1.3 μg/L. Chloroform also was detected in the sample from another well at a concentration of 2.4 μg/L.

Other contaminants of concern were detected in estimated concentrations less than their reporting limits, referred to as estimated values. Samples from three wells showed the presence of tetrachloroethylene (PCE). Estimated concentrations of PCE in the samples ranged from 0.13 to 0.74 μg/L. Trichloroethylene (TCE) was detected in a sample from one of the three wells (0.35 μg/L). 1,1,1-Trichloroethane (1,1,1-TCA) was detected in another well (0.13 μg/L). Dichlorodifluoromethane was detected in samples from three other wells. Estimated concentrations of dichlorodifluoromethane ranged from 0.23 to 1.1 μg/L. Samples from another well, a spring, and a surface-water station also showed the presence of trace amounts of toluene. Estimated concentrations of toluene ranged from 0.11 to 0.47 μg/L. Benzene was detected in a sample from one well at an estimated concentration of 0.18 μg/L. Xylenes and ethylbenzene were detected in the samples from another well at estimated concentrations of 0.38 and 0.1 μg/L, respectively. For the VOC's detected, the frequency of detections and median concentrations are compared to data from ambient rural ground water. Most of these volatile organic compounds, particularly the chlorinated solvents PCE, TCE, and 1,1,1-TCA, occur at concentrations above these ambient levels in the ground water at several solid waste management unit sites at AAFB. Collectively, data obtained during the study can aid in the understanding of regional ground-water-flow pathways and their relation to activities at AAFB.

INTRODUCTION

Arnold Air Force Base (AAFB) occupies about 40,000 acres in Coffee and Franklin Counties, Tennessee (fig. 1). The primary mission of AAFB is to support the development of aerospace systems. This mission is accomplished in part through test facilities at Arnold Engineering Development Center (AEDC), which occupies about 4,000 acres in the center of AAFB.

Numerous site-specific ground-water-contamination investigations have been conducted at designated solid waste management units (SWMU's) at AAFB. Several synthetic volatile organic compounds (VOC's), primarily chlorinated solvents, have been identified in the ground water at AEDC. Private water wells in the Bradley-Brumalow Creeks study area (fig. 1) are located hydraulically downgradient from AEDC and could be affected by transport of VOC's in the ground water at AEDC. The U.S. Geological Survey (USGS), in cooperation with the U.S. Air Force, Arnold Air Force Base, conducted a comprehensive study of the ground-water resources in the Bradley-Brumalow Creeks area. The objectives of the study were to (1) determine if VOC's in ground water from AEDC have affected private water supplies in the Bradley-Brumalow Creeks area, and (2) advance understanding of the ground-water-flow system on the eastern side of AEDC. The study area is located northeast, east, southeast, and south of AEDC, and lies almost exclusively in the Elk River drainage basin (fig. 1). All identified wells and springs used for private water supply within this area and selected locations on local streams were sampled for VOC's and major ions commonly found in ambient water.

Purpose and Scope

This report documents (1) water-level measurements made in and water-quality analyses of samples from 150 private wells in the Bradley-Brumalow Creeks area; (2) water levels measured in 86 existing

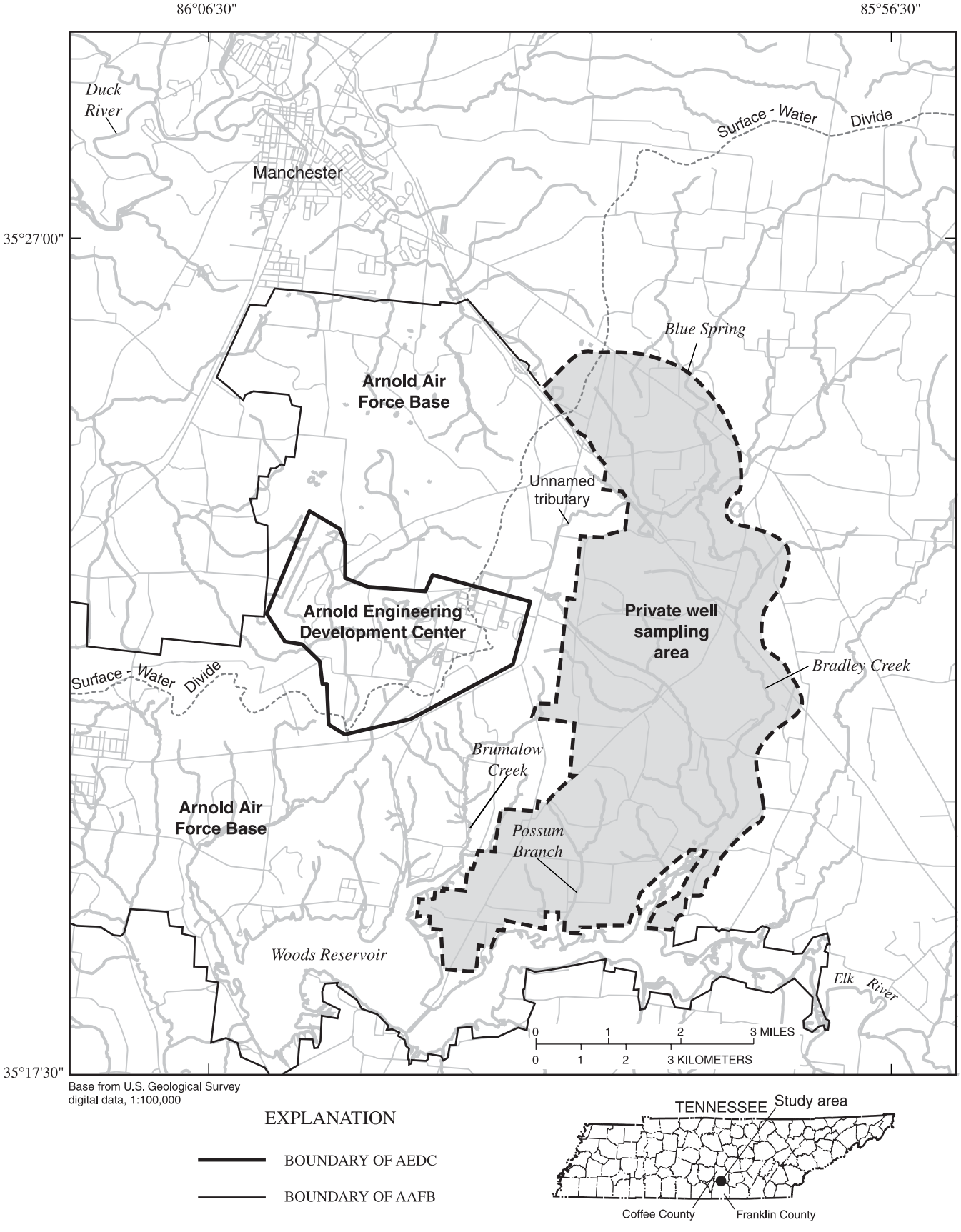


Figure 1. Location of the study area in Middle Tennessee.

monitoring wells located primarily at AAFB; and (3) discharge measurements made in and water-quality analyses of samples collected from 8 area springs and 33 surface-water sites. The data for the study was collected from September to December 1999.

The study focused on locating and sampling all private water wells and springs within the Bradley-Brumalow Creeks area that are used as a source of drinking water, though not all of the wells and springs sampled are currently (1999) used as sources of drinking water. Other tasks included conducting a thorough field reconnaissance to locate and map springs, measuring the discharge of springs and streams during base-flow conditions, and sampling a representative number of the surface-water sites. Information concerning water-well construction details and ground-water altitude data also were collected during the investigation. These data will help to refine the existing regional ground-water-flow-system map (Mahoney and Robinson, 1993). Collectively, the comprehensive results of the investigation may provide an important benefit by aiding future site-specific ground-water contamination investigations and long-term monitoring plans for AAFB.

Study Area

The AAFB area lies on the eastern Highland Rim physiographic region of Tennessee (Miller, 1974) and ranges from poorly drained, flat uplands to valley-dissected, sloping escarpments. A major surface-water divide separating the Duck and Elk River drainage basins bisects AAFB extending from southwest to northeast (fig. 1). Land-surface elevations range from 1,120 feet above sea level at the crest of the drainage divide to about 960 feet near Woods Reservoir (fig. 1).

The study area includes the eastern part of AAFB and the private well sampling area. The boundaries of the private well sampling area were chosen to encompass all ground-water users from the eastern edge of AAFB to the regional ground-water discharge points (Arnold Air Force Base staff, written commun., 1999). Data from Mahoney and Robinson (1993) and Haugh and Mahoney (1994) were evaluated to define the northern, eastern, and southern boundaries of the private well sampling area. The data included (1) size and location of surface-water drainage basins, (2) local and regional dip of the geologic formations, (3) orientations of fracture traces, (4) elevation of the bedrock surface, (5) regional flow directions, (6) flow boundaries, and (7) discharge points for ground water. Ground-water supplies located between the AEDC ground-water recharge area and ground-water discharge points along the Elk River and its tributaries were investigated. Because of the karstic nature of the hydrogeology in the area, all identified ground-water supplies in the private well sampling area were sampled.

The western and southern private well sampling area boundaries abut part of the AAFB property line. Regional ground-water potentiometric-surface altitudes, combined with base-flow elevations in Brumalow and Bradley Creeks, indicate that Woods Reservoir is the southern flow boundary of the ground-water basin (Haugh and Mahoney, 1994). The locations of western and southern boundaries ensure that private water supplies situated between the ground-water recharge area at AEDC and the ground-water-flow boundary and discharge points along Woods Reservoir were sampled.

The eastern private well sampling area boundary is located 2,000 feet east of and parallel to Bradley Creek (fig. 1). Monitoring-well and spring data indicate that Bradley Creek is a discharge boundary of the ground-water basin where AEDC is located. Water-level measurements in monitoring wells on both sides of Bradley Creek show upward gradients and indicate that ground-water flow is toward the creek from either side (Haugh and Mahoney, 1994). Large springs near Bradley Creek indicate upward ground-water-flow gradients. This eastern boundary accommodates any private wells that may divert part of the ground-water flow to the other side of Bradley Creek as a result of pumping. A distance of 2,000 feet was chosen based on Manchester aquifer pumping tests from previous studies conducted throughout AAFB. Notable drawdown during these tests occurred at a distance of 1,000 feet or less from the pumping wells. Monitoring-well development activities indicate hydraulic influences to a distance of 500 feet from the wells (Arnold Air Force Base staff, written commun., 1999).

The northern private well sampling area boundary encompasses an unnamed tributary of Bradley Creek with headwaters at AEDC (fig. 1). The northern boundary encompasses the Elk River-Duck River drainage divide located between AEDC and Blue Spring, and crosses Blue Spring. The northern boundary is upgradient from AEDC with respect to regional ground-water flow (Mahoney and Robinson,

1993; Haugh and Mahoney, 1994). Blue Spring drains areas north of the study area boundary.

Hydrogeologic Setting

The AAFB area is located in a fractured carbonate terrane covered by regolith derived from the in-situ weathering of Mississippian-age carbonates. These units comprise (in descending order): the St. Louis Limestone, the Warsaw Limestone, and the Fort Payne Formation (fig. 2; Wilson, 1976). Regolith in the AAFB area is typically 10 to 100 feet thick and consists primarily of clayey chert rubble with some silt and sand. Typically, the regolith grades upward from gravel-size chert rubble at the top of bedrock to clay-size chert particles with silt, sand, and clay at land surface (Burchett, 1977). Bedrock underlying the regolith consists of the Fort Payne Formation, which is an indurated siliceous limestone containing many chert nodules and platy chert stringers. The bedrock in the AAFB area is generally 20 to 230 feet thick. The upper part of the bedrock contains many fractures and solution openings. Underlying the Fort Payne Formation is the Chattanooga Shale, which consists of 20 to 30 feet of fissile, black, carbonaceous shale. The Chattanooga Shale is considered to be the base of the fresh ground-water system in the study area (Haugh and Mahoney, 1994; Haugh, 1996a).

The ground-water system above the Chattanooga Shale can be divided into three different zones or aquifers (Haugh and Mahoney, 1994): the shallow aquifer, the Manchester aquifer, and the Fort Payne aquifer (fig. 2). The aquifers differ from one another in degree of weathering, amount of chert, and type of weathering product. The aquifers are not separated by confining units of any significant lateral extent; therefore, water is free to flow between these zones at most locations. The shallow aquifer is described as alluvium, residual silt, clay, sand, and clay-size chert particles of the upper part of the regolith; is not continuous throughout the AAFB area; and is perched at some locations. The Manchester aquifer, the primary source of drinking water in the area, consists of chert rubble at the base of the regolith and solution openings in the upper part of the bedrock (Burchett and Hollyday, 1974). The Fort Payne aquifer corresponds to the lower part of the Fort Payne Formation where solution openings are less developed. The base of the Fort Payne aquifer is the Chattanooga Shale (Haugh and Mahoney, 1994; Haugh, 1996a).

Much of the study area for this investigation is located downgradient from AEDC with respect to surface-water and regional ground-water flow. The

Stratigraphy	Thickness, in feet	Lithology	Hydrogeologic unit	Hydrogeologic unit—alternate designation
Regolith derived from in-situ weathering of the St. Louis Limestone, Warsaw Limestone, or Fort Payne Formation	10-100	Clay, silt, and sand with some chert and rock fragments.	Shallow aquifer	Shallow aquifer
		Rock fragments, chert gravel, and rubble with some clay.	Manchester aquifer, upper part	Intermediate aquifer
Fort Payne Formation	20-230	Fractured and dissolutioned cherty limestone and siltstone.	Manchester aquifer, lower part	Deep aquifer
		Dark gray siltstone; dense, cherty limestone; and bedded chert. Few fractures.	Fort Payne aquifer	
Chattanooga Shale	20-30	Dark grayish black, carbonaceous shale.	Chattanooga confining unit	Chattanooga confining unit

Figure 2. Stratigraphy, lithology, and hydrogeologic units for the Arnold Air Force Base area, Tennessee. (Modified from Haugh and Mahoney, 1994.)

surface-water drainage divide of the Duck and Elk Rivers passes through AEDC (fig. 1), where both Brumalow Creek and an unnamed tributary of Bradley Creek originate. Bradley and Brumalow Creeks discharge to Woods Reservoir, an impoundment of the Elk River. Mahoney and Robinson (1993) indicate that AEDC is located on the highest part of the ground-water recharge area, and that ground-water-flow directions are radial away from AEDC. Haugh and Mahoney (1994) state that a downward ground-water-flow potential exists beneath AEDC.

AEDC also is located on the top of a local dome-shaped geologic structure that trends southwest to northeast through the industrial area (Haugh and Mahoney, 1994; Haugh, 1996a). The geologic formations within the dome have components of dip that are northeast, east, southeast, and south from AEDC toward the study area. The local east and southeast dips of the geologic formations coincide with the regional geologic dip. The primary set of fracture traces in these formations is oriented northwest to southeast. A secondary set of fracture traces is oriented northeast to southwest. These fracture traces, particularly where they are oriented parallel to the geologic dip, potentially provide preferential pathways for ground-water flow through the bedrock. The dome structure and fractures in the bedrock influence surface-water- and ground-water-flow directions in the AAFB area (Haugh and Mahoney, 1994; Haugh, 1996a).

GROUND-WATER HYDROLOGY

Ground-water altitudes and flow directions were investigated by conducting base-flow stream measurements, measuring water levels in wells, and constructing a potentiometric-surface map of the Manchester aquifer in the study area. Discharge measurements were made at 33 stream sites and 5 springs; and data were collected from a total of 150 private and 88 monitoring wells (fig. 3). Depths to ground water were determined for 103 of the private wells and 86 of the monitoring wells (table 1, p. 23). Land-surface altitudes for the private wells were determined by plotting the well location from global-positioning-system-determined coordinates on 7.5-minute (1:24,000) USGS topographic maps. Land-surface altitudes were interpolated from the topographic contours. Well-location coordinates are estimated to be accurate to +/-30 feet in the measured wells; land-surface altitudes are estimated to be accurate to +/-5 feet in the measured wells. Water-level altitudes ranged from 946 to 1,081 feet above sea level, and depths to water ranged from 3 to 93 feet below land surface.

Base-Flow Data

Base flow is that part of stream flow derived solely from ground-water discharge to the stream. Base flow supports flow in perennial streams during periods between rainfall events. Most base flow to streams in the study area is probably from the regolith and shallow bedrock (the Manchester aquifer) (Burchett, 1977).

Base-flow discharge measurements were made in September and October 1999 at 5 springs and 33 surface-water sites (fig. 4). Discharge data were used to categorize stream reaches as losing, gaining, or stable. A losing reach is a stream segment in which the rate of discharge decreases between successive downstream measurement sites; in this case, the hydrologic gradient is from the stream to the aquifer. A gaining reach is a stream segment in which the rate of discharge increases between successive downstream measurement sites; in this case, the hydrologic gradient is from the aquifer to the stream. A stable reach occurs where discharge is constant between successive downstream measurement sites. A dry reach is a stream segment in which no measurable discharge is present; in this case, the aquifer is below the stream bed. Base-flow measurements (table 2) represent low base-flow conditions.

Potentiometric-Surface Map

Water-level-altitude data collected from wells and base-flow data collected from streams and springs were used to construct a regional potentiometric-surface map of the Manchester aquifer in the study area. One of several ground-water features evident from the map is a regional ground-water divide which roughly coincides with the Duck River-Elk River surface-water divide (fig. 5). A broad “saddle” occurs along the ground-water divide lying northeast of AEDC. A ground-water depression at AEDC indicates the location of a dewatering facility at the J4 test cell. Two prominent ground-water “troughs” are seen east of the divide extending east and southeast toward Bradley Creek. A ground-water ridge extends southeast from the divide and ends in an area characterized

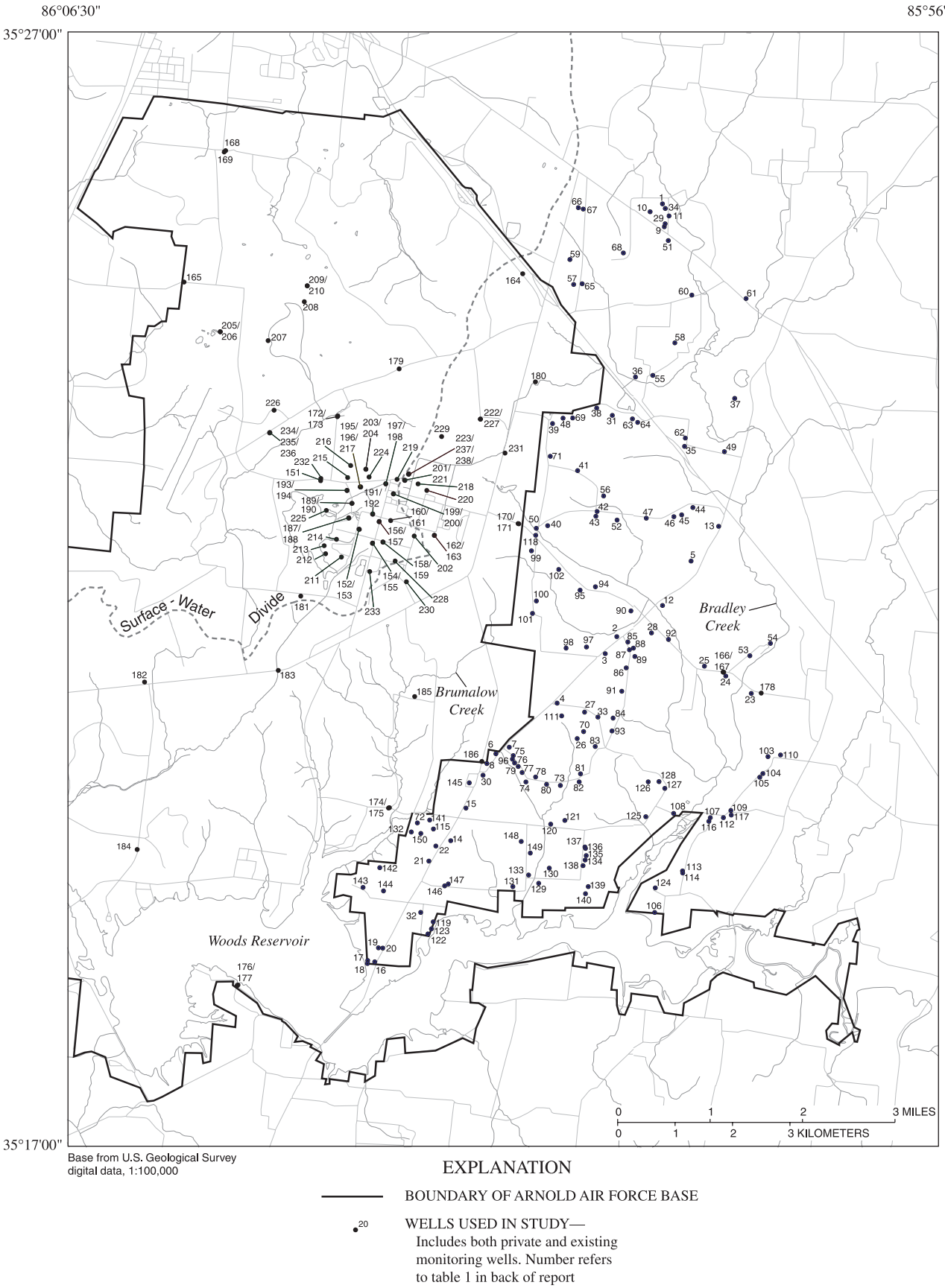


Figure 3. Location of private and monitoring wells used in the Bradley-Brumalow Creeks study area near Arnold Air Force Base, Tennessee.

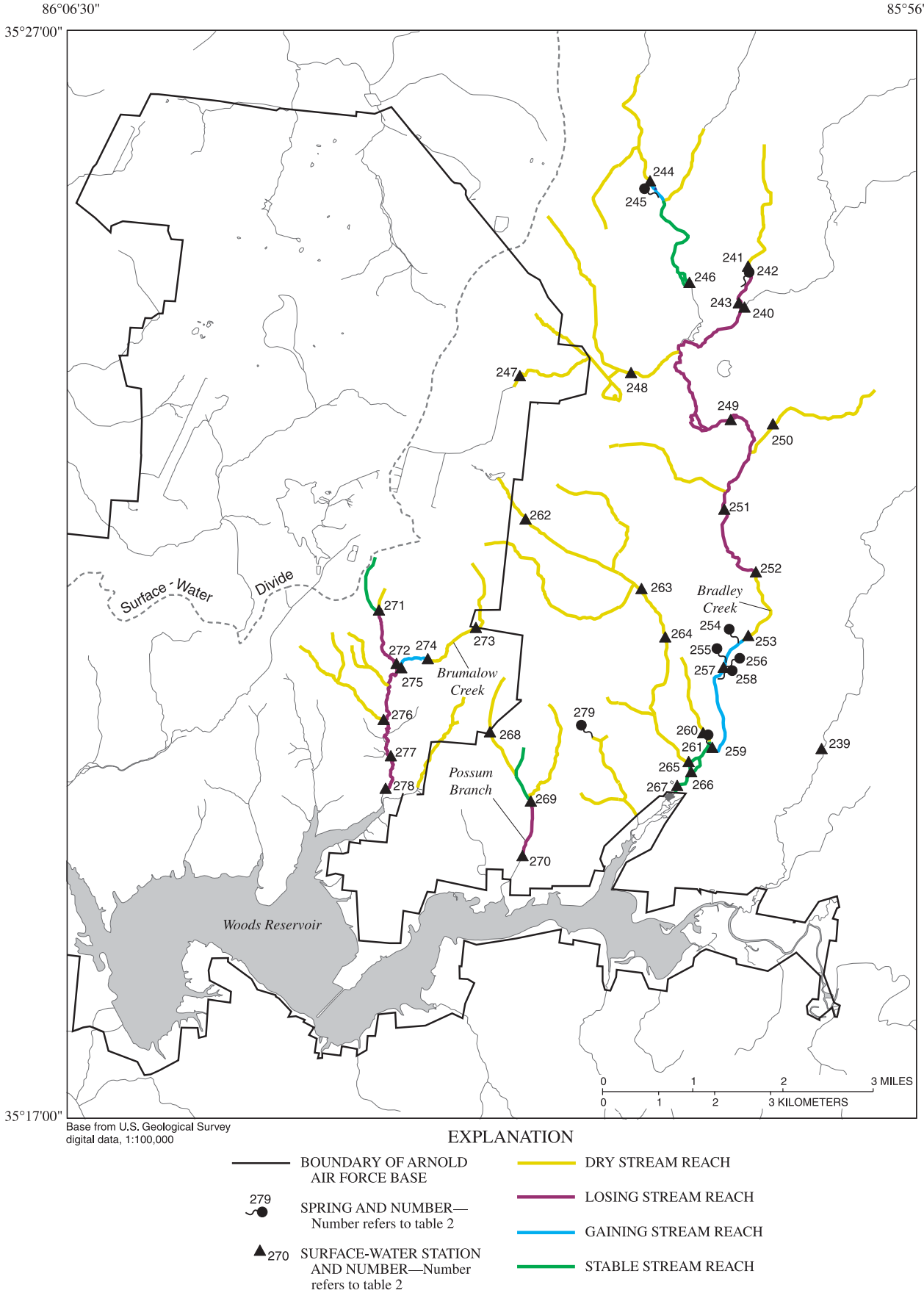


Figure 4. Location of stream and spring measurement sites, and dry, gaining, losing, and stable stream reaches.

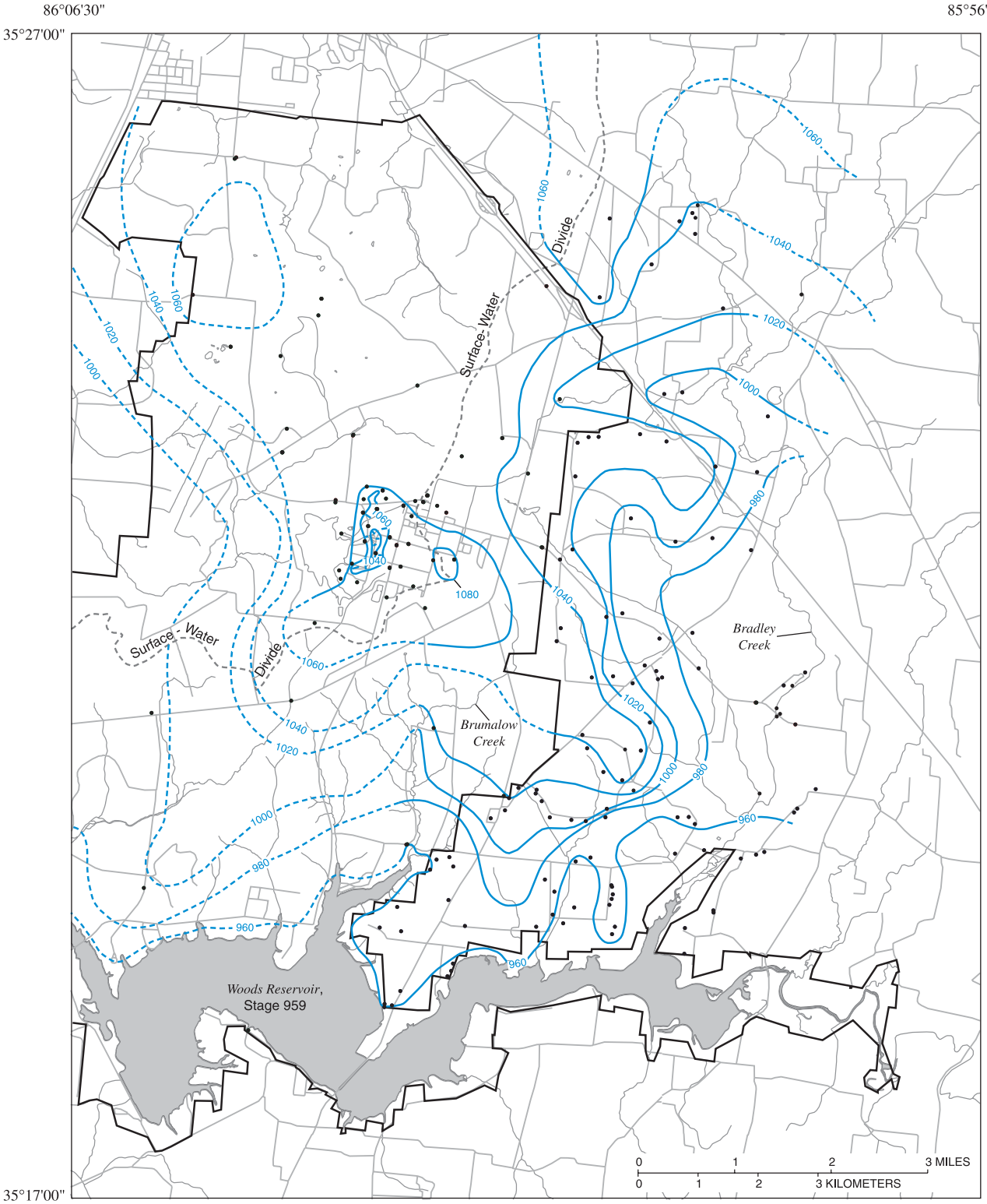
Table 2. Stream and spring sites in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

[ft^3/s, cubic feet per second; mi^2, square miles; °, degrees; ′, minutes; ″, seconds; --, No data; project numbers and land-surface elevations provided where applicable]

Site number (fig. 4)	Station number	Name	Project number (where applicable)	Latitude	Longitude	Land-surface elevation, in feet above sea level	Date (month/day/year)	Discharge, in ft^3/s	Drainage area, in mi^2	Discharge per unit drainage area, in $[(ft^3/s)/mi^2]$
239	03578300	Beans Creek at Prairie Plains, Tenn.		35°20′34″	85°57′37″		10/19/99	0.01	19.52	0.0005
240	03578395	Bradley Creek at State Route 41 near Hillsboro, Tenn.		35°24′50″	85°58′31″		09/08/99	0.04	11.34	0.0039
241	03578399	Bradley Creek Trib above Pond Spring at Hillsboro, Tenn.		35°25′12″	85°58′28″		09/08/99	0.00	1.53	0.0
242	03578400	Pond Spring at Hillsboro, Tenn.	SP-A-02	35°25′10″	85°58′28″	1,031	09/08/99	2.21	--	
243	03578404	Bradley Creek Trib at State Route 41 near Hillsboro, Tenn.		35°24′52″	85°58′35″		09/08/99	1.40	1.75	0.80
244	03578445	Blue Spring Creek above Blue Spring		35°26′03″	85°59′38″		09/08/99	0.00	3.94	0.0
245	03578448	Blue Spring at Blue Spring Creek	SP-A-01	35°25′59″	85°59′34″	1,041	09/08/99	0.72	--	
246	03578452	Blue Spring Creek at Old Hillsboro Hwy near Hillsboro, Tenn.	SW-A-01	35°25′04″	85°59′10″		09/08/99	0.73	11.07	0.066
247	03578460	Unnamed Br to Bradley Creek near Access Rd near Manchester, Tenn.		35°24′10″	86°01′10″		09/08/99	0.00	1.98	0.0
248	03578465	Bradley Creek Trib near Hillsboro, Tenn.		35°24′12″	85°59′51″		09/08/99	0.00	5.54	0.0
249	03578467	Bradley Creek at Hwy 127 near Hillsboro, Tenn.		35°23′45″	85°58′41″		09/08/99	1.06	32.04	0.033
250	03578468	Collier Branch at Prairie Plains Rd near Hillsboro, Tenn.		35°23′42″	85°58′11″		09/08/99	0.00	1.84	0.0
251	03578469	Bradley Creek at Interstate 24 near Hillsboro, Tenn.		35°22′52″	85°58′47″		09/08/99	0.27	35.49	0.0075
252	03578470	Bradley Creek near Interstate 24 near Prairie Plains, Tenn.		35°22′16″	85°58′23″		09/08/99	0.00	36.14	0.0
253	03578485	Bradley Creek near unnamed Spring near Prairie Plains, Tenn.	SW-C-01	35°21′38″	85°58′32″		09/08/99	0.00	37.42	0.0
254	03578490	Joe Marlow Spring near Prairie Plains, Tenn.	SP-C-01	35°21′38″	85°58′35″	966	09/08/99	1.23	--	
255	03578492	Donna Finney Spring at Bradley Creek above Miller Crossroad	SP-A-05	35°21′26″	85°58′45″	965	09/08/99	--	--	
256	03578495	Unnamed Spring near Prairie Plains, Tenn.	SP-B-21	35°21′23″	85°58′43″	965	09/08/99	1.70	--	
257	03578500	Bradley Creek near Prairie Plains, Tenn.	SW-C-02	35°21′21″	85°58′45″		09/08/99	5.23	37.82	0.14
							10/19/99	3.02	37.82	0.080
258	035785001	Leonard Long Spring at Bradley Creek below Miller Crossroad	SP-A-04	35°21′21″	85°58′44″	964	09/08/99	--	--	
259	035785002	Bradley Creek at Prairie Plains, Tenn.	SW-A-03	35°20′35″	85°58′55″		10/19/99	6.15	39.02	0.16
260	035785003	Bradley Creek Trib at Prairie Plains, Tenn.		35°20′41″	85°58′58″		10/19/99	0.00	0.43	0.0
261	035785004	Unnamed Spring at Bradley Creek near Prairie Plains, Tenn.	SP-A-06	35°20′38″	85°58′57″	964	10/19/99	4.55	--	
262	035785015	Dry Creek at AEDC near Manchester, Tenn.		35°22′47″	86°01′06″		09/08/99	0.00	0.67	0.0

Table 2. Stream and spring sites in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee—Continued

Site number (fig. 4)	Station number	Name	Project number (where applicable)	Latitude	Longitude	Land-surface elevation, in feet above sea level	Date (month/day/year)	Discharge, in ft^3/s	Drainage area, in mi^2	Discharge per unit drainage area, in $[(ft^3/s)/mi^2]$
263	035785016	Dry Creek near Miller Church near Manchester, Tenn.		35°22′07″	85°59′44″		09/08/99	0.00	3.78	0.0
264	035785017	Dry Creek at Miller Crossroad near Prairie Plains, Tenn.		35°21′39″	85°59′27″		09/08/99	0.00	4.61	0.0
265	035785018	Dry Creek at mouth at Prairie Plains, Tenn.		35°20′26″	85°59′08″		09/08/99	0.00	5.58	0.0
266	035785019	Bradley Creek below Mill Dam near Prairie Plains, Tenn.	SW-C-04	35°20′20″	85°59′08″		09/08/99	14.8	45.16	0.33
267	03578502	Bradley Creek near Calls, Tenn.	SW-A-02	35°20′07″	85°59′25″		09/08/99	14.6	45.44	0.32
							10/19/99	10.1	45.44	0.22
268	03578508	Unnamed Trib to Possum Branch at State Route 127 near Duncantown, Tenn.		35°20′44″	86°01′31″		09/08/99	0.00	0.43	0.0
269	03578510	Possum Branch at Calls Circle near Duncantown, Tenn.	SW-C-03	35°20′02″	86°01′01″		09/08/99	0.11	1.57	0.068
270	03578515	Possum Branch near Duncantown, Tenn.		35°19′32″	86°01′08″		09/08/99	0.06	1.92	0.029
271	03578610	Brumalow Creek near Arnold Center Rd near Duncantown, Tenn.		35°21′55″	86°02′48″		09/08/99	0.15	0.53	0.28
272	03578625	Brumalow Creek above Brumalow Creek Trib near Duncantown, Tenn.	SW-C-05	35°21′23″	86°02′37″		09/08/99	0.05	0.84	0.061
273	03578630	Brumalow Creek Trib at Hwy 127 at Barnes Rd near Duncantown, Tenn.		35°21′44″	86°01′41″		09/08/99	0.00	0.58	0.0
274	03578635	Brumalow Creek Trib near Hwy 127 near Duncantown, Tenn.		35°21′26″	86°02′15″		09/08/99	0.00	1.40	0.0
275	03578640	Brumalow Creek Trib north of Old Brick Church Rd near Duncantown, Tenn.	SW-C-06	35°21′21″	86°02′34″		09/08/99	0.04	1.57	0.025
276	03578670	Brumalow Creek Trib above Old Brick Church Rd near Duncantown, Tenn.		35°20′51″	86°02′46″		09/08/99	0.00	0.70	0.0
277	03578680	Brumalow Creek above Old Brick Church Rd near Duncantown, Tenn.		35°20′30″	86°02′41″		09/08/99	0.01	3.89	0.0021
278	03578700	Brumalow Creek at Old Brick Church Rd near Duncantown, Tenn.		35°20′11″	86°02′43″		09/08/99	0.00	4.14	0.0
279	352041086001901	Unnamed spring across from 3230 Deans Shop	SP-A-03	35°20′41″	86°00′19″	1,032	09/08/99	--	--	



Base from U.S. Geological Survey digital data, 1:100,000.
Location of dashed contours on western half of figure from Mahoney and Robinson (1993)

EXPLANATION

BOUNDARY OF ARNOLD AIR FORCE BASE

960 POTENTIOMETRIC-SURFACE CONTOUR— Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval 20 feet. Datum is sea level

• WELL OR SPRING IN WHICH WATER-LEVEL MEASUREMENT MADE DURING SEPTEMBER AND OCTOBER 1999 WAS USED FOR CONTROL

Figure 5. Potentiometric surface of the Manchester aquifer, September and October 1999, Arnold Air Force Base, Tennessee.

by relatively steep southerly gradients toward Woods Reservoir.

General ground-water-flow directions are consistent with Mahoney and Robinson (1993), but greater detail is provided for the area east of AAFB (fig. 5) because of the additional number of wells measured during this study. Water-level measurements were made during a 3-week period between September 14 and October 7, 1999. During this same period, continuous water-level data were collected in 12 wells to verify that no major changes in water levels occurred during the sampling period. Hydrographs from wells AEDC-177, AEDC-198, AEDC-199, and AEDC-227 (fig. 6) show water levels were in a slow seasonal decline throughout this period. None of the wells showed more than 2.5 feet of water-level decline during the 3-week sampling period. Some insignificant water-level rises were noted after rainfall events, but none exceeded 1 foot.

GROUND-WATER QUALITY

Water-quality samples collected from 150 private wells, 8 springs, and 9 surface-water sites in the Bradley-Brumalow Creeks area were analyzed for VOC's (table 3) and major ions (table 4). Water samples collected were analyzed for VOC's by Quanterra Laboratory in Denver, Colorado. Analyses were performed by using U.S. Environmental Protection Agency (U.S. EPA) Method 8260b. Method detection limits are 1 microgram per liter (µg/L) or less for all VOC's (primarily chlorinated solvents) identified as a contaminant of concern for AAFB (table 3). Water samples collected were analyzed for major ions by the USGS laboratory in Ocala, Florida, using sample analysis procedures documented in Fishman (1993). Method detection (equal to reporting) limits for major ions are listed in table 4. Results from VOC analyses (appendixes 2 and 4) were used to indicate possible ground-water contamination from AAFB, and results from major ion analyses (appendixes 1 and 3) were used in geochemical analysis to help understand the flow system and to infer well-completion zones.

Field sampling procedures followed those outlined in the U.S. EPA Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (U.S. Environmental Protection Agency, 1997). Wells were purged and sampled from a spigot located closest to the well head, preferably between the well head and any storage/pressure tanks. Water

Table 3. Volatile organic compound analytes, reporting limits, and method detection limits

[µg/L, micrograms per liter]

Analyte	Reporting limit, in µg/L)	Method detection limit, in µg/L)
Acetone	10	2.43
Acetonitrile	20	6.81
Acrolein	20	2.85
Acrylonitrile	20	1.45
Benzene	1.0	0.10
Bromodichloromethane	1.0	0.11
Bromoform	1.0	0.11
Bromomethane	2.0	0.15
2-Butanone (MEK)	5.0	0.72
Carbon disulfide	1.0	0.15
Carbon tetrachloride	1.0	0.10
Chlorobenzene	1.0	0.10
Chloroprene	1.0	0.10
Dibromochloromethane	1.0	0.10
Chloroethane	2.0	0.10
Chloroform	1.0	0.10
Chloromethane	2.0	0.21
Allyl chloride	2.0	0.19
1,2-Dibromo-3-chloropropane (DBCP)	2.0	0.28
1,2-Dibromoethane (EDB)	1.0	0.16
Dibromomethane	1.0	0.15
Trans-1,4-Dichloro-2-butene	1.0	0.31
Dichlorodifluoromethane	2.0	0.16
1,1-Dichloroethane	1.0	0.10
1,2-Dichloroethane	1.0	0.14
1,1-Dichloroethylene	1.0	0.14
Cis-1,2-Dichloroethene	1.0	0.11
Trans-1,2-Dichloroethene	0.5	0.12
1,2-Dichloropropane	1.0	0.12
Cis-1,3-Dichloropropene	1.0	0.10
Trans-1,3-Dichloropropene	1.0	0.10
1,4-Dioxane	200	7.97
Ethylbenzene	1.0	0.10
Ethyl methacrylate	1.0	0.50
2-Hexanone	5.0	0.70
Iodomethane	1.0	0.10
Isobutyl alcohol	50	11.72
Methacrylonitrile	10	1.00
Methylene chloride	1.0	0.19
Methyl methacrylate	1.0	0.25
4-Methyl-2-pentanone	5.0	0.67
Propionitrile	5.0	2.96
Styrene	1.0	0.10
1,1,1,2-Tetrachloroethane	1.0	0.10
1,1,2,2-Tetrachloroethane	1.0	0.23
Tetrachloroethylene	1.0	0.10
Toluene	1.0	0.10
1,1,1-Trichloroethane	1.0	0.10
1,1,2-Trichloroethane	1.0	0.18
Trichloroethylene	1.0	0.10
Trichlorofluoromethane	2.0	0.15
1,2,3-Trichloropropane	1.0	0.10
Vinyl acetate	2.0	0.11
Vinyl chloride	2.0	0.13
Xylenes (total)	1.0	0.30

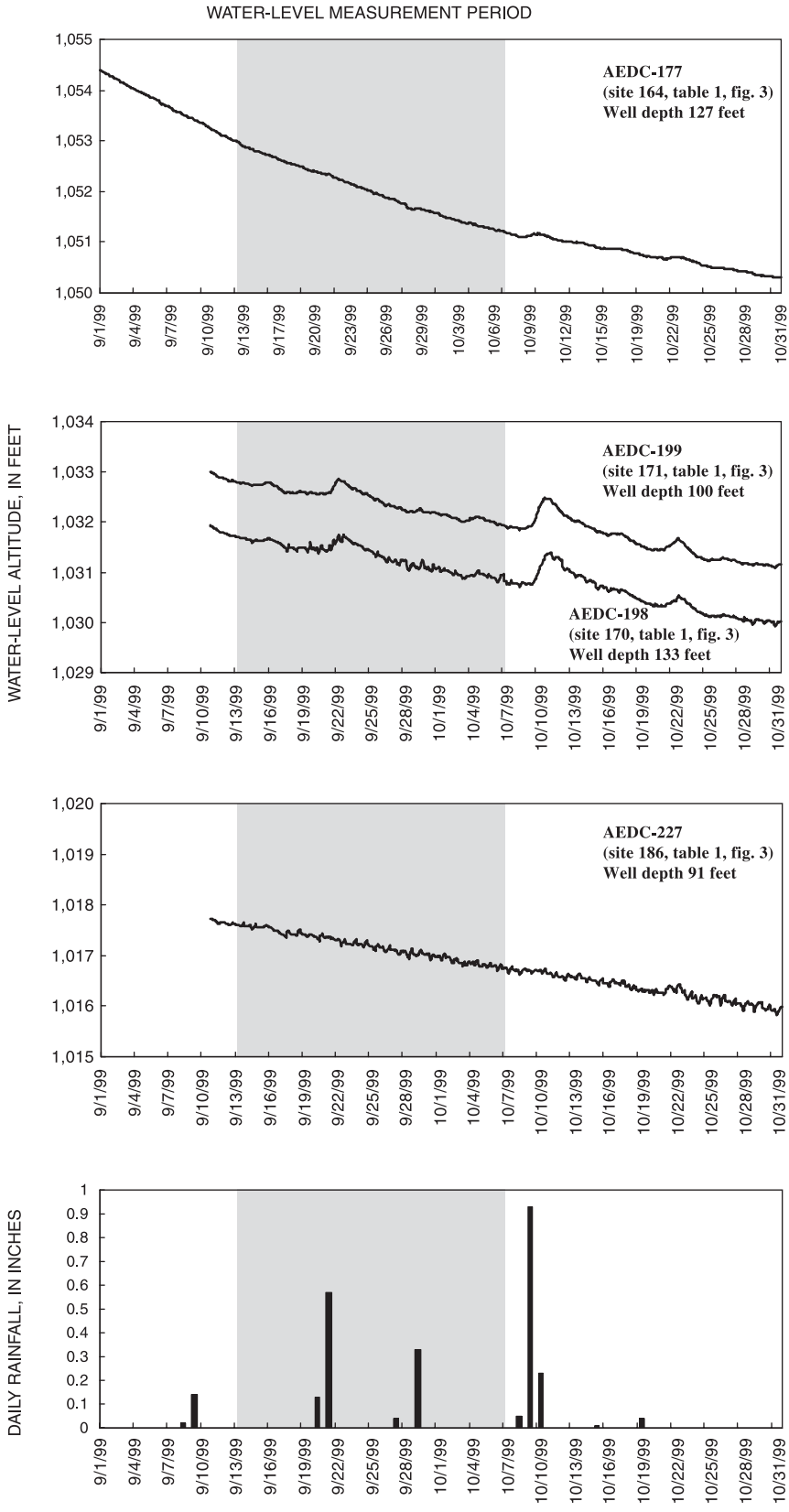


Figure 6. Water levels in wells AEDC-177, AEDC-198, AEDC-199, and AEDC-227, and daily rainfall totals for September and October, 1999.

Table 4. Major ions, selected properties, and their detection limits

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeters]

Ions	Detection limit
Magnesium (mg/L)	0.004
Potassium (mg/L)	0.100
Calcium (mg/L)	0.020
Chloride (mg/L)	0.100
Sodium (mg/L)	0.06
Sulfate (mg/L)	0.200
Fluoride (mg/L)	0.100
Properties	
Alkalinity (mg/L)	1.000
Specific conductance (µS/cm)	1.000
pH (standard units)	0.100

samples were collected after specific conductance, pH, temperature, and turbidity had stabilized. For most wells, field constituents stabilized within 30 minutes. In the few wells where field parameters did not stabilize, samples were collected at the discretion of the field team leader; however, these wells also were purged at least 30 minutes. After purging, specific conductance, pH, water temperature, dissolved oxygen, and turbidity were measured at each well. Water samples then were collected for analysis of VOC's (table 3) and major ions (table 4). Samples were treated and shipped in accordance with current U.S. EPA and USGS sampling protocols.

Inorganic Constituents and Physical Properties

All ground- and surface-water samples were analyzed for major ions (table 4). The complete analytical results for the inorganic constituents and physical properties of the well, spring, and surface-water samples are in appendixes 1 and 3, respectively. Values for the physical properties reported in appendixes 1 and 3 were measured in the field at the time of sample collection.

The sampled water in the AAFB area is predominantly of the calcium bicarbonate type (fig. 7). Specific conductance for well, spring, and surface-water samples ranged from 10 to 788 µS/cm, 13 to 447 µS/cm, and 42 to 546 µS/cm, respectively (table 5 and fig. 8); the median values were 100, 360, and 286 µS/cm, respectively. The ranges for pH in well, spring, and surface-water samples from the study area were 4.5 to 7.8, 4.9 to 7.3, and 7.2 to 8.0, respectively; the median values for pH were 6.2, 7.2, and 7.4, respectively (fig. 9).

Volatile Organic Compounds

Concentrations of most of the VOC's analyzed for (appendixes 2 and 4) were less than detection limits (table 3). None of the sample results exceeded drinking water maximum contaminant levels for public water systems; however, some compounds were detected in concentrations exceeding analytical reporting levels. Wells PW-B-16 and PW-C-08 produced water samples containing toluene in concentrations of 1.4 and 1.3 µg/L, respectively (fig. 10 and appendix 2). Chloroform was detected in the water sample from well PW-B-33 at a concentration of 2.4 µg/L (appendix 2).

Other contaminants of concern were detected in estimated concentrations less than their reporting limits and are indicated with a letter symbol "J" in appendixes 2 and 4 (fig. 10). Wells PW-B-01,

Table 5. Ranges and median values of selected constituents in and physical properties of water from wells, springs, and surface-water sites sampled in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

[µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; °C, degrees Celsius; <, less than]

Constituent property	Wells			Springs			Surface-water sites		
	Min.	Max.	Med.	Min.	Max.	Med.	Min.	Max.	Med.
Specific conductance (µS/cm)	10	788	100	13	447	360	42	546	286
pH (standard units)	4.5	7.8	6.2	4.9	7.3	7.2	7.2	8.0	7.4
Alkalinity (mg/L as $CaCO_3$)	2	259	37	5	196	155	44	199	127
Temperature (°C)	12.1	21.1	16.1	14.8	19.4	15	13.2	15.7	14.1
Calcium (mg/L as Ca)	0.3	100	11	1.2	75	60	13	73	46
Magnesium (mg/L as Mg)	0.3	48	3.1	0.5	9	8.7	2.3	8.8	8.1
Sodium (mg/L as Na)	0.4	14	1.1	0.8	3.4	2.0	0.8	5.4	2.1
Potassium (mg/L as K)	<0.1	4.2	0.2	0.2	1.3	0.8	0.5	2.8	0.9
Chloride (mg/L as Cl)	0.5	22	2.4	1.8	11	5.5	2	11	5.5
Sulfate (mg/L as SO_4)	<0.2	34	0.8	0.5	33	22	2.4	32	17
Fluoride (mg/L as F)	<0.1	2.1	<0.1	<0.1	0.12	<0.1	<0.1	0.11	<0.1

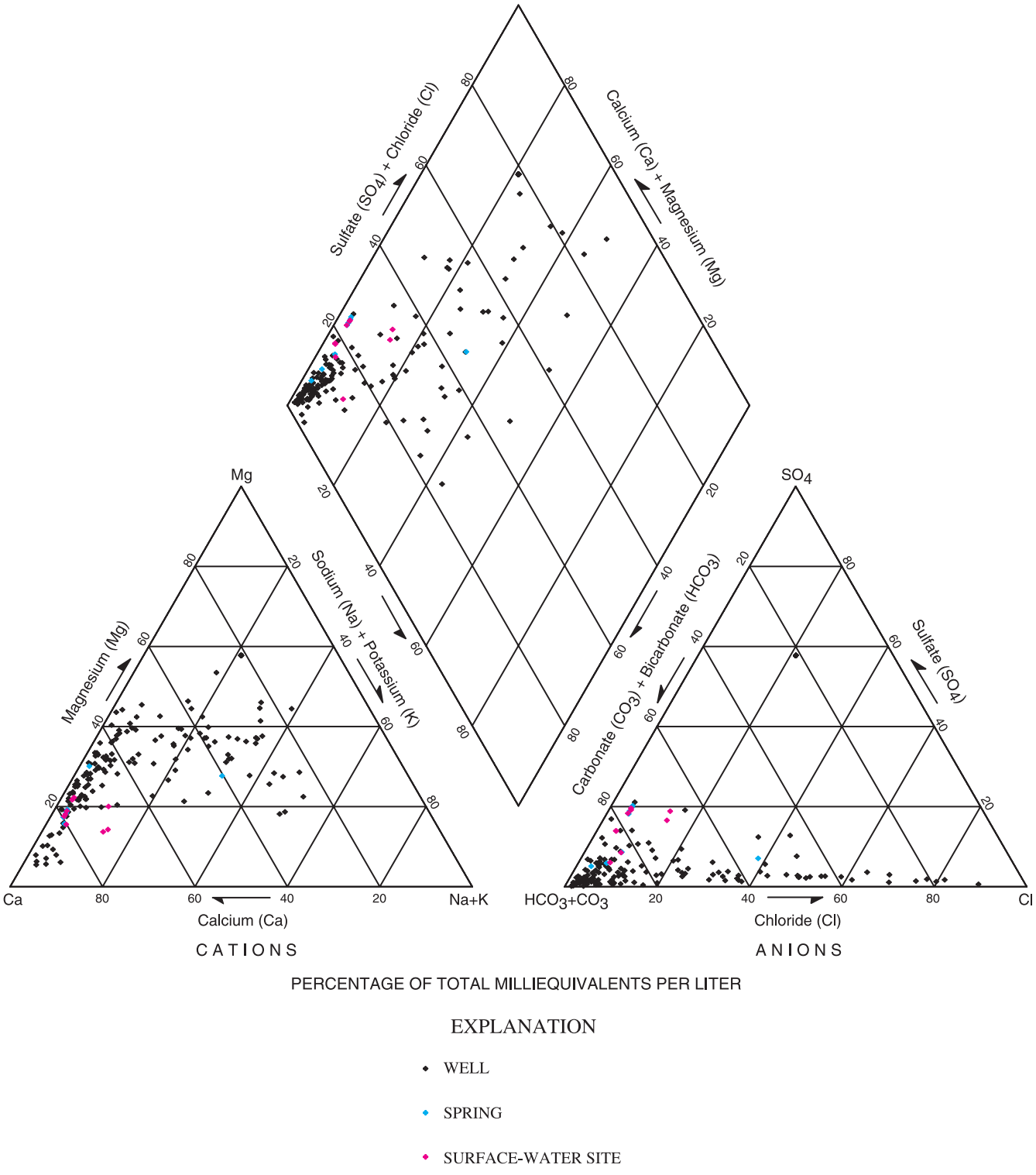


Figure 7. Chemical composition of water samples from private wells, springs, and surface-water sites in the Bradley/Brumalow Creeks area near Arnold Air Force Base, Tennessee.

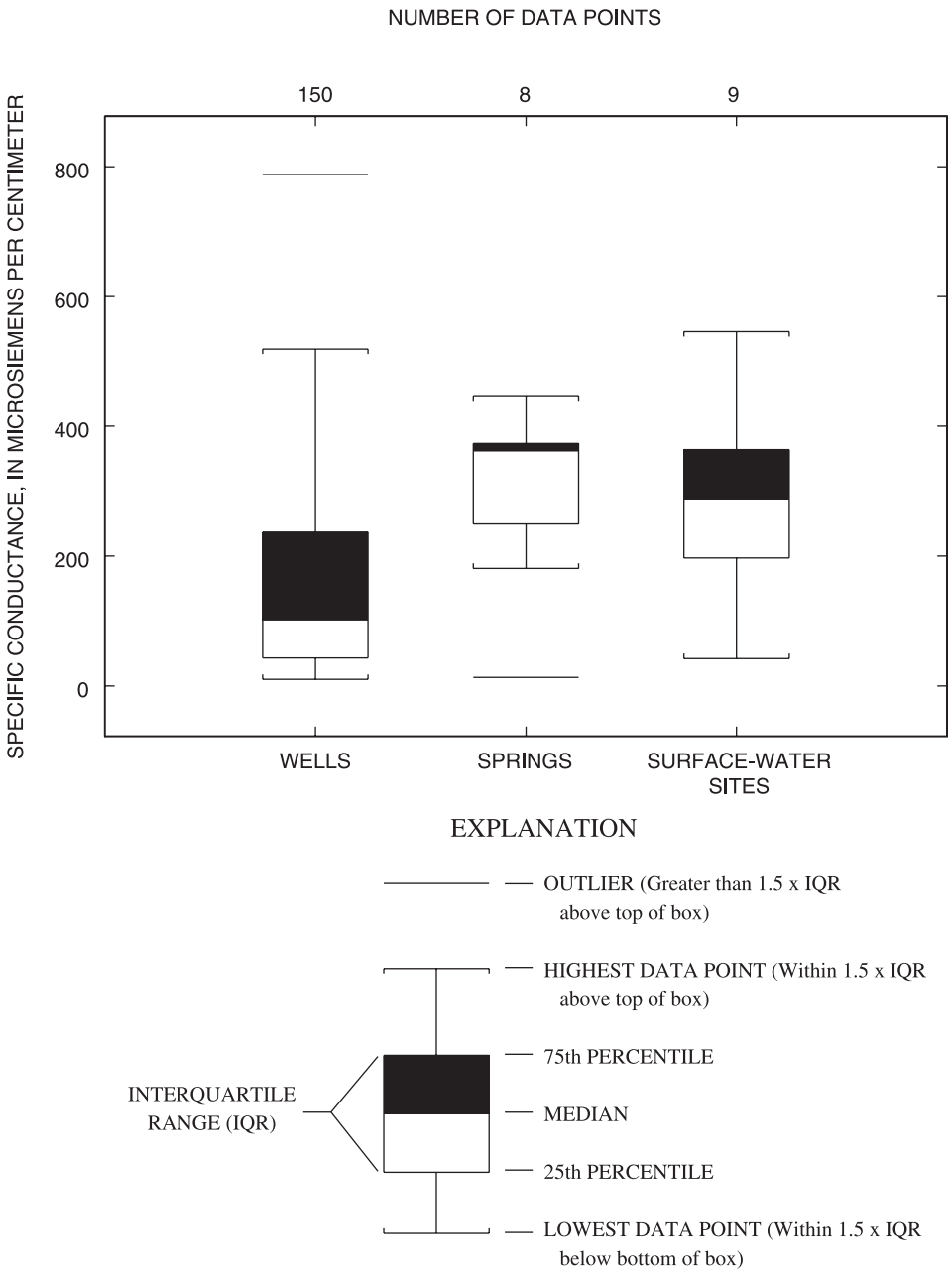


Figure 8. Range in specific conductance of water from private wells, springs, and surface-water sites in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee.

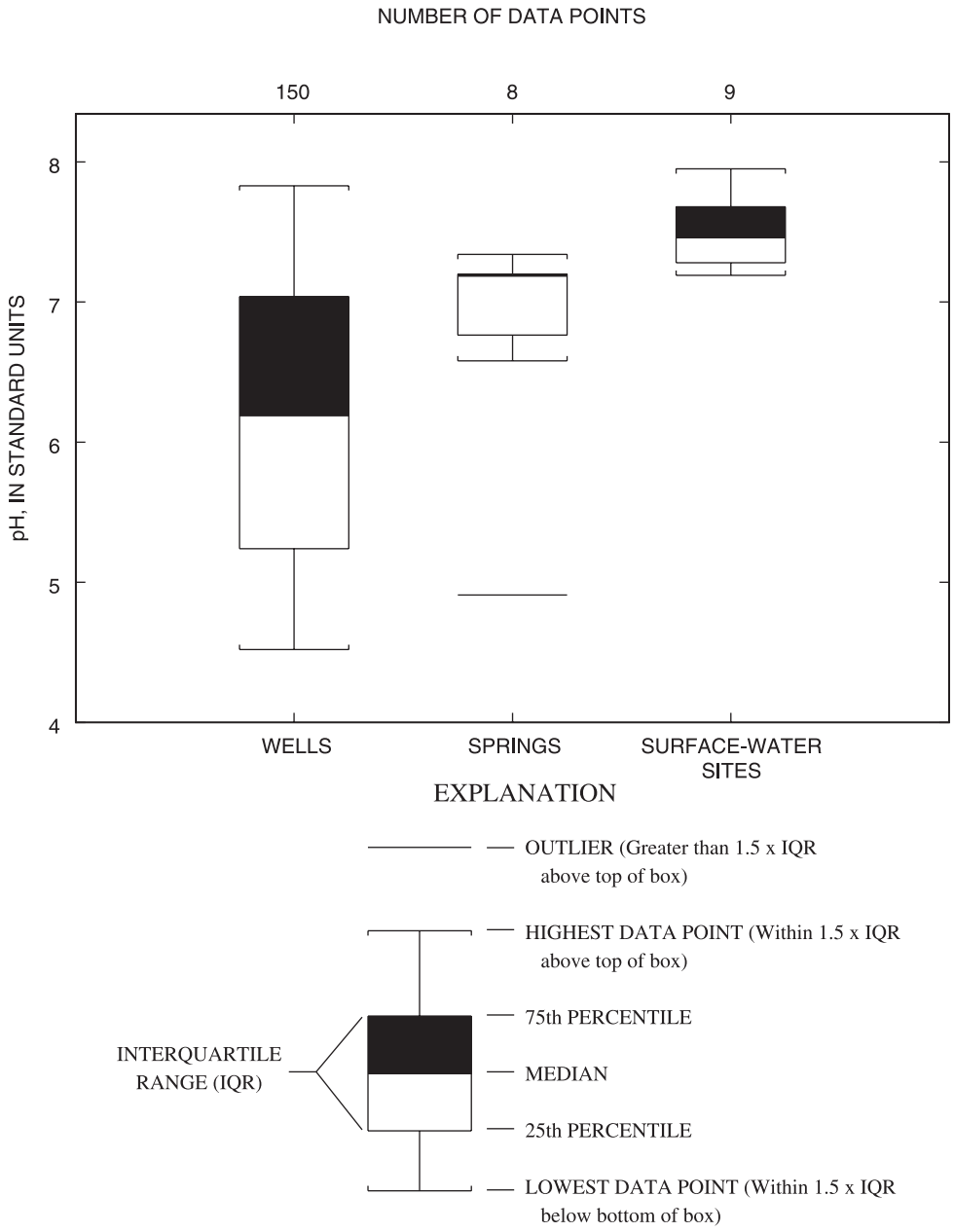


Figure 9. Range in pH of water from private wells, springs, and surface-water sites in the Bradley/Brumalow Creeks area near Arnold Air Force Base, Tennessee.

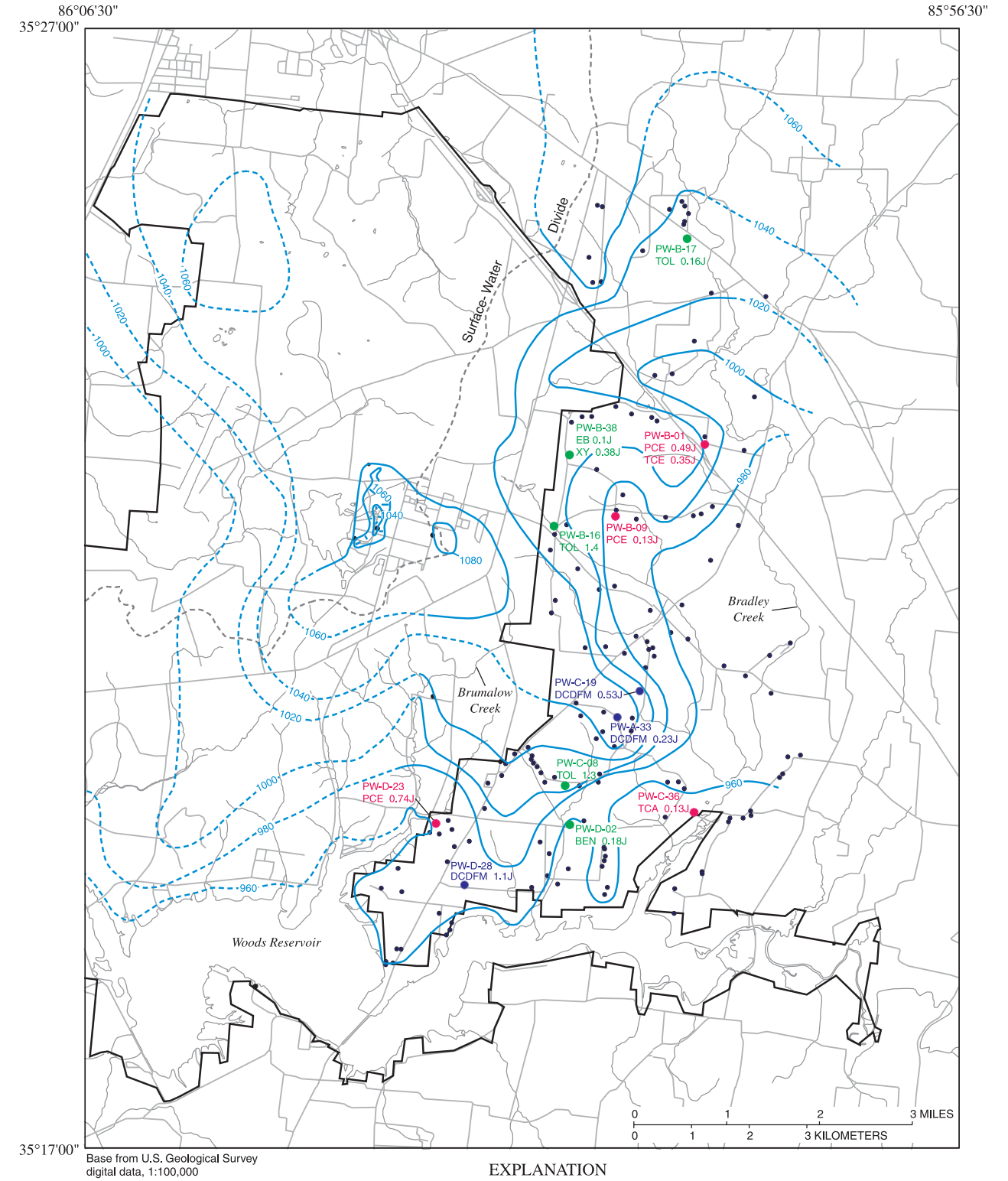


Figure 10. Summary of volatile organic compound detections in private wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee.

PW-B-09, and PW-D-23 showed the presence of tetrachloroethylene (PCE). Estimated concentrations of PCE in the samples ranged from 0.13 (well PW-B-09) to 0.74 µg/L (well PW-D-23). Trichloroethylene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) were detected in water samples from wells PW-B-01 (0.35 µg/L, TCE) and PW-C-36 (0.13 µg/L, TCA). Dichlorodifluoromethane was detected in water samples in estimated concentrations ranging from 0.23 to 1.1 µg/L from wells PW-A-33 (0.23 µg/L), PW-C-19 (0.53 µg/L), and PW-D-28 (1.1 µg/L). Trace amounts of toluene ranging from 0.11 to 0.47 µg/L were present in estimated concentrations in water samples from well PW-B-17 (0.16 µg/L), spring SP-A-03 (0.11 µg/L), and surface-water site SW-C-03 (0.47 µg/L). Benzene was detected in a water sample from well PW-D-02 at an estimated concentration of 0.18 µg/L. Xylenes and ethylbenzene were detected in the water samples from well PW-B-38 at estimated concentrations of 0.38 and 0.1 µg/L, respectively. Frequency of detections and median concentrations for the project data and ambient rural ground water are shown in table 6 (Squillace and others, 1999). For comparison with the ambient ground-water data, the project data was censored at the 0.2 µg/L level. Most of these VOC's, particularly the chlorinated solvents PCE, TCE, and 1,1,1-TCA, occur at concentrations above these ambient levels in the ground water at several SWMU sites at AAFB.

The following compounds also were detected in estimated concentrations less than their respective reporting limits (table 3 and appendixes 2 and 4): acetone, methylene chloride, 2-butanone, chloromethane, chloroform, bromodichloromethane, and carbon disulfide. Acetone, methylene chloride, and 2-butanone are common laboratory contaminants and were detected in trip-blank samples. Chloromethane, chloroform, and bromodichloromethane are disinfectant byproducts from the chlorination of ground and surface waters containing naturally occurring organic matter. Carbon disulfide occurs naturally but also is used as a pesticide intermediate and in manufacturing processes (Lucius and others, 1992).

VOC's detected in concentrations exceeding their respective reporting limits in trip blanks as part of the quality-assurance/quality-control (QA/QC) program for the study include 1,1-dichloroethylene (1,1-DCE) and 2-butanone (appendix 5 and table 3). The highest concentration of 1,1-dichloroethylene in a trip blank was 1.1 µg/L; the highest concentration of 2-butanone reported in a trip blank was 6.0 µg/L (appendix 5). A number of detections in estimated concentrations less than the reporting limits also were reported in trip-blank results, including acetone (2.4 to 5.6 µg/L), toluene (0.13 to 0.14 µg/L), 1,1-dichloroethylene (0.52 to 0.98 µg/L), 2-butanone (2.2 to 3.8 µg/L), and methylene chloride (0.28 to 0.82 µg/L). 1,1-Dichloroethylene systematically occurred in most of the trip blanks.

Table 6. Comparison of frequency of detections and median concentrations of volatile organic compounds from the Bradley-Brumalow Creeks area privat well samples with ambient rural ground-water samples

[µg/L, micrograms per liter;--, No data]

Compound	Number of detections	Frequency of detections, in percent			Median concentrations, in micrograms per liter	
		Bradley-Brumalow Creeks ground-water study area		Ambient rural ground water (reporting level, 0.2 µg/L)	Bradley-Brumalow Creeks ground-water study area (data censored at 0.2 µg/L)	Ambient rural ground water (reporting level, 0.2 µg/L)
		Project detection limits	Data censored at 0.2 µg/L			
Tetrachloroethylene	3	2.0	1.3	2.5	0.62	0.8
Trichloroethylene	1	0.7	0.7	1.6	0.35	0.6
1,1,1-Trichloroethane	1	0.7	0.0	1.1	--	0.5
Dichlorodifluoromethane	3	2.0	2.0	0.8	0.53	0.5
Benzene	1	0.7	0.0	1.0	--	0.7
Toluene	3	2.0	1.3	2.0	1.3	0.3
Ethylbenzene	1	0.7	0.0	0.2	--	2.8
Xylenes	1	0.7	0.7	0.9	0.38	0.65
Bromodichloromethane	1	0.7	0.7	0.8	0.24	0.5
Chloroform	11	7.3	2.6	5.1	0.36	0.5
Chloromethane	20	13	13	0.4	0.24	0.35

Quality-Assurance/Quality-Control Samples

Field quality-assurance samples were collected and analyzed for VOC's. Sampling procedures followed those outlined by the U.S. EPA in 1997. One QA/QC duplicate sample was collected and analyzed for every 10 VOC samples collected. Replicate samples for matrix spikes were collected and analyzed for every 20 samples collected. A trip blank (appendix 5) accompanied each shipment of samples. Duplicate samples were collected for wells PW-A-06, PW-A-15, PW-A-25, PW-B-05, PW-B-15, PW-B-25, PW-B-35, PW-C-05, PW-C-10, PW-C-15, PW-C-25, PW-C-35, PW-C-45, PW-D-05, PW-D-15, and PW-D-25; and springs SP-A-05 and SP-A-06. Analytical results for duplicates are included with the main set of sample data in appendixes 1 through 4.

Quanterra Laboratories followed standard analytical QA/QC practices for all VOC analyses. These practices include lab blanks, quality-control standards, surrogate spikes, matrix spikes, and duplicate analyses.

A level IV data validation was performed by Dames and Moore, Inc., for 34 of the VOC sample results. The validation was based on the U.S. EPA National Functional Guidelines for Data Review, modified to reflect the level of validation requested, the specifics of the analytical method employed, and the provisions of the approved specific quality-assurance protocol. The purpose of data validation is to assess the effect of the overall analytical process on the usability of the data.

The data validation determined that nondetections (results) for acetone, acrolein, acrylonitrile, 2-butanone, 1,4-dioxane, acetonitrile, propionitrile, methacrylonitrile, and isobutylanol were unreliable because of calibration failures or poor instrumentation response; however, none of these VOC's were contaminants of concern for the study. According to the data validation, positive results for methylene chloride and 1,1-dichloroethylene should be considered as nondetections because of trip-blank contamination. Methylene chloride is a common lab contaminant. 1,1-Dichloroethylene systematically occurred in most of the trip blanks.

SUMMARY

Arnold Air Force Base (AAFB) occupies about 40,000 acres in Coffee and Franklin Counties, Tennessee. The primary mission of AAFB is to support the development of aerospace systems. This mission is accomplished through test facilities at Arnold Engineering Development Center (AEDC), which occupies about 4,000 acres in the center of AAFB.

Several synthetic volatile organic compounds (VOC's), primarily chlorinated solvents, have been identified in the ground water at AEDC. Private ground-water supplies in the Bradley-Brumalow Creeks area are hydraulically downgradient from AEDC and could be affected by transport of VOC's in the ground water at AEDC.

From September to December 1999, a comprehensive study of the ground-water resources in the Bradley-Brumalow Creeks area was conducted to determine if VOC's from AEDC have affected local private water supplies and to advance understanding of the ground-water-flow system in this area. The study focused on locating and sampling all private water wells and springs located within the Bradley-Brumalow Creeks area that are used as sources of drinking water, though not all of the wells and springs sampled are currently used for drinking water. Ground-water-flow directions were investigated by conducting base-flow stream measurements, measuring water levels in wells, and constructing a potentiometric-surface map of the Manchester aquifer in the study area. Data were collected from a total of 150 private and 88 monitoring wells during the course of the study. Depths to ground water were determined for 103 of the private wells and 86 of the monitoring wells. The wells ranged in depth from 14 to 167 feet deep. Water-level altitudes ranged from 946 to 1,081 feet above sea level. Depths to water ranged from 3 to 93 feet below land surface. Water-quality samples were collected from the 150 private wells that withdraw water from the Manchester aquifer.

Additionally, a reconnaissance of 8 springs and 33 surface-water sites was conducted in the Bradley-Brumalow Creeks area. Discharge measurements were made at 5 of the 8 springs and the 33 surface-water sites as part of the regional base-flow component of the study. Water-quality samples were collected at 8 of the springs and 9 of the surface-water sites.

Water-level-altitude data collected from wells and base-flow data collected from streams and springs were used to construct a regional potentiometric-surface map of the Manchester aquifer in the study area. Several notable features were evident, including a ground-water divide that roughly follows the regional surface-water divide and a "saddle" along the

ground-water divide lying northeast of AEDC. Two prominent ground-water "troughs" extending east and southeast from the divide toward Bradley Creek also were evident.

Water-quality samples collected from the 150 private wells, 8 springs, and 9 surface-water sites in the Bradley-Brumalow Creeks area were analyzed for major ions and VOC's. Results from the major-ion samples indicate that the water sampled is predominantly calcium bicarbonate type. Specific conductance for sampled water ranged from 10 to 788 μS/cm with a median value of 104 μS/cm. The range and median value for pH of sampled water were 4.5 to 8.0, and 6.3, respectively.

Concentrations of most of the VOC's analyzed for were less than detection limits. None of the sample results exceeded drinking water maximum contaminant levels for public water systems. However, some compounds were detected in concentrations exceeding analytical reporting levels. Water samples from wells PW-B-16 and PW-C-08 contained toluene in concentrations of 1.4 and 1.3 μg/L, respectively; and chloroform was detected in well PW-B-33 at a concentration of 2.4 μg/L.

Other contaminants of concern were detected in estimated concentrations less than their reporting limits, referred to as "estimated values." Water samples from three wells showed the presence of tetrachloroethylene (PCE) ranging from 0.13 to 0.74 μg/L. Trichloroethylene (TCE) was detected in a water sample from one of the three wells (0.35 μg/L), and 1,1,1-trichloroethane (1,1,1-TCA) was detected in a water sample from another well (0.13 μg/L). Estimated concentrations of dichlorodifluoromethane ranging from 0.23 to 1.1 μg/L were detected in water samples from three other wells. Water samples from another well, a spring, and a surface-water site also showed the presence of trace amounts of toluene, which ranged from 0.11 to 0.47 μg/L. Benzene was detected in a water sample from one well at an estimated concentration of 0.18 μg/L. Xylenes and ethylbenzene were detected in water samples from another well at estimated concentrations of 0.38 and 0.1 μg/L, respectively. For the compounds detected, the frequency of detections and median concentrations are compared to data from ambient rural ground water. Most of these VOC's, including the chlorinated solvents PCE, TCE, and 1,1,1-TCA, occurred at concentrations above these ambient levels in the ground water at several solid waste management unit sites at AAFB.

Water-level, water-quality, and stream discharge data collected during the study of private and monitoring wells, springs, and surface-water sites in the Bradley-Brumalow Creeks area provide information that can aid in characterizing the regional ground-water-flow patterns and water quality for AAFB. The potentiometric-surface map and water-quality results from this report can further assist environmental managers at AAFB in assessing the relative risk of past, current, and possible future activities at the facility on local water resources.

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Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

[°, degrees; ′, minutes; ″, seconds; UM, the upper part of the Manchester aquifer; LM, the lower part of the Manchester aquifer; --, No data

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applica-ble)	Well type
1	PW-A-01	35°25′54″	85°59′40″	1,039	1,057	18	64	Measurement	LM-bedrock		Private
2	PW-A-02	35°21′49″	86°00′11″	987	1,038	51	95	Measurement	UM-regolith		Private
3	PW-A-03	35°21′39″	86°00′19″	1,005	1,055	50	84	Owner	UM-regolith		Private
4	PW-A-04	35°21′11″	86°00′53″	1,045	1,101	56	85	Measurement	UM-regolith		Private
5	PW-A-05	35°22′32″	85°59′20″	--	1,068	--	90	Owner	LM-bedrock		Private
6	PW-A-06	35°20′43″	86°01′35″	1,029	1,040	12	57	Measurement	LM-regolith		Private
7	PW-A-07	35°20′47″	86°01′25″	--	1,033	--	83	Owner	UM-regolith		Private
8	PW-A-08	35°20′37″	86°01′41″	1,020	1,061	41	75	Measurement	UM-regolith		Private
9	PW-A-09	35°25′41″	85°59′39″	--	1,073	--	--	--	LM-bedrock		Private
10	PW-A-10	35°25′49″	85°59′48″	1,055	1,082	27	65	Measurement	LM-bedrock		Private
11	PW-A-11	35°25′47″	85°59′35″	--	1,062	--	--	--	LM-bedrock		Private
12	PW-A-12	35°22′07″	85°59′40″	972	1,040	68	--	--	LM-bedrock		Private
13	PW-A-13	35°22′51″	85°59′01″	963	1,000	37	57	Measurement	--		Private
14	PW-A-14	35°19′54″	86°02′06″	--	1,048	--	97	Owner	LM-bedrock		Private
15	PW-A-15	35°20′12″	86°01′55″	--	1,033	--	--	--	UM-regolith		Private
16	PW-A-16	35°18′45″	86°02′58″	960	1,022	62	88	Owner	UM-regolith		Private
17	PW-A-17	35°18′46″	86°03′03″	962	1,011	49	--	--	UM-regolith		Private
18	PW-A-18	35°18′44″	86°03′03″	951	998	47	--	--	UM-regolith		Private
19	PW-A-19	35°18′53″	86°02′56″	--	1,023	--	--	--	LM-bedrock		Private
20	PW-A-20	35°18′53″	86°02′53″	963	1,022	59	65	Owner	--		Private
21	PW-A-21	35°19′42″	86°02′21″	968	1,030	62	100	Owner	--		Private
22	PW-A-22	35°19′51″	86°02′16″	--	1,040	--	67	Owner	LM-bedrock		Private
23	PW-A-23	35°21′17″	85°58′39″	--	980	--	30	Owner	LM-bedrock		Private
24	PW-A-24	35°21′27″	85°58′56″	--	1,005	--	50	Owner	LM-bedrock		Private
25	PW-A-25	35°21′32″	85°59′11″	--	1,021	--	85	Owner	LM-bedrock		Private
26	PW-A-26	35°20′51″	86°00′39″	1,033	1,052	19	60	Measurement	UM-regolith		Private
27	PW-A-27	35°21′06″	86°00′34″	--	1,091	--	--	--	UM-regolith		Private
28	PW-A-28	35°21′51″	85°59′47″	--	1,040	--	--	--	LM-bedrock		Private
29	PW-A-29	35°25′42″	85°59′38″	1,039	1,073	34	78	Measurement	LM-bedrock		Private
30	PW-A-30	35°20′31″	86°01′44″	1,008	1,057	49	93	Measurement	UM-regolith		Private

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
31	PW-A-31	35°23′54″	86°00′14″	1,031	1,060	29	63	Owner	UM-regolith		Private
32	PW-A-32	35°19′13″	86°02′27″	--	1,011	--	80	Owner	LM-bedrock		Private
33	PW-A-33	35°21′04″	86°00′24″	1,054	1,085	31	86	Owner	UM-regolith		Private
34	PW-A-34	35°25′51″	85°59′38″	1,038	1,055	17	72	Measurement	LM-bedrock		Private
35	PW-B-01	35°23′37″	85°59′25″	1,021	1,062	41	90	Measurement	UM-regolith		Private
36	PW-B-02	35°24′16″	85°59′58″	992	1,035	43	75	Owner	LM-bedrock		Private
37	PW-B-03	35°24′04″	85°58′50″	--	1,062	--	80-90	Owner	LM-bedrock		Private
38	PW-B-04	35°23′58″	86°00′25″	--	1,067	--	100	Measurement	UM-regolith		Private
39	PW-B-05	35°23′49″	86°00′56″	1,031	1,092	61	96	Measurement	UM-regolith		Private
40	PW-B-06	35°22′52″	86°00′59″	1,021	1,072	51	65-70	Measurement	UM-regolith		Private
41	PW-B-07	35°23′23″	86°00′38″	--	1,105	--	92	Measurement	--		Private
42	PW-B-08	35°23′00″	86°00′25″	--	1,081	--	96	Measurement	UM-regolith		Private
43	PW-B-09	35°22′57″	86°00′26″	--	1,082	--	93	Measurement	UM-regolith		Private
44	PW-B-10	35°23′02″	85°59′19″	--	1,041	--	--	--	UM-regolith		Private
45	PW-B-11	35°22′58″	85°59′27″	993	1,055	62	90	Measurement	UM-regolith		Private
46	PW-B-12	35°22′57″	85°59′32″	--	1,058	--	80	Owner	UM-regolith		Private
47	PW-B-13	35°22′56″	85°59′51″	1,012	1,071	59	80	Owner	UM-regolith		Private
48	PW-B-14	35°23′53″	86°00′48″	1,025	1,080	55	50-75	Measurement	UM-regolith		Private
49	PW-B-15	35°23′34″	85°58′57″	990	1,062	72	90	Measurement	LM-bedrock		Private
50	PW-B-16	35°22′50″	86°01′07″	--	1,063	--	--	--	UM-regolith		Private
51	PW-B-17	35°25′33″	85°59′36″	--	1,065	--	56	Measurement	LM-bedrock		Private
52	PW-B-18	35°22′55″	86°00′11″	--	1,065	--	100	Measurement	UM-regolith		Private
53	PW-B-19	35°21′38″	85°58′40″	962	982	20	68	Measurement	LM-bedrock		Private
54	PW-B-20	35°21′45″	85°58′25″	966	982	16	18	Measurement	LM-bedrock		Private
55	PW-B-22	35°24′17″	85°59′47″	989	1,050	61	100	Measurement	LM-bedrock		Private
56	PW-B-23	35°23′09″	86°00′20″	987	1,080	93	100	Measurement	UM-regolith		Private
57	PW-B-24	35°25′08″	86°00′41″	1,065	1,089	24	70	Measurement	LM-bedrock		Private
58	PW-B-25	35°24′35″	85°59′31″	--	1,062	--	85	Owner	LM-bedrock		Private
59	PW-B-26	35°25′22″	86°00′44″	--	1,091	--	101	Owner	LM-bedrock		Private
60	PW-B-27	35°25′02″	85°59′20″	1,023	1,041	18	--	--	LM-bedrock		Private

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
61	PW-B-28	35°25′00″	85°58′42″	--	1,060	--	--	--	LM-bedrock		Private
62	PW-B-29	35°23′41″	85°59′24″	--	1,069	--	110	Owner	LM-bedrock		Private
63	PW-B-30	35°23′52″	86°00′01″	--	1,068	--	96	Owner	UM-regolith		Private
64	PW-B-31	35°23′50″	85°59′57″	1,025	1,072	47	65	Measurement	UM-regolith		Private
65	PW-B-32	35°25′08″	86°00′35″	--	1,086	--	65	Measurement	LM-bedrock		Private
66	PW-B-33	35°25′52″	86°00′38″	--	1,101	--	--	--	LM-bedrock		Private
67	PW-B-34	35°25′51″	86°00′35″	1,074	1,098	24	--	--	LM-bedrock		Private
68	PW-B-35	35°25′26″	86°00′07″	1,037	1,102	65	--	--	LM-bedrock		Private
69	PW-B-36	35°23′53″	86°00′42″	1,033	1,082	49	--	--	UM-regolith		Private
70	PW-B-37	35°20′55″	86°00′34″	--	1,065	--	--	--	UM-regolith		Private
71	PW-B-38	35°23′31″	86°00′57″	1,038	1,094	56	80	Measurement	UM-regolith		Private
72	PW-B-39	35°20′04″	86°02′29″	961	1,001	40	83	Measurement	UM-regolith		Private
73	PW-C-01	35°20′25″	86°00′50″	1,001	1,020	19	79	Measurement	UM-regolith		Private
74	PW-C-02	35°20′27″	86°01′14″	1,016	1,020	4	76	Measurement	UM-regolith		Private
75	PW-C-03	35°20′42″	86°01′23″	1,016	1,037	21	69	Measurement	UM-regolith		Private
76	PW-C-04	35°20′38″	86°01′22″	--	1,023	--	85	Owner	UM-regolith		Private
77	PW-C-05	35°20′32″	86°01′17″	--	1,027	--	14	Measurement	UM-regolith		Private
78	PW-C-06	35°20′30″	86°01′07″	--	1,020	--	72	Owner	UM-regolith		Private
79	PW-C-07	35°20′36″	86°01′19″	1,013	1,028	15	--	--	UM-regolith		Private
80	PW-C-08	35°20′26″	86°01′00″	1,011	1,033	22	65	Measurement	UM-regolith		Private
81	PW-C-09	35°20′32″	86°00′36″	1,002	1,039	37	78	Measurement	UM-regolith		Private
82	PW-C-10	35°20′27″	86°00′37″	978	1,022	44	80	Owner/State	UM-regolith		Private
83	PW-C-11	35°20′47″	86°00′26″	1,043	1,072	29	--	--	UM-regolith		Private
84	PW-C-12	35°21′03″	86°00′14″	1,044	1,067	23	70	Measurement	UM-regolith		Private
85	PW-C-13	35°21′46″	86°00′04″	985	1,050	65	115	Measurement	UM-regolith		Private
86	PW-C-14	35°21′31″	86°00′05″	--	1,072	--	90	Owner	UM-regolith		Private
87	PW-C-15	35°21′42″	86°00′03″	982	1,061	79	104	Measurement	UM-regolith		Private
88	PW-C-16	35°21′43″	86°00′00″	982	1,060	78	100	Owner	UM-regolith		Private
89	PW-C-17	35°21′38″	85°59′59″	--	1,072	--	110	Owner	UM-regolith		Private
90	PW-C-18	35°22′04″	86°00′02″	990	1,042	52	74	Measurement	UM-regolith		Private

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
91	PW-C-19	35°21′18″	86°00′08″	1,033	1,082	49	80	Measurement	UM-regolith		Private
92	PW-C-20	35°21′48″	85°59′36″	978	1,015	37	73	Measurement	UM-regolith		Private
93	PW-C-21	35°20′56″	86°00′15″	--	1,071	--	85	Owner	UM-regolith		Private
94	PW-C-22	35°22′17″	86°00′26″	992	1,057	65	90	Owner	UM-regolith		Private
95	PW-C-23	35°22′15″	86°00′37″	1,022	1,065	43	94	Owner	UM-regolith		Private
96	PW-C-24	35°20′40″	86°01′23″	1,012	1,030	18	71	Measurement	UM-regolith		Private
97	PW-C-25	35°21′43″	86°00′32″	1,014	1,061	47	93	Measurement	UM-regolith		Private
98	PW-C-26	35°21′43″	86°00′46″	--	1,080	--	96	Owner	UM-regolith		Private
99	PW-C-27	35°22′38″	86°01′10″	--	1,083	--	80	Owner	UM-regolith		Private
100	PW-C-28	35°22′09″	86°01′07″	1,056	1,091	35	82	Measurement	--		Private
101	PW-C-29	35°22′02″	86°01′09″	1,048	1,078	30	67	Measurement	UM-regolith		Private
102	PW-C-30	35°22′27″	86°00′51″	--	1,082	--	125	Owner	UM-regolith		Private
103	PW-C-31	35°20′41″	85°58′27″	--	992	--	48	Owner	LM-bedrock		Private
104	PW-C-32	35°20′32″	85°58′31″	967	987	20	60	Measurement	LM-bedrock		Private
105	PW-C-33	35°20′30″	85°58′33″	965	987	22	86	Owner	LM-bedrock		Private
106	PW-C-34	35°19′13″	85°59′45″	956	991	35	68	Measurement	UM-regolith		Private
107	PW-C-35	35°20′07″	85°59′07″	--	971	--	50	Owner	LM-bedrock		Private
108	PW-C-36	35°20′09″	85°59′32″	958	972	14	61	Measurement	LM-bedrock		Private
109	PW-C-37	35°20′11″	85°58′53″	--	1,003	--	--	--	LM-bedrock		Private
110	PW-C-38	35°20′42″	85°58′18″	--	1,003	--	--	--	LM-bedrock		Private
111	PW-C-39	35°21′04″	86°00′49″	1,038	1,070	33	75	Measurement	UM-regolith		Private
112	PW-C-40	35°20′07″	85°58′58″	956	987	31	54	Measurement	LM-bedrock		Private
113	PW-C-41	35°19′37″	85°59′26″	955	990	35	55	Measurement	UM-regolith		Private
114	PW-C-42	35°19′35″	85°59′26″	954	988	34	65	Measurement	--		Private
115	PW-C-43	35°20′00″	86°02′18″	967	1,020	53	73	Measurement	UM-regolith		Private
116	PW-C-44	35°20′05″	85°59′08″	953	969	16	76	Measurement	LM-bedrock		Private
117	PW-C-45	35°20′08″	85°58′52″	955	1,001	46	70	Owner	LM-bedrock		Private
118	PW-C-46	35°22′46″	86°01′07″	1,031	1,072	41	91	Measurement	UM-regolith		Private
119	PW-D-01	35°19′08″	86°02′18″	956	1,021	65	87	Measurement	LM-bedrock		Private
120	PW-D-02	35°20′03″	86°00′57″	959	996	37	75	Measurement	UM-regolith		Private

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
121	PW-D-03	35°20′05″	86°00′47″	961	1,023	62	106	Measurement	--		Private
122	PW-D-04	35°19′01″	86°02′22″	946	990	44	77	Measurement	UM-regolith		Private
123	PW-D-05	35°19′04″	86°02′19″	955	1,012	57	82	Measurement	--		Private
124	PW-D-06	35°19′27″	85°59′45″	954	992	38	85	State	LM-bedrock		Private
125	PW-D-07	35°20′07″	85°59′51″	949	984	35	92	Owner	LM-bedrock		Private
126	PW-D-08	35°20′27″	85°59′50″	957	1,003	46	84	Measurement	LM-bedrock		Private
127	PW-D-09	35°20′23″	85°59′38″	967	1,009	42	95	Owner	LM-bedrock		Private
128	PW-D-10	35°20′27″	85°59′42″	966	1,010	44	63	Measurement	LM-bedrock		Private
129	PW-D-11	35°19′30″	86°01′05″	957	982	25	58	Measurement	UM-regolith		Private
130	PW-D-12	35°19′38″	86°00′58″	953	995	42	75	Measurement	UM-regolith		Private
131	PW-D-13	35°19′28″	86°01′23″	964	987	23	66	Measurement	UM-regolith		Private
132	PW-D-14	35°19′59″	86°02′33″	959	1,003	44	77	Measurement	UM-regolith		Private
133	PW-D-15	35°19′34″	86°01′12″	968	990	22	73	Measurement	UM-regolith		Private
134	PW-D-16	35°19′43″	86°00′33″	963	1,006	43	65	Owner	UM-regolith		Private
135	PW-D-17	35°19′45″	86°00′32″	958	1,009	51	83	Measurement	UM-regolith		Private
136	PW-D-18	35°19′49″	86°00′33″	963	1,012	49	72	Measurement	UM-regolith		Private
137	PW-D-19	35°19′50″	86°00′33″	962	1,011	49	85	Measurement	UM-regolith		Private
138	PW-D-20	35°19′40″	86°00′35″	966	1,002	36	74	Measurement	UM-regolith		Private
139	PW-D-21	35°19′28″	86°00′31″	964	985	21	61	Measurement	--		Private
140	PW-D-22	35°19′24″	86°00′33″	967	983	16	54	Measurement	UM-regolith		Private
141	PW-D-23	35°20′05″	86°02′20″	956	998	42	58	Measurement	UM-regolith		Private
142	PW-D-24	35°19′38″	86°02′55″	968	1,012	44	81	Measurement	UM-regolith		Private
143	PW-D-25	35°19′27″	86°03′06″	980	1,032	52	74	Measurement	UM-regolith		Private
144	PW-D-26	35°19′25″	86°02′52″	977	1,042	66	85	Owner	UM-regolith		Private
145	PW-D-27	35°20′26″	86°01′53″	1,002	1,052	50	91	Measurement	UM-regolith		Private
146	PW-D-28	35°19′28″	86°02′10″	970	1,041	71	99	Measurement	LM-bedrock		Private
147	PW-D-29	35°19′29″	86°02′07″	--	1,037	--	--	--	UM-regolith		Private
148	PW-D-30	35°19′53″	86°01′17″	965	1,023	58	65	Owner	UM-regolith		Private
149	PW-D-31	35°19′47″	86°01′11″	962	997	35	69	Measurement	UM-regolith		Private
150	PW-D-32	35°19′58″	86°02′26″	--	998	--	72	Owner	LM-bedrock		Private

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
151	AEDC-98	35°23′17″	86°03′36″	1,052	1,086	34	65	AEDC		Intermediate	Monitoring
152	AEDC-154	35°22′49″	86°03′09″	1,044	1,090	46	68	AEDC		Intermediate	Monitoring
153	AEDC-155	35°22′50″	86°03′09″	1,060	1,090	30	91	AEDC		Deep	Monitoring
154	AEDC-156	35°22′41″	86°03′00″	1,075	1,090	14	77	AEDC		Intermediate	Monitoring
155	AEDC-157	35°22′42″	86°03′00″	1,058	1,090	31	95	AEDC		Deep	Monitoring
156	AEDC-158	35°22′54″	86°02′55″	1,076	1,095	19	76	AEDC		Deep	Monitoring
157	AEDC-159	35°22′54″	86°02′55″	1,073	1,096	23	91	AEDC		Deep	Monitoring
158	AEDC-160	35°22′42″	86°02′53″	1,077	1,096	19	78	AEDC		Intermediate	Monitoring
159	AEDC-161	35°22′42″	86°02′53″	1,077	1,096	19	88	AEDC		Deep	Monitoring
160	AEDC-162	35°22′55″	86°02′47″	1,077	1,096	19	86	AEDC		Intermediate	Monitoring
161	AEDC-163	35°22′54″	86°02′47″	1,075	1,094	19	97	AEDC		Deep	Monitoring
162	AEDC-164	35°22′46″	86°02′17″	1,081	1,103	22	66	AEDC		Intermediate	Monitoring
163	AEDC-165	35°22′46″	86°02′17″	1,081	1,103	22	82	AEDC		Deep	Monitoring
164	AEDC-177	35°25′14″	86°01′16″	1,053	1,089	36	127	AEDC		Deep	Monitoring
165	AEDC-185	35°25′09″	86°05′10″	1,062	1,105	44	61	AEDC		Deep	Monitoring
166	AEDC-188	35°21′29″	85°58′58″	971	1,011	40	112	AEDC		Deep	Monitoring
167	AEDC-189	35°21′29″	85°58′58″	971	1,011	39	85	AEDC		Intermediate	Monitoring
168	AEDC-196	35°26′23″	86°04′41″	1,035	1,081	46	167	AEDC		Deep	Monitoring
169	AEDC-197	35°26′23″	86°04′42″	1,041	1,083	42	48	AEDC		Intermediate	Monitoring
170	AEDC-198	35°22′53″	86°01′19″	1,032	1,072	40	133	AEDC		Deep	Monitoring
171	AEDC-199	35°22′53″	86°01′19″	1,033	1,073	40	100	AEDC		Intermediate	Monitoring
172	AEDC-200	35°23′53″	86°03′24″	1,050	1,067	17	84	AEDC		Deep	Monitoring
173	AEDC-201	35°23′53″	86°03′24″	1,050	1,067	16	58	AEDC		Intermediate	Monitoring
174	AEDC-202	35°20′12″	86°02′49″	961	979	18	91	AEDC		Deep	Monitoring
175	AEDC-203	35°20′12″	86°02′48″	960	976	15	53	AEDC		Intermediate	Monitoring
176	AEDC-204	35°18′32″	86°04′32″	--	965	--	116	AEDC		Deep	Monitoring
177	AEDC-205	35°18′31″	86°04′33″	960	963	3	50	AEDC		Intermediate	Monitoring
178	AEDC-206	35°21′17″	85°58′32″	971	1,006	34	77	AEDC		Deep	Monitoring
179	AEDC-215	35°24′20″	86°02′42″	1,053	1,076	23	61	AEDC		Intermediate	Monitoring
180	AEDC-216	35°24′13″	86°01′08″	1,018	1,055	37	62	AEDC		Intermediate	Monitoring

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
181	AEDC-218	35°22′12″	86°03′49″	1,066	1,083	17	76	AEDC		Intermediate	Monitoring
182	AEDC-223	35°21′23″	86°05′37″	997	1,047	50	71	AEDC		Intermediate	Monitoring
183	AEDC-224	35°21′30″	86°04′05″	1,058	1,080	22	85	AEDC		Intermediate	Monitoring
184	AEDC-225	35°19′48″	86°05′42″	999	1,046	48	66	AEDC		Intermediate	Monitoring
185	AEDC-226	35°21′15″	86°02′31″	1,020	1,058	37	91	AEDC		Intermediate	Monitoring
186	AEDC-227	35°20′38″	86°01′44″	1,017	1,060	43	91	AEDC		Intermediate	Monitoring
187	AEDC-270	35°22′56″	86°03′16″	1,057	1,090	33	88	AEDC		Deep	Monitoring
188	AEDC-271	35°22′56″	86°03′16″	1,063	1,090	27	49	AEDC		Intermediate	Monitoring
189	AEDC-273	35°23′04″	86°03′14″	1,028	1,084	55	93	AEDC		Deep	Monitoring
190	AEDC-274	35°23′04″	86°03′14″	1,049	1,083	34	73	AEDC		Intermediate	Monitoring
191	AEDC-278	35°22′58″	86°03′00″	1,058	1,088	31	94	AEDC		Deep	Monitoring
192	AEDC-279	35°22′58″	86°03′00″	1,054	1,089	35	81	AEDC		Intermediate	Monitoring
193	AEDC-282	35°23′11″	86°03′18″	1,049	1,088	39	110	AEDC		Deep	Monitoring
194	AEDC-283	35°23′11″	86°03′17″	1,061	1,087	26	76	AEDC		Intermediate	Monitoring
195	AEDC-285	35°23′13″	86°03′08″	1,058	1,083	25	103	AEDC		Deep	Monitoring
196	AEDC-286	35°23′13″	86°03′08″	1,063	1,087	24	80	AEDC		Intermediate	Monitoring
197	AEDC-288	35°23′15″	86°02′51″	1,061	1,080	18	114	AEDC		Deep	Monitoring
198	AEDC-289	35°23′15″	86°02′51″	1,061	1,080	18	95	AEDC		Intermediate	Monitoring
199	AEDC-291	35°23′09″	86°02′46″	--	1,081	--	116	AEDC		Deep	Monitoring
200	AEDC-292	35°23′09″	86°02′45″	1,062	1,081	20	95	AEDC		Intermediate	Monitoring
201	AEDC-322	35°23′17″	86°02′38″	1,058	1,082	23	69	AEDC		Intermediate	Monitoring
202	AEDC-327	35°22′46″	86°02′31″	1,079	1,105	26	58	AEDC		Intermediate	Monitoring
203	AEDC-330	35°23′23″	86°03′04″	1,062	1,090	28	96	AEDC		Deep	Monitoring
204	AEDC-331	35°23′23″	86°03′05″	1,063	1,090	27	78	AEDC		Intermediate	Monitoring
205	AEDC-353	35°24′41″	86°04′45″	1,049	1,068	19	162	AEDC		Deep	Monitoring
206	AEDC-354	35°24′41″	86°04′45″	1,047	1,067	21	24	AEDC		Intermediate	Monitoring
207	AEDC-355	35°24′36″	86°04′12″	1,046	1,071	24	32	AEDC		Intermediate	Monitoring
208	AEDC-356	35°24′58″	86°03′47″	1,051	1,070	19	34	AEDC		Intermediate	Monitoring
209	AEDC-358	35°25′07″	86°03′45″	1,052	1,073	21	30	AEDC		Intermediate	Monitoring
210	AEDC-359	35°25′07″	86°03′45″	1,048	1,073	25	85	AEDC		Deep	Monitoring

Table 1. Well-construction and water-level data for private and monitoring wells in the Bradley-Brumalow Creeks area near Arnold Air Force Base, Tennessee

Site number (fig. 3)	Project number	Latitude	Longitude	Water level altitude, in feet above sea level	Land surface altitude, in feet above sea level	Depth to water, in feet below land surface	Well depth, in feet below land surface	Depth source	Inferred hydro-geologic unit (where appli-cable)	Hydrogeologic unit - alternate designation (where applicable)	Well type
211	AEDC-364	35°22′34″	86°03′21″	1,063	1,082	20	64	AEDC		Intermediate	Monitoring
212	AEDC-365	35°22′36″	86°03′32″	1,057	1,072	15	82	AEDC		Intermediate	Monitoring
213	AEDC-366	35°22′40″	86°03′33″	1,056	1,076	20	87	AEDC		Intermediate	Monitoring
214	AEDC-367	35°22′44″	86°03′25″	1,060	1,076	16	75	AEDC		Intermediate	Monitoring
215	AEDC-368	35°23′19″	86°03′17″	1,063	1,090	27	76	AEDC		Intermediate	Monitoring
216	AEDC-369	35°23′25″	86°03′15″	1,059	1,091	32	86	AEDC		Intermediate	Monitoring
217	AEDC-370	35°23′13″	86°03′08″	1,058	1,084	25	80	AEDC		Intermediate	Monitoring
218	AEDC-412	35°23′15″	86°02′28″	1,056	1,086	30	91	AEDC		Intermediate	Monitoring
219	AEDC-413	35°23′18″	86°02′43″	1,056	1,083	27	86	AEDC		Shallow	Monitoring
220	AEDC-420	35°23′11″	86°02′22″	1,057	1,089	32	95	AEDC		Deep	Monitoring
221	AEDC-421	35°23′17″	86°02′38″	1,055	1,082	27	86	AEDC		Intermediate	Monitoring
222	AEDC-428	35°23′52″	86°01′45″	1,044	1,082	38	85	AEDC		Deep	Monitoring
223	AEDC-452	35°23′21″	86°02′35″	1,056	1,083	27	88	AEDC		Intermediate	Monitoring
224	AEDC-454	35°23′19″	86°03′02″	1,062	1,085	24	88	AEDC		Intermediate	Monitoring
225	AEDC-458	35°23′00″	86°03′32″	1,043	1,072	29	72	AEDC		Intermediate	Monitoring
226	AEDC-463	35°23′57″	86°04′08″	1,043	1,069	26	84	AEDC		Intermediate	Monitoring
227	AEDC-465	35°23′52″	86°01′46″	1,045	1,083	38	40	AEDC		Shallow	Monitoring
228	AEDC-470	35°22′31″	86°02′44″	1,068	1,102	33	67	AEDC		Shallow	Monitoring
229	AEDC-473	35°23′42″	86°02′12″	1,053	1,076	23	55	AEDC		Shallow	Monitoring
230	AEDC-487	35°22′20″	86°02′36″	1,076	1,086	9	70	AEDC		Shallow	Monitoring
231	AEDC-488	35°23′33″	86°01′28″	1,031	1,064	33	43	AEDC		Shallow	Monitoring
232	AEDC-494	35°23′18″	86°03′36″	1,052	1,088	36	90	AEDC		Deep	Monitoring
233	AEDC-498	35°22′26″	86°03′02″	1,078	1,089	11	77	AEDC		Shallow	Monitoring
234	AEDC-501	35°23′44″	86°04′11″	1,044	1,069	24	75	AEDC		Shallow	Monitoring
235	AEDC-506	35°23′44″	86°04′11″	1,044	1,069	25	76	AEDC		Shallow	Monitoring
236	AEDC-507	35°23′44″	86°04′11″	1,044	1,069	24	76	AEDC		Shallow	Monitoring
237	AEDC-519	35°23′21″	86°02′35″	1,055	1,082	26	89	AEDC		Shallow	Monitoring
238	AEDC-520	35°23′21″	86°02′35″	1,055	1,082	26	125	AEDC		Deep	Monitoring

APPENDIXES

APPENDIX 1. INORGANIC CONSTITUENTS IN AND PHYSICAL PROPERTIES OF WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; deg C, degrees Celsius. Values given as < (less than) indicate that the concentration was below the detection limit of the analytical method used and does not indicate the presence or absence of the constituent]

Project number	Tennessee local well number	USGS station number	Date	Time	Specific conductance (µS/cm)	pH (standard units)	Alkalinity (mg/L as $CaCO_3$)	Tempera-ture (deg C)	Calcium (mg/L as Ca)	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potas-sium (mg/L as K)	Chloride (mg/L as Cl)	Sulfate (mg/L as SO_4)	Fluoride (mg/L as F)
PW-A-01	Cf:H-006	352554085594001	09/14/99	1310	456	7.2	220	17.0	84	10	3.6	1.1	9.6	20	0.19
PW-A-02	Cf:C-001	352149086001101	09/15/99	1640	17	4.7	3	17.5	0.5	0.3	0.8	<0.1	0.7	0.2	<0.1
PW-A-03	Cf:C-002	352139086001901	09/16/99	1140	69	5.7	21	18.5	6.9	2.4	2.2	0.2	3	0.2	<0.1
PW-A-04	Cf:C-003	352111086005201	09/16/99	1650	45	5.1	7	17.0	2.2	0.8	4	0.1	3.2	0.6	<0.1
PW-A-05	Cf:H-007	352232085592001	09/17/99	1005	333	7.5	167	15.5	52	10	1.1	0.5	3.1	3.3	0.12
PW-A-06	Cf:C-004	352043086013501	09/20/99	1210	82	6.2	34	16.5	11	3	1.6	0.4	1.9	4.8	<0.1
PW-A-07	Cf:C-005	352046086012501	09/20/99	1350	23	5.5	11	17.0	2.8	0.9	0.5	<0.1	0.7	1.1	<0.1
PW-A-08	Cf:C-006	352037086014101	09/20/99	1530	60	4.6	3	16.5	2.5	2	3.4	0.2	6.1	<0.2	<0.1
PW-A-09	Cf:H-008	352541085593801	09/21/99	1320	419	7.4	194	16.5	69	10	3	0.5	8.8	12	<0.1
PW-A-10	Cf:H-009	352549085594801	09/21/99	1440	355	7.4	176	16.0	68	3.6	1.1	0.5	4.4	9.1	0.22
PW-A-11	Cf:H-010	352547085593501	09/22/99	940	519	7.1	259	15.0	100	7	2.3	0.5	3.5	29	0.21
PW-A-12	Cf:D-011	352207085594001	09/22/99	1240	244	7.5	129	17.0	36	10	0.8	0.2	1.9	4.6	<0.1
PW-A-13	Cf:H-011	352251085590101	09/22/99	1530	188	6.4	76	15.5	25	7.8	2.6	0.9	5.9	8.1	<0.1
PW-A-14	Cf:C-007	351954086020601	09/23/99	1100	181	6.9	81	17.0	22	8.1	1.5	0.3	3.3	1.2	<0.1
PW-A-15	Cf:C-008	352012086015501	09/23/99	1200	67	6.1	30	16.0	8.6	2.6	0.7	0.1	1.6	2.5	<0.1
PW-A-16	Fr:S-021	351845086025801	09/23/99	1550	94	6.0	37	17.0	11	4.2	0.9	<0.1	3.1	0.5	<0.1
PW-A-17	Fr:S-022	351846086030301	09/28/99	1015	36	4.6	2	17.0	1.3	0.9	1.3	0.2	2.6	<0.2	<0.1
PW-A-18	Fr:S-023	351844086030301	09/28/99	1145	44	5.2	10	17.0	3.2	1.7	1.6	0.3	3.3	0.2	<0.1
PW-A-19	Fr:S-024	351853086025601	09/28/99	1315	232	7.4	115	17.0	32	10	0.8	0.2	2.4	1.1	<0.1
PW-A-20	Fr:S-025	351853086025301	09/28/99	1500	154	6.6	69	17.0	19	6.9	1.3	0.2	2.8	0.4	<0.1
PW-A-21	Cf:C-009	351942086022101	09/28/99	1640	209	6.6	66	16.5	22	5.8	1.3	0.3	4.9	1.9	<0.1
PW-A-22	Cf:C-010	351951086021601	09/30/99	1015	224	7.3	115	15.5	36	6.7	0.6	0.2	2	1.2	<0.1
PW-A-23	Cf:D-012	352117085583901	09/30/99	1530	351	7.1	154	16.0	59	8.5	1.9	1	5.6	21	<0.1
PW-A-24	Cf:D-013	352127085585601	10/01/99	1020	165	7.3	91	16.0	26	7.9	0.8	0.3	2.3	1.1	<0.1
PW-A-25	Cf:D-014	352132085591101	10/01/99	1130	151	7.6	91	16.0	25	6.9	0.7	0.3	1	0.7	<0.1
PW-A-26	Cf:C-011	352051086003901	10/05/99	1119	13	5.1	6	16.0	1.3	0.6	0.5	0.1	0.7	0.6	<0.1
PW-A-27	Cf:C-012	352106086003401	10/05/99	1255	50	5.5	12	16.5	5	1.8	1.1	0.1	2.4	0.6	<0.1
PW-A-28	Cf:D-015	352151085594701	10/05/99	1515	283	7.7	164	15.0	42	13	1.3	0.4	1.3	1.4	<0.1
PW-A-29	Cf:H-012	352542085593801	10/06/99	1005	309	7.3	148	16.0	55	5.4	2.8	0.4	6.7	6.4	0.1
PW-A-30	Cf:C-013	352031086014401	10/06/99	1230	39	5.1	6	16.5	3.1	1.1	1.4	0.2	4.6	0.3	<0.1

APPENDIX 1. INORGANIC CONSTITUENTS IN AND PHYSICAL PROPERTIES OF WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE--Continued

Project number	Tennessee local well number	USGS station number	Date	Time	Specific conductance (µS/cm)	pH (standard units)	Alkalinity (mg/L as $CaCO_3$)	Tempera-ture (deg C)	Calcium (mg/L as Ca)	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potas-sium (mg/L as K)	Chloride (mg/L as Cl)	Sulfate (mg/L as SO_4)	Fluoride (mg/L as F)
PW-A-31	Cf:G-107	352354086001401	10/07/99	1330	23	4.9	5	16.5	0.5	0.8	1.2	0.2	3.1	<0.2	<0.1
PW-A-32	Fr:S-044	351911086022701	12/08/99	944	171	6.8	80	15.0	28	4.1	2	0.2	2.9	1.6	<0.1
PW-A-33	Cf:C-053	352103086002601	12/08/99	1025	83	7.2	5	12.0	1.4	1.8	1.1	0.3	3	<0.2	<0.1
PW-A-34	Cf:H-028	352553085593801	12/08/99	1305	435	6.6	208	16.5	79	3.4	7.8	0.8	13	4.6	0.12
PW-B-01	Cf:H-013	352337085592501	09/14/99	1730	15	5.0	6	16.5	0.6	0.3	0.9	0.1	0.6	0.7	<0.1
PW-B-02	Cf:H-014	352416085595801	09/15/99	1030	292	7.3	160	16.0	48	10	1.3	0.4	3.3	3.3	0.12
PW-B-03	Cf:H-015	352404085585001	09/15/99	1410	237	7.6	152	16.5	46	11	1.4	0.3	3	2	<0.1
PW-B-04	Cf:G-108	352358086002501	09/15/99	1550	101	5.0	7	16.5	3.9	4.8	6	0.3	9.4	<0.2	<0.1
PW-B-05	Cf:G-109	352349086005601	09/16/99	1030	72	5.3	12	15.5	5.3	2.9	1.9	0.7	4.3	<0.2	<0.1
PW-B-06	Cf:G-110	352252086005901	09/16/99	1320	25	4.7	4	16.0	1.2	0.7	0.9	<0.1	1.6	<0.2	<0.1
PW-B-07	Cf:G-111	352323086003801	09/16/99	1450	153	6.6	60	16.0	19	5.8	1.9	0.3	4.6	1.5	<0.1
PW-B-08	Cf:G-112	352260086002501	09/17/99	1005	22	4.9	6	16.0	1.3	0.9	0.7	0.2	1.5	<0.2	<0.1
PW-B-09	Cf:G-113	352257086002601	09/17/99	1140	133	5.6	12	16.5	7.4	2.5	12	1.4	17	1	<0.1
PW-B-10	Cf:H-016	352302085591901	09/20/99	1305	104	6.3	50	16.5	12	5	0.8	0.3	1.6	0.9	<0.1
PW-B-11	Cf:H-017	352258085592701	09/21/99	1040	33	5.4	14	15.5	3.4	1.6	1	0.2	1.6	0.5	<0.1
PW-B-12	Cf:H-018	352257085593201	09/21/99	1255	33	5.6	16	15.5	3.4	1.5	0.9	0.2	1.2	0.6	<0.1
PW-B-13	Cf:H-019	352256085595101	09/21/99	1425	85	6.3	39	17.5	8.9	4.1	1	0.1	1.8	0.2	<0.1
PW-B-14	Cf:G-114	352352086004801	09/22/99	1030	38	5.2	10	21.0	3	2.2	1.2	0.3	2.6	<0.2	<0.1
PW-B-15	Cf:H-020	352334085585701	09/22/99	1235	212	7.0	109	17.5	26	11	0.8	0.2	1.4	2.1	<0.1
PW-B-16	Cf:G-115	352250086010701	09/22/99	1520	24	4.7	4	17.0	0.7	0.8	0.9	0.3	2.2	0.9	<0.1
PW-B-17	Cf:H-021	352533085593601	09/22/99	1640	436	7.3	189	15.5	77	4.3	5.7	0.8	14	11	0.13
PW-B-18	Cf:G-116	352255086001101	09/23/99	1025	46	5.8	19	16.0	6.6	1.5	0.7	0.2	1.7	0.7	<0.1
PW-B-19	Cf:D-016	352138085582501	09/23/99	1220	369	7.3	152	15.5	61	8.9	2.1	0.8	5.5	34	<0.1
PW-B-20	Cf:D-017	352145085582501	09/23/99	1435	380	7.0	178	16.5	52	16	2.4	2.3	5.6	9	<0.1
PW-B-22	Cf:H-022	352417085594601	09/24/99	955	271	7.7	141	16.0	41	10	1.7	0.3	1.4	8.3	0.3
PW-B-23	Cf:G-117	352308086002001	09/24/99	1135	25	5.7	13	15.0	3.5	0.6	0.5	0.1	0.8	<0.2	<0.1
PW-B-24	Cf:G-118	352508086004101	09/27/99	1330	307	7.3	185	18.0	64	4.2	3.7	0.4	1.8	4	0.36
PW-B-25	Cf:H-023	352435085593101	09/28/99	915	208	7.0	187	15.5	68	6.3	1.9	0.7	5.7	2.8	<0.1
PW-B-26	Cf:G-119	352522086004401	09/28/99	1110	283	7.4	156	15.5	58	2.1	2	0.2	1.3	2.9	0.1
PW-B-27	Cf:H-024	352502085592001	09/28/99	1420	387	7.0	180	16.0	74	3.1	1.7	1.2	5.8	1.8	<0.1

APPENDIX 1. INORGANIC CONSTITUENTS IN AND PHYSICAL PROPERTIES OF WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE--Continued

Project number	Tennessee local well number	USGS station number	Date	Time	Specific conductance (µS/cm)	pH (standard units)	Alkalinity (mg/L as $CaCO_3$)	Tempera-ture (deg C)	Calcium (mg/L as Ca)	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potas-sium (mg/L as K)	Chloride (mg/L as Cl)	Sulfate (mg/L as SO_4)	Fluoride (mg/L as F)
PW-B-28	Cf:H-025	352500085584201	09/28/99	1705	206	7.6	118	16.5	42	3.8	1	0.4	1.8	1.4	0.16
PW-B-29	Cf:H-026	352341085592401	09/29/99	945	189	7.2	104	15.5	23	11	0.5	0.1	0.9	0.4	<0.1
PW-B-30	Cf:G-120	352352086000001	09/29/99	1120	25	4.8	8	16.0	1.4	0.8	0.9	0.1	0.8	0.4	<0.1
PW-B-31	Cf:H-027	352350085595701	09/29/99	1245	24	4.9	6	15.5	1.6	0.5	1.2	0.1	1.9	<0.2	<0.1
PW-B-32	Cf:G-121	352508086003501	09/29/99	1450	414	7.1	218	16.0	81	3.1	4.9	0.4	6.8	5.5	0.17
PW-B-33	Cf:G-122	352552086003801	09/30/99	925	337	7.0	164	15.5	62	3	3	0.7	1.7	0.3	<0.1
PW-B-34	Cf:G-123	352551086003401	09/30/99	1030	398	7.4	197	16.5	66	9.6	2.3	0.5	5.7	11	0.14
PW-B-35	Cf:G-124	352526086000701	09/30/99	1425	788	7.5	181	17.0	85	48	11	0.9	1.5	<0.2	2.1
PW-B-36	Cf:G-125	352353086004201	10/01/99	1010	59	5.3	8	16.0	4.3	2.4	0.6	1	3.4	1.6	<0.1
PW-B-37	Cf:C-014	352055086003401	10/26/99	1040	23	5.0	4	15.5	1.2	0.7	0.7	0.1	1.3	<0.2	<0.1
PW-B-38	Cf:G-126	352331086005701	10/26/99	1305	184	5.1	8	16.5	8	4.9	14	2.2	21	0.6	<0.1
PW-B-39	Cf:C-015	352004086022901	10/26/99	1450	20	5.0	6	14.5	0.8	0.6	1	0.2	1.9	<0.2	<0.1
PW-C-01	Cf:C-016	352025086005001	09/14/99	1340	34	4.6	4	17.0	1.4	1.2	2.1	0.1	3.1	<0.2	<0.1
PW-C-02	Cf:C-017	352027086011401	09/14/99	1630	72	6.4	40	18.0	13	2.1	0.5	0.1	1.3	1.7	<0.1
PW-C-03	Cf:C-018	352042086012301	09/15/99	1115	18	5.3	8	16.0	1.6	0.4	0.9	0.1	1	0.6	<0.1
PW-C-04	Cf:C-019	352038086012201	09/15/99	1405	62	6.2	30	15.5	9	1.9	0.5	<0.1	0.8	1.9	<0.1
PW-C-05	Cf:C-020	352032086011701	09/15/99	1530	53	6.1	26	16.0	8.2	1.5	0.6	0.2	1	1.3	<0.1
PW-C-06	Cf:C-021	352030086010701	09/16/99	940	61	6.2	34	14.5	11	2	0.6	0.1	1.3	1.8	<0.1
PW-C-07	Cf:C-022	352036086011901	09/16/99	1130	61	6.2	29	16.0	8.5	1.6	0.6	<0.1	0.9	1.3	<0.1
PW-C-08	Cf:C-023	352026086006001	09/16/99	1410	75	5.8	23	18.0	8	1.9	2.8	0.5	3.7	1.6	<0.1
PW-C-09	Cf:C-024	352032086003601	09/16/99	1600	52	6.0	26	18.5	8	1.3	0.7	0.2	0.8	0.5	<0.1
PW-C-10	Cf:C-025	352027086003701	09/17/99	945	61	6.2	35	16.5	11	2.6	0.6	0.2	0.7	0.6	<0.1
PW-C-11	Cf:C-026	352047086002601	09/17/99	1115	10	5.0	5	16.0	0.3	0.3	0.4	0.1	1	<0.2	<0.1
PW-C-12	Cf:C-027	352103086001401	09/20/99	1220	55	6.0	27	16.0	8.2	1.8	0.5	0.1	0.5	0.9	<0.1
PW-C-13	Cf:C-028	352146086000401	09/20/99	1530	22	4.9	7	16.5	1.7	0.9	0.8	<0.1	1.4	<0.2	<0.1
PW-C-14	Cf:C-029	352131086000501	09/21/99	1015	30	5.4	9	18.5	2.6	0.8	0.6	1	1.4	2.2	<0.1
PW-C-15	Cf:C-030	352142086000301	09/21/99	1205	43	5.9	22	15.5	5.5	1.6	0.6	<0.1	1	0.6	<0.1
PW-C-16	Cf:D-018	352142086000001	09/21/99	1420	88	6.2	39	16.0	12	3.3	0.8	0.1	1.4	1.2	<0.1
PW-C-17	Cf:D-019	352138085595901	09/21/99	1600	99	6.4	48	16.0	14	3.5	0.7	0.1	1.3	1.4	<0.1
PW-C-18	Cf:C-031	352204086000201	09/22/99	1025	69	6.1	24	15.5	7.8	2.4	0.6	0.2	1	1.1	<0.1

APPENDIX 1. INORGANIC CONSTITUENTS IN AND PHYSICAL PROPERTIES OF WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE--Continued

Project number	Tennessee local well number	USGS station number	Date	Time	Specific conductance (µS/cm)	pH (standard units)	Alkalinity (mg/L as $CaCO_3$)	Tempera-ture (deg C)	Calcium (mg/L as Ca)	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potas-sium (mg/L as K)	Chloride (mg/L as Cl)	Sulfate (mg/L as SO_4)	Fluoride (mg/L as F)
PW-C-19	Cf:C-032	352118086000801	09/22/99	1205	37	4.9	4	16.0	2	1.3	1.3	0.2	2.6	<0.2	<0.1
PW-C-20	Cf:D-020	352148085593601	09/22/99	1450	102	6.1	46	16.0	12	5.1	1	0.8	3	1.5	<0.1
PW-C-21	Cf:C-033	352056086001501	09/22/99	1625	13	5.2	6	16.0	0.5	0.4	0.6	0.2	0.9	<0.2	<0.1
PW-C-22	Cf:C-034	352217086002601	09/24/99	930	91	6.0	34	16.5	11	3.6	1	0.2	2.7	0.8	<0.1
PW-C-23	Cf:C-035	352215086003701	09/24/99	1055	26	5.4	8	16.5	2.2	1	0.9	0.1	1.4	0.6	<0.1
PW-C-24	Cf:C-036	352040086012301	09/27/99	1230	48	6.0	23	16.0	6.8	1.4	0.6	0.1	0.8	1.4	<0.1
PW-C-25	Cf:C-037	352143086003201	09/27/99	1400	26	5.0	5	17.0	1.3	0.7	1.2	0.2	2.3	<0.2	<0.1
PW-C-26	Cf:C-038	352143086004601	09/27/99	1520	76	6.3	37	16.0	9.9	2.7	0.7	0.1	1.1	1.3	<0.1
PW-C-27	Cf:G-127	352238086011001	09/28/99	900	17	4.9	6	16.5	0.8	0.4	0.7	0.1	1.1	0.2	<0.1
PW-C-28	Cf:C-039	352209086010701	09/28/99	1000	152	6.5	68	16.0	21	4	1.2	0.2	1.8	0.7	<0.1
PW-C-29	Cf:C-040	352202086010901	09/28/99	1110	25	4.8	4	21.0	1.3	0.7	0.9	0.1	2.3	<0.2	<0.1
PW-C-30	Cf:C-041	352227086005101	09/28/99	1340	322	5.5	16	16.5	4.3	0.8	0.9	0.1	0.8	0.6	<0.1
PW-C-31	Cf:D-021	352041085582701	09/28/99	1555	315	7.5	155	16.0	44	11	1.5	0.3	2.6	1.1	0.1
PW-C-32	Cf:D-022	352032085583101	09/28/99	1700	356	7.6	173	16.5	46	16	1.1	0.3	4.2	<0.2	0.13
PW-C-33	Cf:D-023	352030085583301	09/29/99	945	296	7.7	156	15.5	45	10	0.7	0.3	2.7	1.1	0.12
PW-C-34	Cf:D-024	351913085594501	09/29/99	1110	70	5.5	18	16.5	6.5	2.6	2.9	0.3	3.2	0.8	<0.1
PW-C-35	Cf:D-025	352007085590701	09/29/99	1220	298	6.8	144	16.0	47	5.2	2.4	0.5	3.4	2	<0.1
PW-C-36	Cf:D-026	352009085593201	09/29/99	1525	233	7.0	97	16.0	35	5.7	2.4	0.6	6.5	0.8	<0.1
PW-C-37	Cf:D-027	352011085585301	09/30/99	1050	265	7.3	128	16.5	43	5.8	1.5	1.1	2.5	1.8	0.1
PW-C-38	Cf:D-028	352042085581801	09/30/99	1315	377	7.0	178	15.5	68	4.9	2.1	0.9	6.5	1.7	<0.1
PW-C-39	Cf:C-042	352104086004901	09/30/99	1545	37	4.9	5	17.5	1.5	1.7	0.9	0.3	3	<0.2	<0.1
PW-C-40	Cf:D-029	352007085585801	10/01/99	1020	256	6.8	115	16.5	40	7.3	2.3	0.3	7.3	0.8	<0.1
PW-C-41	Cf:D-030	351937085592601	10/01/99	1210	100	4.8	4	17.5	5.7	2.8	7	0.4	9.3	<0.2	<0.1
PW-C-42	Cf:D-031	351935085592601	10/05/99	1243	147	6.4	58	17.0	18	4.8	1.7	0.5	4	1.4	<0.1
PW-C-43	Cf:C-043	352000086021801	10/05/99	1600	58	6.0	27	16.0	7.7	2.1	0.7	0.1	1.3	1.1	<0.1
PW-C-44	Cf:D-032	352005085590801	10/06/99	1100	228	7.8	118	16.0	36	7.7	1	0.2	2.1	1.8	0.1
PW-C-45	Cf:D-033	352008085585201	10/07/99	1210	261	7.7	136	17.0	44	7.7	0.9	0.3	1.9	1.6	0.1
PW-C-46	Cf:G-128	352246086010701	10/07/99	1410	38	4.9	5	16.5	2	1.1	1.7	0.4	2.7	0.6	<0.1
PW-D-01	Fr:S-026	351908086021801	09/20/99	1450	272	6.9	136	16.0	45	7.6	1.1	0.3	3	3.3	<0.1
PW-D-02	Cf:C-044	352003086005701	09/21/99	1030	140	4.5	4	16.5	5.2	3.9	12	0.8	22	<0.2	<0.1

APPENDIX 1. INORGANIC CONSTITUENTS IN AND PHYSICAL PROPERTIES OF WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE--Continued

Project number	Tennessee local well number	USGS station number	Date	Time	Specific conductance (µS/cm)	pH (standard units)	Alkalinity (mg/L as $CaCO_3$)	Tempera-ture (deg C)	Calcium (mg/L as Ca)	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potas-sium (mg/L as K)	Chloride (mg/L as Cl)	Sulfate (mg/L as SO_4)	Fluoride (mg/L as F)
PW-D-03	Cf:C-045	352005086004701	09/21/99	1355	144	6.5	58	16.5	21	3.7	0.9	0.7	2.9	3.6	<0.1
PW-D-04	Fr:S-027	351901086022201	09/21/99	1545	50	4.8	6	17.0	3	2.1	1.4	0.2	3.5	<0.2	<0.1
PW-D-05	Fr:S-028	351904086021901	09/22/99	950	150	6.3	67	16.0	24	3.7	1.3	0.3	2.6	0.8	<0.1
PW-D-06	Cf:D-034	351927085594501	09/22/99	1130	246	7.0	125	15.5	35	11	1.1	0.3	1.9	7	<0.1
PW-D-07	Cf:D-035	352007085595101	09/22/99	1355	287	6.9	131	16.0	45	8.2	3.6	0.4	8.7	0.8	<0.1
PW-D-08	Cf:D-036	352027085595001	09/22/99	1600	177	6.8	91	15.5	28	5.3	0.8	0.1	1.1	0.7	<0.1
PW-D-09	Cf:D-037	352023085593801	09/23/99	1025	270	7.6	141	15.5	46	6.8	0.8	0.2	1.6	1	<0.1
PW-D-10	Cf:D-038	352027085594201	09/23/99	1220	245	7.4	135	16.0	44	6.5	0.9	0.2	1.8	0.8	<0.1
PW-D-11	Fr:S-029	351930086010501	09/23/99	1535	145	6.1	51	16.0	15	6.7	1.8	0.5	6	<0.2	<0.1
PW-D-12	Fr:S-030	351938086005801	09/23/99	1800	101	6.4	43	17.0	14	4.4	0.9	0.4	2.9	1.8	<0.1
PW-D-13	Fr:S-031	351928086012301	09/24/99	1020	43	5.0	5	16.0	2.9	1.6	1.1	0.4	3.1	<0.2	<0.1
PW-D-14	Fr:S-032	351959086023301	09/24/99	1210	33	5.3	14	16.0	4	1.3	0.8	0.2	1.9	0.4	<0.1
PW-D-15	Fr:S-033	351934086011201	09/27/99	1210	41	4.7	4	17.0	3.8	2.2	2.2	0.8	7.9	<0.2	<0.1
PW-D-16	Cf:C-046	351943086003301	09/27/99	1500	14	4.8	5	15.5	0.7	0.5	0.8	0.1	1.3	<0.2	<0.1
PW-D-17	Cf:C-047	351945086003201	09/27/99	1650	68	5.9	41	15.5	13	2.3	0.6	0.2	1.2	0.6	<0.1
PW-D-18	Cf:C-048	351949086003301	09/28/99	935	38	4.6	4	17.0	1.3	0.7	2.9	0.3	3.5	0.2	<0.1
PW-D-19	Cf:C-049	351950086003301	09/28/99	1120	61	4.8	6	16.5	3.6	1.9	3.3	0.4	5.3	<0.2	<0.1
PW-D-20	Cf:C-050	351940086003501	09/28/99	1250	103	6.2	54	16.0	15	3.5	0.8	0.1	1.5	0.3	<0.1
PW-D-21	Cf:C-051	351928086003101	09/28/99	1525	151	6.5	76	15.5	19	7.5	1.4	0.3	2.3	1	<0.1
PW-D-22	Fr:S-034	351924086003301	09/28/99	1705	110	5.8	34	16.0	9.2	4.3	2.6	4.2	5.8	3.6	<0.1
PW-D-23	Fr:S-035	352005086022001	09/29/99	1005	34	5.0	8	16.0	1.8	1.2	1.5	0.4	2.6	<0.2	<0.1
PW-D-24	Fr:S-036	351938086025501	09/29/99	1235	55	5.6	20	16.5	5.6	2.5	0.8	0.2	2	<0.2	<0.1
PW-D-25	Fr:S-037	351927086030601	09/29/99	1450	100	6.1	56	16.0	16	4.5	0.7	0.2	2.3	0.2	<0.1
PW-D-26	Fr:S-038	351925086025201	09/29/99	1655	121	6.2	55	16.0	15	6.1	1.3	0.1	3.3	0.6	<0.1
PW-D-27	Cf:C-052	352026086015301	09/30/99	930	76	6.2	39	15.0	10	3.1	0.4	<0.1	0.9	3.8	<0.1
PW-D-28	Fr:S-039	351928086021001	09/30/99	1220	307	7.6	153	16.0	52	11	0.9	0.3	1.8	25	<0.1
PW-D-29	Fr:S-040	351929086020701	09/30/99	1445	85	5.5	16	16.0	8.9	3	1.7	0.3	4.9	0.3	<0.1
PW-D-30	Fr:S-041	351953086011701	09/30/99	1640	107	6.4	53	15.5	12	6	0.5	0.1	2.2	0.3	<0.1
PW-D-31	Fr:S-042	351947086011101	10/01/99	940	68	5.8	32	16.0	7.8	3.9	0.9	0.3	2.5	<0.2	<0.1
PW-D-32	Fr:S-043	351958086022601	10/01/99	1140	216	7.1	105	15.5	33	6.8	0.7	0.2	2.7	1.5	<0.1

APPENDIX 2. VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE—Continued

[μg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (μg/L)	Bromo-dichloro-methane (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Carbon disulfide (μg/L)	Chloro-methane (μg/L)	1,1-Dichloro-ethylene (μg/L)	Ethyl-benzene (μg/L)	Dichloro-difluoro-methane (μg/L)	2-Butanone (μg/L)	Methylene chloride (μg/L)	Tetra-chloro-ethylene (μg/L)	1,1,1-Trichloro-ethane (μg/L)	Trichloro-ethylene (μg/L)	Chloro-form (μg/L)	Xylenes (total) (μg/L)
PW-A-01	4.6J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-02	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-03	3.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-04	2.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-05	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-06	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-06D	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-07	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-08	3.6J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	0.27J	<1
PW-A-09	4.1J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-10	2.5J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-11	3.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-12	4.3J	<1	<1	<1	<1	<2	0.16J	<1	<2	1.1J	<1	<1	<1	<1	<1	<1
PW-A-13	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.38J	<1	<1	<1	<1	<1
PW-A-14	2.6J	<1	<1	<1	0.22J	<2	<1	<1	<2	<5	0.45J	<1	<1	<1	<1	<1
PW-A-15	3.3J	<1	<1	<1	<1	0.25J	<1	<1	<2	<5	0.41J	<1	<1	<1	<1	<1
PW-A-15D	3.1J	<1	<1	<1	<1	<2	<1	<1	<2	2.2J	0.41J	<1	<1	<1	<1	<1
PW-A-16	3.4J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-17	3.5J	<1	<1	<1	<1	<2	<1	<1	<2	3.3J	<1	<1	<1	<1	<1	<1
PW-A-18	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	2.3J	<1	<1	<1	<1	<1	<1
PW-A-19	<10	<1	<1	<1	<1	<2	<1	<1	<2	0.78J	<1	<1	<1	<1	<1	<1
PW-A-20	<10	<1	<1	<1	<1	<2	<1	<1	<2	1.1J	<1	<1	<1	<1	<1	<1
PW-A-21	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	1.0J	<1	<1	<1	<1	<1	<1
PW-A-22	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.24J	<1	<1	<1	<1	<1
PW-A-23	<10	<1	<1	<1	<1	0.23J	<1	<1	<2	<5	0.26J	<1	<1	<1	<1	<1
PW-A-24	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.32J	<1	<1	<1	<1	<1
PW-A-25	2.5J	<1	<1	<1	<1	<2	0.17J	<1	<2	<5	0.3J	<1	<1	<1	<1	<1
PW-A-25D	<10	<1	<1	<1	<1	0.24J	<1	<1	<2	<5	0.35J	<1	<1	<1	<1	<1
PW-A-26	3.6J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-27	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	1.7J	<1	<1	<1	<1	<1	<1

APPENDIX 2. VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE—Continued

[µg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (µg/L)	Bromo-dichloro-methane (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Carbon disulfide (µg/L)	Chloro-methane (µg/L)	1,1-Dichloro-ethylene (µg/L)	Ethyl-benzene (µg/L)	Dichloro-difluoro-methane (µg/L)	2-Butanone (µg/L)	Methylene chloride (µg/L)	Tetra-chloro-ethylene (µg/L)	1,1,1-Trichloro-ethane (µg/L)	Trichloro-ethylene (µg/L)	Chloro-form (µg/L)	Xylenes (total) (µg/L)
PW-A-28	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-29	3.1J	<1	<1	<1	<1	0.36J	<1	<1	<2	1.8J	<1	<1	<1	<1	<1	<1
PW-A-30	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-A-31	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.27J	<1	<1	<1	<1	<1
PW-A-32	5.8J	<1	<1	<1	<1	<2	<1	<1	<2	5.4J	<1	<1	<1	<1	<1	<1
PW-A-33	3.6J	<1	<1	<1	<1	<2	<1	<1	0.23J	3.8J	<1	<1	<1	<1	<1	<1
PW-A-34	5.6J	<1	<1	<1	<1	0.21J	<1	<1	<2	6.7J	<1	<1	<1	<1	0.27J	<1
PW-B-01	<10	<1	<1	<1	<1	<2	0.15J	<1	<2	<5	<1	0.49J	<1	0.35J	<1	<1
PW-B-02	3.1J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-03	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-04	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-05	3.5J	<1	<1	<1	0.15J	0.21J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-05D	<10	<1	<1	<1	<1	0.27J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-06	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	2.2J	<1	<1	<1	<1	<1	<1
PW-B-07	<10	<1	<1	<1	<1	<2	0.19J	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-08	3.5J	<1	<1	<1	<1	<2	0.27J	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-09	3.4J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	0.13J	<1	<1	<1	<1
PW-B-10	2.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-11	3.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-12	<10	<1	<1	<1	0.26J	0.24J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-13	<10	<1	<1	<1	<1	<2	0.56J	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-14	2.6J	<1	<1	<1	<1	<2	0.34J	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-15	<10	<1	<1	<1	0.22J	<2	<1	<1	<2	<5	<1	<1	<1	<1	0.17J	<1
PW-B-15D	3.6J	<1	<1	<1	0.24J	<2	0.25J	<1	<2	<5	<1	<1	<1	<1	0.14J	<1
PW-B-16	2.9J	<1	<1	1.4	<1	<2	<1	<1	<2	<5	0.24J	<1	<1	<1	<1	<1
PW-B-17	2.9J	<1	<1	0.16J	<1	<2	0.18J	<1	<2	0.89J	0.27J	<1	<1	<1	<1	<1
PW-B-18	3.3J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.27J	<1	<1	<1	<1	<1
PW-B-19	2.7J	<1	<1	<1	<1	<2	0.17J	<1	<2	<5	0.28J	<1	<1	<1	0.17J	<1
PW-B-20	2.9J	<1	<1	<1	<1	<2	0.17J	<1	<2	2.4J	<1	<1	<1	<1	<1	<1
PW-B-22	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1

APPENDIX 2. VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE—Continued

[μg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (μg/L)	Bromo-dichloro-methane (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Carbon disulfide (μg/L)	Chloro-methane (μg/L)	1,1-Dichloro-ethylene (μg/L)	Ethyl-benzene (μg/L)	Dichloro-difluoro-methane (μg/L)	2-Butanone (μg/L)	Methylene chloride (μg/L)	Tetra-chloro-ethylene (μg/L)	1,1,1-Trichloro-ethane (μg/L)	Trichloro-ethylene (μg/L)	Chloro-form (μg/L)	Xylenes (total) (μg/L)
PW-B-23	2.5J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-24	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-25	4.1J	<1	<1	<1	<1	<2	<1	<1	<2	3.5J	<1	<1	<1	<1	<1	<1
PW-B-25D	3.9J	<1	<1	<1	<1	<2	<1	<1	<2	3J	<1	<1	<1	<1	<1	<1
PW-B-26	3.1J	<1	<1	<1	<1	<2	<1	<1	<2	2.3J	<1	<1	<1	<1	<1	<1
PW-B-27	4.2J	<1	<1	<1	<1	<2	<1	<1	<2	1.7J	<1	<1	<1	<1	<1	<1
PW-B-28	5.1J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-29	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-30	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	0.14J	<1
PW-B-31	3.5J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-32	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.2J	<1	<1	<1	<1	<1
PW-B-33	3.5J	0.24J	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	2.4	<1
PW-B-34	3J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-35	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-35D	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-B-36	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	2.4J	0.31J	<1	<1	<1	<1	<1
PW-B-37	3.4J	<1	<1	<1	<1	<2	<1	<1	<2	1.8J	0.29J	<1	<1	<1	<1	<1
PW-B-38	<10	<1	<1	<1	<1	<2	<1	0.1J	<2	<5	0.25J	<1	<1	<1	0.46J	0.38J
PW-B-39	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.22J	<1	<1	<1	<1	<1
PW-C-01	3.4J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-02	4.3J	<1	<1	<1	<1	0.23J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-03	2.5J	<1	<1	<1	<1	<2	0.17J	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-04	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-05	2.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-05D	3.4J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-06	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-07	3.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-08	4.4J	<1	<1	1.3	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-09	3.3J	<1	<1	<1	<1	<2	<1	<1	<2	1.4J	<1	<1	<1	<1	<1	<1
PW-C-10	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1

APPENDIX 2. VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE—Continued

[µg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (µg/L)	Bromo-dichloro-methane (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Carbon disulfide (µg/L)	Chloro-methane (µg/L)	1,1-Dichloro-ethylene (µg/L)	Ethyl-benzene (µg/L)	Dichloro-difluoro-methane (µg/L)	2-Butanone (µg/L)	Methylene chloride (µg/L)	Tetra-chloro-ethylene (µg/L)	1,1,1-Trichloro-ethane (µg/L)	Trichloro-ethylene (µg/L)	Chloro-form (µg/L)	Xylenes (total) (µg/L)
PW-C-10D	4J	<1	<1	<1	<1	<2	<1	<1	<2	1.8J	<1	<1	<1	<1	<1	<1
PW-C-11	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.3J	<1	<1	<1	0.11J	<1
PW-C-12	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-13	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-14	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-15	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-15D	<10	<1	<1	<1	<1	0.22J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-16	<10	<1	<1	<1	<1	<2	0.18J	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-17	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-18	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-19	<10	<1	<1	<1	<1	<2	<1	<1	0.53J	<5	<1	<1	<1	<1	<1	<1
PW-C-20	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.33J	<1	<1	<1	<1	<1
PW-C-21	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-22	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-23	2.4J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-24	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-25	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-25D	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-26	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.29J	<1	<1	<1	<1	<1
PW-C-27	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.3J	<1	<1	<1	<1	<1
PW-C-28	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.29J	<1	<1	<1	<1	<1
PW-C-29	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.29J	<1	<1	<1	<1	<1
PW-C-30	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-31	3J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-32	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-33	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-34	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-35	<10	<1	<1	<1	<1	0.23J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-35D	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-36	2.6J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	0.13J	<1	<1	<1

APPENDIX 2. VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE—Continued

[μg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (μg/L)	Bromo-dichloro-methane (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Carbon disulfide (μg/L)	Chloro-methane (μg/L)	1,1-Dichloro-ethylene (μg/L)	Ethyl-benzene (μg/L)	Dichloro-difluoro-methane (μg/L)	2-Butanone (μg/L)	Methylene chloride (μg/L)	Tetra-chloro-ethylene (μg/L)	1,1,1-Trichloro-ethane (μg/L)	Trichloro-ethylene (μg/L)	Chloro-form (μg/L)	Xylenes (total) (μg/L)
PW-C-37	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-38	2.9J	<1	<1	<1	<1	0.26J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-39	<10	<1	<1	<1	<1	0.27J	<1	<1	<2	2.8J	0.29J	<1	<1	<1	<1	<1
PW-C-40	<10	<1	<1	<1	<1	<2	<1	<1	<2	2J	0.3J	<1	<1	<1	<1	<1
PW-C-41	3J	<1	<1	<1	<1	<2	<1	<1	<2	1.3J	<1	<1	<1	<1	<1	<1
PW-C-42	2.5J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-43	2.6J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-C-44	<10	<1	<1	<1	<1	<2	<1	<1	<2	2.7J	<1	<1	<1	<1	<1	<1
PW-C-45	2.6J	<1	<1	<1	<1	<2	<1	<1	<2	1.7J	0.4J	<1	<1	<1	<1	<1
PW-C-45D	3J	<1	<1	<1	<1	<2	<1	<1	<2	2J	0.35J	<1	<1	<1	<1	<1
PW-C-46	2.6J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.31J	<1	<1	<1	<1	<1
PW-D-01	7.7J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-02	7.1J	<1	0.18J	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-03	<10	<1	<1	<1	<1	0.25J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-04	5.5J	<1	<1	<1	<1	<2	<1	<1	<2	1J	<1	<1	<1	<1	<1	<1
PW-D-05	5.6J	<1	<1	<1	<1	<2	<1	<1	<2	0.88J	<1	<1	<1	<1	<1	<1
PW-D-05D	4.6J	<1	<1	<1	<1	<2	<1	<1	<2	1.1J	<1	<1	<1	<1	<1	<1
PW-D-06	5.3J	<1	<1	<1	<1	<2	<1	<1	<2	1.7J	<1	<1	<1	<1	<1	<1
PW-D-07	5.2J	<1	<1	<1	<1	<2	<1	<1	<2	1.3J	<1	<1	<1	<1	<1	<1
PW-D-08	3.9J	<1	<1	<1	<1	<2	<1	<1	<2	1.5J	<1	<1	<1	<1	<1	<1
PW-D-09	5.9J	<1	<1	<1	<1	<2	<1	<1	<2	1.3J	<1	<1	<1	<1	<1	<1
PW-D-11	5.9J	<1	<1	<1	<1	<2	<1	<1	<2	2.8J	<1	<1	<1	<1	<1	<1
PW-D-12	7.3J	<1	<1	<1	<1	<2	<1	<1	<2	3.7J	<1	<1	<1	<1	<1	<1
PW-D-13	5.8J	<1	<1	<1	<1	<2	<1	<1	<2	2J	<1	<1	<1	<1	<1	<1
PW-D-14	4.9J	<1	<1	<1	<1	<2	<1	<1	<2	1.2J	<1	<1	<1	<1	0.13J	<1
PW-D-15	5.3J	<1	<1	<1	<1	0.23J	<1	<1	<2	1.3J	<1	<1	<1	<1	<1	<1
PW-D-15D	5.9J	<1	<1	<1	<1	<2	<1	<1	<2	2.2J	<1	<1	<1	<1	<1	<1
PW-D-16	6.5J	<1	<1	<1	<1	<2	<1	<1	<2	1.7J	0.27J	<1	<1	<1	<1	<1
PW-D-17	7.7J	<1	<1	<1	<1	<2	<1	<1	<2	1.3J	0.31J	<1	<1	<1	<1	<1
PW-D-18	4.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1

APPENDIX 2. VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE—Continued

[µg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (µg/L)	Bromo-dichloro-methane (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Carbon disulfide (µg/L)	Chloro-methane (µg/L)	1,1-Dichloro-ethylene (µg/L)	Ethyl-benzene (µg/L)	Dichloro-difluoro-methane (µg/L)	2-Butanone (µg/L)	Methylene chloride (µg/L)	Tetra-chloro-ethylene (µg/L)	1,1,1-Trichloro-ethane (µg/L)	Trichloro-ethylene (µg/L)	Chloro-form (µg/L)	Xylenes (total) (µg/L)
PW-D-19	5.8J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-20	4.1J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-21	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-22	4.5J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-23	2.9J	<1	<1	<1	<1	0.26J	<1	<1	<2	<5	<1	0.74J	<1	<1	0.12J	<1
PW-D-24	2.7J	<1	<1	<1	<1	<2	<1	<1	<2	2.7J	<1	<1	<1	<1	<1	<1
PW-D-25	2.8J	<1	<1	<1	<1	0.37J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-25D	2.9J	<1	<1	<1	<1	0.22J	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-26	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
PW-D-27	3.6J	<1	<1	<1	<1	0.24J	<1	<1	<2	2.2J	<1	<1	<1	<1	<1	<1
PW-D-28	3.4J	<1	<1	<1	<1	<2	<1	<1	1.1J	<5	<1	<1	<1	<1	<1	<1
PW-D-29	5.5J	<1	<1	<1	<1	0.25J	<1	<1	<2	1.5J	<1	<1	<1	<1	<1	<1
PW-D-30	2.9J	<1	<1	<1	<1	<2	<1	<1	<2	2.7J	0.22J	<1	<1	<1	<1	<1
PW-D-31	4.5J	<1	<1	<1	<1	<2	<1	<1	<2	1.7J	<1	<1	<1	<1	<1	<1
PW-D-32	4.3J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1

APPENDIX 3. INORGANIC CONSTITUENTS IN AND PHYSICAL PROPERTIES OF WATER FROM SPRINGS AND SURFACE-WATER SITES SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; deg C, degrees Celsius. Values given as < (less than) indicate that the concentration was below the detection limit of the analytical method used and does not indicate the presence or absence of the constituent

Project number	USGS station number	Date	Time	Specific conductance (µS/cm)	pH (standard units)	Alkalinity (mg/L as $CaCO_3$)	Temperature (deg C)	Calcium (mg/L as Ca)	Magnesium (mg/L as Mg)	Sodium (mg/L as Na)	Potassium (mg/L as K)	Chloride (mg/L as Cl)	Sulfate (mg/L as SO_4)	Fluo-ride (mg/L as F)
SP-A-01	03578448	09/21/99	1610	447	7.0	196	15.5	75	8.9	3.4	1.3	11	16	0.11
SP-A-02	03578400	09/27/99	1145	356	7.2	163	18.0	59	8.3	2	0.9	6.6	8.6	0.12
SP-A-03	352041086001901	09/27/99	1345	13	4.9	5	19.5	1.2	0.5	0.8	0.5	2	0.5	<0.1
SP-A-04	035785001	09/30/99	1240	364	7.2	156	15.0	61	8.9	2.1	0.8	5.6	29	<0.1
SP-A-05	03578492	10/01/99	1230	318	7.2	151	15.0	60	9	2	0.7	5.4	32	<0.1
SP-A-06	035785004	10/07/99	1100	181	6.6	89	15.0	26	7	0.8	0.2	1.8	3.9	<0.1
SP-B-21	03578495	09/23/99	1630	366	7.3	154	15.0	61	8.7	2.1	0.8	5.4	30	<0.1
SP-C-01	03578490	09/23/99	1055	381	7.2	160	15.0	66	8.7	2.2	0.9	5.7	33	<0.1
SW-A-01	03578452	10/06/99	1100	42	8.0	199	13.0	73	8.6	3.5	1.8	11	16	0.11
SW-A-02	03578502	10/06/99	1445	285	7.7	127	15.5	46	8	1.5	0.5	3.8	17	<0.1
SW-A-03	035785002	10/07/99	1130	361	7.2	155	14.0	60	8.8	2	0.8	5.3	29	<0.1
SW-C-01	03578485	09/23/99	1325	375	7.4	161	13.5	65	8.7	2.2	0.9	5.9	32	<0.1
SW-C-02	03578500	09/23/99	1540	364	7.3	157	15.0	62	8.6	2.1	0.9	5.5	32	<0.1
SW-C-03	03578510	10/06/99	1330	546	7.3	44	15.5	13	2.3	0.8	2.8	2	2.4	<0.1
SW-C-04	035785019	10/06/99	1610	286	7.6	127	15.5	45	8.1	1.5	0.6	3.7	17	<0.1
SW-C-05	03578625	10/07/99	940	197	7.7	73	13.5	29	3.3	5.4	1.1	8.4	16	<0.1
SW-C-06	03578640	10/07/99	1010	167	7.2	64	14.0	24	2.9	4.8	1	7.4	12	<0.1

APPENDIX 4. VOLATILE ORGANIC COMPOUNDS IN WATER FROM SPRINGS AND SURFACE-WATER SITES SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE

[µg/L, micrograms per liter; J, detections less than reporting limits; D, duplicates. Values given as < (less than) indicate that the concentration was below the detection level of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Project number	Acetone (µg/L)	Bromo-dichloro-methane (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Carbon disulfide (µg/L)	Chloro-methane (µg/L)	1,1-Dichloro-ethylene (µg/L)	Ethyl-benzene (µg/L)	Dichloro-difluoro-methane (µg/L)	2-Butanone (µg/L)	Methylene chloride (µg/L)	Tetra-chloro-ethylene (µg/L)	1,1,1-Trichloro-ethane (µg/L)	Trichloro-ethylene (µg/L)	Chloro-form (µg/L)	Xylenes (total) (µg/L)
SP-A-01	4.1J	<1	<1	<1	<1	<2	<1	<1	<2	1.6J	<1	<1	<1	<1	<1	<1
SP-A-02	3.3J	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
SP-A-03	2.5J	<1	<1	0.11J	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
SP-A-04	4.1J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.19J	<1	<1	<1	0.14J	<1
SP-A-05	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.29J	<1	<1	<1	0.16J	<1
SP-A-05D	3.1J	<1	<1	<1	<1	<2	<1	<1	<2	3.9J	0.29J	<1	<1	<1	0.15J	<1
SP-A-06	3.3J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.34J	<1	<1	<1	<1	<1
SP-A-06D	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.31J	<1	<1	<1	<1	<1
SP-B-21	3.9J	<1	<1	<1	<1	<2	<1	<1	<2	3.1J	<1	<1	<1	<1	0.11J	<1
SP-C-01	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	0.14J	<1
SW-A-01	<10	<1	<1	<1	<1	<2	<1	<1	<2	2.4J	<1	<1	<1	<1	<1	<1
SW-A-02	4.1J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.36J	<1	<1	<1	<1	<1
SW-A-03	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.29J	<1	<1	<1	<1	<1
SW-C-01	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	<1	<1	<1	<1	<1	<1
SW-C-02	3J	<1	<1	<1	<1	<2	0.15J	<1	<2	<5	<1	<1	<1	<1	<1	<1
SW-C-03	5.1J	<1	<1	0.47J	<1	<2	<1	<1	<2	2.4J	<1	<1	<1	<1	<1	<1
SW-C-04	<10	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.23J	<1	<1	<1	<1	<1
SW-C-05	<10	<1	<1	<1	<1	<2	<1	<1	<2	1.9J	0.47J	<1	<1	<1	<1	<1
SW-C-06	3.2J	<1	<1	<1	<1	<2	<1	<1	<2	<5	0.22J	<1	<1	<1	<1	<1

APPENDIX 5. TRIP-BLANK DATA FOR VOLATILE ORGANIC COMPOUNDS IN WATER FROM PRIVATE WELLS, SPRINGS, AND SURFACE-WATER SITES SAMPLED IN THE BRADLEY-BRUMALOW CREEKS AREA NEAR ARNOLD AIR FORCE BASE, TENNESSEE

[μg/L, micrograms per liter; J, estimated concentration less than reporting limits. Values given as < (less than) indicate that the concentration was below the detection limit of the analytical method used and does not indicate the presence or absence of the compound. Analytes where no samples showed detections are not listed. Samples were analyzed for compounds listed in table 3]

Trip-blank sample identifier	Analytical report lot number	Date sample collected	Time sample collected	Ace-tone (μg/L)	Toluene (μg/L)	1,1-Dichloro-ethylene (μg/L)	2-Butanone (μg/L)	Methylene chloride (μg/L)
1	D9I160249	09/15/99	1400	<10	<1	0.66J	<5	0.32J
2	D9I170227	09/16/99	1400	<10	<1	<1	<5	0.28J
3	D9I200119	09/17/99	1315	2.4J	<1	0.64J	<5	0.34J
4	D9I210133	09/20/99	1430	<10	<1	0.62J	<5	0.28J
5	D9I220200	09/21/99	1340	<10	<1	<1	<5	0.37J
6	D9I230195	09/22/99	1300	<10	<1	0.71J	<5	0.37J
7	D9I240188	09/23/99	1340	<10	<1	0.56J	<5	0.61J
8	D9I260111	09/24/99	1355	2.5J	<1	0.64J	<5	0.38J
9	D9I280150	09/27/99	1250	3.3J	<1	0.85J	2.2J	0.52J
10	D9I290152	09/28/99	1400	<10	<1	1.1	<5	0.54J
11	D9I300179	09/29/99	1415	<10	<1	0.98J	<5	0.31J
12	D9J010224	09/30/99	1400	<10	<1	1.0	<5	0.46J
13	D9J020173	10/01/99	1400	2.7J	<1	0.72J	3.8J	0.82J
14	D9J070169	10/06/99	1430	<10	<1	0.69J	<5	0.39J
15	D9J080153	10/07/99	1430	<10	<1	0.52J	<5	0.54J
16	D9J270208	10/26/99	1515	<10	0.13J	0.63J	<5	0.58J
17	D9L090160	12/08/99	1335	5.6J	0.14J	1.1	6.0	0.38J