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Investigation of Ground-Water Contamination at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina

Scientific Investigations Report 2006–5311

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

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Suggested citation:
Vroblesky, D.A., Casey, C.C., Petkewich, M.D., Lowery, M.A., Conlon, K.J., and Harrelson, L.G., 2007, Investigation of ground-water contamination at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina: U.S. Geological Survey Scientific Investigations Report 2006–5311, 37 p., 6 app., 1 pl.

Contents

Figures

Tables

Plate

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square foot (ft^2)	929.0	square centimeter (cm^2)
square foot (ft^2)	0.09290	square meter (m^2)
square inch (in^2)	6.452	square centimeter (cm^2)
section (640 acres or 1 square mile)	259.0	square hectometer (hm^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
	Flow rate	
foot per day (ft/d)	0.3048	meter per day (m/d)
foot per year (ft/yr)	0.3048	meter per year (m/yr)
	Hydraulic conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
foot per foot (ft/ft)	1	meters per meter (m/m)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = (°F - 32) / 1.8$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Elevation, as used in this report, refers to distance above the vertical datum.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Concentrations of chemical constituents in sediment are given in micrograms per kilogram (µg/kg).

Abbreviations

$\delta^{13}C$	Delta carbon 13 isotope ratio
CMS	Corrective Measures Study
CSIA	compound-specific stable isotope analysis
CVOC	chlorinated volatile organic compound
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
*c*DCE	*cis*-1,2-dichloroethene
CF	chloroform
g/L	grams per liter
$mg/ft^2/yr$	milligram per square foot per year
mL/min	milliliter per minute
nM	nanomoles per liter
NASA	National Aeronautics and Space Administration
NAVFAC SE	Naval Facilities Engineering Command Southeast
NWS	Naval Weapons Station
ppb	parts per billion
PCE	tetrachloroethene
PCP	pentachlorophenol
PRB	permeable reactive barrier
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facilities Assessment
RFI	Remedial Facilities Investigation
SF6	sulfur hexafluoride
SWMU	Solid Waste Management Unit
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
TU	tritium units
µ	micron
USGS	U.S. Geological Survey
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
ZVI	zero-valent iron

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Abstract

The U.S. Geological Survey and the Naval Facilities Engineering Command Southeast investigated natural and engineered remediation of chlorinated volatile organic compound ground-water contamination at Solid Waste Management Unit 12 at the Naval Weapons Station Charleston, North Charleston, South Carolina. The primary contaminants of interest are tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, *cis*-1,2-dichloroethene, vinyl chloride, 1,1-dichloroethane, and 1,1-dichloroethene.

In general, the hydrogeology of Solid Waste Management Unit 12 consists of a surficial aquifer, composed of sand to clayey sand, overlain by dense clay that extends from about land surface to a depth of about 8 to 10 feet and substantially limits local recharge. During some months in the summer, evapotranspiration and limited local recharge result in ground-water level depressions in the forested area near wells 12MW-12S and 12MW-17S, seasonally reflecting the effects of evapotranspiration. Changes in surface-water levels following Hurricane Gaston in 2004 resulted in a substantial change in the ground-water levels at the site that, in turn, may have caused lateral shifting of the contaminant plume. Hydraulic conductivity, determined by slug tests, is higher along the axis of the plume in the downgradient part of the forests than adjacent to the plume, implying that there is some degree of lithologic control on the plume location. Hydraulic conductivity, hydraulic gradient, sulfur-hexafluoride measurements, and historical data indicate that ground-water flow rates are substantially slower in the forested area relative to upgradient areas.

The ground-water contamination, consisting of chlorinated volatile organic compounds, extends eastward in the surficial aquifer from the probable source area near a former underground storage tank. Engineered remediation approaches include a permeable reactive barrier and phytoremediation. The central part of the permeable reactive barrier along the main axis of the contaminant plume appears to be actively removing contamination; however, ground-water contamination is moving around the southern end of the permeable reactive barrier. Changes in the contaminant concentrations along the path of ground-water transport reflect a complex variety of influences. Potential influences include dechlorination, sorption and desorption, transpirative removal by trees, lateral shifting of the plume, and the presence of zones of differing concentrations possibly reflecting one or more pulse releases of contamination from the source area.

Near the source area at well 12MW-10S, volatile organic compound concentrations of *cis*-1,2-dichlorothene, vinyl chloride, 1,1-dichloroethane, and 1,1,1-trichloroethane continued an irregular decline, while tetrachloroethene and 1,1-dichloroethene showed marked fluctuations in concentration during 2005 and 2006. Volatile organic compound concentrations at well 12MW-03S continued to show decreasing concentrations with the June 2006 concentrations being the lowest yet recorded at that well for several volatile organic compounds. Concentration and delta carbon 13 data indicate that in the upgradient part of the plume, tetrachloroethene is being degraded to trichloroethene, which is being degraded to *cis*-1,2-dichloroethene, and *cis*-1,2-dichloroethene is accumulating faster than it is being depleted.

Ground-water volatile organic compound concentrations also changed in some wells in the forested area in the midpart of the plume. Increasing tetrachloroethene and decreasing trichloroethene and 1,1-dichloroethene concentrations were observed at wells 12MW-05S and 12MW-29S, possibly reflecting a lateral shift in the axis of the contamination plume or an advancing contamination pulse. Substantial decreases in contamination occur in the forested area downgradient from well 12MW-05S. Probable major loss mechanisms in this area include evapotranspiration and sorption.

Introduction

Ground-water contamination by volatile organic compounds (VOCs) is present at Solid Waste Management Unit (SWMU) 12 at the Naval Weapons Station (NWS) Charleston, North Charleston, which is approximately 10 miles north of Charleston, South Carolina (fig. 1). The U.S. Geological Survey (USGS) and the Naval Facilities Engineering Command Southeast (NAVFAC SE) are investigating the effects of natural and engineered remediation of ground-water contamination at SWMU12. The primary VOCs of concern are chlorinated solvents. The higher chlorinated compounds, such as tetrachloroethene (PCE) and 1,1,1-trichloroethane (1,1,1-TCA), are suspected to have been released through several operationally related activities, including surface spills, drainage from floor drains, and a leaking underground storage tank (UST). Trichloroethene (TCE) probably is an original contaminant as well as a dechlorination product. Other VOCs present include *cis*-1,2-dichloroethene (*c*DCE), vinyl chloride (VC), 1,1-dichloroethene (1,1-DCE), and 1,1-dichloroethane (1,1-DCA).

Purpose and Scope

The purpose of this report is to present the findings to date of the USGS and NAVFAC SE investigation of ground-water contamination at SWMU12, with an emphasis on the period from October 2004 through September 2006. The report evaluates the performance of a permeable reactive barrier (PRB), consisting of zero-valent iron (ZVI) at the site, and discusses changes in contaminant concentrations in wells at various locations within the contaminant plume. In addition, the report discusses data associated with age dating ground water at the site.

Site History

SWMU12 was used from the early 1970s to 1981 for preservation of wooden ammunition boxes by impregnation with pentachlorophenol (PCP) in dip tanks outside former Building 88. Degreasing operations at the site produced chlorinated volatile organic compound (CVOC) contamination in the soil and ground water. The CVOCs were primarily chlorinated ethanes and ethenes.

The leaking UST was in the southeastern corner of former Building 88. The last known use of the UST was in 1979 to store solvents for wood preservation. The tank was pumped dry in 1998 and was removed and inspected in September 1999. Water in the excavation hole contained concentrations of total CVOCs greater than 100 milligrams per liter (mg/L) (Tetra Tech NUS, Inc., 2000b). The most concentrated constituents, listed in order of decreasing concentration, were 1,1-DCA at 84,300 micrograms per liter (μg/L), 1,1,1-TCA at 52,600 μg/L, 1,1-DCE at 9,950 μg/L, PCE at 7,630 μg/L, *c*DCE at 4,900 μg/L, 1,2-DCA at 830 μg/L, chloroethane at 500 μg/L, and TCE at an estimated value of 385 μg/L. The tank and associated pipes were corroded, and two holes were present near the bottom of the tank. The tank-fill line was disconnected from the tank. The bottom of the tank extended to a depth of about 7 feet (ft) below ground surface (Tetra Tech NUS, Inc., 2000a).

Several investigations conducted at NWS Charleston have included SWMU12. An Installation Assessment Study for NWS Charleston was completed in January 1984 (Harmon Engineering and Testing, 1984). Although the study did not investigate SWMU12, the report described ordnance-related activities that took place at Building 88, located at SWMU12. A Characterization Study in 1987 (Environmental Science and Engineering, Inc., 1987) included collection of sediment and surface-water samples for PCP analysis. Because only low levels of PCP were detected, the Characterization Study did not recommend further investigation.

An interim Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA) was completed in 1988 because the NWS Charleston began operating under a RCRA interim status. At that time, Building 88 and the vicinity was designated as SWMU12 (Kearney/Centaur, 1988).

As part of the Remedial Facilities Investigation (RFI), Tetra Tech NUS, Inc. (2000a) conducted studies of ground water between 1998 and 1999. These investigations included installation and sampling of 19 monitoring wells and 45 temporary well points. In addition, four separate tidal studies were done at the marshes east and north of SWMU12 and at monitoring wells 12MW-06S and 12MW-06D. The investigation also included collecting and analyzing 11 surface-water and sediment-sample pairs from drainage ditches and from the marshes. Soil samples were collected and analyzed from several locations. Recommendations from the investigation included monitoring the ground water for VOCs and PCP. Supplemental RFI work included installation and sampling of 3 monitoring wells and 12 temporary monitoring wells (Tetra Tech NUS, Inc., 2001).

The USGS and NAVFAC SE began investigations of the ground-water contamination in 2000 following completion of a series of site-evaluation investigations by consulting firms. The purpose of the USGS/ NAVFAC SE investigations was to evaluate effects of natural and engineered remediation at the site. One engineered remediation approach being utilized at the site is a PRB, consisting of ZVI. The PRB (fig. 2) is hydraulically downgradient from the source area (coincident with the phytoremediation test plot shown in figure 2) and is used to intercept and control concentrations of chlorinated solvents moving downgradient into a lowland forest and toward a freshwater wetland. A second engineered remediation approach is a planted grove of loblolly pine (*Pinus taeda*) saplings in the source area. Additional areas were planted with hybrid poplar in March 2005 (fig. 2). Summaries of investigative activities at the site are available elsewhere for the periods 2000 to 2003 (Vroblesky and others, 2003) and October 2003 to October 2004 (Vroblesky and others, 2004a). Important field activities during October 2004 through July 2006 are summarized in table 1.

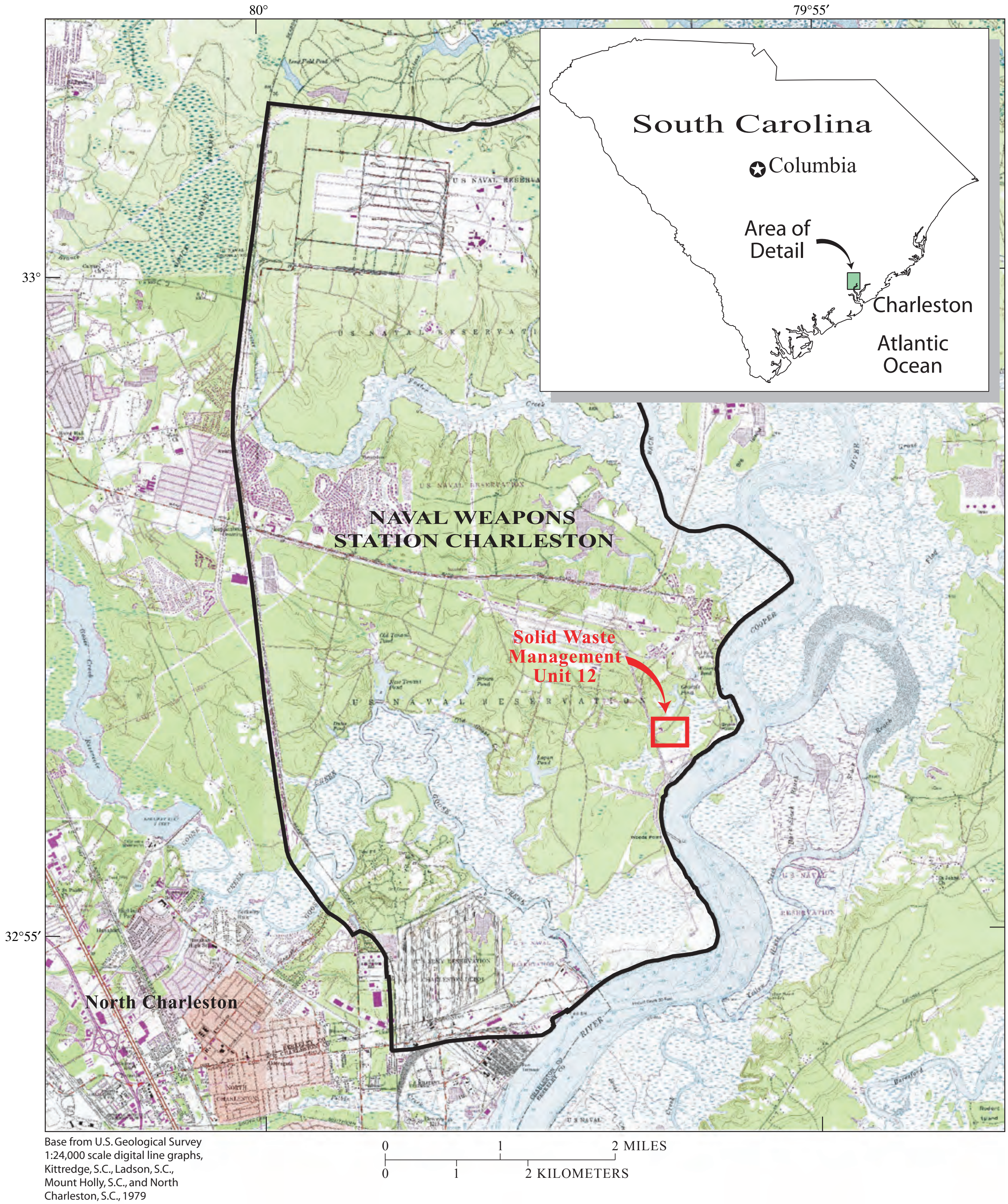

Figure 1. Location of Naval Weapons Station Charleston, North Charleston, South Carolina, and Solid Waste Management Unit 12 (SWMU12).

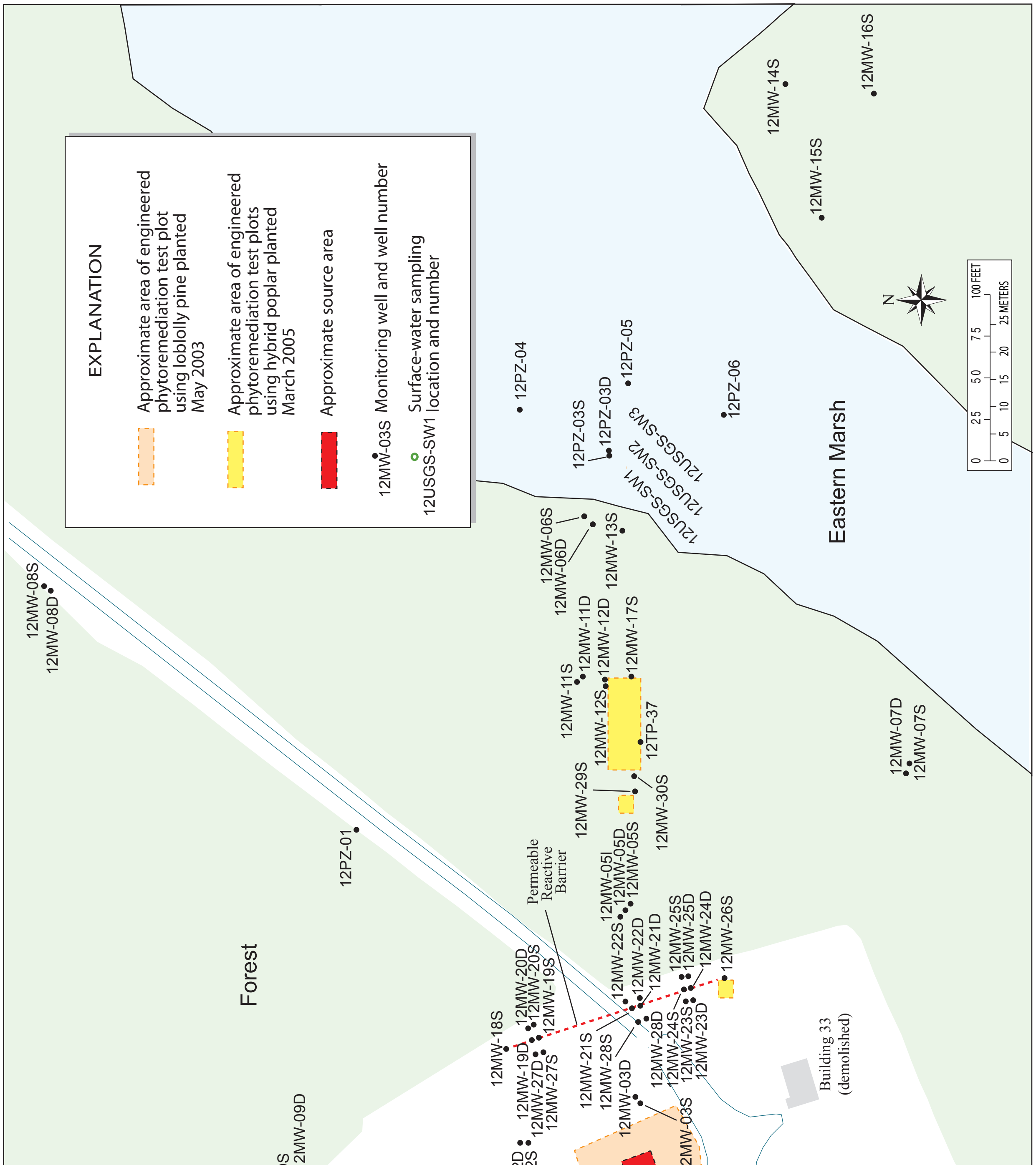

Figure 2. Locations of sampling points at Solid Waste Management Unit 12 (SWMU12), Naval Weapons Station Charleston, North Charleston, South Carolina.

Table 1. Summary of significant field activities during October 2004 to September 2006, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

[VOC, volatile organic compound; PRB, permeable reactive barrier]

Date	Activity
	Leveling and surveying
November 29, 2004	Surveyed locations of trees used for this investigation.
	Phytoremediation
March 25, 2005	Planted 28 hybrid poplar trees, primarily in the area immediately downgradient from well 12MW-30S.
	Water-level monitoring
Monthly	Synoptic water-level measurements.
Monthly maintenance	Continuous monitoring over various time intervals in 13 wells.
	Monitoring ground-water chemistry
February 1–3, 2005	Sample collection.
February 17, 2005, and March 9, 2005	Sampled wells 12MW-29S and 12MW-30S to examine stabilization times.
May 23–25, 2005	Sample collection.
September 12–13, 2005	Sample collection.
September 28, 2005	Resampled well 12MW-26S, which showed questionable results from the sampling earlier in the month.
January 30–31, 2006	Sample collection
June 20–22, 2006	Sample collection
July 5, 2006	Resampled well 12MW-26S, which showed questionable results from sampling in June 2006.
September 11–12, 2006	Sample collection.
Monthly maintenance	Continuous monitoring of dissolved oxygen in selected wells.
	Well construction, development, and slug tests
January 24, 2005	Installed and sampled 12 push-technology temporary wells in the phytoremediation test stand area for VOC characterization and 1 temporary well in the forest for age dating.
June 20–22, 2005	Conducted slug tests in all of the wells associated with the PRB and selected wells across the site.
July 30, 2005	Installed and sampled 12 push-technology temporary wells along the southern end of the PRB and 6 temporary wells between the PRB and well 12MW-05S for VOC analysis.
May 1, 2006	Installed and sampled 11 push-technology temporary wells along the southern end of the PRB, 9 borings to collect cores from the PRB, and 3 borings near the collapsed trench upgradient from the PRB.
	Maintenance
Monthly	Maintenance and monitoring of weather station.
Monthly	Maintenance of phytoremediation test stand.

Methodology

Multiple types of sampling points are present at the site. Wells designated by a prefix of "12MW-" are primarily 2-inch-diameter wells used for monitoring ground-water chemistry and water levels. Exceptions to this are wells 12MW-14S, 12MW-15S, and 12MW-16S, which are 0.5-inch-diameter wells installed to monitor water levels, but typically not included on water-level maps because of questionable reliability. The nomenclature suffixes "S," "I," and "D" designate shallow, intermediate, and deep depths, respectively. Surface-water sampling points are designated using the prefix "12USGS-SW." Wells designated with the prefix "12PZ-" indicate 1-inch-diameter wells, and the suffix "S" and "D" indicate shallow and deep, respectively. The "12PZ-" wells are used primarily for monitoring water levels, although VOC data have been collected from all of them, and well 12PZ-03S is routinely monitored for VOC content. Temporary wells and coring locations installed by the USGS and Columbia Technologies, using push technology during this investigation, are designated by the prefix "TP," or "12PRBDP." Temporary wells installed by push technology and investigated using a membrane-interface probe are designated by the prefix "12MP-."

Low-flow sampling methodology (Barcelona and others, 1994; Shanklin and others, 1995; Sevee and others, 2000) was used to collect ground-water samples from all of the wells near the PRB and from some of the wells elsewhere. In some wells, stabilization of dissolved-oxygen concentrations to environmentally realistic values during the low-flow sampling could not be achieved. Stabilization to low-flow sampling parameters was particularly problematic during winter months when dissolved-oxygen values failed to achieve concentrations low enough to be considered realistic for the site. For these wells, three casing volumes of water were purged prior to collecting the samples, which typically resulted in lower, more environmentally realistic dissolved-oxygen values than the low-flow samples. Three-casing volumes also were purged routinely in some wells where previous sampling has shown that continued pumping produces continuously increasing VOC concentrations, possibly because the highest concentrations in the aquifer are slightly offset from the well screen.

During low-flow sampling, the wells were purged at a rate of approximately 100–200 milliliters per minute (mL/min), until the water temperature, pH, dissolved-oxygen concentration, and specific conductance values stabilized and no additional water-level drawdowns were observed. Stabilization of temperature, pH, dissolved oxygen, and specific conductance were observed by passing the water through a flowthrough cell containing sensors. The pumpage was considered to be stabilized when the observed changes over three 3-minute intervals were within ±3 percent for water temperature and specific conductance, within ±0.1 units for pH, and within ±10 percent for dissolved oxygen.

For most sampling events, stainless-steel, positive-displacement Bennett pumps were used to purge and sample 2-inch (in.)-diameter wells in a transect along the major axis of ground-water contamination, with the exception of wells in the vicinity of the PRB and well 12MW-13S. The Bennett pumps cannot be used near the PRB because suspension of iron particles from the walls destroys the pump seals. Therefore, peristaltic pumps were used for these wells. Well 12MW-13S was sampled by using a peristaltic pump because a field comparison showed no difference between sample concentrations collected with a peristaltic pump and samples collected with a Bennett pump at that well. Samples routinely were analyzed for the solutes listed in table 2.

Slug tests were conducted in 23 wells to estimate the aquifer horizontal hydraulic conductivity in 2005. A falling and rising head slug test was completed for each monitoring well by using an automated data logger, pressure transducer, and solid slug. The horizontal hydraulic conductivity estimates for SWMU12 were calculated by using the Environmental Simulations, Inc., Aquifer Win32 computer software. The Bower and Rice slug-test method was used for the slug-test analysis (Bouwer and Rice, 1976; Bouwer, 1989).

Table 2. Summary of routine sampling constituents for ground water and surface water, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

Constituent	
Volatile organic* compounds	Temperature
Methane, ethane, ethene	Specific conductance
Chloride, sulfate	pH
Total organic carbon	Ferrous iron
Cations**	Dissolved oxygen
Volatile fatty acids	Carbon dioxide
Dissolved hydrogen gas	Hydrogen sulfide
Pumping rate	Alkalinity

* Duplicate samples were collected for approximately 10 percent of the volatile organic compound samples.

** Cations were calcium, magnesium, potassium, and sulfate.

Water levels were measured by a number of methods. Monthly water levels were measured synoptically by using an electric water-level sensor using the top of well casing as the reference point for determining depths to water. Water-level measurements were recorded to the nearest 0.01 ft. Depth to water was converted to altitudes using previously surveyed altitudes of the top of the well casing. These data were used to generate piezometric maps.

Continuous water levels were measured in several wells to monitor short-term and long-term water-table fluctuations. The water-level recorders were (1) Solinst Leveloggers, and (2) Sutron 8200 data loggers coupled to Design Analysis H310 pressure transducers.

A weather station is located onsite and maintained by the USGS. It is adjacent to well 12MW-03S in a field away from established trees. Constituents monitored include precipitation amount, soil moisture, solar radiation (pyranometer and quantum sensor), air temperature, wind speed and direction, barometric pressure, and relative humidity. The instrumentation includes a LI–200SA pyranometer sensor, a Sutron 5600–0800 soil-moisture sensor, a Young model 05103 wind monitor, a Sutron 5600–0120–1,2 barometric pressure sensor, a Sutron tipping-bucket rain gage, and Sutron instruments to measure air temperature and relative humidity. A data-collection platform is set up to transmit by satellite and can be downlinked through the National Aeronautics and Space Administration (NASA) at Wallops Island, Virginia.

The distribution of contaminants in the source-area, unsaturated-zone sediments above the surficial aquifer was examined by collecting cores with a push technology (fig. 3). The sediments were collected by subsampling cores at three

Figure 3. Surface water at Solid Waste Management Unit 12 (SWMU12), Naval Weapons Station Charleston, North Charleston, South Carolina.

depths (1.5 ft, 4 ft, and 6 to 7 ft below land surface) with an Encore sampler. The samples were analyzed for VOC content at a commercial laboratory. The coring was done entirely within the confining unit overlying the surficial aquifer, which extends to a depth of about 10 to 11 ft below land surface in the source area.

The distribution of contaminants in the aquifer near the southern end of the PRB was examined in June 2005 and May 2006 by collecting water samples with push technology from an interval open to the aquifer at 13.5 to 15.5 ft below land surface. The samples were collected by lowering tubing to the bore-hole bottom and raising the tubing 1 ft. The water was obtained by using a peristaltic pump.

Core samples were collected for lithological examination from six borings in and near the PRB and from three borings in and near an area where an early attempt to install a PRB resulted in a collapsed trench that had to be abandoned. The cores were collected by push technology on May 1, 2006.

Hydrology

SWMU12 is located on a topographically low area and is nearly surrounded by local surface-water features (fig. 3). The degree of connectivity between ground water at SWMU12 and the local surface-water features is unclear because temporary borings from the shoreline to approximately 30 ft out into the Eastern Marsh showed the presence of a confining bed separating the surface water from the aquifer (Vroblesky and others, 2003). As will be shown, however, stage changes in George Pond appear to have influenced ground-water levels at SWMU12.

Surface Water

Marshes are present over much of the area surrounding SWMU12 (fig. 3). An investigation in 1999 determined that the surface water at the site is influenced by tides; however, the tidal influence is small (0.02 ft; Tetra Tech NUS, Inc., 2000a). The reason for the small amount of influence is that the marshes are separated from the tidal Cooper River by a retention wall that maintains marsh levels at a higher stage than the mean stage of the Cooper River. In addition, the marshes are a series of ponds separated from each other by berms, further limiting water exchange among the marshes. George Pond connects to a tidally influenced area farther southeast by a conduit through the berm. The dominant influence on stage levels in the marshes is rainfall runoff (Tetra Tech NUS, Inc., 2000a, b).

A major rain event in 2004 appears to have altered the stage of George Pond. On August 29, 2004, Hurricane Gaston passed through Charleston. The hurricane produced 3.2 inches (in.) of rain at SWMU12 over a 10-hour period. Prior to Hurricane Gaston, the stage in the northern marsh was maintained approximately 1 to 2 ft above NAVD 88. At the peak of the storm, the stage level increased to 3.8 ft, and then rapidly dropped until the stage was below the measuring gage. A probable explanation is that damage occurred in part of the surface-water system controlling water levels in the northern marsh.

Inspection of the conduit in 2006 showed that the conduit contained a damaged baffle system that, when undamaged, limits tidal flux into George Pond and allows George Pond to retain water from rainfall runoff at a stage higher than the tidal stage. At the time of the inspection, water was flowing into George Pond through the broken baffle system in response to high tide. A probable explanation for the northern marsh stage data during Hurricane Gaston is that the damage to the baffle system occurred during the hurricane, allowing George Pond and the northern marsh to drain. Although the George Pond stage is not routinely measured, it is clear from observation during monthly maintenance of the northern marsh stage recorder that the George Pond stage substantially decreased following Hurricane Gaston.

Hydrogeologic Framework

In general, the hydrogeologic framework of SWMU12 consists of a surficial aquifer, composed of sand to clayey sand, overlain by dense clay that extends from about land surface to a depth of about 10 to 11 ft in the source area and 8 to 10 ft in the forest. The clay appears to be continuous over most of the site and functions as a confining bed for the surficial aquifer. A series of borings in the eastern marsh in 2003 showed that the clay was continuous beneath the marsh out to at least about 30 ft from the shore near well 12MW-13S.

Beneath the surficial aquifer, sand and clay layers extend to a depth of about 36 to 48.5 ft, where an olive-green clay encountered in the borings for wells 12MW-03D, 12MW-04D, and 12MW-05D (Tetra Tech NUS, Inc., 2000b) probably constitutes the bottom of the hydrogeologic framework relevant to the contaminant investigation at this site.

Ground water moves from recharge areas near former Building 88 in an approximately eastward direction toward areas of lower ground-water levels (fig. 4). The lower ground-water levels beneath the forested area east of former Building 88 are present for a variety of reasons, including limited or nonexistent recharge through the surficial clay and evapotranspiration by the forest.

Aquifer Thickness

Drilling logs (Tetra Tech NUS, Inc., 2001) indicate that the surficial aquifer ranges in thickness from about 13 to 20 ft in the western and northern parts of the study area. The aquifer thickness is about 13.5 ft at well 12MW-09D, in the northern part of the study area (plate 1). Its thickness is about 20 to 20.5 ft at wells 12MW-02D, 12MW-05D, and 12MW-03D, with a clay layer between 15- and 16-ft depth at well 12MW-03D.

In the eastern part of the study area, the thickness of the aquifer is less well defined. The boring log for well 12MW-12D (fig. 2; plate 1) reports a sand layer between 9 and 10 ft and otherwise only clay and silt to a depth of 20.5 ft (Tetra Tech NUS, Inc., 2000b). Boring logs from nearby wells, however, imply a thicker aquifer than indicated by the 12MW-12D boring log. At well 12MW-11D (fig. 2), the boring log reports the interval between about 10 ft and about 30 ft to be sand to silty and clayey sand (Tetra Tech NUS, Inc., 2001). At well 12MW-17S (fig. 2), the boring log describes the zone between a depth of 11 ft and the bottom of the boring at 16 ft as fine grained. Therefore, the interval below 10 ft in well 12MW-12S (fig. 2) probably is more permeable than implied by the boring log.

The thickness of the silty- to clayey-sand part of the aquifer near well 12MW-12S is not known; however, a gamma log taken through the casing of well 12MW-12D showed high gamma counts (typically implying a higher clay percentage) in the depth interval between 14 and about 22 ft (elevation of –8.8 to –25.7 ft relative to NAVD 88) compared to the counts in the apparent silty to clayey sand above 14 ft (–8.8 ft NAVD 88; plate 1). In addition, a soil-conductivity log collected by direct-push methodology using a cone penetrometer showed a zone of relatively high soil conductivity (typically implying a high clay percentage) at a depth of about 17 to 19 ft below land surface in boring 12MIP37 (adjacent to well 12MW-17S, fig. 2). These data imply that a zone of increased clay content is present at the depth of about 14 to 17 ft. Therefore, the thickness of the aquifer in this area probably is about 5 to 8 ft, with the most permeable part being the upper approximately 0.5 to 1 ft.

In the downgradient part of the plume, the lithology is variable. Well 12MW-13S is screened in a substantially more permeable part of the formation than well 12MW-06S, only about 25 ft away, despite similar depths to the screen bottoms. This is evidenced in part by the relatively low well yield at well 12MW-06S as compared to well 12MW-13S (fig. 2; plate 1). Lithologic differences also are present. At well 12MW-13S, clay extends from land surface to a depth of about 8 ft. The boring log shows sand between a depth of 8 ft and the bottom of the boring at 13.5 ft with interspersed layers of clay about 0.5 to 2.5 ft thick. At well 12MW-06S (fig. 2), the clay extends to a depth of 11.7 ft and is underlain by about 1 ft of sand to clayey sand, based on the boring log (Tetra Tech NUS, Inc., 2000b). Below the clayey sand to sand, the interval between depths of 12.7 ft and 24 ft is dominantly clay to sandy clay, with a silty sand between depths of about 16 to 18 ft. The thickness of the aquifer in the downgradient part of the plume is not known because of the lithologically variable nature of the formation and the lack of information deeper than 13.5 ft at well 12MW-13S.

Aquifer Hydraulic Conductivity

Hydraulic conductivity was determined by slug tests in 23 monitoring wells at SWMU12 in 2005 (table 3). The data show that the hydraulic conductivity is higher at contaminated well 12MW-13S (9 feet per day (ft/d)) than nearby uncontaminated well 12MW-06S (0.9 to 0.21 ft/d; Tetra Tech NUS, Inc., 2001). These data imply that there is some degree of lithologic control of the configuration of the water table at the plume location near well 12MW-13S.

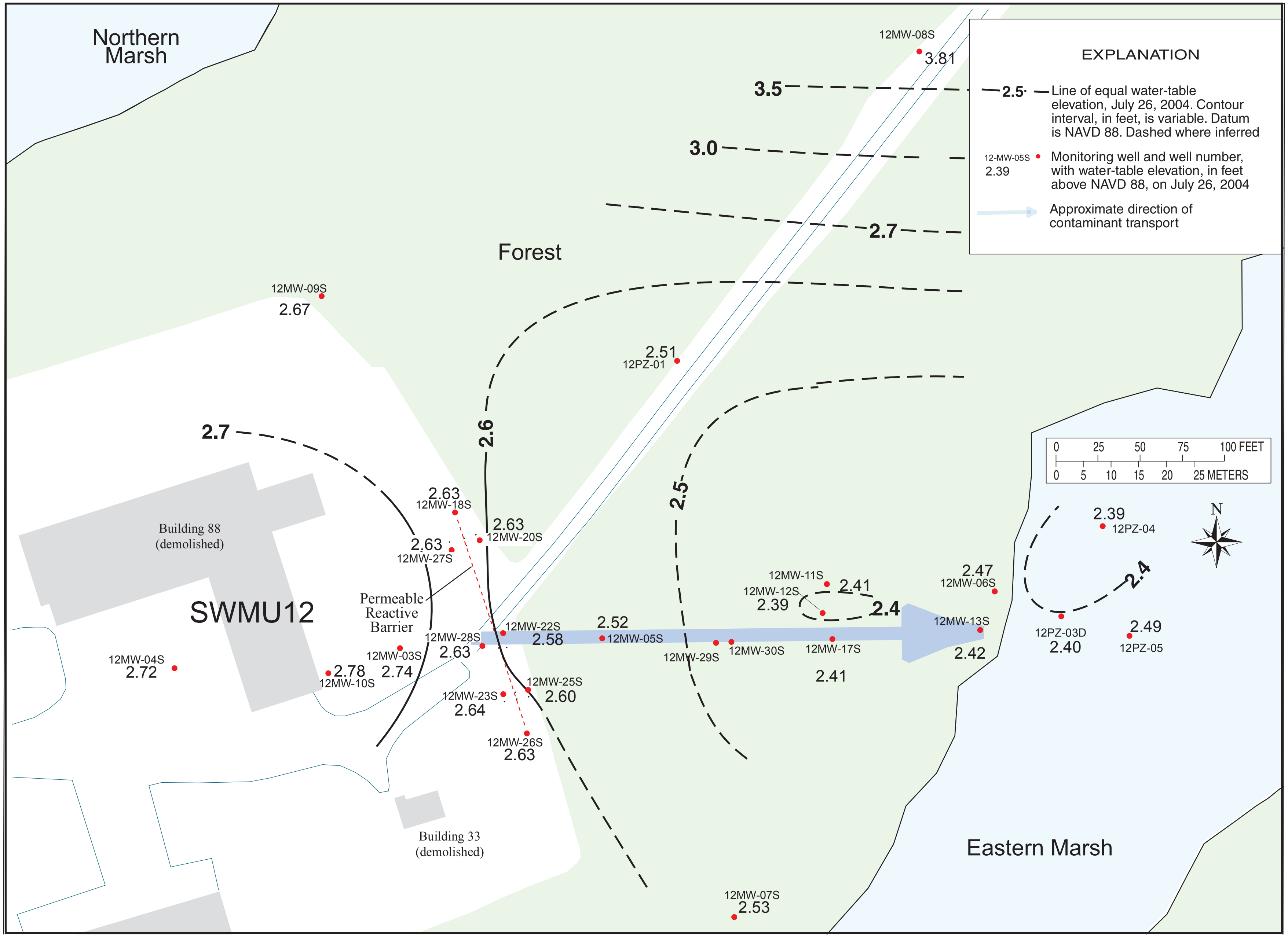

Figure 4. Ground-water levels (July 2004) in the surficial aquifer prior to Hurricane Gaston, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

Table 3. Estimated horizontal hydraulic conductivity derived from slug tests in monitoring wells, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

[---, no data; *, reanalysis of original slug test after shortening the sand-thickness parameter to more closely approximate field conditions; USGS, U.S. Geological Survey]

Well name	Estimated horizontal hydraulic conductivity, in feet per day			Well name	Estimated horizontal hydraulic conductivity, in feet per day
	Tetra Tech NUS, Inc., 2001	USGS reanalysis* of 2001 data	USGS, 2003		USGS, 2005
12MW-01S	3.69	---	---	12MW-12S	4
12MW-01D	2.86 to 3.17	---	---	12MW-13S	9
12MW-02S	1.03 to 1.06	---	---	12MW-17S	10
12MW-02D	2.98 to 3.29	---	---	12MW-18S	5
12MW-03S	3.98 to 4.19	5 to 8	20	12MW-20D	6
12MW-03D	3.19 to 3.49	---	---	12MW-20S	8
12MW-04S	7.12 to 7.22	---	---	12MW-21D	4
12MW-04D	1.47 to 1.58	---	---	12MW-21S	6
12MW-05S	3.0 to 3.7	5 to 7	---	12MW-22D	8
12MW-05D	0.43 to 0.6	---	---	12MW-22S	5
12MW-06S	0.09 to 0.21	---	---	12MW-23D	5
12MW-06D	0.36 to 0.43	---	---	12MW-23S	5
12MW-07S	0.72 to 0.95	---	---	12MW-24D	4
12MW-07D	0.19 to 0.24	---	---	12MW-24S	1
12MW-08S	0.17 to 0.32	---	---	12MW-25D	6
12MW-08D	0.07 to 0.16	---	---	12MW-25S	5
12MW-09S	3.2	---	---	12MW-26S	6
12MW-09D	4.7 to 5.3	---	---	12MW-27D	6
12MW-11S	1.58 to 2.02	---	---	12MW-27S	9
12MW-11D	10.91 to 20.16	---	---	12MW-28D	11
12MW-12S	---	---	3 to 9	12MW-28S	8
12MW-13S	---	---	5	12MW-29S	7
12MW-17S	---	---	7 to 15	12MW-30S	4

Ground-Water Levels

Ground-water levels rise and fall because of a variety of factors, including drought. A drought that began in June 1998 and continued through 2002 (Harwell and others, 2004) resulted in a period of relatively low water levels. Water levels rise when precipitation recharges the aquifer (fig. 5). One probable area of recharge is near well 12MW-01S (approximately 120 ft west of mapped area shown in figure 2), where the surficial clay is largely absent. Elsewhere, recharge appears to be by infiltration downward through localized discontinuities in the surficial clay. Water levels often are highest at well 12MW-10S, indicating that this well is near a localized discontinuity that permits aquifer recharge (fig. 4).

Despite the presence of confining clay over most of the site, ground-water levels sharply rise in rapid response to precipitation (fig. 5). Because of the thick clay layer, it is unlikely that this response is associated with rapid precipitation infiltration to the aquifer across the site. Rather, it is more likely that precipitation recharges the aquifer through discontinuities in the clay near well 12MW-01S and probably near former Building 88. The rapid water-level rises in response to rainfall elsewhere across the site probably reflect rapid transmission of the pressure increases through the confined aquifer.

The forested area provides a major water-loss mechanism through evapotranspiration. Sediment cores collected during this investigation showed the presence of tree roots in the aquifer below the surficial clay at depths greater than 10 ft. Mature

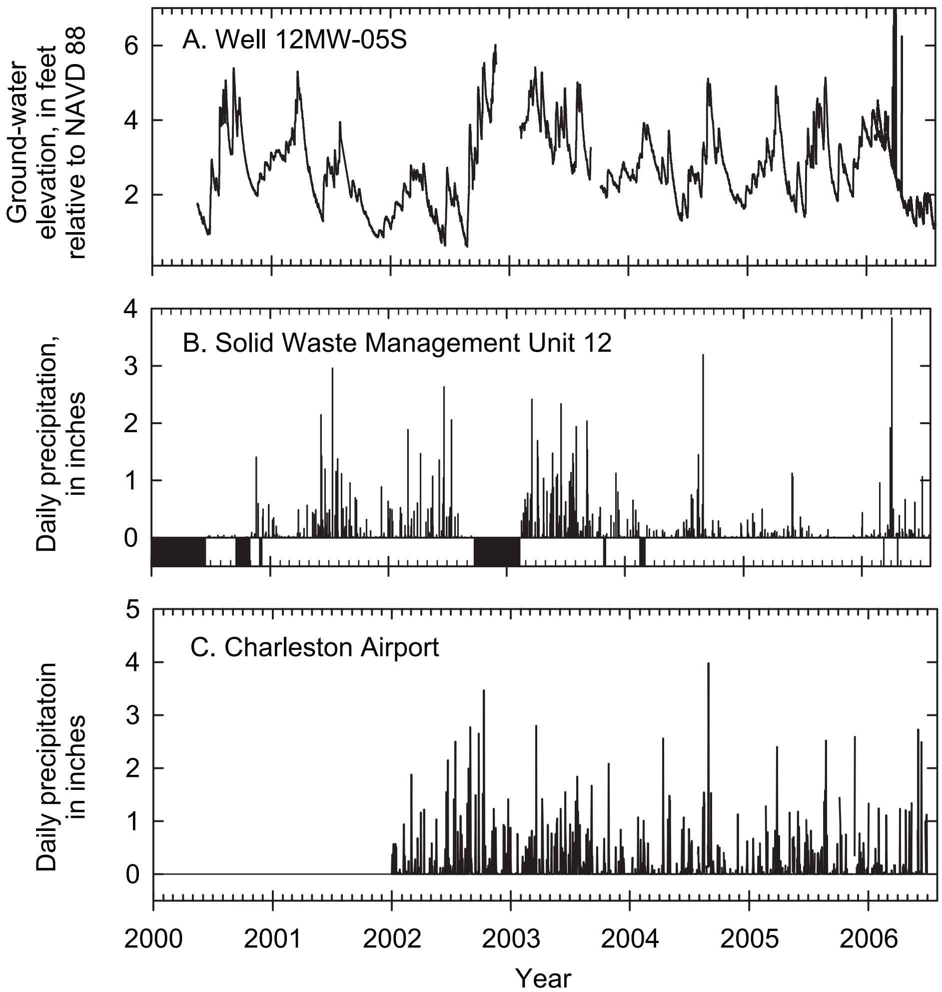

Figure 5. (A) Ground-water elevations at well 12MW-05S, May 2000 to July 2006; (B) daily precipitation at the onsite weather station (negative numbers indicate missing values), June 2000 to July 2006; and (C) daily precipitation values at the Charleston Airport, January 2002 to July 2006.

trees in the forested area at SWMU12 utilize a substantial amount of water from the subsurface, as evidenced by sapflow measurements showing that in July 2003, a loblolly pine near well 12MW-05S transpired an average of 44 gallons per day, and on one day transpired 63 gallons (Jim Vose, Coweeta Hydrologic Laboratory, U.S. Department of Agriculture Forest Service, written commun., 2003). At SWMU12, the annual transpiration (all species combined) is about 1,069,638 gallons per acre per year (R. Hubbard and J.M. Vose, Coweeta Hydrologic Laboratory, U.S. Department of Agriculture Forest Service, written commun., 2004).

During some months in the summer, the ground-water levels in the forested area near wells 12MW-12S and 12MW-17S are lower than ground-water levels beneath the eastern marsh and on the shoreline at well 12MW-13S. This is in part because evapotranspiration removes ground water beneath the forest more rapidly than beneath the eastern marsh. The surficial clay that extends at least 30 ft into the eastern marsh limits near-shore hydraulic exchange between the aquifer and the marsh. Thus, the forested area near wells 12MW-17S and 12MW-12S forms a hydraulic depression during parts of the summer, temporarily providing a hydraulic sink for ground-water contamination being transported from upgradient source areas toward the eastern marsh.

The change in stage of the northern marsh and George Pond following Hurricane Gaston appears to have influenced the ground-water level in the eastern part of SWMU12 at well 12MW-08S. Prior to Hurricane Gaston, the water level at 12MW-08S, near George Pond, was usually higher than in the wells in the central part of the forest along the axis of contamination and sometimes higher than any of the measured wells (Vroblesky and others, 2003, 2004a). The relatively high water levels at well 12MW-08S resulted in a trough-like configuration of the piezometric surface of the surficial aquifer prior to Hurricane Gaston (fig. 4). The axis of the trough approximately aligned with the axis of contaminant transport through the forest, as determined from well sampling and from temporary push-technology wells installed during this and previous investigations (Tetra Tech NUS, Inc., 2000a, b; Vroblesky and others, 2003). The data imply that the trough exerted hydraulic control over the contaminant transport direction. Following the draining of the northern marsh and George Pond, however, ground-water levels at well 12MW-08 dropped. Since that time, the water level in well 12MW-08 has remained lower than those in the central part of the forest near the contamination (see fig. 6 using well 12MW-11S as representative of the central forest area) and sometimes represents the lowest measured water levels at the site during synoptic measurements. The trough-like configuration of the surficial aquifer piezometric surface is no longer present (fig. 7).

The change in ground-water levels has the potential to change the location of the ground-water contamination plume in the forested area. Increasing VOC concentrations in well 12MW-12S during 2006 imply that this hydraulic change has shifted the direction of plume transport to a more northerly tract, although additional monitoring will be needed to confirm the shift.

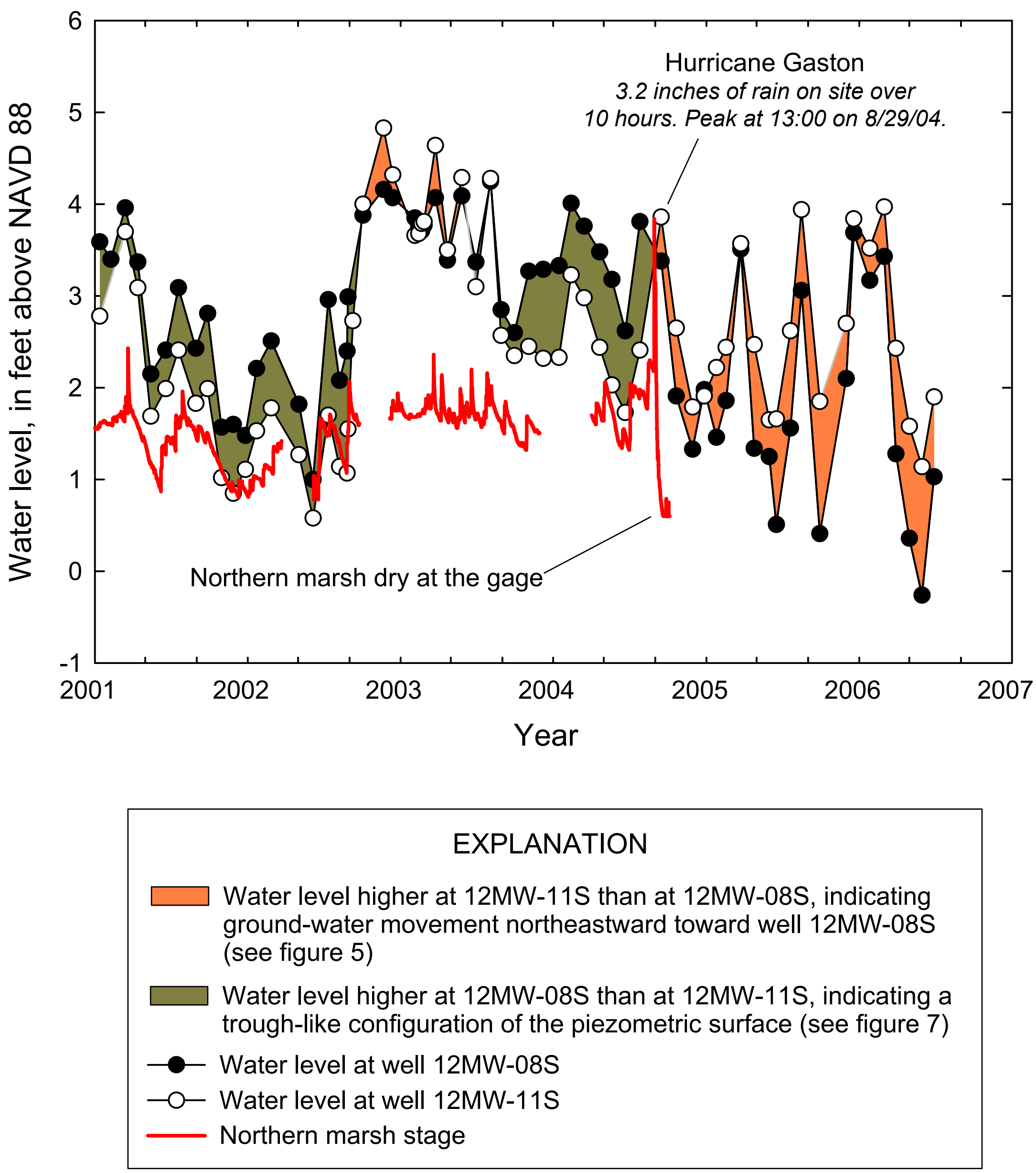

Figure 6. Changes in ground-water levels corresponding to the stage decline in the northern marsh following Hurricane Gaston on August 29, 2000, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

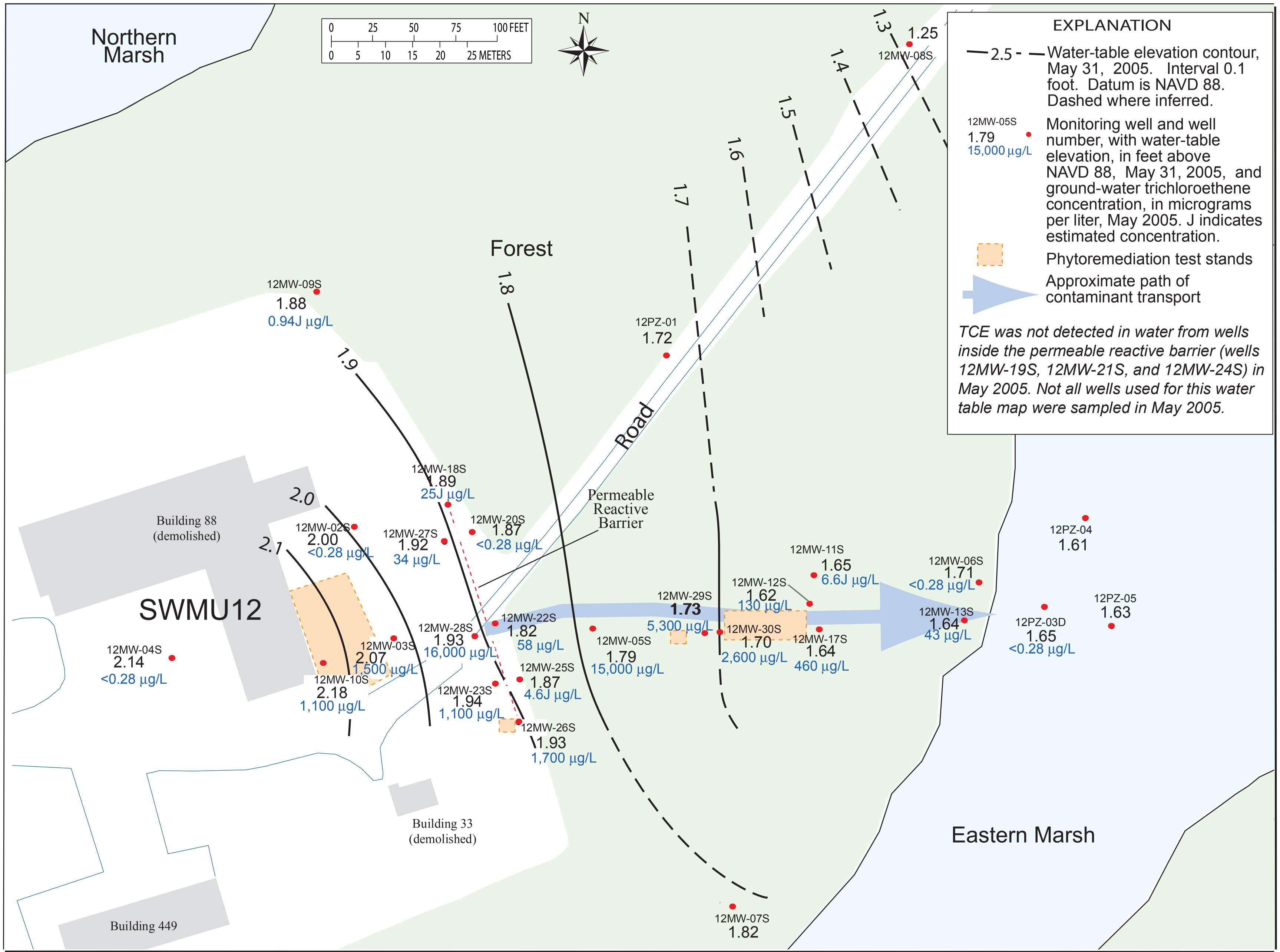

Figure 7. Ground-water levels (May 31, 2005) and trichloroethene (TCE) concentrations (May 23–25, 2005) in the surficial aquifer, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

Ground-Water Age Dating

Ground-water age dating uses techniques that determine the year that water recharged the aquifer. The difference between that date and the sampling date is the age of the water. Ground water at SWMU12 was sampled from seven wells for age dating by analysis of sulfur hexafluoride (SF_6) concentrations in August 2004, January 2005, and March 2006. In addition, ground water was sampled for approximate age dates by tritium in August 2004.

Overview

Atmospheric concentrations of SF_6 are primarily of anthropogenic origin. The troposphere concentration of SF_6 has increased from a steady-state value of 0.054 ± 0.009 to more than 4 parts per trillion during the past 40 years (Busenberg and Plummer, 2000). Ground water can be dated with SF_6 if it is in equilibrium with atmospheric SF_6 at the time of recharge and does not contain significant SF_6 from other sources.

Caution should be exercised with SF_6 data, however, because the age of waters recharged prior to about 1970 cannot be differentiated. Additionally, mixing of recent water with older water will give a recharge date that reflects the mixture.

Tritium also has been used to estimate whether ground water was recharged before or after the time of thermonuclear testing (1952 to the late1960s). While less quantitative than SF_6 analyses, tritium provides supportive data. Ground water that contains less than 2.5 picocuries (about 0.78 tritium units (TU)) is considered to have been recharged prior to 1952–1953, and ground water that contains more than 2.5 picocuries is considered to contain some component of water recharged after 1952–1953 (fig. 8; 1 TU is approximately 3.19 picocuries per liter).

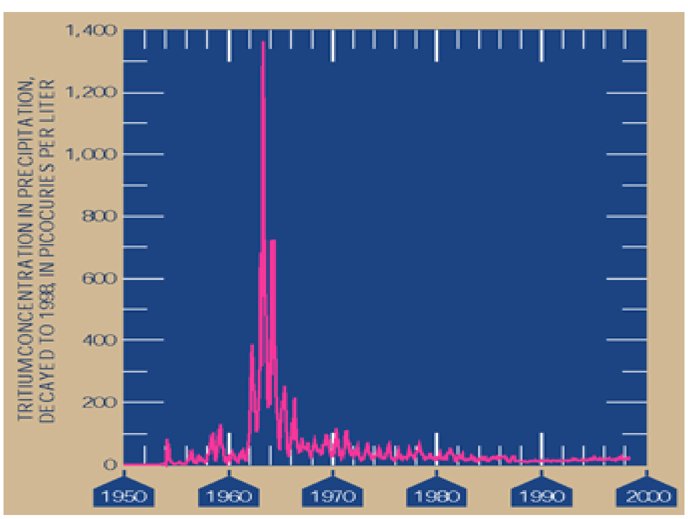

Figure 8. Concentrations of atmospheric tritium (Cordy and others, 2000).

In 1963–64, above-ground nuclear testing by the United States and Russia resulted in rainfall with greater than 1,000 picocuries per liter (about 312 TU). Because tritium concentrations have not changed uniformly with time and because of radioactive decay, tritium age dating does not provide precise recharge dates. Thus, radioactive age dating of water, combined with the use of SF_6 concentrations, provide only information on the date that the water was recharged from the atmosphere. Ground waters with greater than 30 TU are considered to have been recharged in the early 1960s.

The calculated date of recharge is not necessarily the year that the associated contamination entered the aquifer. If water is recharged in areas upgradient from the contamination, and the contamination leached into the aquifer through discontinuities in the overlying confining bed, then the contamination can mix with water that was in the aquifer prior to the contamination spill.

Site Application

Despite the uncertainties with age dating, conclusions can be drawn regarding ground water at SWMU12. The results of the August 2004 sampling of tritium and SF_6 indicate that water at well 12MW-13S, the farthest downgradient well before the marsh, probably was recharged prior to 1953 (table 4). The data also indicate that the ground water at well 12MW-29S, between the source and the marsh, was recharged in about 1980, and the ground water at temporary drive point 12TP-37 near well 12MW-29S was recharged in about 1974–75.

The remaining results are more uncertain. The implied SF_6 age date for water at well 12MW-05S is inconsistent with tritium results. Additionally, water at well 12MW-05S appears to be older than the water downgradient at well 12MW-29S, based on SF_6 data. One likely explanation results from the difference in screen lengths. Well 12MW-05S has a 10-ft-long screen, whereas well 12MW-29S has only a 2.25-ft-long screen. Thus, well 12MW-29S represents a more discrete sample than well 12MW-05S, making it likely that the sample from well 12MW-05S is a mixture of differing age waters, resulting in an age date that is a flow-weighted average of the waters across the screened interval. As such, the calculated age for water from well 23MW-05S is not directly comparable to water from well 12MW-29S. Likewise, ground water at wells 12MW-12S and 12MW-17S, near each other and approximately 90 ft closer to the source area than well 12MW-13S, appears to have been recharged sometime in the 1950s to early 1960s, based on tritium data; however, a more accurate date cannot be obtained because the dates were outside the quantitation range of SF_6.

Table 4. Tritium and sulfur hexafluoride (SF_6) data for ground water from Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, 2004–2005.

[---, no data]

Well number	Date collected	Tritium units	Suggested tritium age date[a]	SF_6 corrected for excess air, in parts per trillion by volume	Implied SF_6 age date
12MW-05S	8/19/2004	9.4 ± 0.8	About 1984[b]	0.4	1974.5[b]
12MW-12S	8/19/2004	2.3 ± 0.6	1953–1962	0.1	1965.5[c]
12MW-13S	8/19/2004	0.3 ± 0.6	Prior to 1953	0.0	1952[c]
12MW-17S	8/19/2004	1.2 ± 0.6	About 1953	0.2	1966.5[c]
12MW-29S	8/19/2004	---	---	0.9	1980
12TP-37	1/24/2005	---	---	0.4	1974.5
12MW-09S	3/1/2006	---	---	0.75–1.07	1987.5–1992

[a] Bob Michel, U.S. Geological Survey, oral commun., November 15, 2004.

[b] Probable inaccurate date because sample may represent a mixing of waters.

[c] Data are outside of the quantitation range, and actual age could be older than implied age.

Ground-Water Flow Rates

Data from SWMU12 indicate that ground-water flow rates likely vary across the site and are slowest in the forested area. The SF_6 data can be used to estimate a ground-water flow rate in the forested area between well 12MW-29S and temporary well 12TP-37 (fig. 2). The distance between the wells is about 32 ft. The ground water at 12MW-29S is about 5 to 6 years younger than at 12TP-37. Therefore, the ground-water flow rate from well 12MW-29S to 12TP-37 is about 5.3 to 6.4 feet per year (ft/yr). The distance from well 12MW-29S to well 12MW-13S is 159 ft, and the age difference in the waters from the two wells is at least 27 years. Therefore, the ground-water flow rate from well 12MW-29S to 12MW-13S is 5.9 ft/yr or slower (table 5).

The average hydraulic gradient for September 2004 to September 2005 from well 12MW-05S to well 12MW-29S is 0.000757 feet per feet (ft/ft). The estimated hydraulic conductivity at well 12MW-29S is 7 ft/d (table 3), and at well 12MW-05S, the estimated hydraulic conductivity is 13 to 14 ft/d (Vroblesky and others, 2003). Assuming a geologically reasonable porosity range between 0.25 and 0.4 and an average hydraulic conductivity of about 10 ft/d, the estimated ground-water flow rate between the wells is about 7 to 11 ft/yr (table 5).

The average hydraulic gradient from well 12MW-03S to well 12MW-05S for the period October 2000 to February 2005 is about 0.0021. Reanalysis of the slug test data from 2001 for wells 12MW-03S and 12MW-05S shows a range of hydraulic conductivity from 10.5 to 14 ft/d (Vroblesky and others, 2003). Assuming a geologically reasonable porosity range between 0.25 and 0.4 and an average hydraulic conductivity of 12 ft/d, the estimated ground-water flow rate between the wells is about 23.0 to 36.8 ft/yr.

Table 5. Summary of estimated probable ground-water flow rates, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

Location	Probable ground-water flow rate, in feet per year	Justification
Former underground storage tank to well 12MW-03S	20 to 22.9	Volatile organic compound concentration changes in well 12MW-03S thought to be related to the underground storage tank removal
Well 12MW-22S to well 12MW-05S	4.6 to 5.6	Based on slug test data and hydraulic gradients
Well 12MW-05S to well 12MW-29S	7 to 11	Based on slug test data and hydraulic gradients
Well 12MW-29S to temporary well 12TP-37	5 to 6.4	Sulfur hexafluoride age-dating data
Well 12MW-29S to well 12MW-13S	5.9 (or slower)	Sulfur hexafluoride and tritium age dating
Source area to 12MW-13S	At least an average of 12.6	Historical information

The average hydraulic gradient betweens wells 12MW-22S and 12MW-05S (60 ft apart) during February 2003 to June 2006 was about 4.63 x10^{-4} ft/ft. The aquifer hydraulic conductivity at well 12MW-22S was about 5 ft/d. Using an estimated porosity range of 0.25 to 0.3 percent, the estimated ground-water velocity is about 4.6 to 5.6 ft/yr between wells 12MW-22S and 12MW-05S (table 5).

The ground-water flow rate also can be estimated from historical information on site activities compared to historical ground-water monitoring data. The time of contaminant transport from the former underground storage tank to well 12MW-03S (about 48 ft away) is probably about 2.1 to 2.4 years, based on the appearance of a 1,1,1-TCA pulse at well 12MW-03S in 2001 thought to be related to the UST removal in 1999 (Vroblesky and others, 2003). This translates to a flow rate of about 20 to 22.9 ft/yr (table 5). One uncertainty in this calculation is that because the tank removal involved movement of contaminated soil and may have involved at least some level of uncontrolled contaminated-water overflow, contamination may have infiltrated the aquifer at areas other than the immediate vicinity of the tank excavation or at an earlier date than the tank removal.

Because the facility was used for the treatment of wood ammunition boxes from the early 1970s until 1981 (Tetra Tech NUS, Inc., 2000a), ground-water contamination related to this process may have taken place as early as 1971–72. The distance from the source area to well 12MW-13S is 392 ft. In order for contamination to have arrived at well 12MW-13S at least by 2003 (about 31 to 32 years after the site began operation), the net contaminant-transport rate must have been at least 12.6 ft/yr (392 ft/31 yrs).

Ground-Water Contamination

The ground-water contamination, consisting of chlorinated aliphatic VOCs, extends eastward in the surficial aquifer from former Building 88 (fig. 7). The orientation and axis of the plume was determined from well sampling and from temporary push-technology wells installed during this and previous investigations (Tetra Tech NUS, Inc., 2000b; Vroblesky and others, 2003). 1,1,1-TCA and PCE are parent contaminants and are found in relatively high concentrations in ground water adjacent to the eastern side of former Building 88 and the former location of the UST. TCE probably is present both as a parent contaminant and as a dechlorination product. Many of the lower chlorinated compounds, such as *c*DCE and VC, probably are transformation products of these parent compounds. At least one compound, however, 1,1-DCE, is an abiotic derivative of 1,1,1-TCA (Vogel, 1994).

In August 2001, ground-water samples were collected from wells by the USGS and from temporary wells by Tetra Tech NUS, Inc., making that the period for which the most aerially comprehensive examination of the ground-water quality is available for the site. The data showed that the highest concentrations of 1,1,1-TCA, PCE, and TCE in ground water were near former Building 88, approximately 10 to 30 ft north, northwest, and northeast of well 12MW-10S (David Beverly, CH2M Hill Constructors, Inc., written commun., 2003). Maximum measured concentrations were 443,000 µg/L of 1,1,1-TCA, 155,000 µg/L of 1,1-DCA, 20,300 µg/L of PCE, and 86,700 µg/L of TCE. VC was present at 2,500 µg/L. Therefore, the area near former Building 88 constitutes the probable source area (fig. 2).

Distribution of Contaminants in the Source Area Unsaturated Zone

Sediment core samples in the confining zone above the aquifer in the source area (fig. 9) were collected from 1.5 ft, 4 ft, and 6 to 7 ft below land surface and indicated that the contaminant concentrations increased with depth (table 6). The most concentrated contaminant detected at a depth of 1.5 ft was 980 micrograms per kilogram (µg/kg) of *c*DCE at site TP24 (table 6; fig. 9) The *c*DCE concentration at TP24 increased to 3,100 µg/kg at a depth of 4 ft and 4,500 µg/kg at a depth of 6 to 7 ft (table 6).

Differences between duplicate samples collected adjacent to each other attest to the contaminant heterogeneity (table 6). This, in turn, probably influences heterogeneity in the ground-water plume concentrations.

The highest contaminant concentrations at 4-ft deep for most VOCs (except 1,4-dioxane) were found at site TP29, in the approximate location of the former UST. Site TP29 contained 21,000 µg/kg of 1,1,1-TCA (fig. 10). Other areas of high VOC concentrations at 4-ft deep were sites TP27 and TP31, east-northeast of site TP29 (fig. 10). Relatively high concentrations of VC (320 µg/kg) and *c*DCE (3,100 µg/kg) were found at site TP24 (table 6). *c*DCE was the most widespread contaminant at this depth, being detected in 8 out of the 11 boreholes.

Substantially higher concentrations of VOCs were found at the 6–7 ft depth relative to the shallower horizons for most constituents (table 6; fig. 11). For the parent compounds PCE and 1,1,1-TCA, relatively high concentrations were found near the former UST (TP29) and the borings east-northeast of the former UST (TP27 and TP31; figs. 11A, 11B). This same area contained relatively high concentrations of TCE (fig. 11C), *c*DCE (fig. 11D), and other constituents (table 6), although much lower in concentration than PCE. In contrast, however, some of the northern test borings (TP28 and TP32) contained substantially higher concentrations of TCE than PCE, indicating that the northern part of the site either is an area of dechlorination activity or that TCE was a primary contaminant in the northern area. The presence of a high VC concentration (1,000 µg/kg) in the soil core from the 6- to 7-ft depth at site TP24 indicates at least some level of dechlorination activity in the northern part of the source area (table 6).

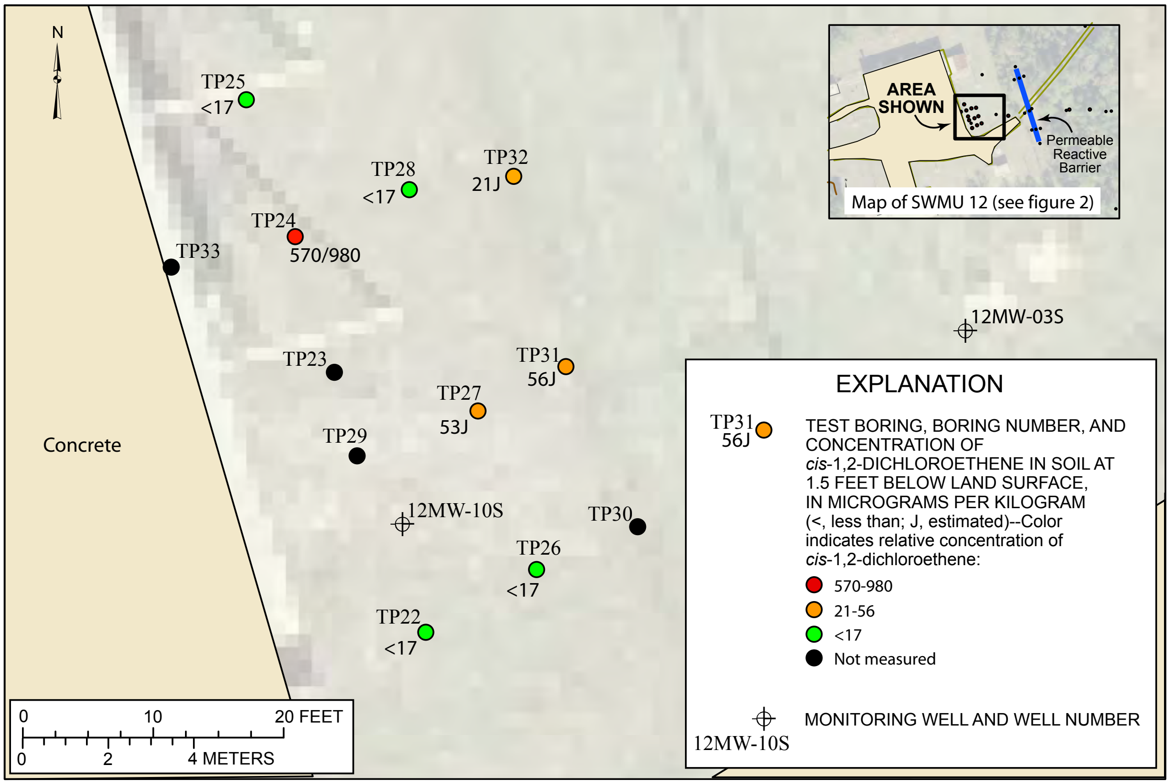

Figure 9. *cis*-1,2-Dichloroethene in soil at 1.5 feet below land surface from analysis of cores collected by direct-push technology, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, January 24, 2005.

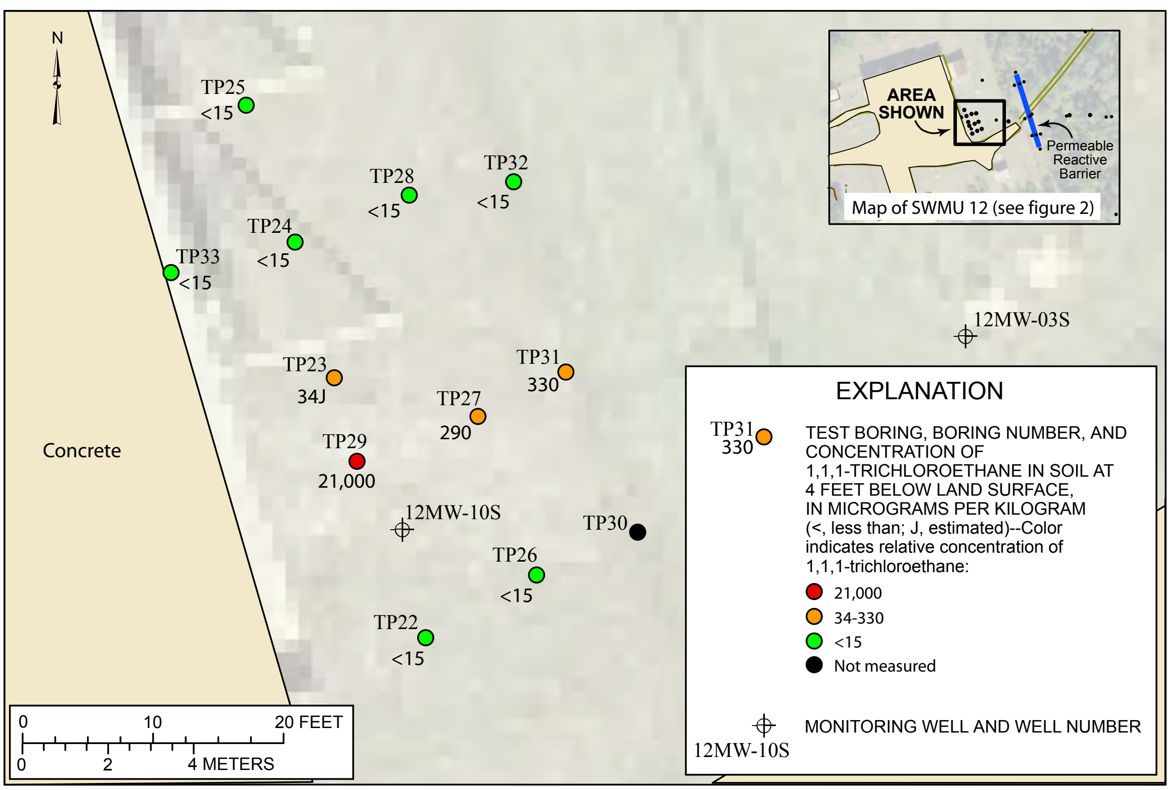

Figure 10. 1,1,1-Trichloroethane in soil at 4 feet below land surface from analysis of cores collected by direct-push technology, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, January 24, 2005.

Table 6. Concentrations of volatile organic compounds detected in soil samples in the vicinity of the suspected source area, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina January 24, 2005.

[1,1,1-TCA, 1,1,1-trichloroethane; 1,1-DCA, 1,1-dichloroethane; 1,1-DCE, 1,1-dichloroethene; 14Diox, 1,4-dioxane; CT, carbon tetrachloride; *c*DCE, *cis*-1,2-dichloroethene; PCE, tetrachloroethene; TCE, trichloroethene; VC, vinyl chloride; <, less than; J, estimated value; *, duplicate sample; all concentrations are in micrograms per kilogram]

Location	Depth below land surface, in feet	1,1,1-TCA	1,1-DCA	1,1-DCE	14Diox	CT	*c*DCE	PCE	TCE	VC
TP22	1.5	<15	<16	<11	<270	<16	<17	<20	<17	<12
	4	<15	<16	<11	<270	<16	<17	<20	<17	<12
	6 to 7	<15	<16	<11	<270	<16	<17	<20	<17	<12
TP23	4	34J	24J	<11	<270	<16	18J	26J	<17	34J
TP24	1.5	<15	<16	<11	<270	<16	570	<20	<17	26J
	1.5*	<15	<16	<11	<270	<16	980	<20	25J	23J
	4	<15	24J	17J	<270	<16	3,100	<20	<17	320
	6 to 7	1,200	920	3,200	<270	140	4,500	3,100	1,900	1,000
TP25	1.5	<15	<16	<11	<270	<16	<17	<20	<17	<12
	4	<15	<16	<11	<270	<16	<17	<20	<17	<12
	6 to 7	<15	<16	<11	<270	<16	21J	<20	<17	<12
TP26	1.5	<15	<16	<11	<270	<16	<17	<20	<17	<12
	4	<15	<16	<11	<270	<16	<17	<20	<17	<12
	6 to 7	<15	<16	<11	<270	<16	59	<20	<17	<12
TP27	1.5	17J	97	24J	370J	<16	53J	48J	<17	<12
	4	290	1,200	360	4,600	36J	360	130	34J	17J
	6 to 7	12,000	2,900	4,100	1,900	1,800	690	4,000	290	39J
TP28	1.5	19J	<16	18J	<270	<16	<17	<20	<17	<12
	4	<15	<16	<11	<270	<16	35J	<20	<17	<12
	6 to 7	630	810	2,300	<270	80	4,100	2,300	10,000	340
TP29	4	21,000	4,700	330	<270	2,500	950	1,900	500	46
	6 to 7	31,000	22,000	19,000	6,200	3,800	2,800	5,800	670	210
TP31	1.5	<15	36J	23J	<270	<16	56J	22J	27J	<12
	4	330	260	220	690J	41J	290	580	53J	17J
	6 to 7	22,000	7,000	28,000	<6,600	25,000	6,800	380,000	22,000	650J
TP32	1.5	<15	<16	<11	<270	<16	21J	<20	<17	<12
	4	<15	<16	13J	<270	<16	89	39J	<17	<12
	6 to 7	290	400	1,200	<270	37J	2,800	760	3,200	220
TP33	4	<15	<16	<11	<270	<16	310	<20	<17	47
	4*	<15	<16	<11	<270	<16	<17	<20	<17	<12
	6 to 7	<15	<16	<11	<270	<16	19J	<20	<17	13J

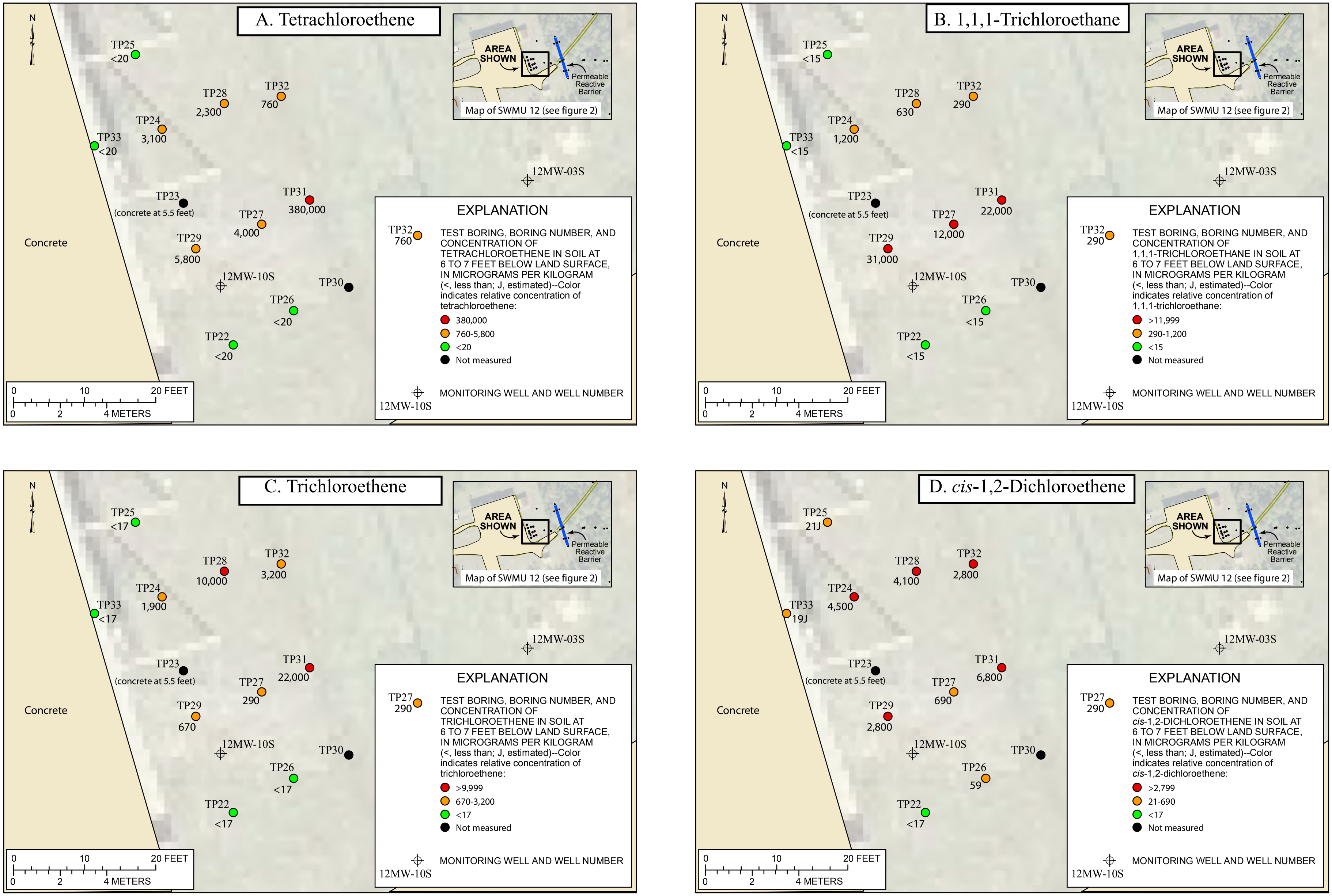

Figure 11. Selected volatile organic compounds in soil at 6 to 7 feet below land surface from analysis of cores collected by direct-push technology, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, January 24, 2005.

Changes in Contaminant Concentration at the Permeable Reactive Barrier

Contaminant concentrations have changed in some wells near the permeable reactive barrier (PRB). The central part of the PRB, along the main axis of the contaminant plume, appears to be actively removing contamination. Evidence for the removal is that concentrations have decreased substantially on the downgradient edge of the PRB at well 12MW-22S (fig. 12A) along the major axis of the contaminant plume, despite the fact that VOC concentrations directly upgradient from the PRB (well 12MW-28S) have not changed substantially (fig. 12B). Although some level of PRB occlusion probably has taken place, there is no evidence of contaminant diversion or ground-water mounding on the upgradient side of the PRB in this area. The lack of ground-water mounding is evidenced by the fact there has not been a systematic increase in water levels at upgradient well 12MW-28S relative to the surrounding wells since the wells were first measured in 2003 (12MW-21S, 12MW-22S, 12MW-23S, 12MW-27S, 12MW-28D, 12MW-21D, and 12MW-22D).

As a check on the remediation influence of the PRB, a series of push-technology temporary wells were installed and sampled in June 2005. The wells were located along the axis of the contamination plume beginning 17.9 ft downgradient from the approximate center of the PRB and extending downgradient to near well 12MW-05S (fig. 13). When combined with data from permanent wells 12MW-22S and 12MW-05S, the data show that contaminant concentrations of 1,1-dichloroethene and parent compounds PCE, TCE, and

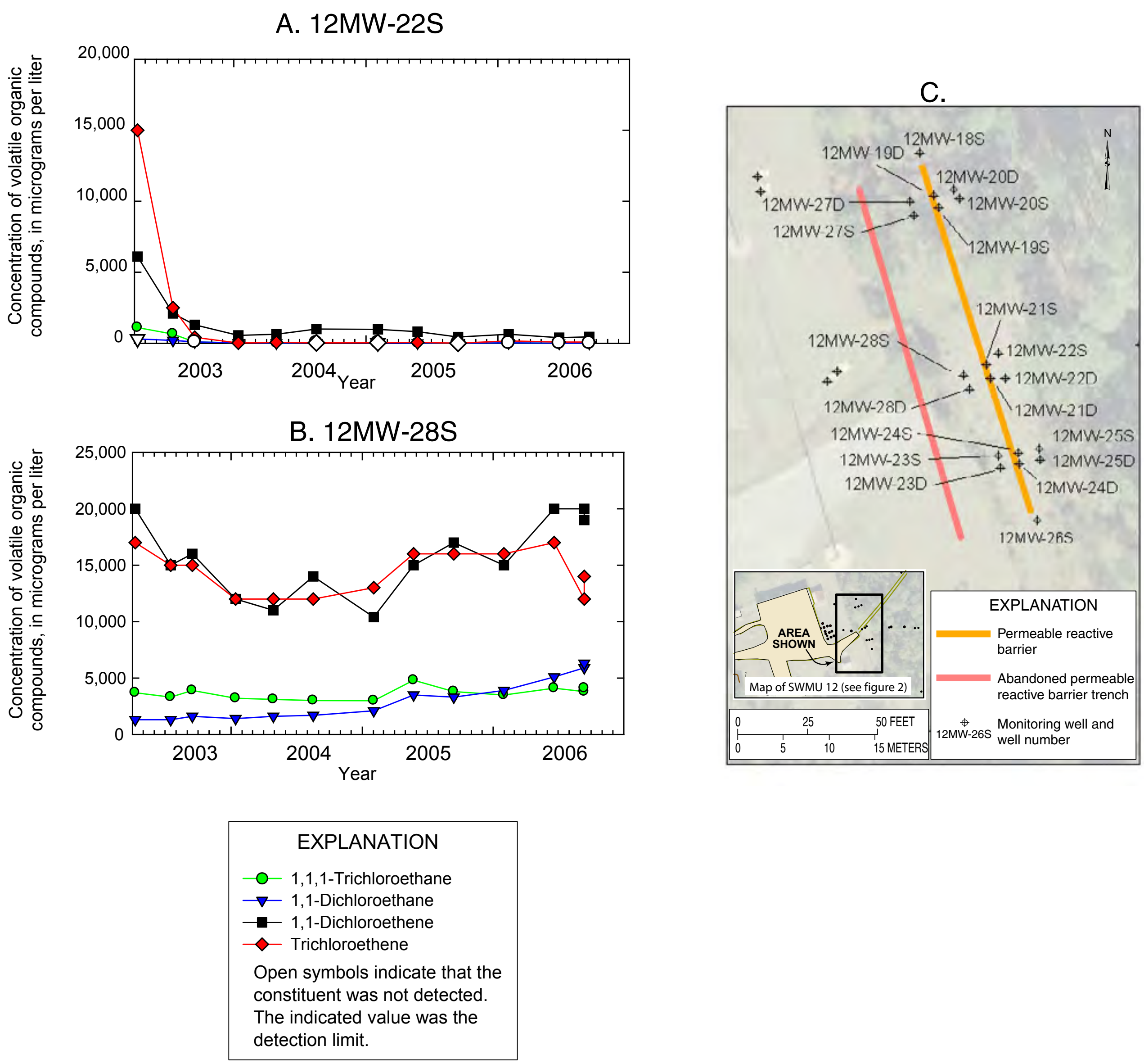

Figure 12. Concentrations of selected volatile organic compounds in ground water at wells (A) 12MW-22S and (B) 12MW-28S, near the permeable reactive barrier (PRB), and (C) locations of wells and collapsed (abandoned) PRB trench and existing PRB, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 2003 to September 2006.

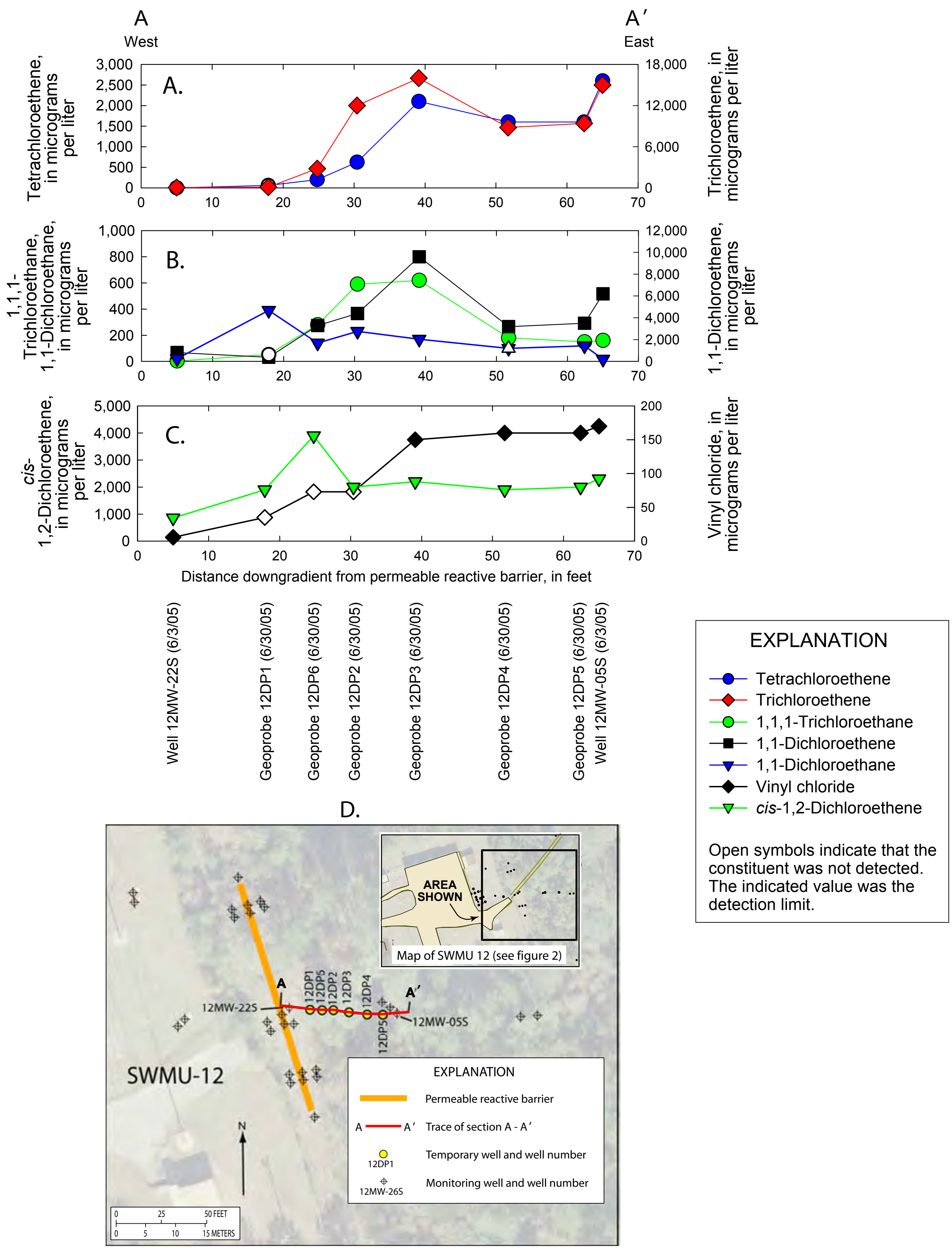

Figure 13. Concentrations of selected volatile organic compounds in ground water between the permeable reactive barrier and well 12MW-05S, and location of section A-A′, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, June 2005.

1,1,1-TCA are substantially lower directly downgradient from the PRB than upgradient of the PRB at well 12MW28S (fig. 11A) and farther downgradient of the PRB at temporary borings and at well 12MW-05S (figs. 13A and 13B). The zone of reduced concentrations appears to extend to about 20 to 25 ft downgradient from the PRB. The difference is less pronounced for transformation products *c*DCE, 1,1-DCA, and possibly VC (figs. 13B and 13C). Although 1,1-DCA may be a compound passing through the PRB (it has been observed at the downgradient edge of the PRB in well 12MW-21S), it is unlikely that VC represents breakthrough because it has not been detected at well 12MW-21S. The transformation products may represent downgradient dechlorination of parent compounds or desorption from the aquifer matrix.

The PRB was emplaced in December 2002. The elapsed time between the emplacement and the June 2005 sampling downgradient from the PRB was 2.6 years. If the zone of reduced concentrations downgradient from the PRB represents contaminant remediation by the PRB, then the remediation front appears to be advancing at a rate of about 9 to 10 ft/yr. The remediation front advancement rate will decrease substantially downgradient from well 12MW-05S, where the hydraulic gradients are lower than near the PRB.

In contrast to the central area of the PRB, the data from the southern end of the PRB indicates that contaminants are moving around the PRB. Evidence for movement of contamination around the southern end of the PRB is the recent sharp increase in concentrations of TCE, 1,1-DCE, and 1,1-DCA in ground water south of the PRB at well 12MW-26S (fig. 14A). The corresponding sharp decline in VOC concentrations at well 12MW-23S (fig. 14B), along the southern upgradient side of the PRB, implies a relation between contaminant loss at well 12MW-23S and contaminant gain at well 12MW-26S. A series of push-technology temporary wells were used on July 30, 2005, and May 1, 2006, at the southern end of the PRB. The data clearly indicate diversion of the plume around the southern end of the wall (figs. 15 and 16). No evidence was seen of contaminant diversion around the northern end of the PRB (fig. 14C).

A probable reason for the contaminant concentration changes at wells 12MW-23S and 12MW-26S is that the contaminated ground water appearing at well 12MW-26S was diverted from a source that formerly transported contamination toward well 12MW-23S. Potential causes for the diversion include (1) inappropriately low permeability in the PRB or (2) an upgradient aquifer blockage caused by a collapsed trench during early attempts to emplace a PRB.

The potential for inappropriately low permeability in the southern end of the PRB cannot be definitively ascertained because there are no wells in that part of the PRB, as evidenced by a series of soil cores collected by push technology on May 1, 2006. The cores showed that well 12MW-24S,

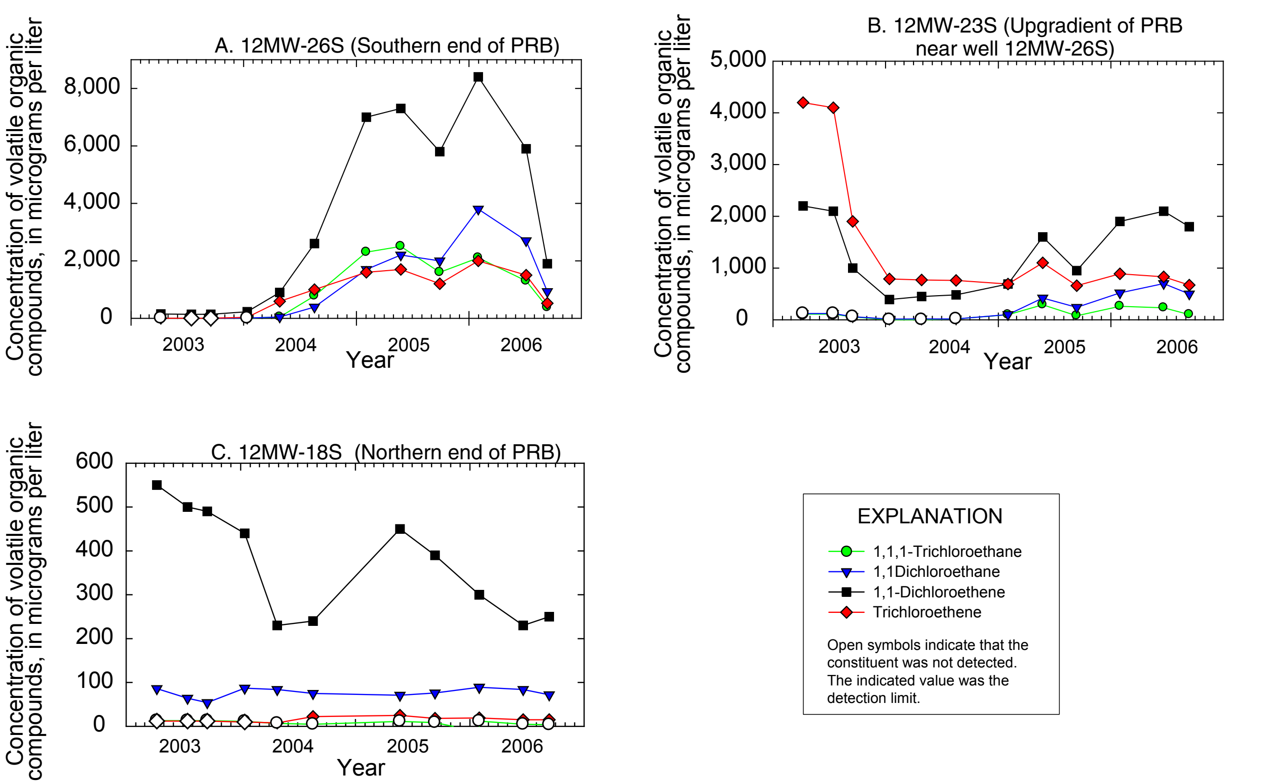

Figure 14. Concentrations of selected volatile organic compounds in ground water at wells (A) 12MW-26S, (B) 12MW-23S, and (C) 12MW-18S, near the southern and northern ends of the permeable reactive barrier, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 2003 to September 2006.

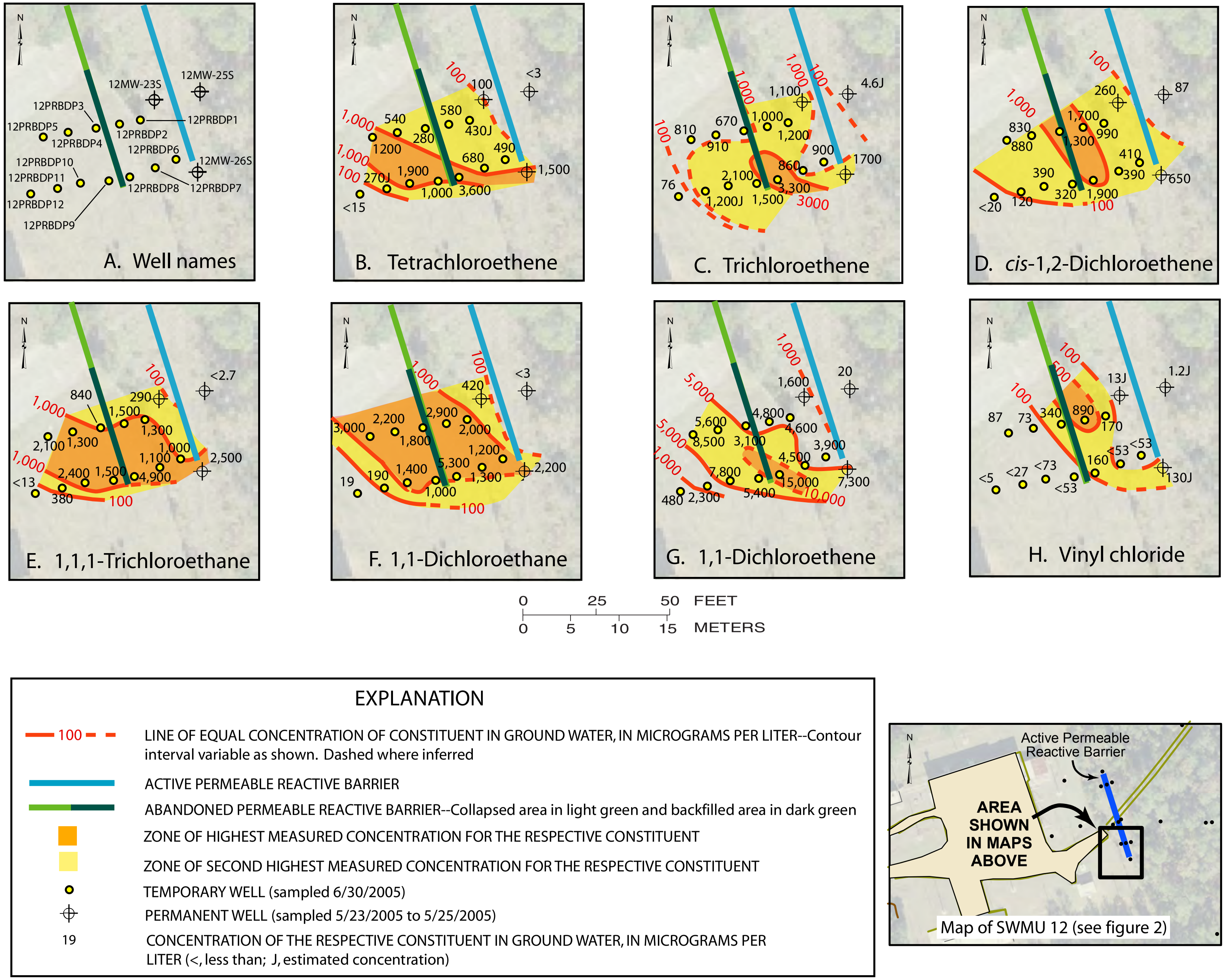

Figure 15. Distributions of volatile organic compounds in ground water near the southern end of the permeable reactive barrier, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, May to June 2005.

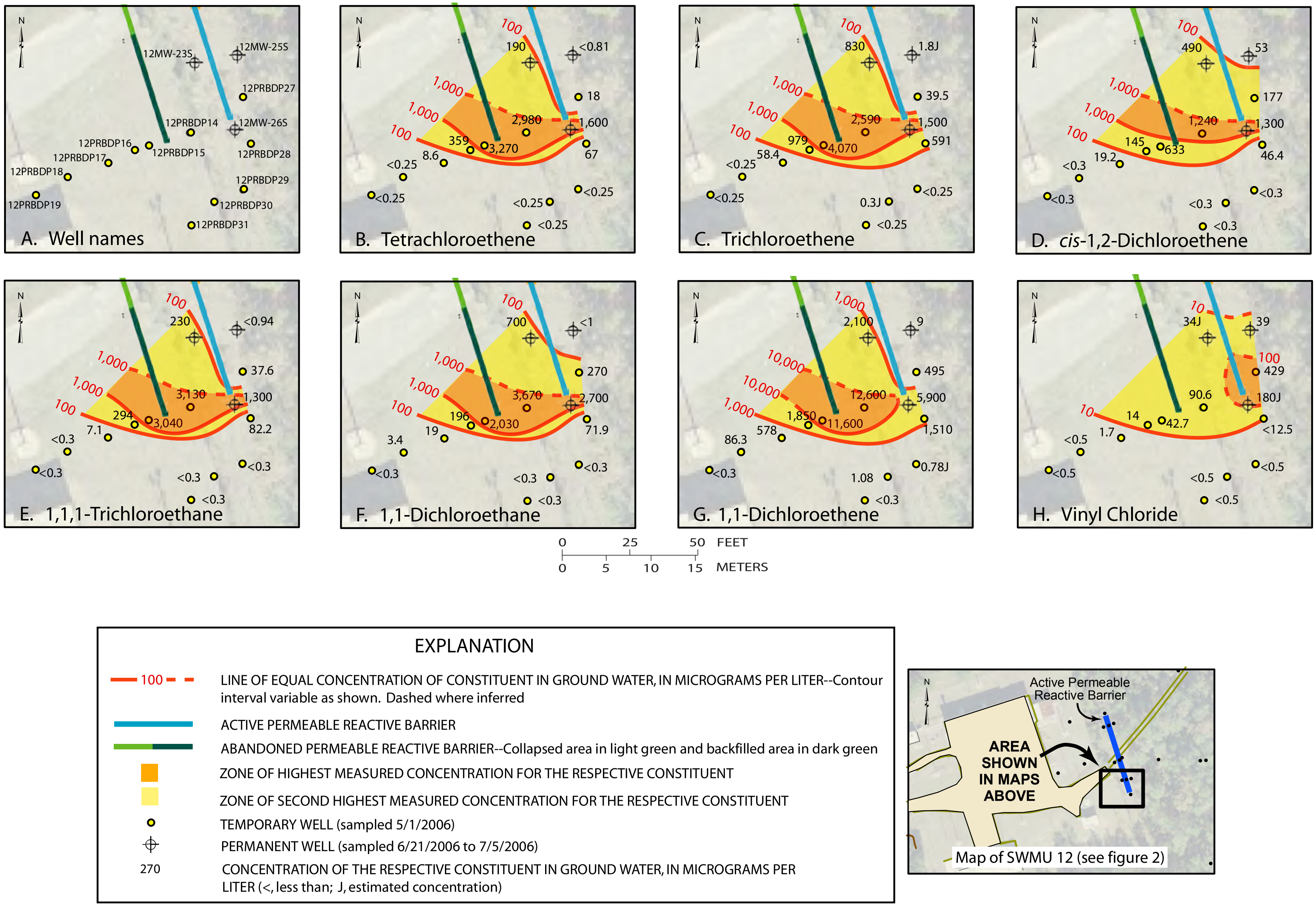

Figure 16. Distributions of volatile organic compounds in ground water near the southern end of the permeable reactive barrier, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, May to July 2006.

formerly thought to be within the PRB, actually is along the downgradient edge of the PRB, and probably not intersecting the PRB. Boring 12PRB32 (fig. 17) showed that the PRB was absent adjacent to well 12MW-24S. Other borings showed that the PRB was present at 12PRB22, 12PRBDP35, and 12PRBDP36, and that the upgradient edge of the PRB was at boring 12PRBDP37 (fig. 17). Likewise, boring 12PRB21, along the main axis of the contamination plume appeared to scrape the downgradient edge of the PRB at some depths and contained sediment from the PRB at other depths. These data imply that well 12MW-21S is probably within the PRB, but may be near the downgradient edge of the PRB.

Despite the lack of data within the southern end of the PRB, chemical and water-level data can be used to estimate the potential for PRB permeability losses. The data indicate that permeability losses probably are taking place within the PRB, but such changes should be less pronounced at the southern end of the PRB than in the central part. At well 12MW-21S, at the downgradient edge of the central part of the PRB, alkalinity has been decreasing (110 mg/L in April 2003 to 50 mg/L in June 2006) and the pH has been increasing (7.6 in April 2003 to 9.18 in June 2006), implying the possibility that there is some level of permeability loss due to carbonate precipitation within the 100-percent ZVI part of the PRB. In addition, dissolved hydrogen concentrations, which are typically less than about 25 nanomoles per liter (nM) in aquifers, were as high as 580,000 nM in the PRB at well 12MW-21S. Thus, there is the potential for permeability occlusion by precipitation and by vapor phase in the central part of the PRB. At the southern end of the PRB, the ratio of ZVI to sand in the fill material ranges from 50/50 to 20/80. Thus, the potential for ZVI-related porosity loss should be less at the southern end of the PRB, where ZVI constitutes a relatively small part of the sand fill, than in the central part, where ZVI constitutes the entire fill. These data do not definitively eliminate PRB clogging at the southern end of the PRB as the major factor causing contaminant bypass, but they indicate that PRB occlusion is less probable at the southern end of the PRB than near the central part of the PRB.

In addition, there have been no long-term systematic changes in hydraulic gradient across PRB in the central and southern parts of the PRB. Thus, there does not appear to be hydraulic mounding on the upgradient side of the PRB, as might be expected if PRB occlusion was important at this site.

A second potential cause for the contaminant diversion around the southern end of the PRB is the collapse and subsequent abandonment of a 110-ft-long trench originally designed to be the PRB on November 11, 2002 (CH2M Hill Constructors, Inc., 2003). The original trench was approximately 25 ft upgradient (west) from the final PRB (fig. 15) and extended

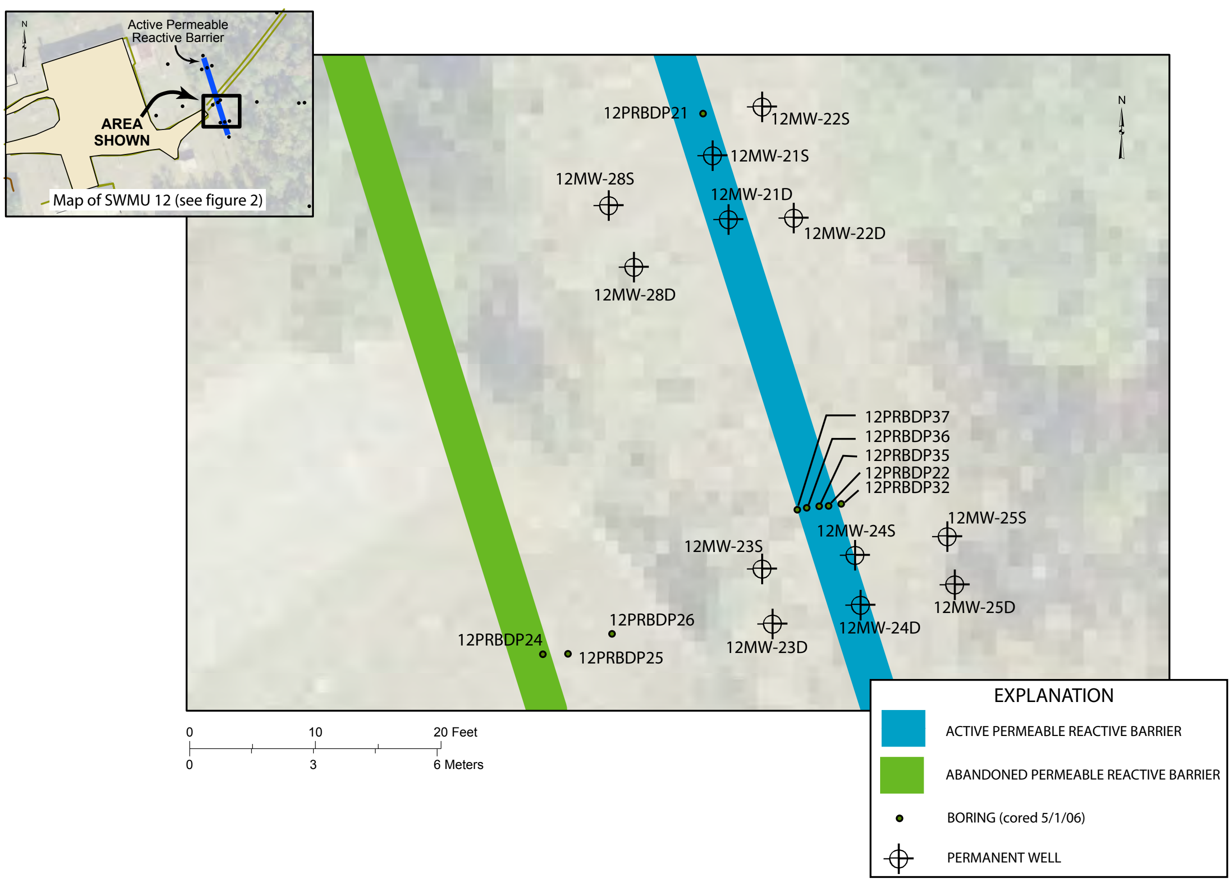

Figure 17. Locations of borings to collect soil cores, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, May 1, 2006.

into clay below the contaminated part of the aquifer. Because there was about 10 ft of clay above the contaminated aquifer, part of the collapsed material and backfilled material would have been clay, possibly producing local zones of reduced aquifer permeability. Thus, relatively low permeability zones in the aquifer at the abandoned trench may have caused contaminated ground water that formerly flowed eastward to well 12MW-23S to be diverted southward and then eastward around the abandoned trench, with a new flow path intercepting well 12MW-26S. A single coring (12PRBDP24) in the approximate location of the collapsed trench (fig. 17) did not reveal obvious blockage of the aquifer; however, there is uncertainty as to whether the coring intersected the collapsed trench, and the lithology of the collapsed trench probably is too heterogeneous to be characterized by a single coring.

In summary, the data presented do not definitively define the cause of the contaminant bypass at the southern end of the PRB. The chemical and hydraulic data, however, imply that there is a greater potential for PRB occlusion at the central part of the PRB than at the southern end. It is probable that some level of occlusion has taken place in the central part of the PRB where the ZVI constitutes 100 percent of the fill material.

Changes in Contaminant Concentration Over Time in Areas Other Than the Permeable Reactive Barrier

Substantial changes in ground-water contaminant concentrations have been observed in some monitoring wells at SWMU12 over the duration of this investigation and have been attributed to a variety of influences, including pulse release from source areas, biodegradation, phytovolatilization, and possible reversal of ground-water flow in downgradient areas near the marsh (Vroblesky and others, 2003, 2004a). Changes in ground-water contaminant concentrations also have been observed at SWMU12 from October 2004 to July 2006 (figs. 18, 19, and 20).

Changes in ground-water VOC concentrations were found in wells near the source area (12MW-10S and 12MW-03S). At well 12MW-10S, concentrations of PCE and 1,1-DCE showed marked fluctuations in concentration during 2005 and 2006 (figs. 18A and 19A), possibly reflecting irregular releases of sorbed contaminants from the source area. Concentrations of 1,1-DCA, 1,1,1-TCA, *c*DCE, and VC continued an irregular decline from 2001 (figs. 19A and 20A).

VOC concentrations at well 12MW-03S continued to show decreasing concentrations, with the June 2006 concentrations being the lowest yet recorded at that well for several VOCs (figs. 18B, 19B, and 20B). Since December 2001, total VOC concentrations at well 12MW-03S have declined from about 215,800 μg/L to less than 1,670 μg/L in June 2006.

Ground-water VOC concentrations also changed in some wells in the forested area in the middle part of the plume. At well 12MW-05S, despite the decrease in TCE and 1,1-DCE concentrations (figs. 18C and 19C), PCE concentrations, which had been relatively uniform since 2002 (usually between 300 and 700 μg/L), sharply increased in 2005 to greater than 2,000 μg/L before declining again in June 2006 (fig. 18C). Increasing PCE and decreasing TCE and 1,1-DCE concentrations also were observed at well 12MW-29S, approximately 67 ft downgradient from well 12MW-05S (fig. 18F). The source of the change is not known; however, the consistency of data implies that changes in wells 12MW-05S and 12MW-29S share a similar cause. The data may reflect a lateral shift in the axis of the contamination plume, as might be expected from the change in the piezometric surface, discussed earlier. It also is possible that the changes represent transport of the pulse of contamination detected in ground water at well 12MW-03S during 2001; however, this is unlikely because the travel time between wells 12MW-05S and 12MW-29S probably is between 9.6 to 11.5 years.

At the downgradient end of the plume, well 12MW-13S showed irregular continued increases in TCE and 1,1-DCE concentrations (figs. 18G and 19G). In addition, the data collected on June 22, 2006, showed *c*DCE at 19 to 23 μg/L, marking the first sampling event that *c*DCE has been detected in the well at concentrations greater than 2 μg/L. These data may reflect continued advancement of the plume.

On the northern side of the facility, concentrations of 1,1-DCE and 1,1-DCA in ground water at well 12MW-09S showed an irregular decline in concentrations from 2000 to 2003. Concentrations declined from greater than 100 μg/L in 2000 to approximately 20 to 30 μg/L in 2003, but have remained approximately unchanged since 2003 (fig. 21).

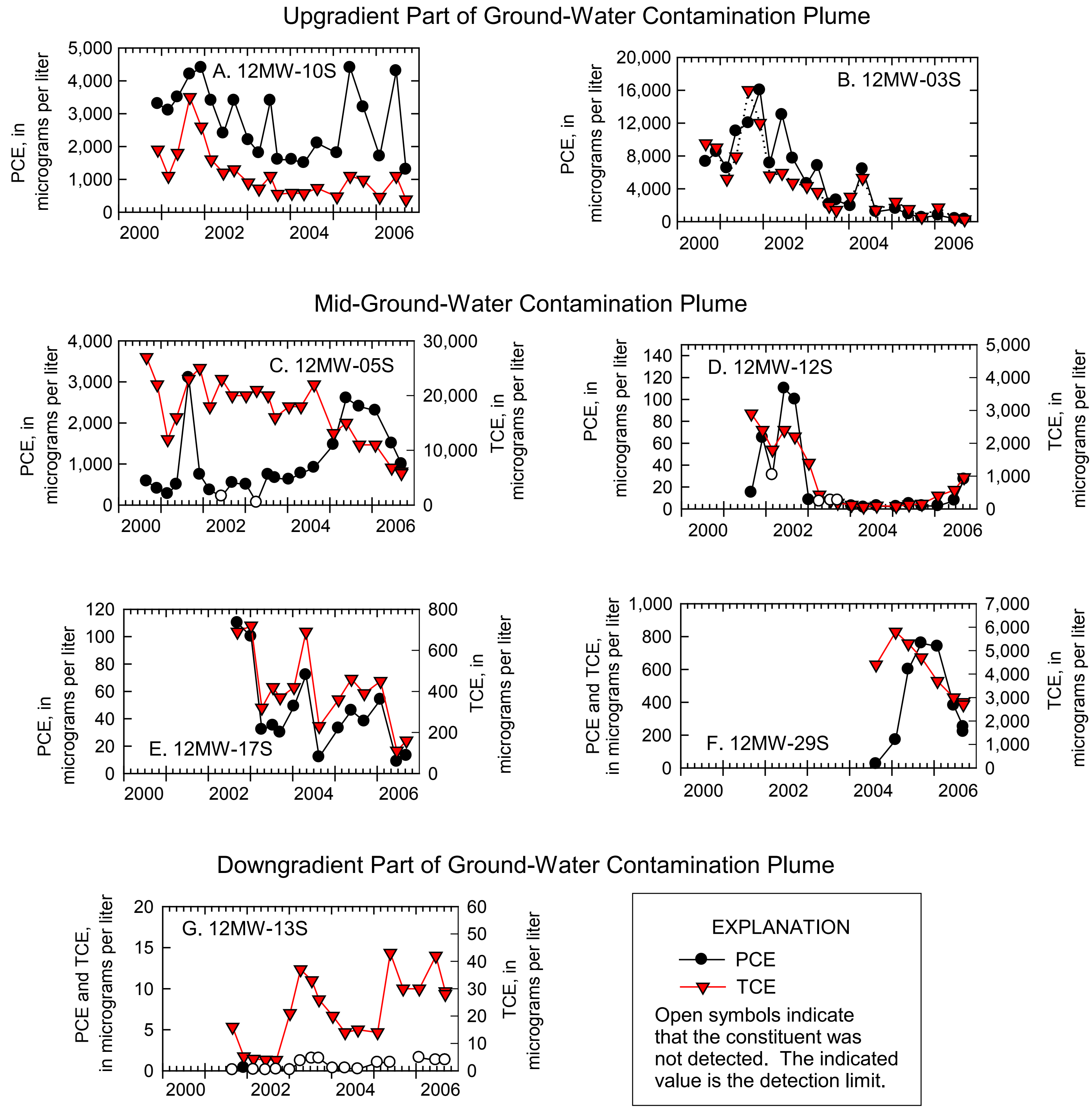

Figure 18. Concentrations of tetrachloroethene (DCE) and trichloroethene (TCE) over time in ground water at selected wells in the ground-water contamination plume, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006.

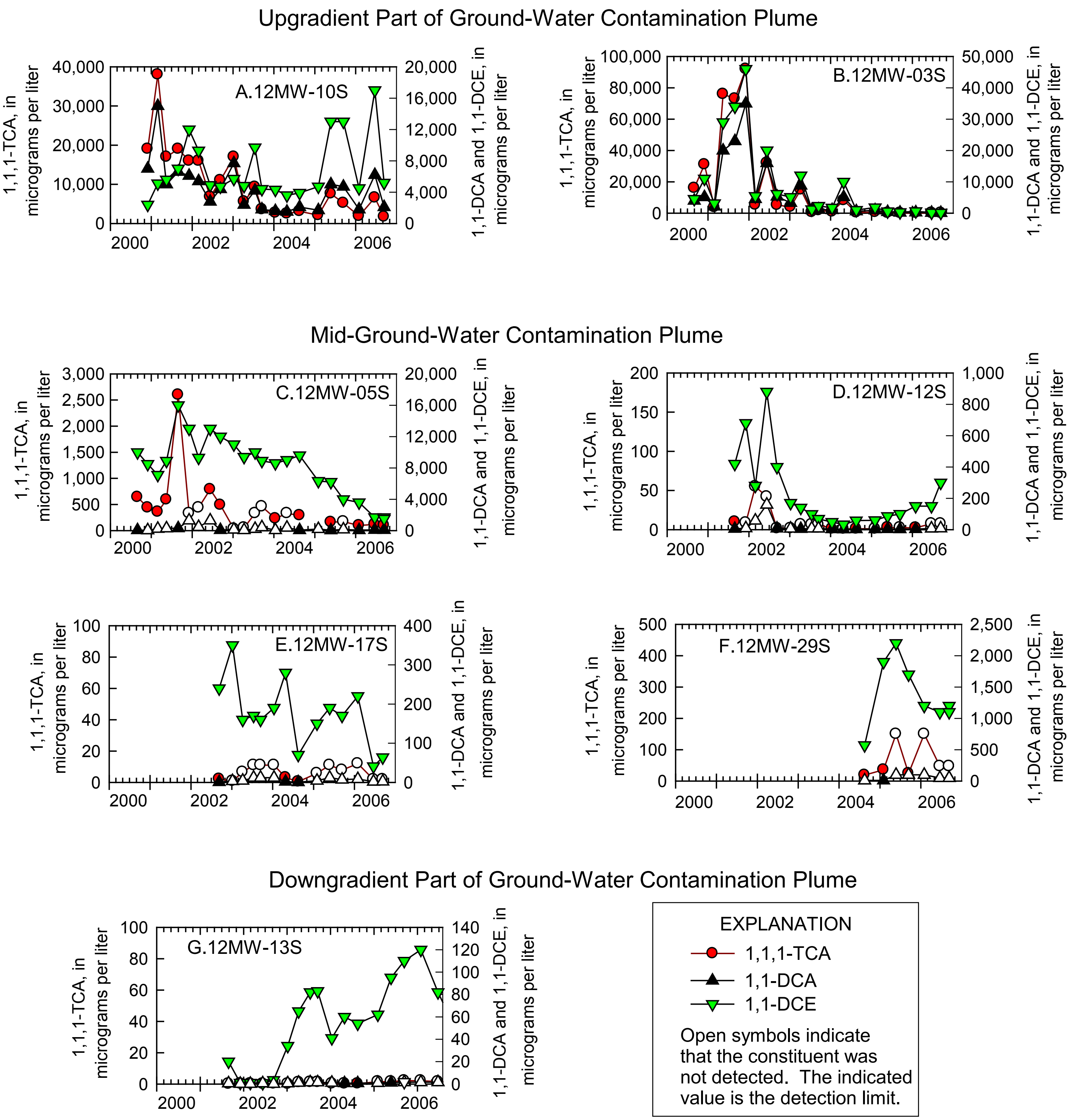

Figure 19. Concentrations of 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), and 1,1-dichloroethene (1,1-DCE) over time in ground water at selected wells in the ground-water contamination plume, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006.

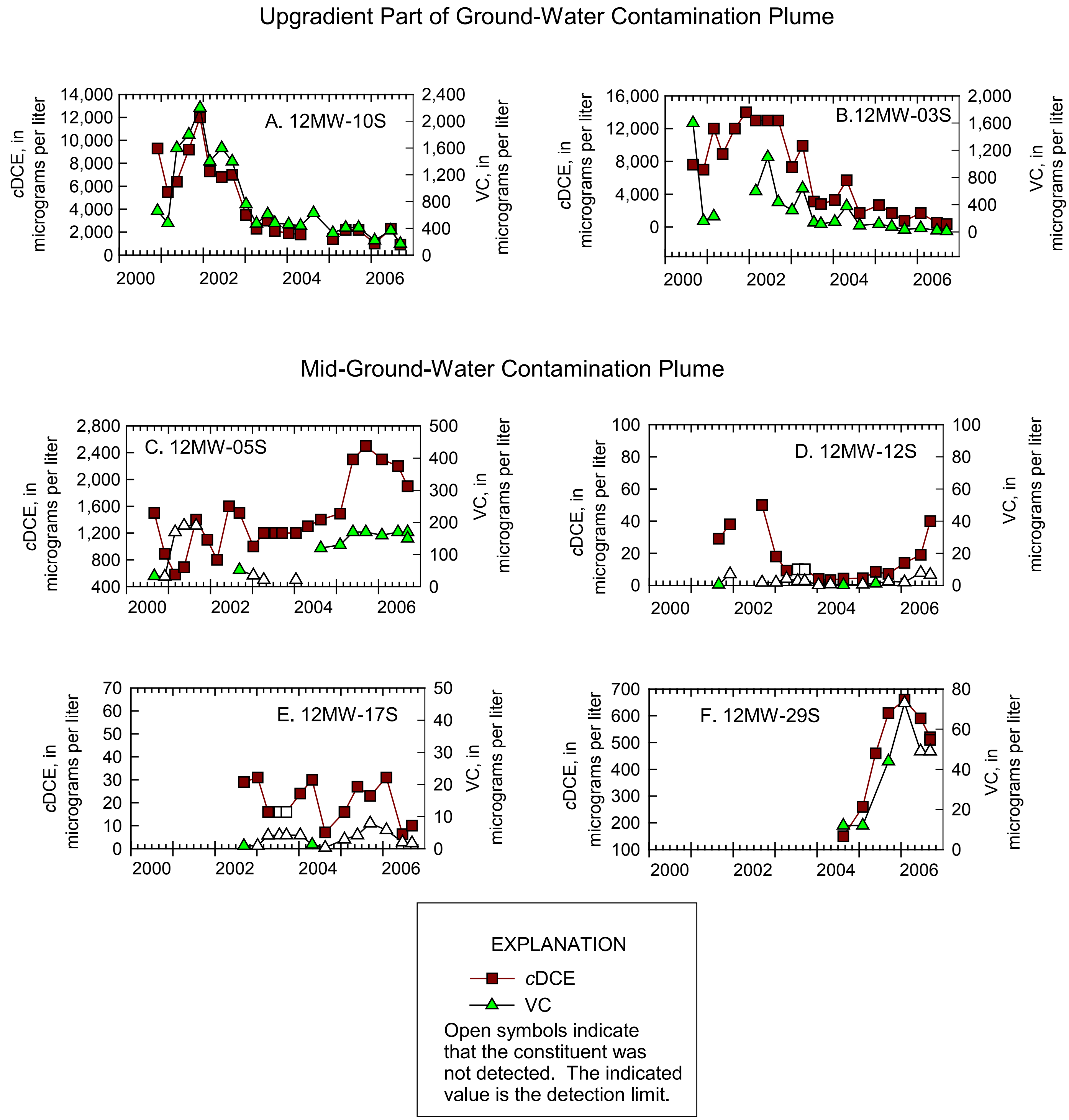

Figure 20. Concentrations of *cis*-1,2-dichloroethene (*c*DCE) and vinyl chloride (VC) over time in ground water at selected wells in the ground-water contamination plume, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006.

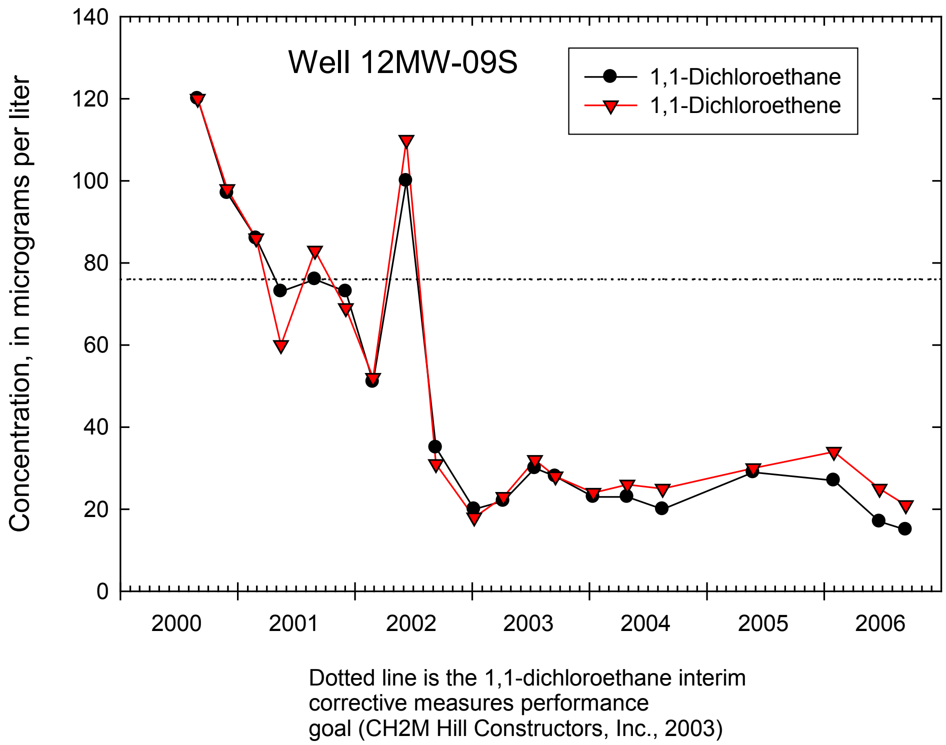

Figure 21. Concentrations of 1,1-dichloroethene and 1,1-dichloroethane over time in ground water at well 12MW-09S, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006.

Changes in Contaminant Concentration Over Distance From Source Areas

Changes in the contaminant concentrations along the path of ground-water transport reflect a complex variety of influences. Potential influences include dechlorination, sorption and desorption, transpirative removal by trees, lateral shifting of the plume, and the presence of zones of differing concentrations possibly reflecting one or more pulse releases of contamination from the source area.

Compound-specific stable isotope analysis (CSIA) of the ratio of ^{13}C and ^{12}C for an individual compound ($\delta^{13}C$) is sometimes a useful tool for examining ground water because microbial dechlorination of chlorinated ethenes preferentially utilizes the lighter isotope (^{12}C), leaving the residual in the parent compound enriched in $\delta^{13}C$ (isotopically heavier, more positive). Carbon isotope fractionation is not significant (less than 0.5 per mil (‰)) for non-degradative processes (such as sorption) but is on the order of tens of ‰ for degradative processes (Dempster and others, 1997; Harrington and others, 1999; Poulson and Drever, 1999; Slater and others, 1999, 2000). Therefore, the use of $\delta^{13}C$ in both parent and daughter compounds is a powerful complement to the conventional approach to monitoring of chlorinated-solvent concentrations and site geochemistry (Hunkeler and others, 1999; Sherwood Lollar and others, 1999, 2001; Song and others, 2002; Vieth and others, 2003).

Interpretation of the potential for contaminant degradation upgradient from the PRB is confounded by the probability that upgradient well 12MW-10S probably is several feet south of the axis of the contamination, as evidenced by a series of temporary wells installed and sampled in August 2001 (Vroblesky and others, 2003). In addition, during sampling of well 12MW-03S in February 2003, the relative percent difference in TCE and *c*DCE concentrations between the time of initial low-flow stabilization and the concentrations taken after pumping for an additional hour were less than 10 percent; however, the PCE concentrations increased. These data indicated that the major body of PCE contamination was offset from well 12MW-03S. Thus, concentrations at wells 12MW-10S and 121MW-03S may not be a reliable indicator of contaminant distribution and maximum concentrations upgradient from the PRB.

Despite the concern regarding use of concentration data in wells 12MW-10S and 12MW-03S as an indicator of aquifer concentrations near the source area, the CSIA data from those wells can provide an indication of the dechlorination potential. The trend toward more positive (heavier) $\delta^{13}C$ PCE values in the downgradient well (12MW-05S) relative to the source-area wells (fig. 22) indicates that dechlorination of PCE to TCE has taken place at the site. The trend toward more negative

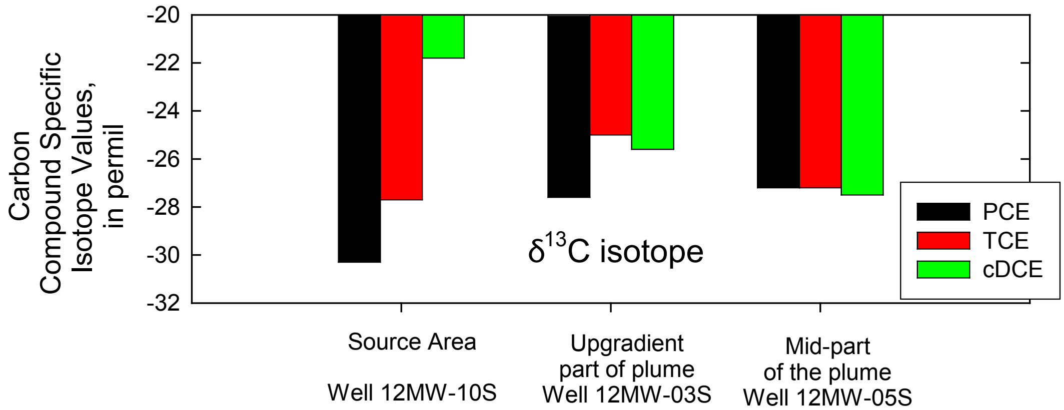

Figure 22. Comparison of carbon compound-specific isotope values for tetrachloroethene (PCE), trichloroethene (TCE), and *cis*-1,2-dichloroethene (*c*DCE) in wells in the source area, the upgradient part of the plume, and in a midpart of the plume, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, September 2005.

(lighter) *c*DCE $\delta^{13}C$ values in downgradient well 12MW-05S relative to the wells in the upgradient part of the plume is strong evidence for the dechlorination of TCE (fig. 22). The trend toward lighter *c*DCE $\delta^{13}C$ values indicates that *c*DCE is being produced from dechlorination of TCE as the lighter, more readily degraded TCE isotopes are used to produce *c*DCE. The $\delta^{13}C$ of TCE, however, does not show a clear trend of becoming heavier or lighter, possibly because TCE is being produced as a daughter product and subsequently is dechlorinated to *c*DCE.

Downgradient from well 12MW-05S, the data show that the VOC concentrations decrease sharply with distance (fig. 23). One explanation is the higher concentrations at well 12MW-05S relative to downgradient wells may represent an advancing front. This is substantiated by PCE concentrations at wells 12MW-05S and 12MW-29S, which have shown recent increases. The fact that TCE has shown a general decline in concentration at those wells (fig. 18), however, argues against an advancing pulse of highly contaminated water. It also is unlikely that the concentration decrease with distance

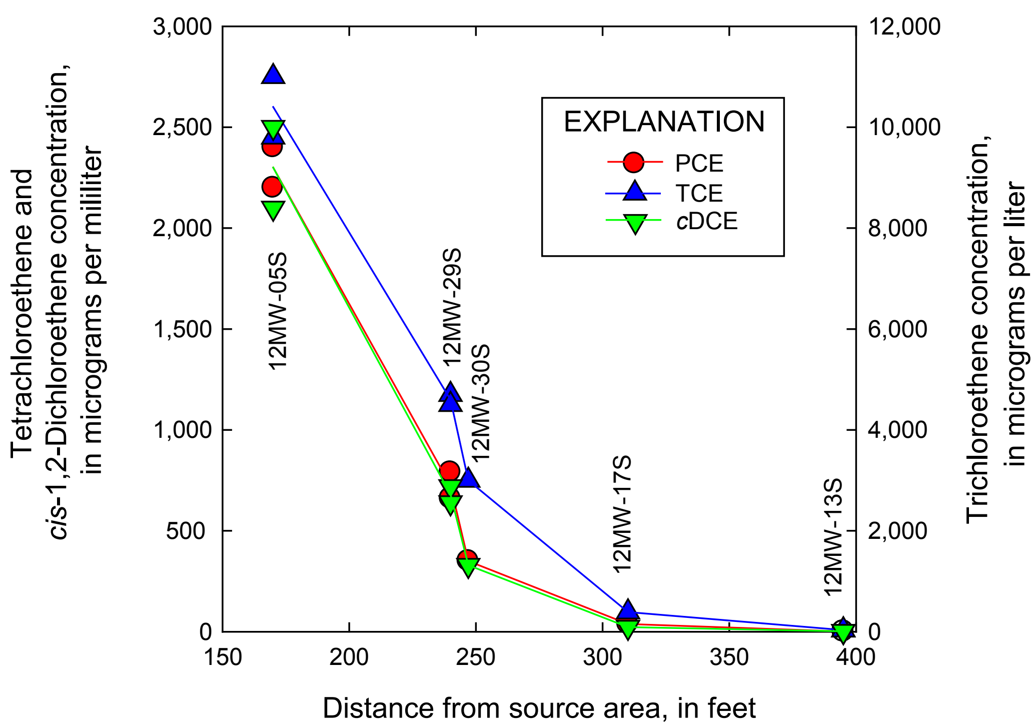

Figure 23. Concentrations of tetrachloroethene (PCE), trichloroethene (TCE), and *cis*-1,2-dichloroethene (*c*DCE) along the axis of contamination in the direction of ground-water flow (left is upgradient), Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, September 2005.

represents a lateral shifting of the plume because the decrease has been present for at least the last 6 years that the USGS has collected samples.

Alternatively, the concentration decrease may represent contaminant removal by natural attenuation along the transport pathway. Assuming that the decrease represents contaminant removal, a variety of data indicates that the removal mechanism is not simple biodegradation, as discussed in the following section. Instead, the probable dominant removal mechanisms are phytovolatilization and sorption.

Biodegradation in the Forest

The lack of daughter-compound production accompanying parent-compound removal argues against contaminant dechlorination as a primary removal mechanism (fig. 23). The PCE/TCE ratios decrease from wells 12MW-05S downgradient to wells 12MW-29S and 12MW-30S, which can imply PCE dechlorination to TCE, but the trend in the ratios varies seasonally between wells 12MW-29S and 12MW-17S (fig. 24A). The isotopic composition of PCE provides some additional insight. The February 2005 PCE δ^{13}C values show only slight enrichment between wells 12MW-05S and 12MW-29S, but on other dates, the changes are too small to be definitive (fig. 25A). Because the concentrations of dissolved hydrogen and inorganic redox solutes indicate that the predominant terminal electron accepting processes downgradient from well 12MW-05S typically are iron reducing or sulfate reducing and occasionally methanogenic, it is highly probable that PCE is dechlorinating to TCE, but the dechlorination apparently is not large enough to manifest a substantial δ^{13}C fractionation in PCE.

The increase in TCE/*c*DCE ratios downgradient from well 12MW-05S (fig. 24B) indicates either (1) TCE production from PCE is faster than *c*DCE production from TCE and(or) (2) *c*DCE is depleted more quickly than TCE. The lack of substantial change in TCE δ^{13}C values between well 12MW-05S and downgradient wells 12MW-29S and 12MW-30S may be because TCE is being dechlorinated as well as being produced by dechlorination of PCE (fig. 25B). The absence of PCE at well 12MW-13S may explain the increase in δ^{13}C of TCE at well 12MW-13S relative to the other wells in the forest, indicating TCE dechlorination (fig. 25B).

The δ^{13}C of *c*DCE becomes lighter along the path of ground-water flow from well 12MW-05S to wells 12MW-29S and 12MW-30S (fig. 25C). This suggests that production of *c*DCE from dechlorination is at a faster rate than *c*DCE

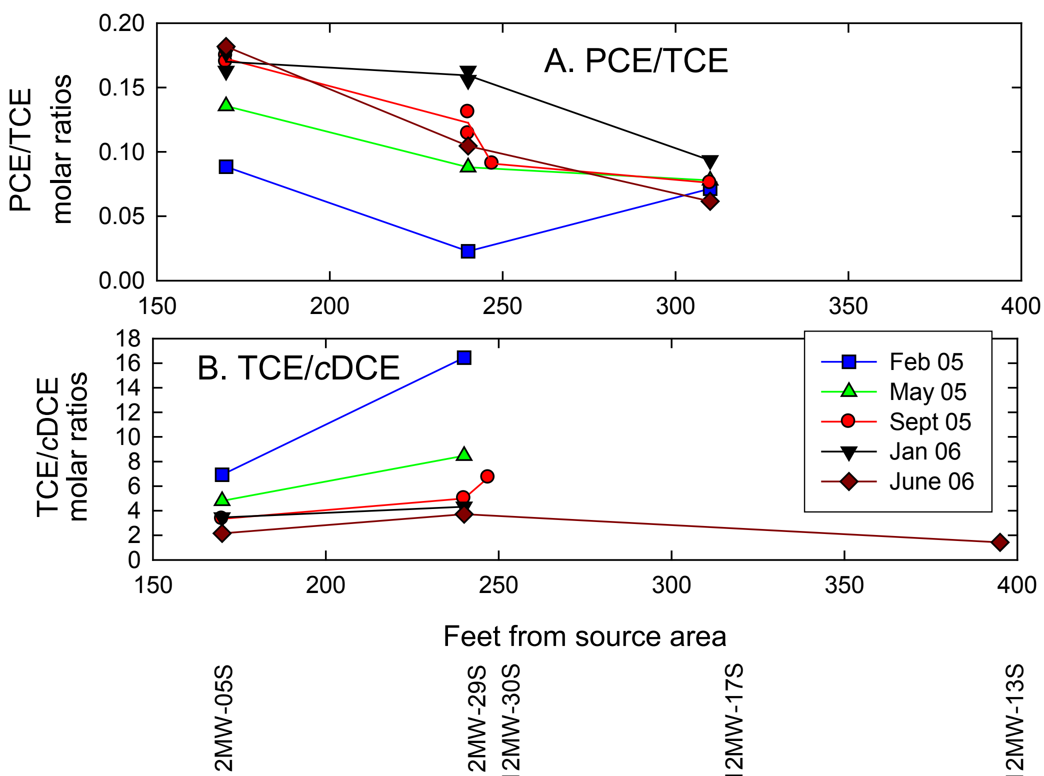

Figure 24. Molar ratios of tetrachloroethene (PCE), trichloroethene (TCE), and *cis*-1,2-dichloroethene (*c*DCE) along the axis of contamination in the direction of ground-water flow (left is upgradient), Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2004 to June 2006.

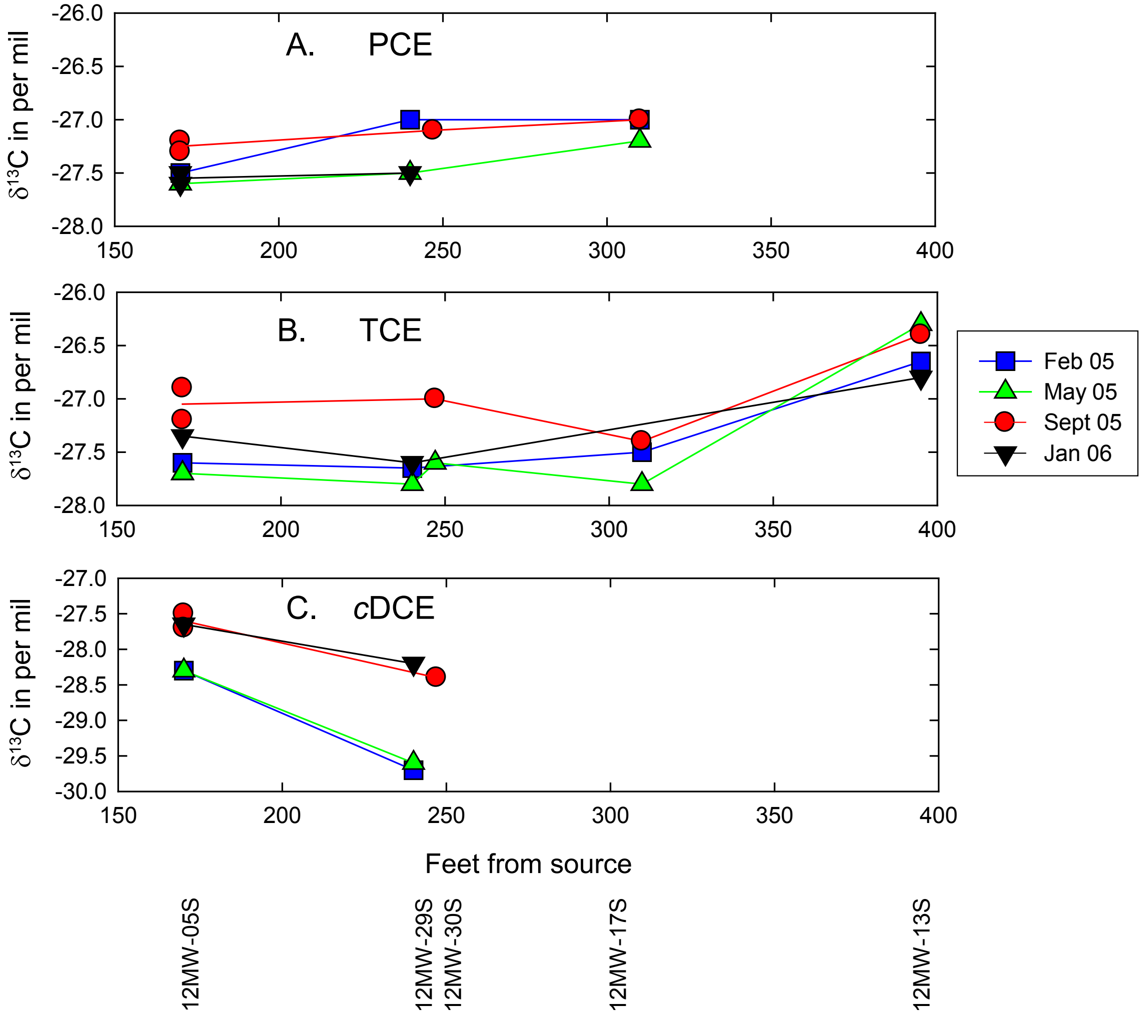

Figure 25. Carbon-13 ($\delta^{13}C$) stable isotopes of tetrachloroethene (PCE) , trichloroethene (TCE), and *cis*-1,2-dichloroethene (*c*DCE) along the axis of contamination in the direction of ground-water flow (left is upgradient), Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, February 2005 to January 2006. The standard deviation of replicates ranged from 0.0 to 0.4 per mil.

is dechlorinated. If no other factors were involved, then an accumulation of *c*DCE would be expected. Instead, *c*DCE, and all chlorinated ethenes tend to decrease in concentration along the transport pathway downgradient from well 12MW-05S (fig. 23). In fact, even between contaminations subject to differing degradation potential, loss rates were similar. Between well 12MW-05S and well 12MW-29S in May, June, and September 2005, the percent decrease in PCE and *c*DCE differed by only 0 to 6 percent.

Overlain on this concentration decrease with distance is a general trend of increasing *c*DCE concentrations with time at some wells in the forest (fig. 20). A plausible explanation may be the advancement of the plume or of pulses within the plume.

The data indicate that there is some level of dechlorination of PCE to TCE and TCE to *c*DCE in the aquifer beneath the forest. It appears, however, that the biodegradation is not sufficient to account for the substantial contaminant decrease along the transport pathway.

Phytoremediation in the Forest

The similarity of ground-water contamination loss rates beneath the forest implies a uniform loss mechanism. One probable major loss mechanism is phytoremediation. Phytoremediation is a general term that covers phytotransformation (transformation of a compound to a different state or compound by the metabolic activity of plants, algae, or fungi), phytodegradation, rhizosphere degradation, phytocontainment, and phytovolatilization. Previous investigations at this site have shown that the trees in the forest growing over the contamination at well 12MW-05S and the farther downgradient wells remove chlorinated solvents from the ground water (Vroblesky and others, 2004b). Because the soil zone consists of tight plastic clay from near land surface to the contaminated confined aquifer at a depth of about 10 ft, most of the water utilized by these trees probably is derived from the contaminated aquifer. Tree roots in the aquifer sediments below the clay have been observed in multiple borings at the site.

The mass of TCE removed by plant uptake can be calculated as follows:

The mass of TCE removed by plant uptake = $(TSCF)(C_{TCE})(T)(f)$ (Doucette and others, 2003),

where *TSCF* is the transpiration stream concentration factor, which is the concentration ratio of a chemical between the transpiration stream in the xylem and the external solution, C_{TCE} is the average ground-water concentration of TCE in milligrams per liter, T is the cumulative volume of water transpired in liters per square meter per year, and f is the fraction of the plant water needs met by contaminated ground water.

The f factor is difficult to measure at most phytoremediation sites described in the literature because ground-water use by plants tends to decrease as the availability of surface water increases (Nilsen and Orcutt, 1996). Doucette and others (2003) suggest that a range for f from 0.1 to 0.5 probably is reasonable for climates with more than 40 centimeters (16 inches) of annual rain, such as South Carolina. The f factor at SWMU12 probably is somewhat higher than at typical sites because the approximate 10-ft-thick clay present from the surface downward in many parts of the forest limits the availability of surface water to the root system. Therefore, f values ranging from 0.5 to about 0.6 were used in calculations for SWMU12.

The term C_{TCE} is based on aquifer TCE concentrations. The TCE concentration in the forested area is about 22 mg/L near well 12MW-05S and about 0.2 mg/L near well 12MW-17S (fig. 3). The value midway between these wells at 12MW-29S and 12MW-30S is about 4 mg/L, which is used as an average value for C_{TCE} across the area.

Based on the above values (and using an average TSCF of 0.12), the calculated mass of TCE removed by phytovolatilization at SWMU12 ranges from about 22.3 to about 27 milligrams per square foot per year (mg/ft^2/yr). If the TSCF value for TCE of Burken and Schnoor (1998) is used, then the calculated mass of TCE removed increases to between about 139 and 195 mg/ft^2/yr. Thus, a substantial amount of VOC is removed from the aquifer by phytovolatilzation. Further evidence of phytovolatilization is the measureable presence of TCE from ground water in the trunks of trees at the site (Vroblesky and others, 2004b). In addition, loblolly pines cored at the site showed TCE concentrations increasing inward from the outer to the inner part of the trunk, an observation found in a previous study (Ma and Burken, 2003) to indicate volatilization loss of TCE from the tree through the bark.

Sorption

An additional contaminant-removal mechanism at SWMU12 is sorption. Losses caused by sorption do not substantially change the isotopic signature. The presence of 1.3 to 2 percent organic carbon in the aquifer (Paul Bradley, U.S. Geological Survey, written commun., 2003) implies a potential for substantial sorption. In addition, analysis of clay confining-bed material overlying the contaminated aquifer (collected approximately 5 ft above the contaminated aquifer at well 12MW-30S in July 2004) showed the presence of 2,500 µg/kg of TCE, indicating substantial movement of solvents into the clay. Thus, it is probable that contaminants will desorb from the clay to the aquifer as contaminant concentrations in the aquifer decline during remediation.

Engineered Phytoremediation

Engineered phytoremediation work at SWMU12 consisted of planting trees above contaminated parts of the aquifer. On May 14, 2003, 126 loblolly pine (*Pinus taeda*) trees were planted in the contaminant source area (fig. 2). The trees were 2 to 3 ft high. In much of the planted area, the soil was either absent or thin (approximately 1 inch thick) because of clay deposited during construction of the nearby PRB. Therefore, holes approximately 2 ft deep and 0.5 ft in diameter were dug and amended with a mixture of potting soil and peat mulch. Each tree was irrigated at the time of planting, but not thereafter. Trees were planted about 3 ft apart in rows about 10 ft apart. Loblolly pines planted in the source area in May 2003 continue to maintain healthy growth despite the complete absence of artificial watering and maintenance (with the exception of occasional weed control). At the end of three growing seasons, the average height of the loblolly pines was about 4 to 6 ft.

In contrast, hybrid poplars planted along various parts of the contamination plume on March 25, 2005, failed to survive. The hybrid poplars showed signs of predation throughout the growth season, despite periodic spraying with Sevin®, as recommended by the distributor. By June 2006, nearly all of the hybrid poplars planted in the forest had died.

Although the growth rate of loblolly pine is smaller than that typically reported for hybrid poplar, the loblolly pines appear to be well adapted to this clayey sediment and are known from earlier investigations at this site to actively remove TCE by transpiration (Vroblesky and others, 2004b). Thus, loblolly pines appear to be a low-maintenance approach to phytoremediation in this clayey soil.

Summary

The USGS and NAVFAC SE investigated natural and engineered remediation of ground-water contamination at SWMU12 at the NWS Charleston, North Charleston, South Carolina. The primary VOCs of concern are PCE; 1,1,1-TCA; TCE; *c*DCE; VC; 1,1-DCE; and 1,1-DCA.

In general, the hydrogeology of SWMU12 consists of a surficial aquifer, composed of sand to clayey sand, overlain by dense clay that extends from about land surface to a depth of about 8 to 10 ft. The clay appears to be continuous over most of the site, including at least 30 ft into the eastern marsh, and functions as a confining bed for the contaminated surficial

aquifer. Probable areas of aquifer recharge are near well 12MW-01S, where the surficial clay is largely absent, and near wells 12MW-10S and 12MW-03S, where measured water levels are often the highest at the site.

Ground water moves from recharge areas near former Building 88 in an approximately eastward direction toward areas of lower ground-water levels. The lower ground-water levels beneath the forested area east of former Building 88 are present because the surficial clay substantially limits input to the aquifer from rainfall infiltration and because the forested area provides a major water-loss mechanism through evapotranspiration (an average of 44 gallons per day in a single tree). During some months in the summer, evapotranspiration and limited local recharge result in ground-water depressions in the forested area near wells 12MW-12S and 12MW-17S, seasonally providing a hydraulic sink for ground-water contamination being transported from upgradient source areas. Changes in surface-water levels following Hurricane Gaston resulted in a substantial change in the water-level configuration of the site. Corresponding changes in VOC concentrations in wells 12MW-05S and 12MW-29S and increasing VOC concentrations in well 12MW-12S during 2006 indicate that this hydraulic change may have shifted the direction of plume transport to a more northerly tract, although additional monitoring will be needed to confirm the shift. Hydraulic conductivity, hydraulic gradient, SF_6 measurements, and historical data indicate that ground-water flow rates are substantially slower in the forested area relative to upgradient areas.

The ground-water contamination, consisting of chlorinated aliphatic VOCs, extends eastward in the surficial aquifer from former Building 88. 1,1,1-TCA and PCE are compounds that probably comprised the original contamination and are found in relatively high concentrations in ground water adjacent to the eastern side of former Building 88 and the former location of the UST. TCE probably is present both as an original contaminant and as a transformation product. Many of the lower chlorinated compounds, such as *c*DCE and VC, probably are transformation products of parent compounds. At least one compound, however, 1,1-DCE, is an abiotic derivative of 1,1,1-TCA. In August 2001, when the most extensive set of ground-water samples was collected, the highest concentrations of 1,1,1-TCA, PCE, and TCE in ground water were near former Building 88, approximately 10 to 30 ft north, northwest, and northeast of well 12MW-10S. Therefore, the area near former Building 88, 10 to 30 ft north, northwest, and northeast of well 12MW-10S, constitutes the probable source area. Sediment core samples in the confining zone above the aquifer in the source area indicated that the contaminant concentrations increased with depth at least to 7 ft in this area.

Concentration changes have been observed in some wells in the vicinity of the PRB. The central part of the PRB, along the main axis of the contaminant plume, appears to be actively removing contamination. Evidence for the removal is that substantial concentration decreases have taken place on the downgradient edge of the PRB at well 12MW-22S along the major axis of the contaminant plume, despite the fact that VOC concentrations directly upgradient from the PRB (well 12MW-28S) have not substantially changed. Temporary wells installed and sampled in June 2005 along the axis of the contamination directly downgradient from the PRB show that the zone of reduced concentrations appears to extend to about 20 to 25 ft downgradient from the PRB. The remediation front appears to be advancing at a rate of about 9 to 10 ft/yr.

In contrast to the central area of the PRB, the data from the southern end of the PRB indicate that contaminants are moving around the PRB. Potential causes for the diversion include (1) inappropriately low permeability in the PRB or (2) an upgradient aquifer blockage caused by a collapsed trench during early attempts to emplace a PRB. The cause of the diversion was not definitively identified during this investigation; however, the chemical and hydraulic evidence imply that the PRB is continuing to function.

Changes in ground-water VOC concentrations were found in wells near the source area (12MW-10S and 12MW-03S). At well 12MW-10S, concentrations of *c*DCE, VC, 1,1-DCA, and 1,1,1-TCA continued an irregular decline, while PCE and 1,1-DCE showed marked fluctuations in concentration during 2005 and 2006. PCE and 1,1-DCE data may reflect irregular releases of sorbed contaminants from the source area. VOC concentrations at well 12MW-03S continued to show decreasing concentrations, with the June 2006 concentrations being the lowest yet recorded at that well for several VOCs.

Ground-water VOC concentrations also changed in some wells in the forested area in the midpart of the plume. At well 12MW-05S, despite the decrease in TCE and 1,1-DCE concentrations, PCE concentrations, which had been relatively uniform since 2002 (usually between 300 and 700 µg/L), sharply increased in 2005 to greater than 2,000 µg/L before declining again in June 2006. Increasing PCE and decreasing TCE and 1,1-DCE concentrations also were observed at well 12MW-29S, downgradient from well 12MW-05S. The source of the change is not known; however, the consistency of data implies that changes in wells 12MW-05S and 12MW-29S share a similar cause. The data may reflect a lateral shift in the axis of the contamination plume, as might be expected from the observed change in the piezometric surface.

At the downgradient end of the plume, well 12MW-13S showed irregular, continued increases in TCE and 1,1-DCE concentrations. In addition, the data collected on June 22, 2006, showed *c*DCE concentrations at 19 to 23 µg/L, marking the first sampling event that *c*DCE has been detected in the well at concentrations greater than 2 µg/L. These data may reflect continued advancement of the plume. On the northern side of the facility, concentrations of 1,1-DCE and 1,1-DCA in ground water at well 12MW-09S showed an irregular decline in concentrations during 2000 to 2003. Concentrations declined from greater than 100 µg/L in 2000 to approximately 20 to 30 µg/L in 2003, but have remained approximately unchanged since 2003.

Changes in the contaminant concentrations along the path of ground-water transport reflect a complex variety of influences. Potential influences include dechlorination, sorption and desorption, transpirative removal by trees, lateral shifting of the plume, and the presence of zones of differing concentrations possibly reflecting one or more pulse releases of contamination from the source area.

$\delta^{13}C$ data indicate in the upgradient part of the plume, PCE is being degraded to TCE, TCE is being degraded to *c*DCE, and *c*DCE degradation is accumulating faster than it is being depleted. Farther downgradient from well 12MW-05S, the VOC concentrations decrease sharply. The primary removal mechanism downgradient from well 12MW-05S is not simple biodegradation. The similarity of loss rates implies a uniform loss mechanism. One probable major loss mechanism is evapotranspiration. The trees in the forest growing over the contamination at well 12MW-05S and the farther downgradient wells remove a substantial amount of chlorinated solvents from the ground water (about 22 to 27 $mg/ft^2/yr$).

An additional removal mechanism is sorption. The presence of 1.3 to 2 percent organic carbon in the aquifer implies that there is a potential for substantial sorption. In addition, analysis of clay confining bed overlying the contaminated aquifer, collected approximately 5 ft above the contaminated aquifer at well 12MW-30S in July 2004, showed the presence of 2,500 μg/kg of TCE, indicating substantial movement of solvents into the clay.

Engineered phytoremediation work at SWMU12 involved planting both loblolly pines and hybrid poplar. The loblolly pines planted in the source area in May 2003 continue to maintain healthy growth despite the complete absence of artificial watering and maintenance (with the exception of occasional weed control). In contrast, nearly all of the hybrid poplars planted in the forest in 2005 died. Thus, loblolly pines appear to be a hardy low-maintenance alternative to hybrid poplars in this clayey sediment.

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Appendix 1. Well-construction data, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina.

[in., inches; ft, feet; rel., relative to; NAD 83, North American Datum of 1983; NAVD 88, North American Vertical Datum of 1988; bgs, below ground surface; btoc, below top of casing; ---, data not available; Horizontal coordinates for all wells (except those with *) were determined by geodimeter. Vertical datum was determined by differential leveling on 8/3/2004 and tied into a benchmark on 9/15/2004. Arbitrary horizontal coordinates output by geodimeter were transformed to Sout Carolina State Plane Coordinate System by using wells 12MW-04D, 12MW-09S, 12MW-08S, and 12MW-07S as control points. State Plane coordinates for these four wells and for wells marked by * were taken from Appendix 1 of Vroblesky and others, 2004a].

Well name	Installation date	State Plane Northing coordinate (NAD 83, feet)	State Plane Easting coordinate (NAD 83, feet)	Well diameter (in.)	Top of riser elevaton (ft rel. NAVD 88)	Ground elevation (ft rel. NAVD 88)	Stand-pipe height (ft)	Screen length (ft)	Depth of screen top (ft bgs)	Depth of screen bottom (ft bgs)	Depth of screen top (ft btoc)	Depth of screen bottom (ft btoc)	Elevation of screen top (ft rel. NAVD 88)	Elevation of screen bottom (ft rel. NAVD 88)
12MW-01D	2/25/1998	405035.719	2324888.000	2	10.74	8.26	2.48	10.00	29.00	39.00	31.48	41.48	-20.74	-30.74
12MW-01S	2/25/1998	405033.531	2324882.500	2	10.73	8.46	2.27	10.00	4.00	14.00	6.27	16.27	4.46	-5.54
12MW-02D	2/26/1998	405183.281	2325292.250	2	8.93	7.02	1.91	10.00	21.00	31.00	22.91	32.91	-13.98	-23.98
12MW-02S	2/26/1998	405178.156	2325293.000	2	9.01	7.02	1.99	10.00	4.00	14.00	5.99	15.99	3.02	-6.98
12MW-03D	2/25/1998	405113.344	2325320.750	2	9.07	6.67	2.40	10.00	20.00	30.00	22.40	32.40	-13.33	-23.33
12MW-03S	2/25/1998	405109.594	2325317.000	2	9.05	6.72	2.33	10.00	4.00	14.00	6.33	16.33	2.72	-7.28
12MW-04D	2/26/1998	405091.906	2325183.250	2	7.41	7.71	-0.30	10.00	22.00	32.00	21.70	31.70	-14.29	-24.29
12MW-04S*	2/27/1998	405097.125	2325181.250	2	7.44	7.75	-0.31	10.00	4.00	14.00	3.69	13.69	3.75	-6.25
12MW-05D	8/7/1999	405119.781	2325434.250	2	8.00	5.89	2.11	10.00	38.50	48.50	40.61	50.61	-32.61	-42.61
12MW-05I	8/27/1999	405122.906	2325429.750	2	8.10	5.81	2.29	10.00	19.00	29.00	21.29	31.29	-13.19	-23.19
12MW-05S	8/6/1999	405116.594	2325438.000	2	7.95	5.92	2.03	10.00	4.00	14.00	6.03	16.03	1.92	-8.08
12MW-06D	8/4/1999	405143.969	2325670.000	2	4.92	3.05	1.87	10.00	32.00	42.00	33.87	43.87	-28.95	-38.95
12MW-06S	8/4/1999	405147.406	2325674.000	2	5.38	3.17	2.21	10.00	4.00	14.00	6.21	16.21	-0.83	-10.83
12MW-07D	8/6/1999	404949.625	2325517.750	2	5.37	3.44	1.93	10.00	35.00	45.00	36.93	46.93	-31.56	-41.56
12MW-07S	8/5/1999	404946.938	2325523.250	2	5.43	3.45	1.98	10.00	4.00	14.00	5.98	15.98	-0.55	-10.55
12MW-08D	8/3/1999	405471.406	2325630.500	2	7.41	5.28	2.13	10.00	29.00	39.00	31.13	41.13	-23.72	-33.72
12MW-08S	8/3/1999	405475.406	2325633.250	2	7.16	5.25	1.91	10.00	4.00	14.00	5.91	15.91	1.25	-8.75
12MW-09D	8/5/1999	405320.875	2325275.750	2	10.29	8.23	2.06	10.00	26.00	36.00	28.06	38.06	-17.77	-27.77
12MW-09S	8/5/1999	405322.406	2325270.000	2	10.52	8.37	2.15	10.00	4.00	14.00	6.15	16.15	4.37	-5.63
12MW-10S	6/22/2000	405094.469	2325274.000	2	9.58	7.24	2.34	11.00	4.50	15.50	6.84	17.84	2.74	-8.26
12MW-11D	6/23/2000	405146.969	2325576.500	2	7.99	5.10	2.89	11.00	22.00	33.00	24.89	35.89	-16.90	-27.90
12MW-11S	6/24/2000	405150.438	2325573.250	2	7.83	5.14	2.69	10.00	4.00	14.00	6.69	16.69	1.14	-8.86
12MW-12D	8/22/2001	405133.906	2325574.750	2	8.27	5.16	3.11	10.00	20.00	30.00	23.11	33.11	-14.84	-24.84
12MW-12S	8/23/2001	405133.500	2325571.000	2	8.47	5.16	3.31	5.00	8.00	13	11.31	16.31	-2.84	-7.84
12MW-13S	8/23/2001	405124.125	2325665.000	2	6.35	2.97	3.38	5.00	8.00	13.00	11.38	16.38	-5.03	-10.03
12MW-14S*	8/20/2001	405022.030	2325936.000	0.5	7.36	4.00	3.36	10.00	5.00	15.00	8.36	18.36	-1.00	-11.00
12MW-15S*	8/20/2001	404999.770	2325854.880	0.5	7.62	4.40	3.22	10.00	5.00	15.00	8.22	18.22	-0.60	-10.60
12MW-16S*	8/23/2001	404968.200	2325930.330	0.5	8.23	4.69	3.39	10.00	5.00	15.00	8.54	18.54	-0.31	-10.31
12MW-17S	4/18/2002	405117.938	2325576.500	2	7.41	4.97	2.38	2.50	9	11.5	11.44	13.94	-4.03	-6.53
12MW-18S	1/23/2003	405192.000	2325350.250	2	10.59	8.33	2.26	5.00	10	15	12.26	17.26	-1.67	-6.67
12MW-19D	1/16/2003	405176.531	2325355.500	1	10.86	8.49	2.37	10.00	25	35	27.37	37.37	-16.51	-26.51
12MW-19S	1/16/2003	405172.156	2325357.000	1	10.81	8.54	2.27	5.00	10	15	12.27	17.27	-1.46	-6.46
12MW-20D	1/24/2003	405178.656	2325362.500	2	10.54	8.30	2.24	10.00	23	33	25.24	35.24	-14.70	-24.70
12MW-20S	1/23/2003	405175.531	2325364.750	2	10.50	8.24	2.26	5.00	10	15	12.26	17.26	-1.76	-6.76
12MW-21D	1/16/2003	405110.750	2325375.750	1	9.90	7.85	2.05	10.00	24	34	26.05	36.05	-16.15	-26.15
12MW-21S	1/16/2003	405115.813	2325374.500	1	9.74	7.63	2.11	5.00	10	15	12.11	17.11	-2.37	-7.37
12MW-22D	1/27/2003	405110.844	2325381.000	2	10.13	7.88	2.25	10.00	24	34	26.25	36.25	-16.12	-26.12
12MW-22S	1/28/2003	405119.688	2325378.500	2	9.88	7.58	2.30	5.00	10	15	12.30	17.30	-2.42	-7.42
12MW-23D	1/22/2003	405078.469	2325379.250	2	9.62	7.37	2.25	10.00	26	36	28.25	38.25	-18.63	-28.63
12MW-23S	1/21/2003	405082.875	2325378.500	2	9.67	7.43	2.24	5.00	13	18	15.24	20.24	-5.57	-10.57
12MW-24D	1/15/2003	405079.969	2325386.250	1	9.73	7.45	2.28	10.00	25	35	27.28	37.28	-17.55	-27.55
12MW-24S	1/15/2003	405084.031	2325385.750	1	9.65	7.38	2.27	5.00	13	18	15.27	20.27	-5.62	-10.62
12MW-25D	1/21/2003	405081.594	2325393.750	2	9.17	6.96	2.21	10.00	26	36	28.21	38.21	-19.04	-29.04
12MW-25S	1/21/2003	405085.531	2325393.250	2	9.17	6.96	2.21	5.00	13	18	15.21	20.21	-6.04	-11.04
12MW-26S	1/21/2003	405059.594	2325392.500	2	9.11	6.90	2.21	5.00	13	18	15.21	20.21	-6.10	-11.10
12MW-27D	1/22/2003	405174.281	2325346.750	2	10.94	8.70	2.24	10.00	23	33	25.24	35.24	-14.30	-24.30
12MW-27S	1/23/2003	405169.531	2325348.250	2	11.01	8.80	2.21	5.00	10	15	12.21	17.21	-1.20	-6.20
12MW-28D	1/27/2003	405106.906	2325368.250	2	9.64	7.39	2.25	10.00	23	33	25.25	35.25	-15.61	-25.61
12MW-28S	1/28/2003	405111.875	2325366.250	2	9.60	7.32	2.28	5.00	10	15	12.28	17.28	-2.68	-7.68
12MW-29S	7/19/2004	405114.750	2325506.250	2	7.38	5.28	2.10	2.25	9.75	12	11.85	14.10	-4.47	-6.72
12MW-30S	7/22/2004	405115.438	2325515.500	2	8.64	5.22	3.42	2.25	9.75	12	13.17	15.42	-4.53	-6.78
12PZ-01*	8/15/2002	405261.850	2325470.420	2	6.32	6.16	0.16	10.00	4.5	14.5	4.66	14.66	1.66	-8.34
12PZ-03D	3/10/2004	405130.594	2325712.750	1	4.72	---	---	2.5	---	---	11.8	14.3	-7.08	-9.58
12PZ-03S	3/8/2004	405130.438	2325709.750	1	5.45	---	---	2.5	---	---	7.5	10	-2.05	-4.55
12PZ-04	2/20/2004	405184.625	2325737.500	1	5.55	---	---	2.5	---	---	15	17.5	-9.45	-11.95
12PZ-05	2/19/2004	405118.969	2325753.500	1	4.34	---	---	2.5	---	---	12.23	14.73	-7.89	-10.39
12PZ-06	2/20/2004	405060.969	2325734.500	1	4.87	---	---	2.5	---	---	14.9	17.4	-10.03	-12.53

Appendix 2. Monthly water-level data from wells at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 1998 to June 2006.

[---. Not measured, all measurements are in feet relative to the National Geodetic Vertical Datum of 1988]

Date	12MW-01D	12MW-01S	12MW-02D	12MW-02S	12MW-03D	12MW-03S	12MW-04D	12MW-04S	12MW-05D	12MW-05I	12MW-05S
4/18/1998	4.33	4.33	4.26	4.26	4.25	4.25	4.39	4.33	---	---	---
5/18/1998	3.75	3.73	3.60	3.61	3.60	3.59	3.75	3.65	---	---	---
6/25/1998	2.32	2.31	2.16	2.16	2.15	2.14	2.20	2.21	---	---	---
8/11/1999	2.41	2.38	2.29	2.29	2.29	2.28	2.36	2.38	2.52	---	2.22
10/28/1999	4.19	4.19	4.16	4.11	4.12	4.13	4.22	4.20	3.95	---	4.06
8/3/2000	3.99	4.02	3.98	---	4.01	---	4.00	4.04	3.75	---	3.92
9/7/2000	---	---	---	---	---	---	---	---	---	---	5.31
10/12/2000	3.23	3.21	3.07	3.06	3.07	3.05	3.12	3.13	3.20	3.03	2.98
11/13/2000	2.28	2.27	2.08	2.07	2.07	2.05	2.14	2.14	2.30	2.03	1.98
1/12/2001	3.30	3.30	3.14	3.14	3.12	3.15	3.17	3.24	3.00	3.08	3.03
2/8/2001	3.15	3.15	2.99	3.00	2.99	2.99	3.07	3.10	2.86	2.94	2.89
3/14/2001	4.17	4.19	4.05	4.05	4.04	4.04	4.12	4.21	3.60	3.96	3.95
4/13/2001	3.61	3.59	3.43	3.43	3.43	3.43	3.60	3.51	3.45	3.39	3.35
5/14/2001	2.28	2.26	2.03	2.01	2.04	2.01	2.13	2.16	2.29	2.00	1.95
6/19/2001	2.50	2.48	2.43	2.44	2.43	2.44	2.41	2.43	2.19	2.55	2.25
7/19/2001	2.80	2.80	2.72	2.70	2.71	2.78	2.76	2.77	2.87	2.70	2.63
8/30/2001	2.25	2.24	2.15	2.14	2.14	2.13	2.21	2.22	2.43	2.11	2.06
9/27/2001	2.29	2.30	2.23	2.23	2.21	2.22	2.25	2.27	2.46	2.19	2.16
10/30/2001	1.29	1.27	1.21	1.20	1.20	1.20	1.28	1.25	1.69	1.20	1.17
11/27/2001	1.10	1.09	1.04	1.03	1.03	1.02	1.05	1.07	1.46	1.02	1.00
12/26/2001	1.38	1.36	1.32	1.31	1.30	1.30	1.33	1.34	1.67	1.30	1.27
1/22/2002	1.93	1.90	1.81	1.80	1.80	1.80	1.80	1.89	1.97	1.79	1.73
2/26/2002	2.26	2.25	2.08	2.07	2.09	2.07	2.22	2.21	2.19	2.04	1.99
5/3/2002	1.78	1.77	1.61	1.63	1.61	1.61	1.69	1.67	1.94	1.58	1.51
6/6/2002	0.96	0.95	0.83	0.83	0.83	0.83	0.85	0.86	1.32	0.81	0.76
7/12/2002	2.15	2.15	2.01	2.03	2.03	2.00	2.08	2.08	1.85	2.28	1.88
8/8/2002	1.53	1.51	1.41	1.40	1.41	1.42	1.45	1.29	1.81	1.39	1.32
8/26/2002	1.41	1.40	1.27	1.26	1.27	1.28	1.33	1.34	1.54	1.24	1.21
8/28/2002	1.86	1.88	1.78	1.69	1.75	1.77	1.84	1.89	1.90	1.71	1.68
9/9/2002	2.94	2.93	2.99	2.99	2.97	2.99	3.03	3.06	3.02	2.95	2.87
10/3/2002	4.23	4.24	4.22	4.23	4.28	4.20	4.27	4.31	3.95	4.15	4.16
11/21/2002	5.19	5.17	5.29	5.36	5.32	5.43	---	---	4.71	5.14	5.06
12/13/2002	4.72	4.72	4.68	4.69	4.68	4.70	4.77	4.74	4.25	4.56	4.50
2/4/2003	4.07	4.03	3.94	3.95	3.92	3.94	3.97	3.93	3.79	3.84	3.78
2/13/2003	4.00	3.98	3.92	3.94	3.95	3.96	3.92	3.95	3.72	3.85	3.79
2/20/2003	4.11	4.10	4.04	4.05	4.05	4.06	4.08	4.11	3.79	3.96	3.89
2/26/2003	4.10	3.99	4.10	4.10	4.19	4.08	4.12	4.15	3.83	4.01	3.94
3/25/2003	5.08	5.08	5.04	5.03	5.02	5.04	5.07	5.11	4.58	4.90	4.83
4/23/2003	3.96	3.94	3.86	3.84	3.87	3.87	3.87	3.89	3.84	3.77	3.67
5/27/2003	4.61	4.61	4.61	4.61	4.60	4.64	4.61	4.68	4.14	4.49	4.44
6/30/2003	3.56	3.55	3.45	3.45	3.45	3.47	3.54	3.50	3.49	3.38	3.28
8/4/2003	4.66	4.71	4.61	4.64	4.56	4.60	4.52	4.62	4.17	4.43	4.39
8/29/2003	3.06	3.05	2.84	2.89	2.92	2.91	2.95	2.95	3.06	2.82	2.74
9/30/2003	2.76	2.73	2.63	2.63	2.65	2.65	2.70	2.69	2.90	2.58	2.50
11/3/2003	2.86	2.86	2.76	2.76	2.78	2.80	2.82	2.85	2.84	2.68	2.61
12/8/2003	2.77	2.77	2.63	2.65	2.64	2.64	2.62	2.76	2.69	2.54	2.49
1/15/2004	2.79	2.78	2.66	2.66	2.67	2.69	2.73	2.77	2.70	2.58	2.50
2/13/2004	3.80	3.83	3.65	3.65	3.65	3.68	3.48	3.96	3.22	3.47	3.41
3/15/2004	3.37	3.37	3.29	3.28	3.30	3.31	3.34	3.57	3.23	3.20	3.13
4/21/2004	2.87	2.86	2.77	2.77	2.78	2.80	2.84	3.04	2.82	2.70	2.63
5/20/2004	2.47	2.45	2.38	2.39	2.38	2.39	2.43	2.45	2.58	2.32	2.25
6/21/2004	2.06	2.05	1.98	1.99	2.01	2.03	2.02	2.06	2.16	1.94	1.87
7/26/2004	2.69	2.66	2.67	---	2.69	2.73	2.70	2.75	2.57	2.75	2.53
9/15/2004	4.22	4.21	4.10	4.13	4.13	4.16	4.27	4.24	3.83	4.04	4.00
10/21/2004	3.16	3.13	2.91	---	2.94	2.96	3.01	3.04	2.94	2.85	2.77
11/29/2004	2.41	2.37	2.09	---	2.12	2.11	2.21	2.19	2.15	1.98	1.93
12/27/2004	2.64	2.63	2.28	---	2.28	2.32	2.33	2.40	2.14	2.10	2.04
1/25/2005	2.77	2.76	2.53	2.52	2.55	2.57	2.67	2.66	2.44	2.43	2.37
2/17/2005	2.98	2.97	2.76	2.74	2.79	2.8	2.87	2.91	2.63	2.67	2.6
3/24/2005	4.06	4.07	3.84	3.82	3.84	3.88	3.92	4.18	3.29	3.71	3.67
4/25/2005	3.00	2.98	2.75	2.73	2.77	2.78	2.83	2.99	2.79	2.70	2.58
5/31/2005	2.29	2.28	2.00	2.00	2.05	2.07	2.08	2.14	2.02	1.89	1.79
6/17/2005	2.19	2.16	1.94	1.92	1.98	2.00	2.07	2.06	2.14	1.90	1.79
7/21/2005	3.09	3.08	2.86	2.85	2.89	2.91	2.96	3.20	2.73	2.96	2.70
8/16/2005	4.24	4.23	4.11	4.14	4.19	4.11	4.21	4.41	3.81	4.06	4.01
9/29/2005	2.42	2.38	2.12	2.11	2.16	2.15	2.21	2.40	2.33	2.05	2.00
10/17/2005	3.38	3.35	3.16	3.14	3.19	3.19	3.31	3.38	3.20	3.10	3.01
12/1/2005	3.17	3.15	2.94	2.93	2.96	2.99	3.04	3.34	2.84	2.86	2.79
12/19/2005	4.35	4.37	4.13	4.14	4.14	4.18	4.18	4.48	3.50	4.02	3.95
1/26/2006	3.83	3.82	3.66	3.65	3.70	3.73	3.74	4.04	3.40	3.61	3.55
3/2/2006	4.29	4.29	4.20	4.20	4.22	4.25	4.26	4.39	3.79	4.12	4.05
3/30/2006	2.97	2.94	2.68	2.67	2.69	2.71	2.75	3.08	2.71	2.62	2.51
5/1/2006	2.14	2.11	1.87	1.85	1.90	1.90	1.97	1.99	2.06	1.81	1.70
5/31/2006	1.66	1.64	1.38	1.39	1.45	1.45	1.51	1.53	1.68	1.35	1.27
6/29/2006	2.43	2.41	2.16	2.18	2.19	2.26	2.27	2.27	2.18	2.11	2.02

Appendix 2. Monthly water-level data from wells at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 1998 to June 2006 (Continued).

[---. Not measured, all measurements are in feet relative to the National Geodetic Vertical Datum of 1988]

Date	12MW-06D	12MW-06S	12MW-07D	12MW-07S	12MW-08D	12MW-08S	12MW-09D	12MW-09S	12MW-10S	12MW-11D	12MW-11S
4/18/1998	---	---	---	---	---	---	---	---	---	---	---
5/18/1998	---	---	---	---	---	---	---	---	---	---	---
6/25/1998	---	---	---	---	---	---	---	---	---	---	---
8/11/1999	2.41	1.63	2.66	2.13	2.43	2.58	2.30	2.26	---	---	---
10/28/1999	3.69	3.56	3.84	4.07	3.70	3.74	4.04	4.09	---	---	---
8/3/2000	3.40	3.42	3.56	3.88	---	---	3.86	3.92	---	---	---
9/7/2000	3.92	3.99	---	5.09	---	---	---	5.44	---	---	---
10/12/2000	3.04	2.56	3.23	2.94	3.06	2.84	3.07	3.02	3.13	3.05	2.74
11/13/2000	2.22	1.54	2.37	1.90	2.28	2.11	2.12	2.02	2.10	2.10	1.76
1/12/2001	2.76	2.78	2.89	2.93	2.83	3.59	3.03	3.12	3.40	2.98	2.78
2/8/2001	2.71	2.64	2.86	2.83	2.77	3.40	2.91	2.94	3.16	---	---
3/14/2001	3.24	3.33	3.37	3.81	3.31	3.96	3.79	4.07	4.08	3.74	3.70
4/13/2001	3.18	2.92	3.36	3.29	3.28	3.37	3.39	3.47	3.52	3.36	3.09
5/14/2001	2.14	1.26	2.36	1.86	2.17	2.15	2.04	1.98	2.12	2.12	1.69
6/19/2001	2.30	1.70	2.54	2.18	2.30	2.41	2.30	2.29	2.52	2.30	1.99
7/19/2001	2.73	2.38	2.95	2.63	2.72	3.09	2.70	2.64	2.79	2.74	2.41
8/30/2001	2.39	1.57	2.61	2.03	2.42	2.43	2.19	2.10	2.22	2.21	1.83
9/27/2001	2.42	2.23	2.71	2.20	2.36	2.81	2.33	2.21	2.30	2.35	1.99
10/30/2001	1.76	1.30	1.95	1.17	1.75	1.57	1.36	1.20	1.27	1.41	1.02
11/27/2001	1.57	1.21	1.72	1.01	1.56	1.60	1.18	1.05	1.08	1.21	0.85
12/26/2001	1.69	1.48	1.87	1.29	1.68	1.48	1.41	1.33	1.36	1.44	1.11
1/22/2002	1.88	1.93	2.07	1.71	1.88	2.21	1.81	1.78	1.91	1.82	1.53
2/26/2002	2.08	2.08	2.20	1.95	2.06	2.51	2.04	2.05	2.17	2.04	1.78
5/3/2002	1.92	1.36	2.13	1.51	1.91	1.82	1.65	1.54	1.68	1.68	1.27
6/6/2002	1.41	0.61	1.63	0.74	1.38	1.00	0.98	0.81	0.92	1.02	0.58
7/12/2002	2.15	1.83	2.35	1.85	2.16	2.96	2.00	1.97	2.13	2.01	1.70
8/8/2002	1.85	1.12	2.07	1.33	1.84	2.08	1.50	1.34	1.49	1.55	1.14
8/26/2002	1.68	1.53	1.85	1.19	1.62	2.40	1.34	1.29	1.38	1.37	1.07
8/28/2002	1.92	2.05	2.09	1.60	1.87	2.99	1.79	1.82	1.85	1.81	1.55
9/9/2002	2.87	2.76	3.06	2.88	2.90	---	2.95	2.95	3.04	2.93	2.73
10/3/2002	3.54	3.59	3.78	4.10	3.66	3.88	4.11	4.21	4.27	4.06	4.00
11/21/2002	4.11	4.08	4.31	5.02	4.26	4.16	4.88	5.14	5.33	4.84	4.83
12/13/2002	3.81	3.72	3.97	4.45	3.94	4.07	4.42	4.64	4.76	4.36	4.32
2/4/2003	3.44	3.27	3.57	3.75	3.54	3.85	3.83	3.93	4.01	3.77	3.66
2/13/2003	3.36	3.27	3.51	3.77	3.46	3.75	3.80	3.89	4.02	3.74	3.68
2/20/2003	3.42	3.34	3.55	3.86	3.51	3.71	3.88	4.00	4.17	3.83	3.79
2/26/2003	3.48	3.39	3.57	3.94	3.58	3.77	3.93	4.32	4.17	3.88	3.81
3/25/2003	4.07	3.91	4.23	4.80	4.15	4.07	4.74	4.99	5.10	4.70	4.64
4/23/2003	3.52	3.17	3.71	3.67	3.61	3.39	3.75	3.80	3.89	3.73	3.50
5/27/2003	3.69	3.67	3.86	4.38	3.76	4.09	4.32	4.59	3.66	4.77	4.29
6/30/2003	3.26	2.81	3.44	3.26	3.34	3.37	3.38	3.39	3.51	3.37	3.10
8/4/2003	3.80	3.80	3.98	4.30	3.92	4.25	4.34	4.62	4.67	4.27	4.28
8/29/2003	2.91	2.22	3.10	2.76	2.97	2.85	2.89	2.85	2.95	2.87	2.57
9/30/2003	2.86	2.45	3.07	2.54	2.83	2.60	2.65	2.56	2.68	2.68	2.35
11/3/2003	2.71	2.53	2.92	2.61	2.69	3.27	2.71	2.72	2.84	2.70	2.45
12/8/2003	2.55	2.41	2.69	2.46	2.53	3.29	2.60	2.61	2.72	2.57	2.32
1/15/2004	2.56	2.39	2.71	2.50	2.56	3.33	2.62	2.63	2.73	2.60	2.33
2/13/2004	2.94	3.03	3.05	3.36	2.98	4.01	3.37	3.58	3.81	3.31	3.23
3/15/2004	2.99	2.76	3.14	3.13	3.09	3.76	3.21	3.25	3.36	3.17	2.98
4/21/2004	2.62	2.33	2.78	2.63	2.68	3.48	2.68	2.74	2.87	2.70	2.44
5/20/2004	2.46	1.76	2.60	2.24	2.54	3.18	2.41	2.37	2.42	2.39	2.03
6/21/2004	2.04	1.53	2.22	1.87	2.07	2.62	2.02	1.99	2.06	2.00	1.73
7/26/2004	2.59	2.47	2.71	2.53	2.67	3.81	2.65	2.67	2.78	2.62	2.41
9/15/2004	3.51	3.56	3.73	4.01	3.43	3.38	3.83	4.05	4.18	3.88	3.86
10/21/2004	2.78	2.61	3.07	2.84	2.60	1.91	2.70	2.79	3.03	2.80	2.65
11/29/2004	2.07	1.72	2.33	1.94	1.86	1.33	1.91	1.98	2.20	1.99	1.79
12/27/2004	2.01	2.01	2.26	2.05	1.74	1.98	2.01	2.17	2.48	2.04	1.91
1/25/2005	2.27	2.28	2.54	2.40	1.97	1.46	2.26	2.42	2.65	2.34	2.22
2/17/2005	2.45	2.53	2.71	2.66	2.2	1.86	2.49	2.63	2.91	2.57	2.44
3/24/2005	2.92	3.16	3.17	3.64	2.71	3.51	3.39	3.74	4.00	3.42	3.57
4/25/2005	2.64	2.25	2.91	2.67	2.43	1.34	2.56	2.62	2.82	2.64	2.47
5/31/2005	1.98	1.71	2.27	1.82	1.70	1.25	1.78	1.88	2.18	1.85	1.65
6/17/2005	2.12	1.55	2.45	1.88	1.79	0.51	1.76	1.80	2.05	1.91	1.66
7/21/2005	2.73	2.61	3.04	2.84	2.49	1.56	2.63	2.71	2.96	2.75	2.62
8/16/2005	3.47	3.65	3.74	4.07	3.46	3.06	3.78	4.02	4.20	3.88	3.94
9/29/2005	2.29	1.53	2.59	2.02	2.02	0.41	1.99	2.02	2.19	2.09	1.85
10/17/2005	3.02	2.93	3.32	3.10	2.82	2.03	2.96	3.02	3.23	3.07	2.92
12/1/2005	2.70	2.74	2.96	2.85	2.42	2.10	2.66	2.80	3.08	2.77	2.70
12/19/2005	3.17	3.35	3.38	3.88	2.99	3.69	3.64	4.00	4.31	3.68	3.84
1/26/2006	3.11	3.27	3.34	3.59	2.95	3.17	3.36	3.56	3.86	3.44	3.52
3/2/2006	3.42	3.57	3.61	4.07	3.31	3.43	3.87	4.11	4.38	3.90	3.97
3/30/2006	2.58	2.48	2.83	2.58	2.36	1.28	2.49	2.55	2.81	2.57	2.43
5/1/2006	2.01	1.49	2.29	1.76	1.75	0.36	1.74	1.74	1.95	1.81	1.58
5/31/2006	1.64	0.89	1.97	1.29	1.39	-0.26	1.31	1.30	1.50	1.41	1.14
6/29/2006	2.12	2.13	2.44	2.08	1.79	1.03	1.93	2.06	2.34	2.04	1.9

Appendix 2. Monthly water-level data from wells at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 1998 to June 2006 (Continued).

[---. Not measured, all measurements are in feet relative to the National Geodetic Vertical Datum of 1988]

Date	12MW-12D	12MW-12S	12MW-13S	12MW-14S	12MW-15S	12MW-16S	12MW-17S	12MW-18S	12MW-19D	12MW-19S	12MW-20D
4/18/1998	---	---	---	---	---	---	---	---	---	---	---
5/18/1998	---	---	---	---	---	---	---	---	---	---	---
6/25/1998	---	---	---	---	---	---	---	---	---	---	---
8/11/1999	---	---	---	---	---	---	---	---	---	---	---
10/28/1999	---	---	---	---	---	---	---	---	---	---	---
8/3/2000	---	---	---	---	---	---	---	---	---	---	---
9/7/2000	---	---	---	---	---	---	---	---	---	---	---
10/12/2000	---	---	---	---	---	---	---	---	---	---	---
11/13/2000	---	---	---	---	---	---	---	---	---	---	---
1/12/2001	---	---	---	---	---	---	---	---	---	---	---
2/8/2001	---	---	---	---	---	---	---	---	---	---	---
3/14/2001	---	---	---	---	---	---	---	---	---	---	---
4/13/2001	---	---	---	---	---	---	---	---	---	---	---
5/14/2001	---	---	---	---	---	---	---	---	---	---	---
6/19/2001	---	---	---	---	---	---	---	---	---	---	---
7/19/2001	---	---	---	---	---	---	---	---	---	---	---
8/30/2001	---	---	1.89	---	---	---	---	---	---	---	---
9/27/2001	2.47	2.00	2.11	---	---	---	---	---	---	---	---
10/30/2001	1.35	1.01	1.10	---	---	---	---	---	---	---	---
11/27/2001	1.19	0.86	0.95	1.75	0.64	0.81	---	---	---	---	---
12/26/2001	1.46	1.11	1.20	2.00	1.28	1.26	---	---	---	---	---
1/22/2002	1.81	1.56	1.61	2.07	1.70	1.35	---	---	---	---	---
2/26/2002	2.06	1.78	1.85	2.23	1.86	1.65	---	---	---	---	---
5/3/2002	1.70	1.29	1.36	---	---	---	---	---	---	---	---
6/6/2002	1.01	0.58	0.65	---	---	---	---	---	---	---	---
7/12/2002	2.01	1.69	1.74	2.22	0.07	1.60	---	---	---	---	---
8/8/2002	1.55	1.13	1.20	1.98	0.16	1.19	---	---	---	---	---
8/26/2002	1.32	1.04	1.10	1.89	1.20	0.99	1.10	---	---	---	---
8/28/2002	1.79	1.49	1.56	2.11	2.17	1.25	1.56	---	---	---	---
9/9/2002	2.95	2.75	2.77	2.97	2.26	2.66	---	---	---	---	---
10/3/2002	4.06	4.01	3.94	3.38	2.61	3.26	4.00	---	---	---	---
11/21/2002	4.85	4.88	5.72	3.91	3.28	3.91	4.85	---	---	---	---
12/13/2002	4.37	4.38	4.22	3.65	3.09	3.62	4.34	---	---	---	---
2/4/2003	3.79	3.69	3.61	3.27	2.66	3.08	3.66	---	---	---	---
2/13/2003	3.70	3.70	3.61	---	---	---	3.66	3.80	3.88	3.91	3.79
2/20/2003	3.71	3.83	3.68	2.62	2.52	4.14	3.80	---	---	---	---
2/26/2003	3.88	3.84	3.46	3.30	2.84	3.21	3.82	3.96	4.04	4.02	4.04
3/25/2003	4.68	4.69	4.52	3.85	3.22	3.86	4.67	4.96	4.93	4.95	4.92
4/23/2003	3.72	3.55	3.46	3.41	2.18	3.08	3.49	3.80	3.78	3.79	3.80
5/27/2003	4.27	4.35	4.18	3.55	3.37	3.60	4.31	4.56	4.55	4.56	4.54
6/30/2003	3.37	3.12	3.09	2.45	1.65	2.82	3.11	3.39	3.39	3.41	3.39
8/4/2003	4.25	4.29	4.15	3.60	3.14	3.60	4.28	4.56	4.52	4.54	4.51
8/29/2003	2.88	2.60	2.58	2.88	1.05	2.47	2.59	2.84	2.87	2.84	2.85
9/30/2003	2.67	2.37	2.41	2.96	1.34	2.51	2.36	2.59	2.57	2.57	2.58
11/3/2003	2.71	2.46	2.49	1.63	1.86	2.30	2.45	2.69	2.70	2.70	2.71
12/8/2003	2.57	2.32	2.33	2.67	2.11	2.15	2.31	2.56	2.58	2.57	2.58
1/15/2004	2.60	2.36	2.36	2.61	2.12	2.21	2.36	2.60	2.62	2.61	2.60
2/13/2004	3.30	3.25	3.19	2.85	3.36	2.60	3.25	3.49	3.52	3.51	3.50
3/15/2004	3.17	2.99	3.07	2.86	2.11	2.55	2.99	3.23	3.73	3.26	3.24
4/21/2004	2.70	2.45	---	2.58	1.70	2.18	2.45	2.71	2.73	2.73	2.71
5/20/2004	2.39	2.06	2.08	2.39	1.03	2.01	2.06	2.32	2.33	2.34	2.35
6/21/2004	1.99	1.71	1.73	1.94	0.80	1.58	1.73	1.94	1.96	1.96	1.95
7/26/2004	2.62	2.39	2.42	2.59	2.14	3.31	2.41	2.63	2.64	2.64	2.65
9/15/2004	3.93	3.89	3.81	3.43	2.79	3.41	3.87	4.07	4.10	4.09	4.09
10/21/2004	2.80	2.67	2.67	2.88	2.12	2.66	2.64	2.84	2.87	2.87	2.87
11/29/2004	1.97	1.78	1.79	2.19	1.49	1.83	1.78	2.01	2.05	2.02	2.03
12/27/2004	2.04	1.91	1.90	2.17	2.46	1.78	1.86	2.16	2.19	2.16	2.17
1/25/2005	2.33	2.21	2.21	2.41	2.22	2.11	---	2.44	2.50	2.49	2.46
2/17/2005	2.55	2.47	2.48	2.57	2.4	2.33	2.47	2.67	2.71	2.7	2.69
3/24/2005	3.43	3.56	3.45	2.91	3.39	2.85	3.56	3.77	3.79	3.79	3.75
4/25/2005	2.64	2.47	2.46	2.69	1.64	2.40	2.47	2.67	2.74	2.73	2.70
5/31/2005	1.84	1.62	1.64	2.08	1.44	1.69	1.64	1.89	2.14	1.91	1.91
6/17/2005	1.89	1.66	1.71	2.32	1.08	2.00	1.64	1.86	1.92	1.90	1.90
7/21/2005	2.74	2.62	2.63	2.87	1.87	2.71	2.62	2.80	2.86	2.85	2.83
8/16/2005	3.87	3.93	3.87	3.45	2.93	3.47	3.93	4.08	4.13	4.11	4.09
9/29/2005	2.09	1.83	1.85	2.43	0.50	2.04	1.84	2.13	2.10	2.08	2.09
10/17/2005	3.06	2.91	2.92	3.11	2.10	2.89	2.91	3.10	3.16	3.14	3.12
12/1/2005	2.76	2.67	2.70	2.83	2.65	2.65	2.68	2.86	2.91	2.89	2.89
12/19/2005	3.67	3.84	3.70	3.05	3.55	3.61	3.81	4.06	4.10	4.10	4.06
1/26/2006	3.43	3.52	3.46	3.13	3.15	3.14	3.48	3.63	3.67	3.66	3.64
3/2/2006	3.89	3.98	3.88	3.34	3.18	3.37	3.97	4.18	4.22	4.23	4.18
3/30/2006	2.56	2.43	2.44	2.66	1.95	2.38	2.40	2.61	2.65	2.64	2.63
5/1/2006	1.81	1.54	1.60	2.14	1.07	1.79	1.54	1.78	1.84	1.80	1.82
5/31/2006	1.40	1.11	1.11	1.81	0.31	1.39	1.11	1.31	1.37	1.35	1.36
6/29/2006	2.04	1.85	1.91	2.27	1.05	2.08	1.88	2.09	2.14	2.1	2.12

Appendix 2. Monthly water-level data from wells at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 1998 to June 2006 (Continued).

[---. Not measured, all measurements are in feet relative to the National Geodetic Vertical Datum of 1988]

Date	12MW-20S	12MW-21D	12MW-21S	12MW-22D	12MW-22S	12MW-23D	12MW-23S	12MW-24D	12MW-24S	12MW-25D	12MW-25S
4/18/1998	---	---	---	---	---	---	---	---	---	---	---
5/18/1998	---	---	---	---	---	---	---	---	---	---	---
6/25/1998	---	---	---	---	---	---	---	---	---	---	---
8/11/1999	---	---	---	---	---	---	---	---	---	---	---
10/28/1999	---	---	---	---	---	---	---	---	---	---	---
8/3/2000	---	---	---	---	---	---	---	---	---	---	---
9/7/2000	---	---	---	---	---	---	---	---	---	---	---
10/12/2000	---	---	---	---	---	---	---	---	---	---	---
11/13/2000	---	---	---	---	---	---	---	---	---	---	---
1/12/2001	---	---	---	---	---	---	---	---	---	---	---
2/8/2001	---	---	---	---	---	---	---	---	---	---	---
3/14/2001	---	---	---	---	---	---	---	---	---	---	---
4/13/2001	---	---	---	---	---	---	---	---	---	---	---
5/14/2001	---	---	---	---	---	---	---	---	---	---	---
6/19/2001	---	---	---	---	---	---	---	---	---	---	---
7/19/2001	---	---	---	---	---	---	---	---	---	---	---
8/30/2001	---	---	---	---	---	---	---	---	---	---	---
9/27/2001	---	---	---	---	---	---	---	---	---	---	---
10/30/2001	---	---	---	---	---	---	---	---	---	---	---
11/27/2001	---	---	---	---	---	---	---	---	---	---	---
12/26/2001	---	---	---	---	---	---	---	---	---	---	---
1/22/2002	---	---	---	---	---	---	---	---	---	---	---
2/26/2002	---	---	---	---	---	---	---	---	---	---	---
5/3/2002	---	---	---	---	---	---	---	---	---	---	---
6/6/2002	---	---	---	---	---	---	---	---	---	---	---
7/12/2002	---	---	---	---	---	---	---	---	---	---	---
8/8/2002	---	---	---	---	---	---	---	---	---	---	---
8/26/2002	---	---	---	---	---	---	---	---	---	---	---
8/28/2002	---	---	---	---	---	---	---	---	---	---	---
9/9/2002	---	---	---	---	---	---	---	---	---	---	---
10/3/2002	---	---	---	---	---	---	---	---	---	---	---
11/21/2002	---	---	---	---	---	---	---	---	---	---	---
12/13/2002	---	---	---	---	---	---	---	---	---	---	---
2/4/2003	---	---	---	---	---	---	---	---	---	---	---
2/13/2003	3.85	3.89	3.86	3.84	3.83	3.91	3.81	3.84	3.85	3.83	3.85
2/20/2003	---	---	---	---	---	---	---	---	---	---	---
2/26/2003	4.01	4.02	4.03	4.03	3.99	3.94	3.98	3.86	4.02	3.96	3.96
3/25/2003	4.90	4.92	4.97	4.93	4.91	4.90	4.95	4.88	4.92	4.87	4.91
4/23/2003	3.77	3.79	3.81	3.79	3.74	3.80	3.79	3.79	3.77	3.78	3.76
5/27/2003	4.53	4.50	4.56	4.51	4.49	4.48	4.52	4.45	4.49	4.45	4.49
6/30/2003	3.38	3.39	3.43	3.38	3.34	3.40	3.40	3.39	3.36	3.39	3.34
8/4/2003	4.53	4.46	4.48	4.45	4.46	4.42	4.49	4.40	4.42	4.41	4.45
8/29/2003	2.82	2.82	2.88	2.85	2.79	2.88	2.87	2.88	2.81	2.89	2.81
9/30/2003	2.54	2.59	2.61	2.58	2.53	2.64	2.59	2.62	2.56	2.64	2.57
11/3/2003	2.67	2.70	2.72	2.71	2.65	2.73	2.71	2.73	2.69	2.72	2.67
12/8/2003	2.56	2.58	2.56	2.56	2.51	2.59	2.58	2.58	2.54	2.57	2.53
1/15/2004	2.58	2.60	2.60	2.59	2.53	2.62	2.62	2.61	2.36	2.62	2.56
2/13/2004	3.50	3.48	3.44	3.48	3.44	3.48	3.51	3.46	3.47	3.46	3.46
3/15/2004	3.23	3.24	3.27	3.21	3.19	3.24	3.26	3.23	3.11	3.24	3.22
4/21/2004	2.69	2.72	2.75	2.70	2.66	2.73	2.72	2.72	2.67	2.73	2.69
5/20/2004	2.32	2.34	2.38	2.33	2.28	2.36	2.35	2.35	2.30	2.35	2.29
6/21/2004	1.93	1.95	1.96	1.94	1.90	1.98	1.96	1.99	1.93	1.98	1.95
7/26/2004	2.63	2.62	2.63	2.61	2.58	2.64	2.64	2.62	2.60	2.64	2.60
9/15/2004	4.03	4.10	3.98	4.05	4.04	4.07	4.08	4.03	4.03	4.02	4.03
10/21/2004	2.84	2.88	2.89	2.88	2.82	2.85	2.96	2.91	2.85	2.89	2.85
11/29/2004	2.00	2.05	2.06	2.05	1.97	2.08	2.06	2.09	2.00	2.06	2.02
12/27/2004	2.13	2.18	1.93	2.16	2.09	2.21	2.18	2.18	2.13	2.18	2.14
1/25/2005	2.43	2.49	2.34	2.48	2.44	2.46	2.56	2.50	2.44	2.50	2.47
2/17/2005	2.66	2.72	2.74	2.7	2.65	2.72	2.72	2.72	2.65	2.7	2.69
3/24/2005	3.74	3.86	3.60	3.72	3.70	3.71	3.75	3.70	3.71	3.62	3.71
4/25/2005	2.68	2.74	2.78	2.73	2.65	2.75	2.75	2.74	2.69	2.75	2.70
5/31/2005	1.87	1.95	1.89	1.91	1.82	1.97	1.94	1.93	1.87	1.94	1.87
6/17/2005	1.86	1.95	1.97	1.93	1.85	1.98	1.96	1.99	1.88	1.97	1.89
7/21/2005	2.79	2.86	2.93	3.04	2.60	2.88	2.87	2.88	2.79	2.85	2.81
8/16/2005	4.08	4.08	4.13	4.09	4.06	4.09	4.13	4.09	4.09	4.05	4.08
9/29/2005	2.05	2.20	2.12	2.10	2.02	2.16	2.11	2.14	2.05	2.14	2.06
10/17/2005	3.08	3.20	3.17	3.14	3.07	3.16	3.16	3.17	3.10	3.16	3.10
12/1/2005	2.85	2.92	2.91	2.91	2.84	2.92	2.93	2.93	2.87	2.89	2.90
12/19/2005	4.04	4.07	4.09	4.04	4.01	4.01	4.08	3.99	4.03	3.96	4.01
1/26/2006	3.62	3.65	3.69	3.65	3.62	3.64	3.66	3.63	3.63	3.61	3.63
3/2/2006	4.16	4.18	4.25	4.17	4.15	4.14	4.20	4.13	4.17	4.12	4.16
3/30/2006	2.59	2.67	2.68	2.65	2.59	2.67	2.67	2.67	2.62	2.66	2.61
5/1/2006	1.77	1.80	1.80	1.82	1.75	1.88	1.78	1.87	1.79	1.86	1.81
5/31/2006	1.30	1.38	1.39	1.38	1.31	1.44	1.40	1.42	1.34	1.44	1.35
6/29/2006	2.08	2.15	2.13	2.14	2.06	2.17	2.16	2.16	2.11	2.15	2.1

Appendix 2. Monthly water-level data from wells at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, April 1998 to June 2006 (Continued).

[---. Not measured, all measurements are in feet relative to the National Geodetic Vertical Datum of 1988]

Date	12MW-26S	12MW-27D	12MW-27S	12MW-28D	12MW-28S	12MW-29S	12MW-30S	12PZ-01	12PZ-03D	12PZ-03S	12PZ-04
4/18/1998	---	---	---	---	---	---	---	---	---	---	---
5/18/1998	---	---	---	---	---	---	---	---	---	---	---
6/25/1998	---	---	---	---	---	---	---	---	---	---	---
8/11/1999	---	---	---	---	---	---	---	---	---	---	---
10/28/1999	---	---	---	---	---	---	---	---	---	---	---
8/3/2000	---	---	---	---	---	---	---	---	---	---	---
9/7/2000	---	---	---	---	---	---	---	---	---	---	---
10/12/2000	---	---	---	---	---	---	---	---	---	---	---
11/13/2000	---	---	---	---	---	---	---	---	---	---	---
1/12/2001	---	---	---	---	---	---	---	---	---	---	---
2/8/2001	---	---	---	---	---	---	---	---	---	---	---
3/14/2001	---	---	---	---	---	---	---	---	---	---	---
4/13/2001	---	---	---	---	---	---	---	---	---	---	---
5/14/2001	---	---	---	---	---	---	---	---	---	---	---
6/19/2001	---	---	---	---	---	---	---	---	---	---	---
7/19/2001	---	---	---	---	---	---	---	---	---	---	---
8/30/2001	---	---	---	---	---	---	---	---	---	---	---
9/27/2001	---	---	---	---	---	---	---	---	---	---	---
10/30/2001	---	---	---	---	---	---	---	---	---	---	---
11/27/2001	---	---	---	---	---	---	---	---	---	---	---
12/26/2001	---	---	---	---	---	---	---	---	---	---	---
1/22/2002	---	---	---	---	---	---	---	---	---	---	---
2/26/2002	---	---	---	---	---	---	---	---	---	---	---
5/3/2002	---	---	---	---	---	---	---	---	---	---	---
6/6/2002	---	---	---	---	---	---	---	---	---	---	---
7/12/2002	---	---	---	---	---	---	---	---	---	---	---
8/8/2002	---	---	---	---	---	---	---	---	---	---	---
8/26/2002	---	---	---	---	---	---	---	---	---	---	---
8/28/2002	---	---	---	---	---	---	---	1.72	---	---	---
9/9/2002	---	---	---	---	---	---	---	---	---	---	---
10/3/2002	---	---	---	---	---	---	---	4.14	---	---	---
11/21/2002	---	---	---	---	---	---	---	5.03	---	---	---
12/13/2002	---	---	---	---	---	---	---	4.52	---	---	---
2/4/2003	---	---	---	---	---	---	---	3.86	---	---	---
2/13/2003	3.80	3.87	3.89	3.87	3.88	---	---	3.85	---	---	---
2/20/2003	---	---	---	---	---	---	---	3.96	---	---	---
2/26/2003	3.83	4.01	4.04	4.03	3.98	---	---	4	---	---	---
3/25/2003	4.88	4.95	4.95	4.94	4.98	---	---	4.87	---	---	---
4/23/2003	3.78	3.79	3.78	4.10	3.80	---	---	3.73	---	---	---
5/27/2003	4.50	4.55	4.54	4.52	4.54	---	---	4.49	---	---	---
6/30/2003	3.37	3.40	3.39	3.40	3.43	---	---	3.34	---	---	---
8/4/2003	4.47	4.51	4.54	4.47	4.50	---	---	4.47	---	---	---
8/29/2003	2.85	2.85	2.85	2.87	2.88	---	---	2.79	---	---	---
9/30/2003	2.59	2.58	2.57	2.61	2.61	---	---	2.54	---	---	---
11/3/2003	2.69	2.73	2.70	2.72	2.73	---	---	2.63	---	---	---
12/8/2003	2.56	2.59	2.57	2.59	2.58	---	---	---	---	---	---
1/15/2004	2.61	2.63	2.60	2.61	2.62	---	---	---	---	---	---
2/13/2004	3.50	3.54	3.50	3.51	3.50	---	---	---	---	---	---
3/15/2004	3.22	3.26	3.25	3.25	3.28	---	---	---	2.92	-4.18	2.97
4/21/2004	2.71	2.73	2.72	2.73	2.74	---	---	2.61	2.47	2.71	2.40
5/20/2004	2.28	2.36	2.34	2.35	2.37	---	---	2.22	2.08	1.99	2.00
6/21/2004	1.94	1.95	1.95	1.96	1.97	---	---	1.85	1.72	1.71	1.67
7/26/2004	2.63	2.65	2.64	2.64	2.63	---	---	2.55	2.47	2.92	2.40
9/15/2004	4.07	4.08	4.09	4.08	4.10	3.95	3.95	3.95	3.68	1.13	3.50
10/21/2004	2.88	2.89	2.87	2.89	2.89	2.73	2.72	2.72	2.68	2.36	2.62
11/29/2004	2.03	2.04	2.03	2.07	2.05	1.85	1.84	1.88	1.80	2.25	1.61
12/27/2004	2.16	2.20	2.17	2.20	2.17	1.98	1.97	2.01	1.88	2.16	1.77
1/25/2005	2.50	2.50	2.49	2.50	2.51	2.30	2.28	2.28	2.24	2.53	2.07
2/17/2005	2.72	2.72	2.69	2.74	2.73	2.54	2.53	2.52	2.48	2.64	2.42
3/24/2005	3.75	3.79	3.77	3.75	3.75	3.63	3.62	3.62	3.20	2.77	3.07
4/25/2005	2.74	2.73	2.72	2.74	2.76	2.55	2.53	2.55	2.47	2.78	2.41
5/31/2005	1.93	1.95	1.92	1.94	1.93	1.73	1.70	1.72	1.65	2.90	1.61
6/17/2005	1.95	1.91	1.90	1.95	1.96	1.73	1.70	1.67	1.81	2.50	1.77
7/21/2005	2.86	2.85	2.84	2.87	2.87	2.69	2.66	2.66	2.69	2.67	2.65
8/16/2005	4.12	4.12	4.11	4.10	4.13	4.00	3.99	3.97	2.11	4.44	4.11
9/29/2005	2.07	2.10	2.08	2.12	2.12	1.93	1.93	1.92	1.83	2.60	1.70
10/17/2005	3.13	3.15	3.13	3.15	3.17	2.96	3.00	2.97	2.92	2.63	2.88
12/1/2005	2.91	2.92	2.87	2.92	2.93	2.73	2.72	2.73	2.69	2.74	2.57
12/19/2005	4.04	4.11	4.10	4.06	4.10	3.88	3.86	3.90	3.41	2.81	3.21
1/26/2006	3.63	3.66	3.66	3.65	3.68	3.55	3.55	3.52	3.32	2.91	3.21
3/2/2006	4.15	4.21	4.21	4.16	4.22	4.04	4.03	4.05	3.67	2.98	---
3/30/2006	2.63	2.65	2.64	2.66	2.68	2.48	2.46	2.49	2.44	2.92	2.44
5/1/2006	1.82	1.82	1.81	1.86	1.82	1.66	1.66	1.64	1.64	2.64	1.59
5/31/2006	1.37	1.38	1.37	1.39	1.40	1.19	1.19	1.19	1.16	2.26	---
6/29/2006	2.15	2.15	2.13	2.16	2.15	1.96	1.95	1.92	1.98	2.93	---

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006.

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-02D	8/30/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<10	<10	38	<5	2.1	<5	<5	<5	<2
12MW-02D	11/29/2000	<0.18	<0.18	<0.21	0.22J	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	52	<0.18	2.7J	<0.21	<0.18	<0.17	<0.15
12MW-02D	2/27/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	11	<0.26	1.3J	<0.13	<0.13	<0.14	<0.17
12MW-02D	5/15/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	34	<0.33	2.3J	<0.38	<0.43	1.5	<0.19
12MW-02D	8/29/2001	<0.22	<0.23	<0.2	0.32J	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	29	<0.26	2.2J	<0.13	<0.13	<0.14	<0.17
12MW-02D	12/3/2001	<0.22	<0.23	<0.2	<0.16	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	44	<0.26	2.9J	<0.13	<0.13	<0.14	<0.17
12MW-02D	2/27/2002	<0.22	<0.23	<0.2	<0.16	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	7.8	<0.26	1.9J	<0.13	<0.13	<0.14	<0.17
12MW-02D	6/10/2002	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<5	<5	53	<0.24	3.6	<0.1	<0.17	<0.13	<0.18
12MW-02D	9/9/2002	0.52J	0.39J	<0.18	1.2	<5.4	---	<0.24	<0.24	0.25J	<10	<10	<10	<0.24	5.9	2.1	<0.19	1.2	<0.2
12MW-02D	1/8/2003	<0.17	<0.64	<0.15	0.35J	<8.8	---	<0.12	<0.15	<0.28	<10	<10	41	<0.24	3.2	0.2J	<0.17	0.36J	<0.18
12MW-02D	4/9/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<0.5	<0.5	6.5	<0.12	2.7	<0.17	<0.14	<0.12	<0.1
12MW-02D	7/16/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	42	<0.43	2.4	<0.31	<0.34	<0.25	<0.11
12MW-02D	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11
12MW-02D	5/23/2005	<0.29	<0.21	<0.18	<0.17	<3.5	---	<0.22	<0.2	<0.23	<0.5	<0.5	20	<0.2	2	<0.21	<0.19	<0.28	<0.15
12MW-02D	6/20/2006	<0.19	<0.19	<0.19	<0.15	<7.7	---	<0.2	<0.21	<0.19	<0.4	<0.5	17	<0.36	1.3J	<0.16	<0.19	<0.3	<0.2
12MW-02S	8/30/2000	<5	12	<5	200	---	---	<5	<5	<5	<10	<10	67	<5	1.9	<5	<5	<5	<2
12MW-02S	11/29/2000	<0.18	5.7	<0.21	110	---	---	<0.18	<0.17	0.75	<0.5	<0.5	3.3	<0.18	<1	<0.21	<0.18	0.24J	<0.15
12MW-02S	2/27/2001	<2.2	8.6	<2	160	---	---	<1.6	<2.3	<2.4	<0.5	<0.5	37	<2.6	1.1J	<1.3	<1.3	<1.4	<1.7
12MW-02S	5/15/2001	<2.7	5.4J	<3.5	81	---	---	<3.5	<2.7	<3.1	<0.5	<0.5	6.3	<3.3	1.7J	<3.8	<4.3	6.4J	<1.9
12MW-02S	8/29/2001	<0.33	2.1J	<0.3	23	---	<0.2	<0.24	<0.3	<0.56	<0.5	<0.5	<0.5	<0.47	1.9J	<0.21	<0.35	4.8	<0.35
12MW-02S	12/3/2001	<0.44	5.5	<0.39	69	---	<0.2	<0.32	<0.46	0.66J	<0.5	<0.5	6.1	<0.51	2.3J	<0.25	<0.26	0.47J	<0.35
12MW-02S	2/27/2002	<1.1	2.8J	<0.98	46	---	<0.2	<0.81	<1.2	<1.2	<0.5	<0.5	1.2J	<1.3	1.2J	<0.63	<0.65	<0.68	<0.87
12MW-02S	6/10/2002	<0.84	6.7J	<0.76	84	<44	<1	<0.6	<0.75	<1.4	<5	<5	16	<1.2	2.7	<0.52	<0.87	<0.64	<0.88
12MW-02S	9/9/2002	<1.3	5.4	<0.88	58	<27	---	<1.2	<1.2	<1	<10	<10	11	<1.2	1.8	<0.82	<0.96	<0.83	<0.99
12MW-02S	1/8/2003	<0.84	15	<0.76	130	<44	<1	<0.6	<0.75	1.6J	<10	<10	24	<1.2	1.8	<0.52	<0.87	2.3	<0.88
12MW-02S	4/9/2003	<2.1	27	<1.8	250	<40	---	<1.4	<2	2.9J	<0.5	<0.5	21	<1.4	3.3	<2.2	<1.8	<1.5	<1.3
12MW-02S	7/15/2003	<2.7	14	<3.4	100	<64	---	<2.9	<3	<4	<50	<50	76	<4.3	1.3J	<3.1	<3.4	<2.5	<1.1
12MW-02S	9/17/2003	<1.6	26	<1.4	150	<32	---	<1.1	<1.6	<2.2	<5	<5	60	<1.2	1.2J	<1.7	<1.4	2.1J	2.8J
12MW-02S	1/14/2004	<2.1	29	<1.8	140	<40	---	<1.4	<2	<2.7	<10	<10	<10	<1.4	1.4J	<2.2	<1.8	<1.5	<1.3
12MW-02S	4/28/2004	<2.4	200	<2.7	530	69J	---	<2.3	<2.8	11	<20	<20	140	<2.2	4.1	<2.6	<2.6	11	3.4J
12MW-02S	8/16/2004	<0.27	<0.3	<0.34	1.9	<6.4	---	<0.29	<0.3	<0.4	<50	<50	670	<0.43	1.2J	<0.31	<0.34	<0.25	<0.11
12MW-02S	2/2/2005	<0.29	0.66J	<0.18	5.4	<3.5	---	<0.22	<0.2	0.29J	<0.5	<0.5	1.4J	<0.2	<0.54	<0.21	<0.19	0.36J	<0.15
12MW-02S	5/23/2005	<0.29	0.54J	<0.18	4.2	<3.5	---	<0.22	<0.2	<0.23	<0.5	<0.5	2.8	<0.2	1.4J	<0.21	<0.19	<0.28	<0.15
12MW-02S	9/12/2005	<0.21	1.1	<0.16	7.8	<7	---	<0.2	<0.23	0.18J	<0.5	<0.5	9.3	<0.25	1.6J	<0.16	<0.21	<0.19	0.37J
12MW-02S	1/30/2006	<0.21	11	0.17J	55	10J	---	<0.2	<0.23	0.84	<0.5	<0.5	10	<0.25	---	<0.16	<0.21	0.71	1.8
12MW-02S	6/20/2006	<0.19	0.8	<0.19	6.1	<7.7	---	<0.2	<0.21	<0.19	<0.4	<0.5	1.1	<0.36	<0.54	<0.16	<0.19	<0.3	<0.2
12MW-02S	9/11/2006	<0.19	0.66J	<0.21	4.1	<6.6	---	<0.21	<0.2	<0.34	<0.4	<0.5	1.2	<0.3	---	<0.16	<0.17	<0.19	<0.17
12MW-03D	8/30/2000	<5	<5	<5	<5	---	---	<5	<5	18	<10	<10	24	<5	1.6	<5	<5	6	<2
12MW-03D	11/30/2000	<0.36	<0.35	<0.42	0.99J	---	---	<0.37	<0.35	24	<0.5	<0.5	24	<0.36	2.1J	<0.41	<0.36	5.8	<0.31
12MW-03D	2/27/2001	<0.22	<0.23	<0.2	0.54	---	---	<0.16	<0.23	6.8	8.5	8.6	13	<0.26	<0.96	<0.13	<0.13	1.4	<0.17
12MW-03D	5/15/2001	9.8	1.6	<0.35	7.5	---	---	<0.35	<0.27	15	<0.5	<0.5	22	<0.33	1.5J	6	<0.43	15	0.88
12MW-03D	8/29/2001	<0.17	<0.64	<0.15	2.7	---	<0.2	<0.12	<0.15	19	<0.5	<0.5	21	<0.24	1.8J	<0.1	<0.17	12	0.73
12MW-03D	12/4/2001	<0.17	<0.64	<0.15	6.3	---	<0.2	<0.12	<0.15	44	<0.5	<0.5	47	<0.24	2.5J	<0.1	<0.17	33	1.3
12MW-03D	2/27/2002	<0.22	<0.23	<0.2	1.2	---	0.07J	<0.16	<0.23	13	<0.5	<0.5	15	<0.26	1.2J	<0.13	<0.13	3.3	0.2J
12MW-03D	6/11/2002	<0.17	<0.64	<0.15	3.2	<8.8	---	<0.12	<0.15	21	<5	<5	50	<0.24	1.4J	<0.1	<0.17	19	<0.18

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-03D	9/10/2002	0.57J	0.45J	<0.18	2.1	<5.4	---	<0.24	<0.24	14	<10	<10	16	<0.24	1.2J	0.7	<0.19	4.6	0.3J
12MW-03D	1/9/2003	<0.17	<0.64	<0.15	1.2	<8.8	<1	<0.12	<0.15	11	<10	<10	<10	<0.24	1.9	<0.1	<0.17	2	0.73
12MW-03D	4/9/2003	<0.27	1.8	<0.34	1.9	<6.4	---	<0.29	<0.3	11	<0.5	<0.5	3.4	<0.43	2.1	<0.31	<0.34	3.2	0.65
12MW-03D	7/15/2003	<0.16	1.5	<0.14	1.9	<3.2	---	<0.11	<0.16	13	<10	<10	68	<0.12	1.6J	<0.17	0.15J	3.3	0.82
12MW-03D	8/16/2004	<0.27	4.7	<0.34	4.3	<6.4	---	<0.29	<0.3	16	---	---	---	<0.43	---	<0.31	<0.34	4	1.8
12MW-03D	5/25/2005	<0.29	1.5	<0.18	2.3	<3.5	---	<0.22	<0.2	8.7	<0.5	<0.5	18	<0.2	1.7J	0.23J	<0.19	3.4	0.27J
12MW-03D	6/21/2006	<0.19	0.56J	<0.21	1.3	<6.6	---	<0.21	<0.2	6.9	<0.4	<0.5	2.7	<0.3	0.97J	<0.16	<0.17	1.8	0.19J
12MW-03S	8/30/2000	16,000	4,000	2,300	4,500	---	---	<5	<5	7,600	39	<10	140	<5	3.6	7,300	<5	9,500	1,600
12MW-03S	11/30/2000	31,000	5,100	<170	11,000	---	---	<150	<140	7,000	32	17	160	<140	7.8	8,500	<140	9,000	160J
12MW-03S	2/27/2001	3,700	2,100	<200	3,100	---	---	<160	<230	12,000	11	30	140	<260	3J	6,500	<130	5,200	230J
12MW-03S	5/15/2001	76,000	20,000	<1700	29,000	---	---	<1700	<1400	8,900	69	24	180	<1,700	24	11,000	<2100	7,900	<940
12MW-03S	8/29/2001	73,000	23,000	<760	34,000	---	51	<600	<750	12,000	75	53	190	<1,200	30	12,000	<870	16,000	<880
12MW-03S	12/5/2001	92,000	35,000	<760	46,000	---	71	<600	<750	14,000	120	200	410	<1,200	48	16,000	<870	12,000	<880
12MW-03S	2/27/2002	5,300	4,500	<200	5,400	---	1.2	<160	<230	13,000	14	44	130	<260	6.7	7,100	<130	5,600	600
12MW-03S	6/11/2002	32,000	16,000	260J	20,000	<8,800	26	<120	<150	13,000	64	140	400	<240	24	13,000	<170	5,900	1,100
12MW-03S	9/10/2002	5,200	5,300	75	6,100	6,800	---	<6	<7.5	13,000	42	14	67	<12	10	7,700	<8.7	4,700	440
12MW-03S	1/9/2003	4,000	3,300	45	5,100	2,700	4.1	<6	<7.5	7,300	17	<10	71	<12	7.7	4,600	<8.7	4,300	320
12MW-03S	4/10/2003	15,000	8,800	150J	12,000	12,000	12.4	<57	<80	9,900	15	51	64	<58	11	6,800	<72	3,600	640
12MW-03S	7/17/2003	580	960	<85	1,200	<1,600	0.094	<73	<74	3,100	<10	20	73	<110	<5	2,100	<84	1,900	140
12MW-03S	9/16/2003	1,700	1,200	<50	2,300	1,100J	1.35	<56	<53	2,800	<5	12	79	<59	5.2	2,600	<59	1,400	120J
12MW-03S	1/14/2004	940	1,000	<17	1,700	1,000J	0.166	<15	<15	3,300	10	<10	80	<21		1,900	<17	3,000	150
12MW-03S	4/27/2004	8,100	5,100	65J	10,000	3,300	2.84	<29	<30	5,700	12J	28	170	<43	5.3	6,400	<34	5,300	380
12MW-03S	8/18/2004	370	590	<27	1,000	<400	0.548	<23	<28	1,700	<5	<5	52	<22	2.8	1,200	<26	1,400	96
12MW-03S	2/2/2005	650	890	10.4	1,820	593	0.262	1	1.13	2,670	2.7J	5.3	28	5	<5	1,550	1	2,400	120
12MW-03S	5/24/2005	67J	360	<85	540	<1600	<0.07M	<73	<74	1,700	<2.5	2.7J	39	<110	7	910	<84	1,500	79J
12MW-03S	9/13/2005	29J	160	<13	270	940J	---	<16	<18	760	<0.5	<0.5	2.3	<20	1.5J	470	<16	560	36J
12MW-03S	1/31/2006	39J	260	<13	590	<560	---	<16	<18	1,700	<0.5	<0.5	5.1	<20	---	770	<16	1700	58
12MW-03S	6/21/2006	<9.4	92	<9.7	150	110	---	<9.8	<10	520	<0.4	<0.5	2.2	<18	1.6J	340	<9.6	370	23J
12MW-03S	9/12/2006	<9.4	78	<11	120	<330	---	<10	<10	370	<0.4	<0.5	1.9	<15	---	260	<8.5	260	13J
12MW-03SR	8/30/2000	19,000	2,000	1,100	5,200	---	---	<5	<5	8,500	<10	<10	190	<5	3.6	8,800	<5	12,000	850
12MW-03SR	2/27/2001	3,800	2,100	<200	3,300	---	---	<160	<230	12,000	12	34	190	<260	2.4J	7,100	<130	5,700	210J
12MW-03SR	8/29/2001	74,000	24,000	<350	30,000		52	<350	<270	13,000	120	80	290	<330	28	12,000	<430	12,000	1,200
12MW-03SR	12/5/2001	93,000	36,000	<760	48,000	---	72	<600	<750	15,000	140	190	430	<1200	46	16,000	<870	13,000	<880
12MW-03SR	2/27/2002	5,700	4,600	<200	5,800	---	0.98	<160	<230	13,000	45	45	140	<260	6.6	7,500	<130	6,000	620
12MW-03SR	6/11/2002	33,000	16,000	270J	20,000	<8800	26	<120	<150	14,000	66	130	390	<240	25	13,000	<170	6,100	1,200
12MW-03SR	9/10/2002	5,300	5,300	<190	6,300	<11000	---	<150	<190	13,000	15	<10	62	<300	12	7,700	<220	4,900	480J
12MW-03SR	1/9/2003	3,700	3,100	<76	4,600	<4400	4.6	<60	<75	7,000	20	<10	44	<120	7.7	4,500	<87	4,200	360
12MW-03SR	4/10/2003	15,000	8,500	140J	11,000	9,900	---	<57	<80	9,900	13	20	87	<58	12	6,700	<72	3,800	590
12MW-03SR	7/17/2003	590	990	<85	1,300	<1600	0.073	<73	<74	3,200	1.8	6.7	81	<110	<5	2,100	<84	2,200	140
12MW-03SR	9/16/2003	---	---	---	---	---	1.61	---	---	---	---	---	---	---	<5	---	---	---	---
12MW-03SR	1/14/2004	---	---	---	---	---	0.471	---	---	---	---	---	---	---	---	---	---	---	---
12MW-03SR	4/27/2004	---	---	---	---	---	3.19	---	---	---	---	---	---	---	5.2	---	---	---	---
12MW-03SR	8/18/2004	1,120	1,050	13.5	1,820	722	0.508	<0.33	1.22	2,070	---	---	---	4.12J	3.1	1,710	<0.39	2,040	78.0J
12MW-03SR	2/2/2005	---	---	---	---	---	0.287	---	---	---	---	---	---	---	<5	---	---	---	---
12MW-04D	8/28/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	64	<5	2.7	<5	<5	<5	<2

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-04D	11/28/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	100	<0.18	3.3J	<0.21	<0.18	<0.17	<0.15
12MW-04D	2/26/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	46	<0.26	1.3J	<0.13	<0.13	<0.14	<0.17
12MW-04D	5/14/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	57	<0.33	3J	<0.38	<0.43	<0.34	<0.19
12MW-04D	8/27/2001	<0.27	<0.29	<0.35	<0.26	---	<0.2	<0.35	<0.27	<0.31	<0.5	<0.5	39	<0.33	1.9J	<0.38	<0.43	<0.34	<0.19
12MW-04D	12/3/2001	<0.17	<0.64	<0.15	<0.13	---	---	<0.12	<0.15	<0.28	<0.5	<0.5	73	<0.24	4.3	<0.1	<0.17	<0.13	<0.18
12MW-04D	2/26/2002	<0.22	<0.23	<0.2	<0.16	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	33	<0.26	1J	<0.13	<0.13	<0.14	<0.17
12MW-04D	6/11/2002	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<5	<5	62	<0.24	3	<0.1	<0.17	<0.13	<0.18
12MW-04D	9/9/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	<0.2	<10	<10	38	<0.24	2.9	<0.16	<0.19	<0.17	<0.2
12MW-04D	1/7/2003	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<10	<10	<10	<0.24	2	<0.1	<0.17	<0.13	<0.18
12MW-04D	4/7/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	12	<0.43	2.1	<0.31	<0.34	0.28J	<0.11
12MW-04D	7/14/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<10	<10	53	<0.12	1.8	<0.17	<0.14	<0.12	<0.1
12MW-04D	8/18/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	---	---	---	<0.18	---	<0.2	<0.21	<0.2	<0.15
12MW-04S	8/28/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	38	<5	6.4	<5	<5	<5	<2
12MW-04S	11/28/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	6.5	8.5	12	<0.18	7.7	<0.21	<0.18	<0.17	<0.15
12MW-04S	2/26/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	77	<0.26	6.8	<0.13	<0.13	<0.14	<0.17
12MW-04S	5/14/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	<0.5	<0.33	11	<0.38	<0.43	<0.34	<0.19
12MW-04S	8/27/2001	<0.27	<0.29	<0.35	<0.26	---	<0.2	<0.35	<0.27	<0.31	<0.5	<0.5	2.1	<0.33	7.2	<0.38	<0.43	<0.34	<0.19
12MW-04S	12/3/2001	<0.17	<0.64	<0.15	<0.13	---	---	<0.12	<0.15	<0.28	<0.5	<0.5	<0.5	<0.24	9.7	<0.1	<0.17	<0.13	<0.18
12MW-04S	2/26/2002	<0.22	<0.23	<0.2	<0.16	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	1.9	<0.26	5.2	<0.13	<0.13	<0.14	<0.17
12MW-04S	6/11/2002	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<5	<5	<5	<0.24	8	<0.1	<0.17	<0.13	<0.18
12MW-04S	9/9/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	<0.2	<10	<10	16	<0.24	11	<0.16	<0.19	<0.17	<0.2
12MW-04S	1/7/2003	<0.17	<0.64	<0.15	<0.13	<8.8	<1	<0.12	<0.15	<0.28	<10	<10	<10	<0.24	7.6	<0.1	<0.17	<0.13	<0.18
12MW-04S	4/7/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	22	<0.43	7.5	<0.31	<0.34	<0.25	<0.11
12MW-04S	7/14/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<5	<5	25	<0.12	7.5	<0.17	<0.14	<0.12	<0.1
12MW-04S	9/16/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<5	<5	35	<0.12	11	<0.17	<0.14	<0.12	<0.1
12MW-04S	1/12/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<10	<10	<10	<0.43	7.2	<0.31	<0.34	<0.25	<0.11
12MW-04S	4/26/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	29	<0.43	10	<0.31	<0.34	<0.25	<0.11
12MW-04S	8/18/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	26	<0.43	9.1	<0.31	<0.34	<0.25	<0.11
12MW-04S	2/1/2005	<0.29	<0.21	<0.18	<0.17	3.9J	---	<0.22	<0.2	<0.23	<0.5	0.65J	30	<0.2	7.5	<0.21	<0.19	<0.28	<0.15
12MW-04S	5/23/2005	<0.29	<0.21	<0.18	<0.17	10J	---	<0.22	<0.2	<0.23	<0.5	<0.5	7.4	<0.2	8.3	<0.21	<0.19	<0.28	<0.15
12MW-04S	9/12/2005	<0.21	<0.17	<0.16	<0.2	<7	---	<0.2	<0.23	<0.18	<0.5	<0.5	18	<0.25	9.6	<0.16	<0.21	<0.19	<0.2
12MW-04S	1/30/2006	<0.21	<0.17	<0.16	<0.2	<7	---	<0.2	<0.23	<0.18	<0.5	<0.5	10	<0.25	---	<0.16	<0.21	<0.19	<0.2
12MW-04S	6/21/2006	<0.19	<0.21	<0.21	<0.14	<6.6	---	<0.21	<0.2	<0.34	<0.4	<0.5	3.7	<0.3	7.8	<0.16	<0.17	<0.19	<0.17
12MW-04S	9/11/2006	<0.19	<0.21	<0.21	<0.14	<6.6	---	<0.21	<0.2	<0.34	<0.4	<0.5	3.5	<0.3	---	<0.16	<0.17	<0.19	<0.17
12MW-05D	8/30/2000	<5	<5	<5	<5	---	---	<5	<5	6.2	<10	<10	<10	<5	2.6	<5	<5	9.6	<2
12MW-05D	11/30/2000	1.4	<0.18	<0.21	2.6	---	---	<0.18	<0.17	2.5	<0.5	<0.5	5.9	<0.18	2.5J	3.1	<0.18	5.3	<0.15
12MW-05D	2/28/2001	<0.22	<0.23	<0.2	0.68	---	---	<0.16	<0.23	1.4	6.6	<0.5	10	<0.26	3.6	<0.13	<0.13	1.8	<0.17
12MW-05D	5/15/2001	<0.27	<0.29	<0.35	0.83J	---	---	<0.35	<0.27	2.1	<0.5	<0.5	13	<0.33	3.7	<0.38	<0.43	1.8	<0.19
12MW-05D	8/28/2001	<0.17	<0.64	<0.15	0.97	---	0.36	<0.12	<0.15	3.5	<0.5	5.1	34	<0.24	5.4	<0.1	<0.17	0.55	<0.18
12MW-05D	12/4/2001	<0.22	<0.23	<0.2	0.3J	---	<0.2	<0.16	<0.23	0.75J	<0.5	<0.5	6.4	<0.26	4.3	<0.13	<0.13	1	<0.17
12MW-05D	2/28/2002	<0.22	<0.23	<0.2	0.37J	---	---	<0.16	<0.23	0.76J	<0.5	<0.5	5.9	<0.26	2.9J	<0.13	<0.13	0.74	<0.17
12MW-05D	6/11/2002	<0.17	<0.64	<0.15	0.39J	<8.8	---	0.15J	<0.15	0.97J	<5	<5	6J	<0.24	4	<0.1	<0.17	0.89	<0.18
12MW-05D	9/10/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	0.54J	<10	<10	<10	<0.24	3.7	<0.16	<0.19	0.56J	<0.2
12MW-05D	1/8/2003	<0.17	<0.64	<0.15	0.34J	<8.8	---	<0.12	<0.15	0.39J	<10	<10	<10	<0.24	3	<0.1	<0.17	0.64	<0.18
12MW-05D	4/7/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	6.8	<0.43	3.7	<0.31	<0.34	0.47J	<0.11

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-05I	8/30/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<10	<10	16	<5	1.8	<5	<5	<5	<2
12MW-05I	11/30/2000	23	3.3	<0.42	12	---	---	<0.37	<0.35	23	<0.5	<0.5	22	<0.36	2.1J	12	<0.36	20	0.43J
12MW-05I	2/28/2001	0.33J	<0.23	<0.2	0.46J	---	---	<0.16	<0.23	1.1	<0.5	<0.5	9.8	<0.26	<0.96	0.46	<0.13	0.73	<0.17
12MW-05I	5/16/2001	1.4	<0.29	<0.35	0.6J	---	---	<0.35	<0.27	0.31J	<0.5	<0.5	13	<0.33	1.2J	0.86J	<0.43	0.71J	<0.19
12MW-05I	8/29/2001	0.48J	<0.29	<0.35	0.59J	---	<0.2	<0.35	<0.27	<0.31	<0.5	<0.5	12	<0.33	<0.96	0.7J	<0.43	0.73J	<0.19
12MW-05I	12/4/2001	<0.22	<0.23	<0.2	0.25J	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	17	<0.26	3.5	<0.13	<0.13	1	<0.17
12MW-05I	2/27/2002	<0.22	<0.23	<0.2	0.4J	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	11	<0.26	1.3J	<0.13	<0.13	1.5	<0.17
12MW-05I	6/11/2002	<0.17	<0.64	<0.15	0.35J	<8.8	---	<0.12	<0.15	<0.28	<5	<5	14J	<0.24	1.1J	<0.1	<0.17	1	<0.18
12MW-05I	9/10/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	<0.2	<10	<10	<10	<0.24	1.4J	0.17J	<0.19	0.63	<0.2
12MW-05I	1/8/2003	<0.17	<0.64	<0.15	<0.13	<8.8	<1	<0.12	<0.15	<0.28	<10	<10	14	<0.24	0.99J	<0.1	<0.17	0.61	<0.18
12MW-05I	4/7/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	7.9	<0.43	2	<0.31	<0.34	0.3J	<0.11
12MW-05I	7/14/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<1	<1	7.1	<0.12	0.69J	<0.17	<0.14	0.37J	<0.1
12MW-05I	8/18/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11
12MW-05I	5/25/2005	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	8.1	<0.43	1.2J	<0.31	<0.34	0.61J	<0.11
12MW-05I	6/22/2006	<0.19	<0.21	<0.21	<0.14	<6.6	---	<0.21	<0.2	<0.34	<0.4	<0.5	8.1	<0.3	1.4J	<0.16	<0.17	<0.19	<0.17
12MW-05S	8/30/2000	640	66	13	10,000	---	---	<5	<5	1,500	<10	<10	170	<5	2.4	580	<5	27,000	33
12MW-05S	11/30/2000	440	<35	<42	8,500	---	---	<37	<35	890	<0.5	8.8	170	<36	2.5J	400	<36	22,000	<31
12MW-05S	2/28/2001	360J	<230	<200	7,100	---	---	<160	<230	580J	<0.5	6	130	<260	1.6J	270J	<130	12,000	<170
12MW-05S	5/16/2001	590J	<290	<350	8,900	---	---	<350	<270	690J	<0.5	<0.5	130	<330	3.7	500J	<430	16,000	<190
12MW-05S	8/29/2001	2,600	310J	<350	16,000	---	0.72	<350	<270	1,400	8.9	<0.5	110	<330	1.7J	3,100	<430	23,000	<190
12MW-05S	12/4/2001	<330	<1300	<300	13,000	---	<0.2	<240	<300	1,100J	<0.5	<0.5	110	<470	4	740J	<350	25,000	<350
12MW-05S	2/28/2002	<440	<460	<390	9,300	---	<0.2	<320	<460	800J	<0.5	<0.5	85	<510	2J	360J	<260	18,000	<350
12MW-05S	6/11/2002	790J	<1300	<300	13,000	<18000	<1	<240	<300	1,600J	<5	<5	170	<470	3.3	<210	<350	23,000	<350
12MW-05S	9/10/2002	490	74J	<15	12,000	<880	---	<12	<15	1,500	<10	<10	56	<24	4.9	540	<17	20,000	52J
12MW-05S	1/8/2003	<33	<130	<30	11,000	<1800	<1	<24	<30	1,000	<10	<10	160	<47	3.4	500	<35	20,000	<35
12MW-05S	4/10/2003	<53	<60	<68	9,400	<1300	<1	<58	<59	1,200	<0.5	1.4	39	<85	2.2	<61	<67	21,000	<21
12MW-05S	7/17/2003	<330	<210	<280	10,000	<6300	<0.07	<230	<320	1,200J	<13	<13	140	<230	<5	740J	<290	20,000	<210
12MW-05S	9/16/2003	<460	<430	<400	8,900	<6800	<0.07	<450	<420	1,200J	<5	5.2	95	<470	<5	660J	<470	16,000	<350
12MW-05S	1/14/2004	230	<60	<68	8,600	<1300	0.07	<58	<59	1,200	<10	<10	62	<85	---	620	<67	18,000	<21
12MW-05S	4/27/2004	<330	<370	<420	9,000	<8000	<0.07	<360	<370	1,300J	---	---	---	<530	<5	770J	<420	18,000	<130
12MW-05S	8/18/2004	290	68J	<43	9,600	<630	<0.067	<36	<44	1,400	<50	<50	180	<35	2.5	910	<42	22,000	120
12MW-05S	2/2/2005	157J	<200	<36	6,330	<13	0.084	1	1.95	1,490	<5	5.5J	100	410J	<5	1,470	3.59	13,100	130
12MW-05S	5/24/2005	160	40J	<15	6,200	<280	0.064JM	<17	<16	2,300	<2.5	<2.5	92	<16	43	2,600	<15	15,000	170
12MW-05S	9/13/2005	79	35J	<13	4,000	<560	---	<16	<18	2,500	<0.5	<0.5	4.6	<20	---	2,400	<16	11,000	140
12MW-05S	1/31/2006	99J	65J	<18	3,600	<350	---	<22	<20	2,300	<0.5	1.1J	69	34J	---	2,300	<19	11,000	160
12MW-05S	6/20/2006	120J	100J	<97	1,700	30J	---	<98	<100	2,200	1.1J	2.7	130	<180	3.3	1,500	<96	6,800	170J
12MW-05S	9/12/2006	100J	100J	<97	1,700	<3900	---	<98	<100	1,900	0.43J	1.1J	130	<180	---	1,000	<96	6,100	170J
12MW-05SR	8/30/2000	730	71	15	12,000	---	---	<5	<5	1,600	<10	<10	170	<5	2.4	670	<5	31,000	36
12MW-05SR	11/30/2000	450J	<140	<170	8,400	---	---	<150	<140	710	<0.5	<0.5	150	<140	4.5J	260J	<140	21,000	<120
12MW-05SR	2/28/2001	360J	<230	<200	7,200	---	---	<160	<230	580J	8.6	6.6	140	<260	2.3J	280J	<130	12,000	<170
12MW-05SR	5/16/2001	510J	<290	<350	9,200	---	---	<350	<270	690J	<0.5	4.6	99	<330	3.2	440J	<430	17,000	<190
12MW-05SR	8/29/2001	1,900	<290	<350	13,000	---	1.1	<350	<270	1,300	<0.5	<0.5	110	<330	1.8J	2,200	<430	21,000	<190
12MW-05SR	12/4/2001	<330	<1300	<300	14,000	---	<0.2	<240	<300	1,200J	<0.5	<0.5	140	<470	3.7	<210	<350	25,000	<350
12MW-05SR	6/11/2002	840J	<1300	<300	14,000	<18000	---	<240	<300	1,700J	<5	<5	170	<470	3.7	<210	<350	23,000	<350
12MW-05SR	9/10/2002	<330	<1300	<300	12,000	<18000	---	<240	<300	1,700J	<10	<10	130	<470	4.7	560J	<350	20,000	<350

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-05SR	1/8/2003	<330	<1300	<300	11,000	<18000	<1	<240	<300	1,200J	<10	<10	35	<470	3	550J	<350	20,000	<350
12MW-05SR	4/10/2003	<330	<210	<280	8,100	<6300	---	<230	<320	1,100J	<0.5	2.5	62	<230	2.4	380J	<290	18,000	<210
12MW-05SR	7/17/2003	<330	<210	<280	9,900	<6300	---	<230	<320	1,200J	<10	<10	130	<230	---	720J	<290	19,000	<210
12MW-05SR	9/16/2003	<460	<430	<400	9,300	<6800	---	<450	<420	1,300J	<5	<5	100	<470	---	700J	<470	18,000	<350
12MW-05SR	1/14/2004	<530	<600	<680	9,000	<13000	---	<580	<590	1,200J	<10	<10	78	<850	---	650J	<670	18,000	<210
12MW-05SR	4/27/2004	<530	<600	<680	7,500	<13000	---	<580	<590	1,300J	<5	<5	170	<850	---	810J	<670	20,000	<210
12MW-05SR	8/18/2004	<380	<390	<430	8,800	<6300	---	<360	<440	1,500	<20	<20	140	<350	---	1000J	<420	22,000	<310
12MW-05SR	2/2/2005	<580	<420	<360	8,900	<7000	---	<440	<400	2,000	<5	<5	100	1,100J	---	2,300	<380	20,000	<290
12MW-05SR	5/24/2005	<530	<600	<680	5,900	<13000	---	<580	<590	2,300J	<2.5	<2.5	92	<850	---	2,800	<670	16,000	<210
12MW-05SR	9/13/2005	<210	<170	<160	3,900	<7000	---	<200	<230	2,100	<0.5	<0.5	110	<250	---	2,200	<210	9,800	<200
12MW-05SR	1/31/2006	<210	<170	<160	3,600	<7000	---	<200	<230	2,400	<0.5	0.78J	73	<250	---	2,500	<210	11,000	<200
12MW-05SR	6/20/2006	120J	120J	<97	1,900	<3900	---	<98	<100	2,500	0.88J	2.4	100	<180	---	1,700	<96	6,900	200J
12MW-05SR	9/12/2006	99J	98J	<97	1,500	<3900	---	<98	<100	1,900	<0.4	0.6J	110	<180	---	980	<96	5,800	150J
12MW-06D	8/29/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	27	<5	1.8	<5	<5	<5	<2
12MW-06D	11/29/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	16	<0.18	2.8J	<0.21	<0.18	<0.17	<0.15
12MW-06D	2/27/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	16	<0.26	1.5J	<0.13	<0.13	<0.14	<0.17
12MW-06D	5/14/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	9.2	<0.26	3.9	<0.13	<0.13	<0.14	<0.17
12MW-06D	8/28/2001	<0.17	<0.64	<0.15	<0.13	---	---	<0.12	<0.15	<0.28	<0.5	<0.5	310	<0.24	2.1J	<0.1	<0.17	<0.13	<0.18
12MW-06S	8/29/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	36	<5	2	<5	<5	<5	<2
12MW-06S	11/29/2000	0.42J	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	46	<0.18	4.3	<0.21	<0.18	<0.17	<0.15
12MW-06S	2/27/2001	0.29J	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	23	<0.26	1.4J	<0.13	0.15J	<0.14	<0.17
12MW-06S	5/14/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	11	<0.26	2.9J	<0.13	<0.13	<0.14	<0.17
12MW-06S	8/28/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	15	<0.33	3.2	<0.38	<0.43	<0.34	<0.19
12MW-06S	12/4/2001	<0.22	<0.23	<0.2	<0.16	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	430	<0.26	3.4	<0.13	<0.13	0.15J	<0.17
12MW-06S	2/26/2002	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	71	<0.26	3.5	<0.13	<0.13	<0.14	<0.17
12MW-06S	6/11/2002	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<5	<5	75	<0.24	5.1	<0.1	<0.17	<0.13	<0.18
12MW-06S	9/9/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	<0.2	<10	<10	28	<0.24	4.8	<0.16	<0.19	<0.17	<0.2
12MW-06S	1/7/2003	<0.26	<0.24	<0.18	<0.33	<5.4	<1	<0.24	<0.24	<0.2	<10	<10	44	<0.24	3.6	<0.16	<0.19	<0.17	<0.2
12MW-06S	4/8/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	20	<0.43	2.5	<0.31	<0.34	<0.25	<0.11
12MW-06S	8/19/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	---	---	---	<0.18	---	<0.2	<0.21	<0.2	<0.15
12MW-06S	5/23/2005	<0.29	<0.21	<0.18	<0.17	<3.5	---	<0.22	<0.2	<0.23	---	---	---	<0.2	---	<0.21	<0.19	<0.28	<0.15
12MW-06S	6/22/2006	<0.19	<0.21	<0.21	<0.14	<6.6	---	<0.21	<0.2	<0.34	---	---	---	<0.3	---	<0.16	<0.17	<0.19	<0.17
12MW-07D	8/28/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	19	<5	2.1	<5	<5	<5	<2
12MW-07D	11/29/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	10	<0.18	2.3J	<0.21	<0.18	<0.17	<0.15
12MW-07D	2/26/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	5.8	20	<0.26	1.4J	<0.13	<0.13	<0.14	<0.17
12MW-07D	5/14/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	9.4	<0.26	2.2J	<0.13	<0.13	<0.14	<0.17
12MW-07D	8/29/2001	0.7J	<0.29	<0.35	0.78J	---	<0.2	<0.35	<0.27	<0.31	11	<0.5	11	<0.33	1.1J	1J	<0.43	0.44J	<0.19
12MW-07S	8/28/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	120	<5	3.1	<5	<5	<5	<2
12MW-07S	11/28/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	120	<0.18	1.5J	<0.21	<0.18	<0.17	<0.15
12MW-07S	2/26/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	340	<0.26	<0.96	<0.13	0.14J	<0.14	<0.17
12MW-07S	5/14/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	190	<0.26	1.2J	<0.13	<0.13	<0.14	<0.17
12MW-07S	8/29/2001	0.55J	<0.29	<0.35	0.67J	---	<0.2	<0.35	<0.27	<0.31	<0.5	<0.5	150	<0.33	<0.96	0.77J	<0.43	0.38J	<0.19
12MW-08D	8/29/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	7.6	<5	5.3	<5	<5	<5	<2
12MW-08D	11/28/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	8.3	<0.18	3J	<0.21	<0.18	<0.17	<0.15
12MW-08D	2/26/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	5.7	<0.26	1.8J	<0.13	<0.13	<0.14	<0.17

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-08D	5/14/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	2.5	<0.33	3.1J	<0.38	<0.43	<0.34	<0.19
12MW-08D	8/27/2001	<0.27	<0.29	<0.35	<0.26	---	<0.2	<0.35	<0.27	<0.31	<0.5	<0.5	5.4	<0.33	3.9	<0.38	<0.43	<0.34	<0.19
12MW-08S	8/28/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	150	<5	1.3	<5	<5	<5	<2
12MW-08S	11/28/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	52	<0.18	<1	<0.21	<0.18	<0.17	<0.15
12MW-08S	2/26/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	53	<0.26	<0.96	<0.13	<0.13	<0.14	<0.17
12MW-08S	5/14/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	12	<0.33	2.5J	<0.38	<0.43	<0.34	<0.19
12MW-08S	8/27/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	3.7	<0.33	1.7J	<0.38	<0.43	<0.34	<0.19
12MW-09D	8/29/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	720	<5	3	<5	<5	<5	<2
12MW-09D	11/29/2000	<0.18	0.24J	<0.21	0.18J	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	940	<0.18	5.4	<0.21	<0.18	<0.17	<0.15
12MW-09D	2/27/2001	<0.22	0.34J	<0.2	0.34J	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	640	<0.26	4.8	<0.13	<0.13	<0.14	<0.17
12MW-09D	5/15/2001	<0.27	0.31J	<0.35	0.3J	---	---	<0.35	<0.27	<0.31	<0.5	<0.5	380	<0.33	5	<0.38	<0.43	<0.34	<0.19
12MW-09D	8/29/2001	<0.22	0.33J	<0.2	0.52	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	570	<0.26	4.4	<0.13	<0.13	<0.14	<0.17
12MW-09D	12/3/2001	<0.17	<0.64	<0.15	<0.13	---	<0.2	<0.12	<0.15	<0.28	13	<0.5	550	<0.24	4.6	<0.1	<0.17	<0.13	<0.18
12MW-09D	2/26/2002	<0.22	<0.23	<0.2	0.19J	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	310	<0.26	5.1	<0.13	<0.13	<0.14	<0.17
12MW-09D	6/10/2002	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<5	<5	360	<0.24	5.8	<0.1	<0.17	<0.13	<0.18
12MW-09D	9/10/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	<0.2	<10	<10	230	<0.24	5.2	<0.16	<0.19	<0.17	<0.2
12MW-09D	1/7/2003	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<10	<10	300	<0.24	4.1	<0.1	<0.17	<0.13	<0.18
12MW-09D	4/9/2003	<0.16	0.14J	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<0.5	<0.5	340	<0.12	4.4	<0.17	<0.14	<0.12	<0.1
12MW-09D	7/16/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<50	<50	370	<0.43	4	<0.31	<0.34	<0.25	<0.11
12MW-09D	8/16/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	---	---	---	<0.18	---	<0.2	<0.21	<0.2	<0.15
12MW-09S	8/29/2000	<5	120	<5	120	---	---	<5	<5	<5	<2	<2	61	<5	2.5	<5	<5	<5	<2
12MW-09S	11/29/2000	1	97	<0.21	98	---	---	<0.18	<0.17	0.3J	<0.5	5.6	130	<0.18	1.9J	<0.21	<0.18	0.94	0.49J
12MW-09S	2/27/2001	0.79	86	<0.2	86	---	---	<0.16	<0.23	0.32J	<0.5	<0.5	92	<0.26	1.9J	<0.13	<0.13	0.89	0.24J
12MW-09S	5/15/2001	<2.2	73	<2.8	60	---	---	<2.8	<2.2	<2.4	<0.5	5.9	270	<2.7	3.3	<3	<3.4	<2.7	<1.5
12MW-09S	8/29/2001	<1.7	76	<1.6	83	---	<0.2	<1.3	<1.8	<1.9	<0.5	<0.5	230	<2.1	2.2J	<1	<1	1.3J	<1.4
12MW-09S	12/3/2001	<1.3	73	<1.2	69	---	<0.2	<0.95	<1.2	<2.2	<0.5	<0.5	120	<1.9	4	<0.82	<1.4	<1	<1.4
12MW-09S	2/26/2002	<1.7	51	<1.6	52	---	---	<1.3	<1.8	<1.9	<0.5	<0.5	64	<2.1	2.2J	<1	<1	<1.1	<1.4
12MW-09S	6/10/2002	<1.3	100	<1.2	110	290	---	<0.95	<1.2	<2.2	<5	<5	57	<1.9	3.2	<0.82	<1.4	<1	<1.4
12MW-09S	9/10/2002	<1	35	<0.7	31	150	---	<0.96	<0.98	<0.81	<10	<10	220	<0.95	2.4	<0.66	<0.77	1.3J	<0.79
12MW-09S	1/7/2003	<0.67	20	<0.6	18	63J	7	<0.48	<0.6	<1.1	<10	<10	560	<0.94	10	<0.41	<0.7	<0.51	<0.7
12MW-09S	4/8/2003	<0.33	22	<0.28	23	68	---	<0.23	<0.32	<0.44	<0.5	<0.5	630	<0.23	4	<0.34	<0.29	0.47J	<0.21
12MW-09S	7/15/2003	<0.53	30	<0.68	32	80	---	<0.58	<0.59	<0.8	<50	<50	660	<0.85	2.4	<0.61	1.5J	0.71J	0.39J
12MW-09S	9/17/2003	<0.33	28	<0.28	28	85	---	<0.23	<0.32	<0.44	<50	<50	700	<0.23	3.3	<0.34	0.46J	0.61J	<0.21
12MW-09S	1/13/2004	<0.41	23	<0.35	24	87	---	<0.28	<0.4	<0.55	<10	<10	220	<0.29	2.1	<0.43	<0.36	<0.31	<0.26
12MW-09S	4/28/2004	<0.47	23	<0.54	26	83	---	<0.45	<0.55	<0.36	<5	<5	54	<0.44	3.7	<0.51	<0.52	<0.5	<0.39
12MW-09S	8/16/2004	<0.53	20	<0.68	25	77	---	<0.58	<0.59	<0.8	<5	<5	87	<0.85	2.5	<0.61	<0.67	<0.49	<0.21
12MW-09S	5/25/2005	<0.66	29	<0.85	30	99	---	<0.73	<0.74	<1	<25	<25	100	<1.1	2.1	<0.77	<0.84	0.94J	0.62J
12MW-09S	1/31/2006	<0.52	27	<0.41	34	110	---	<0.51	<0.58	<0.45	<0.5	<0.5	72	<0.62	---	<0.4	<0.52	0.78J	0.65J
12MW-09S	6/22/2006	<0.47	17	<0.53	25	76	---	<0.52	<0.51	<0.85	<0.4	<0.5	110	<0.76	1.8	<0.4	<0.43	<0.47	0.63J
12MW-09S	9/12/2006	<0.47	15	<0.53	21	59	---	<0.52	<0.51	<0.85	<0.4	<0.5	49	1J	---	<0.4	<0.43	0.6J	0.57J
12MW-10S	11/30/2000	19,000	7,000	<420	2,400	---	---	<370	<350	9,300	38	330	1,200	<360	14	3,300	<360	1,900	660J
12MW-10S	2/28/2001	38,000	15,000	<390	5,100	---	---	<320	<460	5,500	97	240	1,400	<510	17	3,100	<260	1,100	480J
12MW-10S	5/16/2001	17,000	5,000	<440	5,600	---	---	<430	<340	6,400	27	190	970	<420	14	3,500	<540	1,800	1,600
12MW-10S	8/29/2001	19,000	6,600	<190	7,000	---	6.1	<150	<190	9,200	23	130	510	<300	12	4,200	<220	3,500	1,800
12MW-10S	12/5/2001	16,000	6,100	<300	12,000	---	5.4	<240	<300	12,000	28	150	370	<470	13	4,400	<350	2,600	2,200

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c*DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-10S	2/27/2002	16,000	5,400	<390	9,300	---	8.2	<320	<460	7,300	31	210	790	<510	13	3,400	<260	1,600	1,400
12MW-10S	6/11/2002	6,800	2,800	<140	4,900	<4300	6	<190	<200	6,800	6.3J	140	470	<190	12	2,400	<150	1,200	1,600
12MW-10S	9/10/2002	11,000	4,400	47	4,700	1,700	---	<4.8	<6	7,000	130	11	180	<9.4	13	3,400	<7	1,300	1,400
12MW-10S	1/8/2003	17,000	7,700	79J	5,700	<1800	4.3	<24	<30	3,500	160	36	31	<47	12	2,200	<35	900	760
12MW-10S	4/10/2003	5,600	2,400	<170	4,800	<3200	9.2	<150	<150	2,300	11	140	710	870	11	1,800	<170	710	470
12MW-10S	7/16/2003	9,300	4,200	<270	9,700	<5100	4.94	<230	<240	3,000	20	96	940	<340	15	3,400	<270	1,100	610
12MW-10S	9/16/2003	3,600	1,800	<140	4,400	<2600	1.33	<120	<120	2,100	4.2	44	810	<170	11	1,600	<130	550	480
12MW-10S	1/14/2004	2,700	1,600	<27	4,300	<510	5.59	<23	<24	1,900	54	<10	1,200	<34		1,600	<27	580	460
12MW-10S	4/27/2004	2,500	1,500	<140	3,600	<2600	6.33	<120	<120	1,800	---	---	---	<170	9.8	1,500	<130	570	440
12MW-10S	8/18/2004	3,100	2,100	27J	3,900	<130	5.35	<7.2	<8.8	---	<50	<50	1,100	<7	11	2,100	<8.4	730	630
12MW-10S	2/2/2005	2,100	1,700	21J	4,700	330J	4.4	<8.7	<7.9	1,400	25J	100	1,300	<8	12	1,800	<7.6	470	330
12MW-10S	5/24/2005	7,600	5,000	82J	13,000	<1400	18	<87	<79	2,200	26	74	860	<80	20	4,400	<76	1,100	410
12MW-10S	9/13/2005	5,200	4,700	<200	13,000	<8700	---	<250	<290	2,200	<0.5	1.6	1,600	<310	---	3,200	<260	980	410J
12MW-10S	1/31/2006	1,900	1,800	<82	4,500	<3500	---	<100	<120	1,000	2.9	14	300	<120	---	1,700	<100	460	220J
12MW-10S	6/21/2006	6,600	6,200	91J	17,000	1,200	---	<82	<81	2,300	140	230	710	<120	---	4,300	<68	1,100	370
12MW-10S	9/12/2006	1700	2100	<85	5,200	<2600	---	<82	<81	920	1.4	6.5	460	<120	---	1,300	<68	380	170J
12MW-10SR	5/16/2001	16,000	5,200	<700	5,800	---	---	<690	<550	6,700	28	200	1,100	<660	15	3,500	<860	1,700J	1,700
12MW-10SR	8/29/2001	18,000	5,900	<390	6,600	---	4.8	<320	<460	8,300	35	160	610	<510	13	3,700	<260	2,400	1,700
12MW-10SR	12/5/2001	17,000	5,900	<300	11,000	---	5.3	<240	<300	12,000	42	200	450	<470	11	4,100	<350	2,500	2,300
12MW-10SR	2/27/2002	16,000	5,400	<390	9,300	---	7.5	<320	<460	7,300	28	190	810	<510	12	3,300	<260	1,600	1,400
12MW-10SR	8/18/2004	2,910	2,090	26.5	3,310	529	---	0.571J	1.59	2,520	---	---	---	4.24J	---	2,150	1.04	689	422
12MW-11D	8/29/2000	<5	<5	<5	<5	---	---	<5	<5	<5	<2	<2	39	<5	2.6	<5	<5	<5	<2
12MW-11D	11/29/2000	<0.18	<0.18	<0.21	<0.17	---	---	<0.18	<0.17	<0.17	<0.5	<0.5	39	<0.18	4.1	<0.21	<0.18	<0.17	<0.15
12MW-11D	2/27/2001	<0.22	<0.23	<0.2	0.41J	---	---	<0.16	<0.23	0.75J	<0.5	6.9	42	<0.26	1.6J	2.3	<0.13	0.98	<0.17
12MW-11D	5/15/2001	<0.27	<0.29	<0.35	<0.26	---	---	<0.35	<0.27	<0.31	<0.5	5.2	28	<0.33	2.8J	<0.38	<0.43	<0.34	<0.19
12MW-11D	8/28/2001	<0.22	<0.23	<0.2	0.24J	---	---	<0.16	<0.23	<0.24	<0.5	6.6	26	<0.26	2.2J	<0.13	<0.13	0.47	<0.17
12MW-11D	12/4/2001	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	31	<0.26	3.2J	<0.13	<0.13	<0.14	<0.17
12MW-11D	2/27/2002	<0.22	<0.23	<0.2	<0.16	---	---	<0.16	<0.23	<0.24	<0.5	<0.5	22	<0.26	2.5	<0.13	<0.13	<0.14	<0.17
12MW-11D	6/10/2002	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<5	<5	35	<0.24	3.1	<0.1	<0.17	<0.13	<0.18
12MW-11D	9/9/2002	<0.26	<0.24	<0.18	<0.33	<5.4	---	<0.24	<0.24	<0.2	<10	<10	65	<0.24	2.5	<0.16	<0.19	<0.17	<0.2
12MW-11D	1/8/2003	<0.17	<0.64	<0.15	<0.13	<8.8	---	<0.12	<0.15	<0.28	<10	<10	40	<0.24	2.8	<0.1	<0.17	<0.13	<0.18
12MW-11D	4/9/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<0.5	<0.5	12	<0.12	2.4	<0.17	<0.14	<0.12	<0.1
12MW-11D	7/16/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	83	<0.43	2.7	<0.31	<0.34	<0.25	<0.11
12MW-11S	8/29/2000	<5	20	<5	130	---	---	<5	<5	<5	<2	<2	17	<5	6	<5	<5	7.6	<2
12MW-11S	11/29/2000	0.34J	6.1	<0.21	65	---	---	<0.18	<0.17	0.37J	<0.5	<0.5	19	<0.18	2.1J	<0.21	<0.18	3.8	<0.15
12MW-11S	2/27/2001	<0.87	9.3	<0.78	70	---	---	<0.65	<0.92	8.9	<0.5	<0.5	19	<1	1.4J	15	<0.52	16	<0.7
12MW-11S	5/15/2001	<1.1	5.5	<1.4	41	---	---	<1.4	<1.1	<1.2	<0.5	<0.5	12	<1.3	2.2J	<1.5	<1.7	2.6J	<0.75
12MW-11S	8/28/2001	1.1J	7	<0.78	80	---	<0.2	<0.65	<0.92	1.3J	<0.5	<0.5	15	<1	1.4J	<0.5	<0.52	38	<0.7
12MW-11S	1/8/2003	<0.17	12	0.23J	71	<8.8	---	<0.12	<0.15	0.58J	---	---	---	<0.24	---	<0.1	<0.17	1.4	<0.18
12MW-11S	8/19/2004	<1.5	13	<1.7	110	<25	---	<1.4	<1.8	<1.2	---	---	---	<1.4	---	<1.6	<1.7	<1.6	<1.2
12MW-11S	5/23/2005	<2.7	13	<3.4	89	<64	---	<2.9	<3	<4	---	---	---	<4.3	---	<3.1	<3.4	6.6J	<1.1
12MW-11S	6/20/2006	<0.94	8	<0.97	52	<39	---	<0.98	<1	<0.95	---	---	---	<1.8	---	<0.81	<0.96	3.1J	<0.98
12MW-11SR	11/29/2000	0.57J	8.5	<0.21	74	---	---	<0.18	<0.17	0.68	<0.5	<0.5	14	<0.18	2.4J	<0.21	<0.18	6.4	<0.15
12MW-12D	8/28/2001	<0.22	<0.23	<0.2	0.34J	---	<0.2	<0.16	2	<0.24	<0.5	<0.5	8.5	<0.26	4.2	<0.13	0.41	2.3	<0.17
12MW-12D	8/18/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	---	---	---	<0.18	---	<0.2	<0.21	<0.2	<0.15

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-12S	8/28/2001	10	5.8	0.95	420	---	<0.2	<0.16	<0.23	29J	<0.5	<0.5	20	<0.26	1.6J	15	0.22J	2,900	0.44J
12MW-12S	12/4/2001	<8.7	<9.2	<7.8	680	---	<0.2	<6.5	<9.2	38	<0.5	<0.5	24	<10	2.4J	65	<5.2	2,400	<7
12MW-12S	2/27/2002	<55	<58	<49	280	---	<0.2	<41	<58	<61	<0.5	<0.5	21	<64	1.3J	<31	<32	1,800	<44
12MW-12S	6/10/2002	<42	<160	<38	880	<2200	<1	<30	<37	<70	<5	<5	33	<59	2.8	110	<44	2,400	<44
12MW-12S	9/9/2002	<1.7	7.5J	<1.5	400	<88	---	<1.2	<1.5	50	<10	<10	20	<2.4	2.2	100	<1.7	2,200	<1.8
12MW-12S	1/8/2003	<1.7	<6.4	<1.5	170	<88	<1	<1.2	<1.5	18	<10	<10	13	<2.4	1J	8	<1.7	1,400	<1.8
12MW-12S	4/10/2003	<6.6	4.7J	<5.6	140	<130	---	<4.5	<6.4	9.2J	<0.5	<0.5	13	<4.6	1.3J	<6.9	<5.8	430	<4.1
12MW-12S	7/16/2003	<6.6	<7.5	<8.5	99	<160	---	<7.3	<7.4	<10	<25	<25	63	<11	1.5J	<7.7	<8.4	250	<2.7
12MW-12S	9/15/2003	<6.6	<7.5	<8.5	68	<160	<0.07	<7.3	<7.4	<10	<0.5	<0.5	8.6	<11	<5	<7.7	<8.4	180	<2.7
12MW-12S	1/13/2004	1.2	2.7	<0.28	48	<6.3	<0.07	<0.23	<0.32	4	<10	<10	<10	<0.23	---	2.6	<0.29	120	<0.21
12MW-12S	4/26/2004	<0.94	2.3J	<1.1	33	<16	<0.07	<0.9	<1.1	3.3	---	---	---	<0.88	<5	1.4J	<1	65	<0.77
12MW-12S	8/17/2004	1.2	3.1	0.29J	58	<3.2	<0.067	<0.18	<0.22	4.2	<1.3	<1.3	21	<0.18	1.7	2.7	<0.21	93	0.24J
12MW-12S	2/1/2005	<1.2	2.8J	<0.73	60	<14	---	<0.87	<0.79	4.4	0.66J	<0.5	14	1.5J	<0.54	2J	<0.76	80	<0.58
12MW-12S	5/24/2005	2.7J	4.1J	<3.4	86	<64	---	<2.9	<3	8.4J	<25	<25	69J	<4.3	5.7	4.6J	<3.4	130	1.2J
12MW-12S	9/12/2005	<2.6	3.1J	<2	100	<87	---	<2.5	<2.9	7.2J	<0.5	<0.5	18	<3.1	1.6J	2.7J	<2.6	150	<2.5
12MW-12S	1/30/2006	2.4J	3.5J	<1.6	150	<70	---	<2	<2.3	14	<0.5	<0.5	8.9	4.3J	---	2.7J	<2.1	400	<2
12MW-12S	6/20/2006	<7.5	<7.7	<7.7	150	<310	---	<7.8	<8.2	19J	<0.4	<0.5	17	16J	1.4J	7.6J	<7.6	570	<7.8
12MW-12S	9/11/2006	<7.5	<8.4	<8.5	300	<260	---	<8.2	<8.1	40J	<0.4	<0.5	3.8	<12	---	27	<6.8	960	<6.6
12MW-13S	8/28/2001	<0.17	<0.64	<0.15	20	---	---	<0.12	<0.15	0.47J	<0.5	<0.5	4	<0.24	2.2J	<0.1	<0.17	16	<0.18
12MW-13S	12/4/2001	<0.22	<0.23	<0.2	1	---	<0.2	1.7	<0.23	<0.24	<0.5	<0.5	<0.5	<0.26	5.6	0.35J	<0.13	5.2	<0.17
12MW-13S	2/26/2002	<0.22	<0.23	<0.2	1	---	<0.2	<0.16	<0.23	<0.24	<0.5	<0.5	2.9	<0.26	1.7J	<0.13	<0.13	4.3	<0.17
12MW-13S	6/11/2002	<0.17	<0.64	<0.15	0.82	<8.8	<1	<0.12	<0.15	<0.28	<5	<5	<5	<0.24	1.6J	<0.1	<0.17	4	<0.18
12MW-13S	9/10/2002	<0.26	<0.24	<0.18	3.5	<5.4	---	<0.24	<0.24	<0.2	<10	<10	<10	<0.24	1.2J	<0.16	<0.19	3.9	<0.2
12MW-13S	1/7/2003	<0.17	<0.64	<0.15	34	<8.8	<1	<0.12	<0.15	<0.28	<10	<10	<10	<0.24	1.5J	<0.1	<0.17	21	<0.18
12MW-13S	4/8/2003	<1.1	<1.2	<1.4	65	<26	<1	<1.2	<1.2	<1.6	<0.5	<0.5	1.7	<1.7	2	<1.2	<1.3	37	<0.42
12MW-13S	7/15/2003	<1.3	<1.5	<1.7	82	<32	---	<1.5	<1.5	<2	<0.5	<0.5	1.8	<2.1	0.88J	<1.5	<1.7	33	<0.53
12MW-13S	9/15/2003	<1.3	<1.5	<1.7	83	<32	<0.07	<1.5	<1.5	<2	<0.5	<0.5	1.1	<2.1	<5	<1.5	<1.7	26	<0.53
12MW-13S	1/13/2004	<0.27	<1.2	<0.34	41	<26	0.043J	<0.29	<0.3	<0.4	<10	<10	<10	<0.43	7.6	<0.31	<0.34	20	<0.11
12MW-13S	4/28/2004	<0.27	0.77J	<0.34	60	<6.4	<0.07	<0.29	<0.3	<0.4	<0.5	<0.5	3.5	<0.43	<5	<0.31	<0.34	14	<0.11
12MW-13S	8/17/2004	0.23J	0.82	<0.22	54	<3.2	<0.067	<0.18	<0.22	0.27J	<0.5	<0.5	4.1	<0.18	0.8J	<0.2	<0.21	15	0.23J
12MW-13S	2/2/2005	<1.5	<1	<0.91	62	<17	---	<1.1	<0.99	<1.2	<0.5	<0.5	2.6	1.3J	<0.54	<1	<0.95	14	<0.73
12MW-13S	5/24/2005	<1.5	1.3J	<0.91	95	<17	0.063JM	<1.1	<0.99	<1.2	<0.5	<0.5	2.4	<1	4.2J	<1	<0.95	43	<0.73
12MW-13S	9/12/2005	<2.1	<1.7	<1.6	110	<70	---	<2	<2.3	<1.8	<0.5	<0.5	<0.5	<2.5	---	<1.6	<2.1	30	<2
12MW-13S	1/30/2006	<2.1	<1.7	<1.6	120	<70	---	<2	<2.3	<1.8	<0.5	<0.5	1.2J	3.4J		<1.6	<2.1	30	<2
12MW-13S	6/22/2006	<1.5	<1.7	<1.7	82	<53	---	<1.6	<1.6	23	<0.4	<0.5	10	<2.4	1.1J	<1.3	<1.4	42	<1.3
12MW-13S	9/11/2006	<1.5	<1.7	<1.7	64	<53	---	<1.6	<1.6	14	<0.4	<0.5	1.2	<2.4	---	<1.3	<1.4	29	<1.3
12MW-13SR	4/8/2003	<0.16	0.77	<0.14	52	<3.2	---	<0.11	<0.16	0.39J	---	---	---	<0.12	---	<0.17	<0.14	31	<0.1
12MW-13SR	7/15/2003	<1.3	<1.5	<1.7	76	<32	---	<1.5	<1.5	<2	---	---	---	<2.1	---	<1.5	<1.7	31	<0.53
12MW-13SR	9/15/2003	<1.3	<1.5	<1.7	82	<32	---	<1.5	<1.5	<2	---	---	---	<2.1	---	<1.5	<1.7	25	<0.53
12MW-13SR	1/13/2004	<1.1	<1.2	<1.4	47	<26	---	<1.2	<1.2	<1.6	---	---	---	<1.7	---	<1.2	<1.3	21	<0.42
12MW-13SR	4/28/2004	<1.5	<1.6	<1.7	57	<25	---	<1.4	<1.8	<1.2	---	---	---	<1.4	---	<1.6	<1.7	15	<1.2
12MW-13SR	8/17/2004	<0.38	0.91J	<0.43	55	<6.3	---	<0.36	<0.44	<0.29	---	---	---	<0.35	---	<0.41	<0.42	15	<0.31
12MW-13SR	2/2/2005	<1.5	1.1J	<0.91	61	<17	---	<1.1	<0.99	<1.2	---	---	---	1.7J	---	<1	<0.95	14	<0.73
12MW-13SR	5/24/2005	<1.5	1.2J	<0.91	92	<17	---	<1.1	<0.99	<1.2	<0.5	<0.5	2.4	<1	2.5	<1	<0.95	42	<0.73
12MW-13SR	9/12/2005	<2.1	<1.7	<1.6	120	<70	---	<2	<2.3	<1.8	<0.5	<0.5	0.72J	<2.5	---	<1.6	<2.1	33	<2

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-13SR	1/30/2006	<2.1	<1.7	<1.6	130	<70	---	<2	<2.3	<1.8	<0.5	<0.5	0.88J	3.4J	---	<1.6	<2.1	32	<2
12MW-13SR	6/22/2006	<1.5	<1.7	<1.7	87	<53	---	<1.6	<1.6	19	<0.4	<0.5	8.8	<2.4	---	<1.3	<1.4	39	<1.3
12MW-13SR	9/11/2006	<1.5	<1.7	<1.7	61	<53	---	<1.6	<1.6	13	<0.4	<0.5	2.3	<2.4	---	<1.3	<1.4	28	<1.3
12MW-14S	8/30/2001	<0.17	<0.64	<0.15	<0.13	---	---	<0.12	<0.15	<0.28	11	<0.5	1.4J	<0.24	2.6J	<0.1	<0.17	<0.13	<0.18
12MW-17S	9/10/2002	2.1	0.98	<0.18	240	<5.4	---	<0.24	<0.24	29J	<10	<10	19	<0.24	1.6J	110	0.32J	690	0.91
12MW-17S	1/7/2003	<0.84	<3.2	<0.76	350	<44	<1	<0.6	<0.75	31	<10	<10	46	<1.2	2.1	100	<0.87	720	<0.88
12MW-17S	4/9/2003	<6.6	<4.2	<5.6	160	<130	---	<4.5	<6.4	16J	<0.5	<0.5	45	<4.6	3	32	<5.8	320	<4.1
12MW-17S	7/15/2003	<11	<12	<14	170	<260	---	<12	<12	<16	<5	<5	73	<17	1.9	35J	<13	420	<4.2
12MW-17S	9/15/2003	<11	<12	<14	160	<260	<0.07	<12	<12	<16	<5	<5	26	<17	<5	30J	<13	370	<4.2
12MW-17S	1/13/2004	<11	<12	<0.68	190	<13	<0.07	<0.58	<0.59	24	<10	<10	35	<0.85		49	<0.67	420	<4.2
12MW-17S	4/26/2004	3.1	1.9	<0.43	280	<6.3	<0.07	<0.36	<0.44	30	<5	<5	39	<0.35	<5	72	<0.42	690	1.3
12MW-17S	8/17/2004	0.44J	0.51J	<0.43	70	<6.3	<0.067	<0.36	<0.44	7.1	<5	<5	41	<0.35	1.7	12	<0.42	230	<0.31
12MW-17S	2/1/2005	<5.8	<4.2	<3.6	150	<70	0.11	<4.4	<4	16J	2.4J	<1	23	<4	<5	33	<3.8	360	<2.9
12MW-17S	5/24/2005	<11	<12	<14	190	<260	---	<12	<12	27J	<25	<25	90	<17	3.2	46	<13	460	<4.2
12MW-17S	9/12/2005	<8.3	<7	<6.5	170	<280	---	<8.1	<9.2	23J	<0.5	<0.5	29	<9.9	1.8	38	<8.2	390	<7.9
12MW-17S	1/31/2006	<12	<8.4	<7.3	220	<140	---	<8.7	<7.9	31J	<0.5	<0.5	23	<8	---	54	<7.6	450	<5.8
12MW-17S	6/20/2006	<1.9	<1.9	<1.9	41	<77	---	<2	<2.1	6.3J	<0.4	<0.5	21	<3.6	1.7	9	<1.9	110	<2
12MW-17S	9/11/2006	<1.9	<2.1	<2.1	64	<66	---	<2.1	<2	10J	<0.4	<0.5	12	<3	---	13	<1.7	160	<1.7
12MW-18S	4/9/2003	<13	86	<17	550	<320	---	<15	<15	<20	<0.5	<0.5	130	<21	9.4	<15	<17	<12	<5.3
12MW-18S	7/16/2003	<13	64	<17	500	<320	---	<15	<15	<20	<25	<25	62	<21	3.9	<15	<17	<12	<5.3
12MW-18S	9/17/2003	<13	54	<17	490	<320	---	<15	<15	<20	<5	<5	600	<21	4.1	<15	<17	<12	<5.3
12MW-18S	1/14/2004	<11	87	<14	440	<260	---	<12	<12	<16	<10	<10	150	<17	3.9	<12	<13	<9.9	<4.2
12MW-18S	4/27/2004	<6.6	84	<8.5	230	<160	---	<7.3	<7.4	<10	<20	<20	190	<11	7.6	<7.7	<8.4	7.7J	<2.7
12MW-18S	8/19/2004	<4.7	75	<5.4	240	<79	---	<4.5	<5.5	4.4J	<50	<50	510	<4.4	8.8	<5.1	<5.2	22	<3.9
12MW-18S	2/3/2005	<7.3	47	<4.6	380	<87	---	<5.5	<5	9.1J	---	---	---	7.4J	---	<5.2	<4.8	16J	<3.6
12MW-18S	5/23/2005	<11	71	<14	450	<260	---	<12	<12	<16	---	---	---	<17	---	<12	<13	25J	4.7J
12MW-18S	9/12/2005	<8.3	76	<6.5	390	<280	---	<8.1	<9.2	9.8J	---	---	---	<9.9	---	<6.4	<8.2	18J	<7.9
12MW-18S	1/31/2006	<12	89	<7.3	300	<140	---	<8.7	<7.9	<9.4	---	---	---	<8	---	<8.4	<7.6	19J	<5.8
12MW-18S	6/20/2006	<4.7	84	<5.3	230	<160	---	<5.2	<5.1	<8.5	---	---	---	<7.6	---	<4	<4.3	15J	4.4J
12MW-18S	9/11/2006	<3.7	72	<3.9	250	<150	---	<3.9	<4.1	6.2J	---	---	---	<7.2	---	<3.2	<3.8	15J	4.5J
12MW-19D	4/8/2003	<11	<12	<14	<16	<260	---	<12	<12	<16	3.2	7.4	72	<17	980	<12	<13	<9.9	<4.2
12MW-19D	7/14/2003	<13	<8.4	<11	<14	<250	---	<9	<13	<18	2.8	4.5	1,100	<9.2	670	<14	<12	<9.8	<8.2
12MW-19D	9/17/2003	<6.6	<4.2	<5.6	<6.8	<130	---	<4.5	<6.4	<8.8	<5	<5	2,600	<4.6	510	<6.9	<5.8	<4.9	<4.1
12MW-19D	1/14/2004	<2.1	<2.4	<2.7	<3.3	<51	---	2.6J	<2.4	<3.2	<10	<10	3,900	<3.4	---	<2.4	<2.7	<2	<0.85
12MW-19D	4/27/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	2.4	<0.22	<0.15	<200	<200	5,200	0.24J	220	<0.2	1.1	<0.2	<0.15
12MW-19D	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	2.5	<0.3	<0.4	<500	<500	5,100	<0.43	100	<0.31	20	<0.25	<0.11
12MW-19S	4/8/2003	<13	<15	<17	<21	<320	---	<15	<15	<20	1.9	4.9	130	<21	930	<15	<17	<12	<5.3
12MW-19S	7/14/2003	<13	22J	<11	<14	<250	---	<9	<13	<18	<250	<250	2,900	<9.2	650	<14	<12	<9.8	<8.2
12MW-19S	9/17/2003	<18	<17	<16	<21	<270	---	<18	<17	<17	<5	6	2,900	<19	670	<14	<19	<17	<14
12MW-19S	1/14/2004	<0.82	8.3	<0.7	<0.86	<16	---	1.3J	<0.8	<1.1	<10	<10	2,300	1J	360	<0.86	<0.72	<0.61	<0.52
12MW-19S	4/27/2004	<0.94	7.1	<1.1	<0.91	<16	---	1.3J	<1.1	<0.73	<200	<200	4,200	1.2J	270	<1	<1	<1	<0.77
12MW-19S	8/19/2004	<0.94	4.5	<1.1	<0.91	<16	---	1.7J	<1.1	<0.73	<500	<500	3,300	<0.88	150	<1	<1	<1	<0.77
12MW-19S	2/2/2005	<1.5	5.3	<0.91	<0.85	30J	---	1.3J	<0.99	<1.2	<250	<250	6,600	1.4J	67	<1	<0.95	<1.4	<0.73
12MW-19S	5/25/2005	<0.29	5.7	0.43J	<0.17	30	---	1.3	<0.2	<0.23	2.3	5.1	6,600	<0.2	61	<0.21	<0.19	<0.28	<0.15
12MW-19S	9/13/2005	<0.29	1.7	<0.18	<0.17	9.3J	---	1.3	<0.2	<0.23	<0.5	<0.5	3,200	<0.2	31	<0.21	<0.19	<0.28	<0.15

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c*DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-19S	1/31/2006	<0.21	0.53J	<0.16	<0.2	<7	---	1.3	<0.23	<0.18	55	0.52J	4,300	<0.25	---	<0.16	<0.21	<0.19	<0.2
12MW-19S	9/12/2006	<0.19	4.7	0.26J	<0.15	17J	---	2	<0.21	<0.19	<0.4	0.91J	3,300	<0.36	---	<0.16	<0.19	<0.3	<0.2
12MW-20D	4/8/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	4.5	<0.43	2	<0.31	<0.34	<0.25	<0.11
12MW-20D	7/15/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	35	<0.43	1.8	<0.31	<0.34	<0.25	<0.11
12MW-20D	9/16/2003	<0.16	<0.11	<0.14	<0.17	<3.2	---	<0.11	<0.16	<0.22	<0.5	<0.5	14	<0.12	1.9	<0.17	<0.14	<0.12	<0.1
12MW-20D	1/12/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<10	<10	65	<0.43	2.3	<0.31	<0.34	<0.25	<0.11
12MW-20D	4/26/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	250	<0.43	4.7	<0.31	<0.34	<0.25	<0.11
12MW-20D	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<50	<50	400	<0.43	2.9	<0.31	<0.34	<0.25	<0.11
12MW-20D	5/25/2005	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<250	<250	3,800	<0.43	2.1	<0.31	0.63J	<0.25	<0.11
12MW-20D	6/21/2006	<0.19	<0.19	<0.19	0.15J	<7.7	---	<0.2	<0.21	<0.19	<0.4	<0.5	1,100	<0.36	2.2	<0.16	<0.19	<0.3	<0.2
12MW-20S	4/9/2003	<13	67	<17	410	<320	---	<15	<15	<20	<0.5	<0.5	59	<21	3	<15	<17	<12	<5.3
12MW-20S	7/16/2003	<5.3	35	<6.8	220	<130	---	<5.8	<5.9	<8	1.1	2.3	230	<8.5	260	<6.1	<6.7	<4.9	<2.1
12MW-20S	9/16/2003	<2.7	17	<3.4	110	<64	---	<2.9	<3	<4	<5	5.3	5,100	<4.3	500	<3.1	<3.4	<2.5	<1.1
12MW-20S	1/14/2004	<0.66	7	<0.85	43	26J	---	3.1	<0.74	<1	<10	<10	7,800	<1.1	310	<0.77	<0.84	<0.62	<0.27
12MW-20S	4/26/2004	<1.1	2.7J	<1.4	38	33J	---	3J	<1.2	<1.6	<200	<200	3,300	<1.7	92	<1.2	46	<0.99	<0.42
12MW-20S	8/19/2004	<0.75	0.88J	<0.86	13	31J	---	3.6	<0.88	<0.58	<500	<500	6,900	<0.7	38	<0.82	51	<0.8	<0.62
12MW-20S	2/2/2005	<0.29	1.5	0.45J	14	23	---	3.3	<0.2	0.34J	<250	<250	8,200	<0.2	7.2	<0.21	2.1	0.37J	0.22J
12MW-20S	5/25/2005	<0.29	0.57J	<0.18	6.9	6.8J	---	5	<0.2	<0.23	<500	<500	7,200	<0.2	6.2	<0.21	2.2	<0.28	<0.15
12MW-20S	9/13/2005	<0.29	1.2	<0.18	12	11J	---	3.7	<0.2	<0.23	0.86J	<0.5	5,400	<0.2	6.4	<0.21	0.8	<0.28	<0.15
12MW-20S	1/31/2006	<0.42	3.1	<0.33	26	19J	---	3.1	<0.46	0.61J	<500	<500	12,000	<0.49	---	<0.32	0.61J	0.42J	<0.39
12MW-20S	6/22/2006	<0.19	0.76	<0.21	6.5	<6.6	---	2.6	<0.2	<0.34	<0.4	<0.5	3,100	<0.3	6.2	<0.16	0.42J	<0.19	<0.17
12MW-20S	9/11/2006	<0.19	1.3	<0.21	12	10J	---	3	<0.2	<0.34	<0.4	<0.5	8,900	<0.3	---	<0.16	0.46J	<0.19	<0.17
12MW-21D	4/7/2003	<1.1	3.4J	<1.4	<1.6	<26	---	2.1J	<1.2	2.3J	4.2	7.7	2,400	<1.7	850	<1.2	<1.3	<0.99	<0.42
12MW-21D	7/15/2003	<0.82	1.1J	<0.7	<0.86	<16	---	2.3	<0.8	1.4J	<500	<500	1,900	<0.58	440	<0.86	<0.72	<0.61	<0.52
12MW-21D	9/16/2003	<0.82	<0.53	<0.7	<0.86	<16	---	1.9J	<0.8	<1.1	<5	<5	3,900	<0.58	360	<0.86	<0.72	<0.61	<0.52
12MW-21D	1/12/2004	<0.82	<0.53	<0.7	<0.86	<16	---	1.8J	<0.8	<1.1	<10	<10	15,000	<0.58	240	<0.86	<0.72	<0.61	<0.52
12MW-21D	4/27/2004	<1.3	<1.5	<1.7	<2.1	<32	318	1.8J	<1.5	<2	<500	<500	5,000	<2.1	130	<1.5	<1.7	<1.2	<0.53
12MW-21D	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	1.8	<0.3	<0.4	<500	<500	4,200	<0.43	97	<0.31	<0.34	<0.25	<0.11
12MW-21S	4/8/2003	<1.3	21	<1.7	<2.1	<32	456.9	<1.5	<1.5	2.9J	110	18	110	<2.1	440	<1.5	<1.7	<1.2	<0.53
12MW-21S	7/15/2003	<5.3	25	<6.8	<8.2	<130	117	<5.8	<5.9	<8	39	13	160	<8.5	430	<6.1	<6.7	<4.9	<2.1
12MW-21S	9/15/2003	<5.3	17J	<6.8	<8.2	<130	321	<5.8	<5.9	<8	15	6.9	1,400	<8.5	430	<6.1	<6.7	<4.9	<2.1
12MW-21S	1/13/2004	<1.3	47	<1.7	<2.1	<32	316	<1.5	<1.5	11	13	10	2,000	<2.1	370	<1.5	<1.7	<1.2	<0.53
12MW-21S	4/27/2004	<0.94	56	2J	<0.91	<16	390	1.5J	<1.1	6.3	40	15	1,400	<0.88	340	<1	<1	<1	<0.77
12MW-21S	8/19/2004	<1.9	55	3J	<1.8	<32	288M	2.4J	<2.2	2.2J	<130	<130	1,900	<1.8	100	<2	<2.1	<2	<1.5
12MW-21S	2/1/2005	<2.9	21	<1.8	<1.7	<35	70	<2.2	<2	<2.3	<25	31J	2,000	<2	250	<2.1	<1.9	<2.8	<1.5
12MW-21S	5/24/2005	<12	24J	<7.3	7.2J	<140	279	<8.7	<7.9	<9.4	11	8.9	2,200	<8	310	<8.4	<7.6	<11	<5.8
12MW-21S	9/13/2005	<12	20J	<7.3	<6.8	<140	---	<8.7	<7.9	<9.4	<0.5	<0.5	43	<8		<8.4	<7.6	<11	<5.8
12MW-21S	1/31/2006	<0.83	12	1.8J	<0.82	43J	---	1.8J	<0.92	<0.72	2.7	2.1	1500J	1.7J	---	<0.64	<0.82	<0.74	<0.79
12MW-21S	6/22/2006	<0.19	13	1.5	<0.15	<7.7	---	2.2	<0.21	<0.19	6.3	7.4	730	<0.36	---	<0.16	<0.19	<0.3	<0.2
12MW-21S	9/11/2006	<1.9	20	<2.1	<1.4	<66	---	2.5J	<2	<3.4	0.81J	<0.5	640	<3	---	<1.6	<1.7	<1.9	<1.7
12MW-21SR	4/8/2003	---	---	---	---	---	455.4	---	---	---	96	23	95	---	460	---	---	---	---
12MW-21SR	7/15/2003	---	---	---	---	---	---	---	---	---	41	19	<250	---	---	---	---	---	---
12MW-21SR	9/15/2003	---	---	---	---	---	---	---	---	---	11	6.3	1,100	---	---	---	---	---	---
12MW-21SR	1/13/2004	---	---	---	---	---	---	---	---	---	16	13	4,100	---	360	---	---	---	---
12MW-21SR	4/27/2004	---	---	---	---	---	---	---	---	---	43	17	2,000	---	---	---	---	---	---

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-21SR	8/19/2004	<5.3	46	<6.8	<8.2	<130	---	<5.8	<5.9	<8	<130	<130	1,900	<8.5	---	<6.1	<6.7	<4.9	<2.1
12MW-21SR	2/1/2005	---	---	---	---	---	---	---	---	---	25J	33J	2,000	---	---	---	---	---	---
12MW-22D	4/9/2003	<0.16	3.1	<0.14	8	<3.2	388.9	0.41J	<0.16	29	1.5	3.4	1,800	0.44	190	<0.17	0.2J	0.21J	0.55
12MW-22D	7/14/2003	<0.41	2.2	<0.35	3.1	<7.9	106	0.93J	<0.4	9.6	5.2	8.6	1,900	0.67J	320	<0.43	0.55J	<0.31	0.58J
12MW-22D	9/17/2003	<0.41	0.96	<0.35	1.8	<7.9	311	0.86J	<0.4	6.6	<5	<5	5,700	<0.29	250	<0.43	100	<0.31	<0.26
12MW-22D	1/12/2004	<2.7	<3	<3.4	<4.1	<64	103	<2.9	<3	5.5J	<10	<10	16,000	<4.3		<3.1	140	<2.5	<1.1
12MW-22D	4/28/2004	<2.4	<2.5	<2.7	<2.3	<40	94.1	<2.3	<2.8	3.9J	<250	<250	4,400	<2.2	47	<2.6	130	<2.5	<1.9
12MW-22D	8/17/2004	<0.94	<0.98	<1.1	1.2J	<16	---	0.99J	<1.1	3.4	---	---	---	<0.88	---	<1	58	<1	<0.77
12MW-22D	5/25/2005	<1.2	<0.84	<0.73	<0.68	<14	51.4	1.4J	<0.79	1.3J	<500	<500	6,600	<0.8	80	<0.84	43	<1.1	<0.58
12MW-22D	6/21/2006	<0.19	<0.19	<0.19	<0.15	<7.7	---	1.3	<0.21	0.33J	<0.4	<0.5	5,500	<0.36	---	<0.16	1.2	<0.3	0.84
12MW-22S	4/10/2003	1,100	<300	<340	6,100	<6400	4.7	<290	<300	1,200J	1.4	1.4	40	1,800	4	790J	<340	15,000	<110
12MW-22S	7/17/2003	650	200J	<170	2,100	<3200	23.7	<150	<150	5,400	<5	11	400	<210	57	<150	<170	2,500	<53
12MW-22S	9/15/2003	<82	100J	<70	1,300	<1600	77.3	<57	<80	4,600	1.2	3.2	92	<58	100	<86	<72	420	<52
12MW-22S	1/14/2004	43	33	<6.8	550	<130	235	<5.8	<5.9	2,100	<10	<10	2,400	<8.5		<6.1	<6.7	13J	<2.1
12MW-22S	4/28/2004	11J	19	<4.2	630	<80	208	<3.6	<3.7	1,500	<500	<500	3,600	<5.3	100	<3.8	<4.2	63	4.5J
12MW-22S	8/17/2004	<24	27J	<27	1,000	<400	29.5	<23	<28	1,600	<500	<500	5,000	<22	20	<26	<26	<25	<19
12MW-22S	2/3/2005	<37	<26	<23	980	<440	0.604	<27	<25	1,200	<250	<250	4,400	38J	8.1	<26	<24	<36	<18
12MW-22S	5/24/2005	4.4J	21	1.8J	820	<35	0.616M	<2.2	<2	860	<250	<250	5,000	<2	11	<2.1	<1.9	58	5.7
12MW-22S	9/13/2005	<8.3	11J	<6.5	440	<280	---	<8.1	<9.2	460	<0.5	<0.5	7.1	17J		<6.4	<8.2	<7.4	61
12MW-22S	1/31/2006	<17	23J	<13	630	<560	---	<16	<18	480	250J	<250	4,500	<20	---	<13	<16	170	280
12MW-22S	6/20/2006	<7.5	11J	<7.7	390	<310	---	<7.8	<8.2	210	0.75J	<0.5	7,700	19J	---	<6.5	<7.6	82	170
12MW-22S	9/11/2006	<7.5	11J	<7.7	450	<310	---	<7.8	<8.2	200	<0.4	<0.5	2,700	<14	---	<6.5	<7.6	89	130
12MW-23D	4/8/2003	<0.16	<0.11	<0.14	0.72	<3.2	---	<0.11	<0.16	<0.22	<0.5	<0.5	9.6	<0.12	1.9	<0.17	<0.14	0.58	<0.1
12MW-23D	7/14/2003	<0.16	<0.11	<0.14	0.4J	<3.2	---	<0.11	<0.16	<0.22	<10	<10	120	<0.12	1.7	<0.17	<0.14	0.35J	<0.1
12MW-23D	9/17/2003	<0.16	<0.11	<0.14	0.22J	<3.2	---	<0.11	<0.16	<0.22	<5	<5	120	<0.12	<0.54	<0.17	0.26J	0.24J	<0.1
12MW-23D	1/12/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<10	<10	2,700	<0.43	2.2	<0.31	<0.34	<0.25	<0.11
12MW-23D	4/27/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<50	<50	680	<0.43	3.2	<0.31	<0.34	<0.25	<0.11
12MW-23D	8/18/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<200	<200	3,200	<0.43	2.8	<0.31	<0.34	<0.25	<0.11
12MW-23D	5/25/2005	<0.29	0.4J	<0.18	<0.17	<3.5	---	<0.22	<0.2	<0.23	<100	<100	1,700	<0.2	1.4J	<0.21	<0.19	<0.28	0.49J
12MW-23D	6/21/2006	<0.19	0.73J	<0.21	<0.14	<6.6	---	<0.21	<0.2	<0.34	<0.4	<0.5	1,700	<0.3	2	<0.16	<0.17	<0.19	1.8
12MW-23S	4/9/2003	<110	<120	<140	2,200	<2600	<1	<120	<120	370J	1.1	2	65	740	2.8	<120	<130	4,200	<42
12MW-23S	7/16/2003	<110	<120	<140	2,100	<2600	<0.07	<120	<120	450J	1.2	2.7	99	<170	<5	<120	<130	4,100	<42
12MW-23S	9/17/2003	<53	<60	<68	1,000	<1300	<0.07	<58	<59	280	<5	5.2	110	<85	<5	<61	<67	1,900	<21
12MW-23S	1/14/2004	<2.1	13	<2.7	390	<51	0.07	<2.3	<2.4	150	<10	<10	31	<3.4	---	14	<2.7	790	<0.85
12MW-23S	4/27/2004	<2.4	16	<2.7	450	<40	<0.07	<2.3	<2.8	150	<5	<5	89	<2.2	<5	19	<2.6	770	<1.9
12MW-23S	8/17/2004	<15	16J	<17	480	<250	0.072J	<14	<18	160	<20	<20	170	38J	1.8	21J	<17	760	<12
12MW-23S	2/1/2005	97	99	<15	690	<280	---	<17	<16	150	<5	<5	89	<16	---	38J	<15	690	<12
12MW-23S	2/3/2005	---	---	---	---	---	0.154	---	---	---	---	---	---	---	<5	---	---	---	---
12MW-23S	5/25/2005	290	420	<15	1,600	<280	0.068JM	<17	<16	260	<10	<10	240	<16	30	100	<15	1,100	13J
12MW-23S	9/12/2005	77	240	<16	950	<700	---	<20	<23	200	<0.5	<0.5	6.9	<25	---	50J	<21	660	<20
12MW-23S	1/30/2006	260	520	<16	1,900	<700	---	<20	<23	360	0.54J	<0.5	570	30J	---	180	<21	890	23J
12MW-23S	6/21/2006	230	700	<27	2,100	<820	---	<26	<25	490	0.57J	<0.5	720	<38	---	190	<21	830	34J
12MW-23S	9/12/2006	99J	500	<39	1,800	<1500	---	<39	<41	400	<0.4	<0.5	650	<72	---	100J	<38	670	39J
12MW-24D	4/7/2003	<1.3	<1.5	<1.7	<2.1	<32	---	<1.5	<1.5	<2	2.1	4.6	7,700	<2.1	420	<1.5	<1.7	<1.2	<0.53
12MW-24D	7/16/2003	<1.3	<1.5	<1.7	<2.1	<32	---	1.6J	<1.5	<2	0.96	2	1,600	<2.1	260	<1.5	<1.7	<1.2	<0.53

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-24D	9/16/2003	<0.66	<0.75	<0.85	<1	<16	---	1.3J	<0.74	<1	<5	<5	7,500	<1.1	160	<0.77	<0.84	<0.62	<0.27
12MW-24D	1/12/2004	<0.16	<0.11	<0.14	0.29J	<3.2	---	1.6	<0.16	<0.22	<10	<10	14,000	0.25J	280	<0.17	0.53	0.18J	<0.1
12MW-24D	4/27/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	1.8	<0.3	<0.4	<500	<500	4,900	<0.43	120	<0.31	6	<0.25	<0.11
12MW-24D	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	2	<0.3	<0.4	<500	<500	5,800	<0.43	180	<0.31	21	<0.25	<0.11
12MW-24S	4/7/2003	<2.7	<3	<3.4	28	<64	---	<2.9	<3	120	2	5.3	3,500	<4.3	450	<3.1	<3.4	52	<1.1
12MW-24S	7/16/2003	<1.3	<1.5	<1.7	17	<32	---	1.9J	<1.5	75	<500	<500	1,400	<2.1	310	<1.5	<1.7	69	1.4J
12MW-24S	9/16/2003	<0.82	<0.53	<0.7	10	<16	---	2.5	<0.8	47	<5	5.8	4,600	<0.58	370	<0.86	<0.72	37	1.5J
12MW-24S	1/13/2004	<0.82	<0.53	<0.7	22	<16	---	2.7	<0.8	38	<10	<10	11,000	<0.58	85	<0.86	1J	6.1	1.8
12MW-24S	4/27/2004	<0.94	<0.98	<1.1	5.7	<16	---	2.8J	<1.1	54	<5	<5	4,300	<0.88	52	<1	1.1J	1.5J	<0.77
12MW-24S	8/18/2004	<1.3	<1.5	<1.7	5.8J	<32	---	2.7J	<1.5	58	<500	<500	8,700	<2.1	32	<1.5	<1.7	<1.2	<0.53
12MW-24S	2/1/2005	<1.5	<1	<0.91	5.7	<17	---	2.5J	<0.99	60	<250	<250	8,700	<1	27	<1	<0.95	<1.4	1.2J
12MW-24S	5/25/2005	<1.5	1.4J	<0.91	2.8J	30J	---	2.6J	<0.99	40	<500	<500	7,100	<1	29	<1	<0.95	<1.4	11
12MW-24S	9/12/2005	<0.42	13	1.4	1.3J	58	---	2.3	<0.46	18	1.7	7.5	6,000	0.53J	13	<0.32	0.48J	<0.37	17
12MW-24S	1/30/2006	<0.42	2.1	1.1J	0.68J	56	---	1.7	<0.46	7.8	<250	<250	7,800	0.61J	---	<0.32	<0.41	<0.37	12
12MW-24S	6/21/2006	<0.19	0.97	1.6	0.32J	72	---	2	<0.2	5.1	0.52J	0.91J	8,900	<0.3	15	<0.16	0.47J	<0.19	14
12MW-24S	9/11/2006	<0.19	0.36J	0.71J	0.31J	33	---	2	<0.2	4.2	2.3	0.65J	5,800	<0.3	---	<0.16	0.48J	<0.19	8.7
12MW-25D	4/8/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<0.5	<0.5	22	<0.43	1.7J	<0.31	<0.34	0.46J	<0.11
12MW-25D	7/15/2003	<0.27	<0.3	<0.34	1.1J	<6.4	---	<0.29	<0.3	<0.4	<10	<10	180	<0.43	11	<0.31	<0.34	0.76J	<0.11
12MW-25D	9/16/2003	<0.16	0.18J	<0.14	1.3	<3.2	---	0.13J	<0.16	0.35J	<5	<5	920	<0.12	57	<0.17	<0.14	0.83	<0.1
12MW-25D	1/12/2004	<0.27	<0.3	<0.34	1.1J	<6.4	---	<0.29	<0.3	0.59J	<10	<10	2,900	<0.43	87	<0.31	<0.34	<0.25	<0.11
12MW-25D	4/28/2004	<0.19	0.44J	<0.22	1.6	<3.2	---	0.51J	<0.22	0.33J	<500	<500	4,900	0.55J	200	<0.2	0.45J	0.51J	<0.15
12MW-25D	8/16/2004	<0.27	<0.3	<0.34	1J	<6.4	---	<0.29	<0.3	0.48J	<500	<500	6,000	<0.43		<0.31	2.6	<0.25	<0.11
12MW-25D	5/23/2005	<0.29	<0.21	<0.18	1.3	<3.5	---	0.64J	<0.2	0.33J	<250	<250	6,300	0.24J	100	<0.21	58	0.29J	0.29J
12MW-25D	6/21/2006	<0.19	<0.19	<0.19	0.26J	<7.7	---	0.62J	<0.21	0.31J	<0.4	<0.5	5,900	<0.36	7	<0.16	0.61J	<0.3	0.54J
12MW-25S	4/9/2003	<1.3	<1.5	<1.7	25	<32	<1	<1.5	<1.5	24	<0.5	<0.5	21	<2.1	1.2J	<1.5	<1.7	63	<0.53
12MW-25S	7/15/2003	<1.3	<1.5	<1.7	43	<32	<0.07	<1.5	<1.5	36	<5	<5	30	<2.1	<5	<1.5	<1.7	100	0.56J
12MW-25S	9/17/2003	<1.3	<1.5	<1.7	33	<32	4.72	<1.5	<1.5	48	<10	<10	180	<2.1	<5	<1.5	<1.7	58	<0.53
12MW-25S	1/13/2004	<0.82	0.73J	<0.7	25	<16	15.6	<0.57	<0.8	64	<10	<10	1,700	<0.58		<0.86	11	13	<0.52
12MW-25S	4/27/2004	<1.3	<1.5	<1.7	23	<32	11.5	<1.5	<1.5	67	<10	<10	3,500	<2.1	15	<1.5	37	5.6	<0.53
12MW-25S	8/18/2004	<0.94	<0.98	<1.1	23	<16	<0.067	<0.9	<1.1	69	<500	<500	6,500	<0.88	13	<1	41	6.5	<0.77
12MW-25S	2/1/2005	<1.5	<1	<0.91	25	<17	---	<1.1	<0.99	83	<250	<250	6,400	<1	6.8	<1	34	1.4J	1.1J
12MW-25S	5/23/2005	<2.7	<3	<3.4	20	<64	---	<2.9	<3	87	<250	<250	4,700	<4.3	9.9	<3.1	15	4.6J	1.2J
12MW-25S	9/12/2005	<2.1	<1.7	<1.6	16	<70	---	<2	<2.3	78	<0.5	<0.5	6,100	<2.5	5.7	<1.6	3.9J	2.4J	9.7
12MW-25S	1/30/2006	<2.1	<1.7	<1.6	11	<70	---	<2	<2.3	62	<250	<250	6,800	4J	---	<1.6	2.2J	<1.9	28
12MW-25S	6/21/2006	<0.94	<1	<1.1	9	<33	---	<1	<1	53	<0.4	<0.5	5,100	<1.5	6.3	<0.81	2J	1.8J	39
12MW-25S	9/11/2006	<0.94	<1	<1.1	6	<33	---	<1	<1	41	<0.4	<0.5	4,300	<1.5	---	<0.81	2.2J	2J	51
12MW-26S	4/8/2003	<0.16	4.6	0.6	150	<3.2	<1	<0.11	<0.16	0.35J	<0.5	<0.5	79	<0.12	3.1	<0.17	<0.14	0.25J	0.41
12MW-26S	7/16/2003	<0.66	4.3	<0.85	140	<16	25	<0.73	<0.74	<1	<130	<130	930	<1.1	51	<0.77	31	<0.62	0.45J
12MW-26S	9/17/2003	<3.3	<3.7	<4.2	140	<80	---	<3.6	<3.7	<5	<5	<5	140	<5.3	---	<3.8	42	<3.1	<1.3
12MW-26S	1/13/2004	<3.3	7J	<4.2	230	<80	2.83	<3.6	<3.7	12J	<10	<10	3,700	<5.3	---	<3.8	13J	32	<1.3
12MW-26S	4/27/2004	47	46	<6.8	900	<130	---	<5.8	<5.9	62	<100	<100	1,200	<8.5	---	18J	<6.7	590	<2.1
12MW-26S	8/18/2004	780	390	<6.8	2,600	<130	1.1M	<5.8	<5.9	160	<250	<250	3,500	<8.5	2.8	320	<6.7	1,000	9.8
12MW-26S	2/2/2005	2,300	1,700	<46	7,000	<870	---	<55	<50	440	<25	<25	1,300	<50	---	1,100	<48	1,600	73J
12MW-26S	5/25/2005	2,500	2,200	<91	7,300	<1700	---	<110	<99	650	---	---	---	<100	---	1,500	<95	1,700	130J
12MW-26S	9/28/2005	1,600	2,000	<82	5,800	<3500	---	<100	<120	810	---	---	---	<120	---	1,300	<100	1,200	140J

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c* DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-26S	1/31/2006	2,100	3,800	75	8,400	2,000	---	<17	<16	1,500	---	---	---	29J	---	2,100	<15	2,000	280
12MW-26S	7/5/2006	1,300	2,700	<97	5,900	<3900	---	<98	<100	1,300	---	---	---	<180	---	1,600	<96	1,500	180J
12MW-26S	9/12/2006	380	930	<42	1,900	<1300	---	<41	<40	510	---	---		<61	---	420	<34	520	130
12MW-27D	4/8/2003	<0.16	0.15J	<0.14	0.49J	<3.2	---	<0.11	<0.16	<0.22	<0.5	<0.5	8.2	<0.12	3.7	<0.17	<0.14	0.28J	<0.1
12MW-27D	7/15/2003	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<5	<5	22	<0.43	2	<0.31	<0.34	<0.25	<0.11
12MW-27D	9/16/2003	<0.23	<0.22	<0.2	<0.26	<3.4	---	<0.23	<0.21	<0.22	<0.5	<0.5	11	<0.24	---	<0.18	<0.23	<0.22	<0.18
12MW-27D	1/12/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	<10	<10	<10	<0.43	2.5	<0.31	<0.34	<0.25	<0.11
12MW-27D	4/28/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	<1	<1	16	<0.18	3.9	<0.2	<0.21	<0.2	<0.15
12MW-27D	8/18/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	9.6	<1.3	71	<0.18	4.3	<0.2	<0.21	<0.2	<0.15
12MW-27D	5/23/2005	<0.29	<0.21	<0.18	<0.17	<3.5	---	<0.22	<0.2	<0.23	<130	<130	3,700	<0.2	5.9	<0.21	<0.19	<0.28	<0.15
12MW-27D	6/21/2006	<0.19	<0.21	<0.21	0.18J	<6.6	---	<0.21	<0.2	<0.34	<0.4	<0.5	4,100	<0.3	3.5	<0.16	<0.17	<0.19	0.2J
12MW-27S	4/9/2003	<1.3	110	<1.7	290	53J	---	<1.5	<1.5	8.8	<0.5	<0.5	110	<2.1	2.4	<1.5	<1.7	18	4.6
12MW-27S	7/16/2003	<6.6	94	<8.5	400	<160	---	<7.3	<7.4	16J	<25	<25	190	<11	3.3	<7.7	<8.4	45	5.8J
12MW-27S	9/16/2003	<5.7	74	<5	380	<85	---	<5.6	<5.3	<5.4	<5	<5	180	<5.9	3.3	<4.5	<5.9	42	<4.4
12MW-27S	1/14/2004	<0.41	100	1.2	340	56	---	<0.28	<0.4	11	<10	<10	110	<0.29	2.6	<0.43	<0.36	25	4.5
12MW-27S	4/27/2004	<0.47	98	1.1J	380	55	---	<0.45	<0.55	14	<5	<5	140	<0.44	3.2	<0.51	<0.52	36	3.1
12MW-27S	8/18/2004	<0.66	120	1.3J	500	65	---	<0.73	<0.74	14	<50	<50	610	<1.1	3.7	<0.77	<0.84	36	6.1
12MW-27S	2/3/2005	<7.3	65	<4.6	330	<87	---	<5.5	<5	13J	---	---	---	<5	---	<5.2	<4.8	34	3.8J
12MW-27S	5/23/2005	<7.3	61	<4.6	380	<87	---	<5.5	<5	16J	<50	<50	1,100	<5	5	<5.2	12J	34	5.4J
12MW-27S	9/13/2005	<4.2	40	<3.3	240	<140	---	<4	<4.6	15	<0.5	<0.5	750	6.6J	3.8	<3.2	<4.1	25	<3.9
12MW-27S	1/31/2006	<5.2	53	<4.1	200	<170	---	<5.1	<5.8	13J	<0.5	<0.5	1,000	<6.2	---	<4	<5.2	17	<4.9
12MW-27S	6/21/2006	<3.7	50	<4.2	200	<130	---	<4.1	<4	16J	<0.4	<0.5	470	<6.1	5.1	<3.2	<3.4	18	4.3J
12MW-27S	9/12/2006	<3.7	54	<3.9	240	<150	---	<3.9	<4.1	18	<0.4	<0.5	530	<7.2	---	<3.2	<3.8	22	5.5J
12MW-28D	4/8/2003	<0.16	1.7	<0.14	4.2	<3.2	---	<0.11	<0.16	2.3	<0.5	<0.5	9.1	<0.12	1.7J	3.1	<0.14	7.6	<0.1
12MW-28D	7/15/2003	<0.66	7.5	<0.85	14	<16	---	<0.73	<0.74	9.7	<1	<1	13	<1.1	1.1J	10	<0.84	26	0.59J
12MW-28D	9/17/2003	<0.16	6.1	<0.14	12	<3.2	---	<0.11	<0.16	12	<5	<5	92	<0.12	2	6.7	<0.14	16	0.65
12MW-28D	1/12/2004	<0.27	8.6	<0.34	2.7	<6.4	---	<0.29	<0.3	20	<10	<10	430	<0.43	13	0.58J	<0.34	2.9	23
12MW-28D	4/26/2004	<0.66	5.7	<0.85	<1	<16	---	<0.73	<0.74	<1	<2.5	<2.5	1,100	<1.1	7.2	<0.77	<0.84	<0.62	40
12MW-28D	8/17/2004	<0.75	8.5	<0.86	<0.73	<13	---	<0.72	<0.88	<0.58	<500	<500	3,800	0.76J	3	<0.82	<0.84	<0.8	43
12MW-28D	5/25/2005	<1.2	6.9	<0.73	<0.68	<14	0.076	<0.87	<0.79	<0.94	<250	<250	5,700	<0.8	44	<0.84	<0.76	<1.1	55
12MW-28D	6/22/2006	<0.94	3.4J	<0.97	<0.76	<39	---	<0.98	<1	<0.95	<0.4	0.5J	3,800	<1.8	---	<0.81	<0.96	<1.5	59
12MW-28S	4/9/2003	3,700	1,300J	<680	20,000	<13000	<1	<580	<590	5,300	3.6	6.7	63	<850	5.2	5,300	<670	17,000	350J
12MW-28S	7/17/2003	3,300	1,300	<280	15,000	<6300	0.087	<230	<320	4,500	12	15	1,100	<230	<5	5,600	<290	15,000	<210
12MW-28S	9/15/2003	3,900	1,600	<280	16,000	<6300	0.077	<230	<320	5,300	6.6	6.5	520	<230	<5	5,600	<290	15,000	<210
12MW-28S	1/14/2004	3,200	1,400	<34	12,000	<640	0.084	<29	<30	5,400	12	<10	280	<43	---	5,100	<34	12,000	280
12MW-28S	4/28/2004	3,100	1,600	<42	11,000	<800	<0.07	<36	<37	5,300	<25	<25	310	<53	<5	5,500	<42	12,000	290
12MW-28S	8/17/2004	3,000	1,700	<27	14,000	<400	<0.067	<23	<28	5,300	<25	<25	370	<22	2.5	5,200	<26	12,000	380
12MW-28S	2/2/2005	2,990	2,090	20	10,400	200	0.111	<1	<25	4,410	16J	19J	310	<25	<5	4,750	12.2	13,000	<200
12MW-28S	5/24/2005	4,800	3,500	<420	15,000	<8000	<0.07M	<360	<370	6,000	16	7J	310	<530	7.5	7,900	<420	16,000	440J
12MW-28S	9/13/2005	3,800	3,300	31J	17,000	<440	---	<27	<25	5,200	19	10	410	<25	---	7,200	<24	16,000	340
12MW-28S	1/31/2006	3,500	3,900	39J	15,000	<440	---	<27	<25	5,300	16	5.7	490	41J	---	8,600	<24	16,000	330
12MW-28S	6/20/2006	4,100	5,100	<240	20,000	140	---	<250	<260	4,800	25	7.9	720	520J	3.8	8,600	<240	17,000	430J
12MW-28S	9/12/2006	3,800	5,900	<240	20,000	<9600	---	<250	<260	4,000	9.6	3.4	610	<450	---	5,900	<240	12,000	370J
12MW-28SR	4/9/2003	3,100	1,100J	<680	18,000	<13000	---	<580	<590	4,800	3.6	6.5	77	<850	4.7	4,900	<670	16,000	290J
12MW-28SR	7/17/2003	3,200	1,200	<280	14,000	<6300	---	<230	<320	4,400	12	15	1,200	<230	---	5,200	<290	14,000	<210

Appendix 3. Concentrations of organic compounds measured in ground water and surface water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[R, replicate sample; all concentrations are in micrograms per liter except for acetate and total organic carbon, which are in milligrams per liter; <, less than; ---, data not measured; J, estimated; *, replicate sample analyzed at General Engineering Laboratory; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; CF, chloroform; cDCE, cis-1,2-dichloroethene; Meth, methane; MC, methylene chloride; TOC, total organic carbon; PCE, tetrachloroethene;TCE, trichloroethene; VC, vinyl chloride]

Site identification	Sample date	111TCA	11DCA	12DCA	11DCE	1,4-Dioxane	Acetate	Benzene	CF	*c*DCE	Ethane	Ethene	Meth	MC	TOC	PCE	Toluene	TCE	VC
12MW-28SR	9/15/2003	3,900	1,600	<280	16,000	<6300	---	<230	<320	5,600	7.1	6.7	310	<230	---	5,500	<290	15,000	<210
12MW-28SR	1/14/2004	3,000	1,500	<340	11,000	<6400	---	<290	<300	5,100	<10	<10	280	<430	---	4,700	<340	12,000	<110
12MW-28SR	4/28/2004	2,800	1,500	<340	10,000	<6400	---	<290	<300	4,700	<25	<25	340	<430	---	5,200	<340	12,000	300J
12MW-28SR	8/17/2004	3,100	2,000	<220	14,000	<3200	---	<180	<220	5,100	<25	<25	360	<180	---	5,500	<210	13,000	360J
12MW-28SR	2/2/2005	3,400	2,200	<230	13,000	<4400	---	<270	<250	5,500	17J	18J	330	690J	---	7,400	<240	14,000	420J
12MW-28SR	5/24/2005	4,600	3,400	<420	15,000	<8000	0.053JM	<360	<370	5,900	17	6.2J	310	<530	8.6	7,800	<420	16,000	410J
12MW-28SR	9/13/2005	3,600	3,100	<230	16,000	<4400	---	<270	<250	4,900	<0.5	<0.5	1.5	<250	---	6,800	<240	15,000	380J
12MW-28SR	1/31/2006	3,600	4,000	<230	15,000	<4400	---	<270	<250	5,300	16	5.8	540	<250	---	8,500	<240	16,000	400J
12MW-28SR	6/20/2006	4,200	5,100	<240	20,000	160	---	<250	<260	4,800	28	9	570	570J	3.4	8,500	<240	18,000	420J
12MW-28SR	9/12/2006	4,100	6,300	<270	19,000	<8200	---	<260	<250	4,100	7.4	2.4	720	<380	---	6,300	<210	14,000	380J
12MW-29S	8/17/2004	19J	<9.8	<11	570	<160	<0.067	<9	<11	150	<5	<5	54	<8.8	1.3	24J	<10	4,400	12J
12MW-29S	2/2/2005	36J	8.9J	<7.3	1,900	<140	---	<8.7	<7.9	260	<2	<2	40	130J	<0.54	170	<7.6	5,800	12J
12MW-29S	5/24/2005	<150	<100	<91	2,200	<1700	---	<110	<99	460	<2.5	<2.5	43	<100	1.8	600	<95	5,300	<73
12MW-29S	9/13/2005	24J	<10	<9.1	1,700	<170	---	<11	<9.9	720	<0.5	<0.5	60	<10	1.8	790	<9.5	4,700	44
12MW-29S	1/31/2006	<150	<100	<91	1,200	<1700	---	<110	<99	660	<0.5	<0.5	33	<100	---	740	<95	3,700	<73
12MW-29S	6/20/2006	<47	<48	<48	1,100	<1900	---	<49	<52	590	<0.4	<0.5	60J	120J	2	380	<48	3,000	<49
12MW-29S	9/11/2006	<47	<48	<48	1,200	<1900	---	<49	<52	520	<0.4	6.4	41	<90	---	250	<48	2,800	<49
12MW-29SR	8/17/2004	<130	<150	<170	560J	<3200	<0.067	<150	<150	<200	<5	<5	60	<210	1.3	<150	<170	4,900	<53
12MW-29SR	8/17/2004	4.35	3.93	0.755J	429	<25	---	<0.33	<0.36	134	---	---	---	4.20J	---	17.3	0.409J	3,900	2.6
12MW-29SR	5/24/2005	<150	<100	<91	2,300	<1700	---	<110	<99	480	<2.5	<2.5	43	<100	5.2	620	<95	5,500	<73
12MW-29SR	9/13/2005	<100	<87	<82	1,600	<3500	---	<100	<120	640	<0.5	<0.5	24	200J	1.8	660	<100	4,500	<99
12MW-29SR	1/31/2006	<0.29	<0.21	<0.18	1,200	<3.5	---	<0.22	<0.2	540	<0.5	<0.5	27	<0.2	---	690	<0.19	3,300	<0.15
12MW-29SR	6/20/2006	<19	<19	<19	1,100	<770	---	<20	<21	620	<0.4	<0.5	40	<36	1.2J	440	<19	3,100	41J
12MW-29SR	9/11/2006	<47	<48	<48	1,100	<1900	---	<49	<52	510	<0.4	<0.5	34	<90	---	220	<48	2,700	<49
12MW-30S	8/18/2004	18J	<9.8	<11	440	<160	<0.067	<9	<11	110	<5	<5	52	<8.8	1.6	53	<10	3,800	<7.7
12MW-30S	5/24/2005	<120	<84	<73	1,200	<1400	---	<87	<79	270J	<1	<1	27	<80	3.3	200J	<76	2,600	<58
12MW-30S	9/13/2005	14J	5.8J	<4.6	1,200	<87	---	<5.5	<5	330	<0.5	<0.5	33	<5	2.1	350	<4.8	3,000	24
12MW-30SR	8/18/2004	<94	<98	<110	470	<1600	0.078J	<90	<110	100J	<5	<5	47	<88	1.5	<100	<100	3,700	<77
12PZ-03D	8/19/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	<20	<20	180	<0.18	---	<0.2	<0.21	<0.2	<0.15
12PZ-03D	2/1/2005	<0.29	<0.21	<0.18	<0.17	<3.5	---	<0.22	<0.2	<0.23	---	---	---	<0.2	---	<0.21	<0.19	<0.28	<0.15
12PZ-03D	5/23/2005	<0.29	<0.21	<0.18	<0.17	<3.5	---	<0.22	<0.2	<0.23	---	---	---	<0.2	---	<0.21	<0.19	<0.28	<0.15
12PZ-03D	1/31/2006	<0.21	<0.17	<0.16	<0.2	<7	---	<0.2	<0.23	<0.18	---	---	---	<0.25	---	<0.16	<0.21	<0.19	<0.2
12PZ-03D	6/22/2006	<0.19	<0.21	<0.21	<0.14	<6.6	---	<0.21	<0.2	<0.34	---	---	---	<0.3	---	<0.16	<0.17	<0.19	<0.17
12PZ-03S	8/19/2004	<0.19	<0.2	<0.22	<0.18	<3.2	---	<0.18	<0.22	<0.15	---	---	---	<0.18	---	<0.2	<0.21	<0.2	<0.15
East Marsh Site 1	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11
East Marsh Site 2	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11
East Marsh Site 3	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11
North Marsh Site 1	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	0.44J	<0.25	<0.11
North Marsh Site 2	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11
North Marsh Site 3	8/16/2004	<0.27	<0.3	<0.34	<0.41	<6.4	---	<0.29	<0.3	<0.4	---	---	---	<0.43	---	<0.31	<0.34	<0.25	<0.11

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006.

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-01S	1/30/2006	---	---	---	---	---	---	-0.05	---	---	2.5	4.94	---	---	95	---	---	18.29	---
12MW-02D	8/30/2000	---	---	---	28	---	---	1.5	---	78	0.1	6.93	---	---	841	1.7	<0.05	22.11	---
12MW-02D	11/29/2000	175	---	42	22	180	---	1.5	8.5	110	0.5	7.21	5.3	130	1,101	5.4	<0.05	20.38	---
12MW-02D	2/27/2001	175	---	35	20	130	---	0.3	5.6	45	1.5	6.93	5.2	150	951	<5	<0.05	20.21	---
12MW-02D	5/15/2001	150	---	50	15	190	---	1	10	140	0.77	6.97	5.7	150	1,157	<10	<0.05	20.85	---
12MW-02D	8/29/2001	200	---	39	25	170	---	0.15	7.7	96	0.25	6.91	4.6	140	1,057	<5	<0.05	22.84	---
12MW-02D	12/3/2001	200	<4	46	18	200	---	2.5	9	110	0.2	7.19	4.5	140	1,192	<10	<0.05	20.19	---
12MW-02D	2/27/2002	150	<2	43	13.5	190	---	0.4	8.6	73	0.8	7.13	5.2	170	1,030	<5	<0.05	14.37	---
12MW-02D	6/10/2002	225	0.74	45	19	210	---	1	9.3	110	0.3	6.96	6	170	1,210	<10	<0.05	23.12	---
12MW-02D	9/9/2002	178	<2	45	23	95	---	0.35	5.3	41	0.7	6.9	2.5	93	783	11	<0.05	24.84	---
12MW-02D	1/8/2003	200	<1.6	33	23	130	0.2	0.85	6	75	0.5	6.89	4.5	150	978	4.3	<0.05	19.79	---
12MW-02D	4/9/2003	210	<1.6	32	24	110	---	<0.05	5.1	50	0.25	7.07	4	130	820	6	<0.05	18.32	---
12MW-02D	7/16/2003	225	<1	40	28	180	---	<0.05	8	100	0.2	6.96	<0.48	150	1,051	5.3	0.8	23.39	---
12MW-02D	8/16/2004	200	---	---	18	120	---	0.2	---	---	0.5	5.53	---	---	1,111	2.8J	<0.05	21.97	19.2
12MW-02D	5/23/2005	175	---	33	20	140	---	1	6.6	79	0.2	7.02	4.8	150	908	2.5J	<0.05	21.9	2.4
12MW-02D	6/20/2006	185	---	---	23	120	---	0.6	---	---	0.2	7.04	---	---	821	3	-0.05	22.56	---
12MW-02S	8/30/2000	---	---	---	250	---	---	0.5	---	<15	0.5	4.81	---	---	80.6	9.1	<0.05	24.11	---
12MW-02S	11/29/2000	<50	---	0.76	70	9.9	---	<0.05	0.49	7.4	0.7	5.1	<0.41	13	76	14	<0.05	21	---
12MW-02S	2/27/2001	<10	---	0.76	100	11	---	0.1	0.47	6.4	0.9	4.89	<0.54	12	77	12	<0.05	18.46	---
12MW-02S	5/15/2001	110	---	0.72	95	10	---	<0.05	0.48	5.8	1.6	4.97	<0.54	11	87.4	11	<0.05	22.2	---
12MW-02S	8/29/2001	<10	---	0.39	85	<5	---	0.1	0.38	3.9	0.5	4.83	<0.54	7.6	50	8.5	<0.05	23.89	---
12MW-02S	12/3/2001	<10	<0.2	0.51	60	9.1	0.3	0.1	0.39	3.6	0.9	4.78	<0.54	11	63.6	12	<0.05	20.68	---
12MW-02S	2/27/2002	<10	<0.2	0.39	24	5.2	---	<0.05	0.47	4.3	2.5	4.93	<0.54	9.9	49	10	<0.05	13.77	---
12MW-02S	6/10/2002	<10	<0.5	<0.3	80	8	0.82	0.1	0.38	3.2	0.25	4.61	<0.39	11	54	11	<0.05	23.15	---
12MW-02S	9/9/2002	<10	<0.2	0.48	70	8.1	---	0.1	0.62	6.5	0.88	4.8	<0.39	11	61.8	9.9	<0.05	24.92	---
12MW-02S	1/8/2003	<10	<0.2	0.57	35	14	0.1	0.05	0.59	6.9	1	5.11	0.51J	15	77.8	15	<0.05	18.32	---
12MW-02S	4/9/2003	<10	<0.2	0.95	50	15	4.7	0.4	0.79	27	0.3	4.73	<0.48	19	99.5	14	<0.05	16.87	---
12MW-02S	7/15/2003	<10	<0.2	0.65	80	13	2.9	0.3	0.49	6.5	0.15	4.99	<0.48	12	77	11	<0.05	24	---
12MW-02S	9/17/2003	<10	---	0.6	160	15	14	0.5	0.48	4.4	0.15	4.95	<0.48	14	78.8	10	<0.05	25.1	8.3
12MW-02S	1/14/2004	<10	---	0.49	100	13	---	<0.05	0.44	4	1.5	5.12	<0.48	8.9	67.6	8.9	<0.05	18.64	7
12MW-02S	4/28/2004	<10	---	1.4	125	28	---	0.1	1.1	9.2	0.15	4.78	<0.53	19	87.9	13	<0.05	18.05	212
12MW-02S	8/16/2004	<10	---	<0.15	70	4.7	---	<0.05	0.3	1.8J	1.5	4.81	<0.53	8.1	54.5	9	---	24.42	3.4
12MW-02S	2/2/2005	<10	---	0.17J	50	4.4	---	0.1	0.44	---	2	5.18	0.57J	9.2	68.7	9.8	<0.05	16.76	23.3
12MW-02S	5/23/2005	<10	---	0.22J	50	4	---	<0.05	0.3	2.2	2	4.87	<0.36	8.7	50.2	10	<0.05	21.37	3.3
12MW-02S	9/12/2005	<10	---	0.18J	120	5.1	---	<0.05	0.32	1.9J	0.25	4.7	<0.36	9.6	53.9	11	<0.05	24.65	---
12MW-02S	1/30/2006	---	---	---	---	8.6	---	-0.05	---	---	0.7	4.88	---	---	74	10	---	19.3	---
12MW-02S	6/20/2006	-10	---	---	95	5	---	-0.05	---	---	3	4.84	---	---	54	11	-0.05	23.63	---
12MW-02S	9/11/2006	<10	---	---	120	7.6	---	<0.05	---	---	2	4.4	---	---	56	9	<0.05	25.17	---
12MW-03D	8/30/2000	---	---	---	21	---	---	1.5	---	84	0.15	7.04	---	---	748	<1	<0.05	24	---
12MW-03D	11/30/2000	225	---	33	13	110	---	1.5	6.5	80	0.6	7.1	5.2	---	714	<5	<0.05	17.9	---
12MW-03D	2/27/2001	150	---	30	18	97	---	0.5	6	70	0.6	6.98	4.7	110	682	<5	<0.05	19.29	---
12MW-03D	5/15/2001	155	---	34	18	110	---	0.5	6.7	120	0.9	7.03	4.9	100	736	<5	<0.05	22.04	---
12MW-03D	8/29/2001	170	---	39	15	120	---	1	7.6	89	0.15	7.03	5.2	100	816	<5	<0.05	22.72	---
12MW-03D	12/4/2001	175	<2	43	17	150	0.2	1.5	8.8	100	0.15	7.22	6.1	110	963	<5	0.15	21.52	---
12MW-03D	2/27/2002	200	<1	33	10	110	---	0.8	7	72	0.8	7.22	5.5	110	768	2.6	<0.05	17.76	---
12MW-03D	6/11/2002	250	0.62	40	16	140	0.15	1	7.8	94	0.25	7	6.1	120	899	<5	<0.05	23.21	---
12MW-03D	9/10/2002	200	<1	29	19	110	---	1.5	6.3	77	0.05	7.08	5.1	100	748	<2.5	<0.05	23.71	---
12MW-03D	1/9/2003	200	<0.8	26	20	76	0.1	0.1	5.1	46	0.8	7	4.7	100	627	2.7	<0.05	18.6	---
12MW-03D	4/9/2003	160	<0.6	27	15.5	61	---	0.15	5.2	83	0.25	7.08	4.4	98	612	3	<0.05	18.5	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-03D	7/15/2003	150	<0.5	28	22	81	---	0.6	5.6	100	0.1	6.99	4.2	92	659	2.5J	<0.05	22.18	---
12MW-03D	8/16/2004	150	---	---	14	57	---	1	---	---	0.1	6.95	---	---	608	3.2	<0.05	22.65	0
12MW-03D	5/25/2005	50	---	33	13	110	---	0.2	6.6	76	0.2	7.67	5.1	110	742	3.4	<0.05	20.5	0
12MW-03D	6/21/2006	140	---	---	19	110	---	0.2	---	---	0.1	7.09	---	---	749	2.1J	-0.05	23.69	---
12MW-03S	8/30/2000	---	---	---	250	---	---	7	---	<15	0.05	5.34	---	---	331	4.7	<0.05	25.52	---
12MW-03S	11/30/2000	<50	---	4.9	60	110	---	15	3.7	30	0.3	5.3	0.67J	---	416	5.3	<0.05	17.4	---
12MW-03S	2/27/2001	<10	---	1.2	145	62	---	2	2	7	0.4	4.43	<0.54	37	241	5.4	<0.05	17.27	---
12MW-03S	5/15/2001	<10	---	17	250	210	---	16	12	100	0.2	4.83	0.9J	87	733	<10	<0.05	26.57	---
12MW-03S	8/29/2001	<10	---	28	250	260	---	17.5	16	150	---	4.71	1.4J	95	880	<10	<0.05	24	---
12MW-03S	12/5/2001	<10	<5	40	325	400	1.6	32.5	25	220	<0.025	4.7	2.3	130	1,305	<13	<0.05	22.49	---
12MW-03S	2/27/2002	<10	<1	2.1	160	110	---	3	4	18	<0.025	4.39	<0.54	55	372	3.8	<0.05	16.87	---
12MW-03S	6/11/2002	<10	0.98	24	250	230	33.06	14	14	130	<0.025	4.84	1.8	95	822	<10	<0.05	23.05	---
12MW-03S	9/10/2002	<10	<1	8.3	225	160	7.05	6	6.4	57	0.075	4.45	0.66J	64	367	3.1	<0.05	25.93	---
12MW-03S	1/9/2003	<10	<1.6	2.3	190	130	0.2	5.4	3.1	16	0.15	4.18	0.44J	51	311	<4	<0.05	17.45	---
12MW-03S	4/10/2003	38	<2	9.8	60	170	25	37.5	6.9	56	0.1	5.24	0.7J	62	590	<5	0.15	16.43	---
12MW-03S	7/17/2003	<10	<0.5	2.5	160	93	3.6	9	2.7	16	<0.025	4.87	<0.48	39	213	3.2	0.25	23.36	---
12MW-03S	9/16/2003	<10	---	2.6	160	80	3	5	2.5	17	0.23	4.95	<0.48	39	198	3.8	0.05	24.46	29.4
12MW-03S	1/14/2004	<10	---	1	140	62	4	1	2	8.3	0.2	4.39	<0.48	28	234	8	<0.05	19.16	4.9
12MW-03S	4/27/2004	<10	---	8.6	180	110	71	10	5.7	49	<0.025	5.08	1.2J	43	385	6.7	<0.05	18.12	---
12MW-03S	8/18/2004	<10	---	0.38	170	33	1.2	3.7	1.2	4.7	0.075	4.62	<0.53	26	143.9	13	0.05	25.48	11.2
12MW-03S	2/2/2005	<10	---	2.4	120	44	1.6	4	2.1	---	0.05	4.9	<0.53	29	198	13	<0.05	19.12	0
12MW-03S	5/24/2005	<10	---	0.3	145	27	1.6	1.8	0.74	2.8	0.1	4.95	<0.36	22	162	19	---	20.61	7.7
12MW-03S	9/13/2005	<10	---	0.46	35	19	---	2	0.65	2.7	0.2	5.23	<0.36	19	138.8	18	<0.05	24.17	8.9
12MW-03S	1/31/2006	---	---	---	---	21	---	0.35	---	---	0.15	4.81	---	---	149	18	---	19.45	5.1
12MW-03S	6/21/2006	-10	---	---	110	13	---	0.9	---	---	0.1	5.02	---	---	123	23	-0.05	23.39	---
12MW-03S	9/12/2006	<10	---	---	45	11	---	0.1	---	---	0.2	4.68	---	---	112	23	<0.05	23.02	---
12MW-03SR	8/30/2000	---	---	---	---	---	---	---	---	<15	---	---	---	---	---	4.7	---	---	---
12MW-03SR	2/27/2001	---	---	0.5	---	59	---	---	1.7	6.8	---	---	<0.54	38	---	5.3	---	---	---
12MW-03SR	8/29/2001	---	---	28	---	270	---	---	16	150	---	---	1.3J	93	---	<10	---	---	---
12MW-03SR	12/5/2001	---	<5	40	---	410	---	---	25	220	---	---	2.3	120	---	<13	---	---	---
12MW-03SR	2/27/2002	---	<1	2.1	---	110	---	---	4	17	---	---	<0.54	54	---	5.2	---	---	---
12MW-03SR	6/11/2002	---	0.77	23	---	200	---	---	14	130	---	---	1.8	92	---	<10	---	---	---
12MW-03SR	9/10/2002	---	<1	8.6	---	170	---	---	6.6	62	---	---	0.79J	63	---	2.9	---	---	---
12MW-03SR	1/9/2003	---	<1.6	2.5	---	130	---	---	3.2	16	---	---	0.52J	51	---	5.4	---	---	---
12MW-03SR	4/10/2003	---	<2	9.3	---	170	24	---	6.6	53	---	---	0.49J	66	---	<5	---	---	---
12MW-03SR	7/17/2003	---	<0.5	2.5	---	94	---	---	2.7	17	---	---	<0.48	38	---	3.5	---	---	---
12MW-04D	8/28/2000	---	---	---	---	---	---	0.9	---	99	0.15	7.07	---	---	632	2.8	<0.05	26.96	---
12MW-04D	11/28/2000	200	---	41	14	79	---	2	8	110	0.3	7.1	7.5	100	749	<5	<0.05	23.5	---
12MW-04D	2/26/2001	145	---	36	<10	67	---	0.35	5.4	58	0.7	8.26	6.4	75	571	<5	<0.05	22.37	---
12MW-04D	5/14/2001	110	---	43	12	88	---	0.2	8.7	97	0.9	7.1	6.8	86	730	<5	---	23.5	---
12MW-04D	8/27/2001	150	---	46	17	84	---	0.9	9.2	120	0.2	7.16	6.7	79	633	<5	<0.05	25.15	---
12MW-04D	12/3/2001	200	<1	49	15.5	92	---	1.5	10	120	0.1	7.39	6.2	84	791	<5	<0.05	21.8	---
12MW-04D	2/26/2002	180	<1	44	10.5	81	---	0.7	8.5	100	0.5	7.13	6.6	94	721	<2.5	<0.05	21.73	---
12MW-04D	6/11/2002	225	<0.5	40	16	98	---	0.9	7.8	110	0.45	7.09	7.1	100	781	<5	<0.05	23.38	---
12MW-04D	9/9/2002	225	<0.4	43	20	63	---	1.5	8.1	120	0.075	7.03	5.9	75	669	<1	<0.05	26.29	---
12MW-04D	1/7/2003	200	<0.4	40	18	40	---	1	7.1	88	0.7	7.15	5	60	531	3.4	<0.05	20.34	---
12MW-04D	4/7/2003	100	<0.6	36	18	45	---	<0.05	6.9	30	0.075	7.65	5.4	58	479	4.9	<0.05	21.81	---
12MW-04D	7/14/2003	210	0.31J	47	15	69	---	0.6	9.3	120	0.15	7.03	5	61	682	1.4J	<0.05	24.6	---
12MW-04D	8/18/2004	200	---	---	23	51	---	0.8	---	---	<0.025	6.83	---	---	555	2.1	<0.05	22.99	6

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-04S	8/28/2000	---	---	---	---	---	---	3.5	---	43	0.25	4.21	---	---	138.1	8.8	<0.05	27.92	---
12MW-04S	11/28/2000	<50	---	0.31	300	22	---	1.5	0.96	44	0.35	4.57	<0.41	23	144	14	<0.05	22.84	---
12MW-04S	2/26/2001	<10	---	<0.3	275	19	---	3	0.89	45	0.3	5.32	<0.54	19	80	14	---	18.42	---
12MW-04S	5/14/2001	<10	---	0.44	250	19	---	0.25	0.86	41	2.5	4.42	<0.54	19	129	12	<0.05	22.96	---
12MW-04S	8/27/2001	<10	---	0.3	325	17	---	0.15	0.84	37	0.6	4.36	<0.54	18	132	12	<0.05	28.42	---
12MW-04S	12/3/2001	<10	0.68	<0.3	300	16	0.2	<0.05	0.81	34	0.25	4.49	<0.54	18	120	15	<0.05	22.42	---
12MW-04S	2/26/2002	<10	0.68	<0.3	300	16	---	0.35	0.83	37	1	4.65	<0.54	21	121	17	<0.05	19.87	---
12MW-04S	6/11/2002	<10	0.74	<0.3	325	17	0.4	0.05	0.67	32	3.5	4.45	<0.39	21	125	15	<0.05	24.04	---
12MW-04S	9/9/2002	<10	0.45	<0.3	260	14	---	2.5	0.67	29	0.3	4.52	<0.39	19	123.5	14	<0.05	28.67	---
12MW-04S	1/7/2003	<10	0.61	<0.3	250	17	---	3.1	0.73	36	0.2	4.7	<0.39	22	132.4	18	<0.05	17.7	---
12MW-04S	4/7/2003	<10	0.67	<0.3	300	16	---	3.5	0.73	41	0.1	4.75	<0.48	20	129.8	16	<0.05	20.4	---
12MW-04S	7/14/2003	<10	0.67	0.26J	300	15	---	1.5	0.63	39	0.25	4.27	<0.48	13	113	17	<0.05	25.89	---
12MW-04S	9/16/2003	<10	---	0.24J	275	14	---	3	0.63	27	0.15	4.62	<0.48	18	123.4	16	<0.05	26.68	13
12MW-04S	1/12/2004	<10	---	0.78	200	17	---	0.7	0.8	38	0.25	4.44	<0.48	16	123.5	16	<0.05	18.82	32.6
12MW-04S	4/26/2004	<10	---	0.15J	225	14	---	2.5	0.75	39	0.8	4.47	<0.53	15	118	21	<0.05	20.48	48.4
12MW-04S	8/18/2004	<10	---	9.1	225	12	---	0.8	0.8	25	0.2	4.64	1J	18	170	29	<0.05	25.31	54.1
12MW-04S	2/1/2005	<10	---	0.27J	225	12	---	1	0.85	---	0.7	4.83	<0.53	18	125.7	18	<0.05	19.28	27.6
12MW-04S	5/23/2005	<10	---	0.36	300	13	---	0.5	0.68	36	0.25	4.58	<0.36	16	116.9	18	<0.05	23.95	19.2
12MW-04S	9/12/2005	<10	---	0.4	260	12	---	4.5	0.62	26	0.15	4.71	<0.36	16	126.8	18	<0.05	27.15	---
12MW-04S	1/30/2006	---	---	---	---	9.7	---	2.5	---	---	0.2	4.77	---	---	125	20	---	19.82	---
12MW-04S	6/21/2006	-10	---	---	250	11	---	1	---	---	0.15	4.61	---	---	140	56	-0.05	25.97	---
12MW-04S	9/11/2006	<10	---	---	300	16	---	4	---	---	0.2	4.71	---	---	125	19	<0.05	28.85	---
12MW-05D	8/30/2000	---	---	---	19	---	---	0.5	---	84	0.6	7.3	---	---	1,235	11	<0.05	21.5	---
12MW-05D	11/30/2000	250	---	41	15	180	---	1	9.7	73	0.6	7.3	12	---	1,391	13	<0.05	17.8	---
12MW-05D	2/28/2001	350	---	46	22	180	---	0.5	11	91	0.4	7.19	12	210	1,295	7.6	0.8	17	---
12MW-05D	5/15/2001	250	---	43	18	92	---	0.5	9.8	80	0.3	7.38	9.9	200	1,285	8.2	0.35	20.23	---
12MW-05D	8/28/2001	350	---	39	17	---	---	0.4	9.4	63	0.8	7.26	11	220	1,283	---	0.4	22.24	---
12MW-05D	12/4/2001	350	<2	35	18	130	0.5	0.9	9	58	0.25	7.49	10	210	1,220	<5	0.1	19.96	---
12MW-05D	2/28/2002	300	<1	33	11.5	150	---	0.7	8.8	48	0.8	7.21	11	230	1,171	14	0.1	12.34	---
12MW-05D	6/11/2002	375	0.65	32	13	130	---	0.5	7.8	41	0.2	7.33	11	230	1,170	14	<0.05	22.58	---
12MW-05D	9/10/2002	375	<2	31	18	130	---	0.7	7.8	47	0.25	7.37	9.6	210	1,298	12	0.05	21.82	---
12MW-05D	1/8/2003	300	<2	39	18	170	0.3	0.6	9	68	0.15	7.38	11	220	1,251	13	<0.05	17.98	---
12MW-05D	4/7/2003	325	<1.6	42	18	180	---	0.8	9.7	78	0.15	7.76	12	210	1,229	10	<0.05	19.23	---
12MW-05I	8/30/2000	---	---	---	19	---	---	0.7	---	49	0.35	6.95	---	---	637	1.1	<0.05	20.9	---
12MW-05I	11/30/2000	120	---	17	13.5	100	---	1	3.5	42	0.55	7.16	3.3	---	634	<5	<0.05	18.56	---
12MW-05I	2/28/2001	120	---	15	16	93	---	0.15	3.3	40	0.35	6.88	3.2	100	597	<5	<0.05	17.92	---
12MW-05I	5/16/2001	100	---	16	16	98	---	0.4	3.4	46	0.8	6.84	3	97	618	5.9	<0.05	18.94	---
12MW-05I	8/29/2001	125	---	20	20	120	---	0.7	4	48	0.075	6.89	3.4	110	665	<5	<0.05	21.69	---
12MW-05I	12/4/2001	150	<2	22	16	130	1.5	1.5	4.4	53	0.075	7.01	3.7	110	760	<5	<0.05	20.22	---
12MW-05I	2/27/2002	150	<1	22	10	130	---	0.5	4.9	55	0.6	7.16	4	130	773	4.7	<0.05	15.12	---
12MW-05I	6/11/2002	137	0.64	24	15	150	---	0.5	4.7	55	0.15	6.89	4.1	130	826	5.5	<0.05	22.62	---
12MW-05I	9/10/2002	110	<1	18	18	130	---	0.6	4	47	0.075	7	3.3	120	740	2.9	<0.05	21.22	---
12MW-05I	1/8/2003	140	<1	13	18	87	0.3	3	2.7	32	0.7	6.85	3.1	97	562	<2.5	<0.05	17.17	---
12MW-05I	4/7/2003	---	<1	14	---	92	1.5	---	3.1	48	---	6.76	2.9	98	570	<2.5	---	19.23	---
12MW-05I	7/14/2003	<10	<0.5	16	15	100	7.2	0.5	3.4	44	0.15	6.64	2.7	89	617	1.9J	<0.05	20.32	---
12MW-05I	8/18/2004	100	---	---	17	110	---	0.4	---	---	<0.025	6.89	---	---	678	2.3J	<0.05	21	0
12MW-05I	5/25/2005	110	---	19	10	110	---	<0.05	3.8	51	0.2	7.05	3.4	120	666	2.2	<0.05	18.48	0
12MW-05I	6/22/2006	125	---	---	18	120	---	0.4	---	---	0.1	6.79	---	---	695	3.1	-0.05	20.81	---
12MW-05S	8/30/2000	---	---	---	260	---	---	3.5	---	34	0.15	5.29	---	---	578	2.8	<0.05	21.67	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-05S	11/30/2000	<50	---	8.1	100	130	---	2	4.4	40	0.3	5.28	1.4J	---	527	5.5	<0.05	18.94	---
12MW-05S	2/28/2001	25	---	9	90	120	---	0.9	4.6	35	0.6	5.44	1.5J	85	500	<5	<0.05	16.53	---
12MW-05S	5/16/2001	19	---	8.8	200	130	---	4.5	4.5	32	0.35	5.3	1.2J	73	529	<5	<0.05	18.39	---
12MW-05S	8/29/2001	<10	---	9.2	225	140	---	3.5	4.8	34	0.1	5.21	1.3J	75	543	<5	<0.05	22.43	---
12MW-05S	12/4/2001	<10	<2	7.4	250	130	5.5	2.5	4.3	30	0.15	5.16	1.1J	67	526	<5	<0.05	20.01	---
12MW-05S	2/28/2002	<10	<1	7.9	125	120	---	1.5	4.6	31	0.7	5.81	1.3J	78	505	4	<0.05	12.93	---
12MW-05S	6/11/2002	<10	1.1	7.3	250	130	---	2.5	4.1	28	0.05	5.08	1.3J	76	529	<5	<0.05	21.38	---
12MW-05S	9/10/2002	<10	<1	6.4	270	130	0.62	2.5	4	28	0.25	4.99	1.2J	74	546	3	<0.05	21.95	---
12MW-05S	1/8/2003	<10	<1.6	6.6	165	120	3.7	1.5	3.9	25	0.3	5.22	1.1J	77	493	4	<0.05	16.32	---
12MW-05S	4/10/2003	<10	<1.6	6	185	120	3.1	2.5	3.7	22	0.3	5.11	1.1J	75	473	5.3	<0.05	15.92	---
12MW-05S	7/17/2003	<10	<0.8	6.6	175	130	8.4	2.5	3.9	25	<0.025	5.43	0.91J	69	489	4.5	<0.05	21.47	---
12MW-05S	9/16/2003	<10	---	5.7	---	110	2.7	2	3.5	22	0.2	4.91	1.3J	71	459	4.4	<0.05	20.92	1.9
12MW-05S	1/14/2004	<10	---	6.2	40	120	2	1	3.4	25	0.4	5.1	1.3J	56	464	3.7J	<0.05	17.53	3.9
12MW-05S	4/27/2004	<10	---	---	135	---	3	2	---	---	<0.025	5.28	---	---	470	---	<0.05	17.79	---
12MW-05S	8/18/2004	---	---	6	<10	110	1.8	1.5	3.7	23	0.3	4.97	<0.53	26	450	4.2	<0.05	21.74	2.7
12MW-05S	2/2/2005	<10	---	5.8	180	110	1.9	1.5	3.4	---	0.05	5.31	1.4J	62	454	4	<0.05	17.96	---
12MW-05S	5/24/2005	<10	---	5.9	180	96	1.5	1.25	3	22	0.05	6.24	1.1J	59	399	4.2	<0.05	17.84	1.5
12MW-05S	9/13/2005	<10	---	5	80	97	---	1.5	2.7	20	0.1	5.6	1.1J	54	378	4.2	<0.05	21.84	7.9
12MW-05S	1/31/2006	---	---	---	---	76	---	1	---	---	0.15	5.22	---	---	353	4.3	---	18.41	0.3
12MW-05S	6/20/2006	-10	---	---	100	83	---	3	---	---	0.05	5.16	---	---	346	4.6	-0.05	20.09	---
12MW-05S	9/12/2006	<10	---	---	70	75	---	1.5	---	---	0.1	5.17	---	---	343	5.6	<0.05	21.43	---
12MW-05SR	11/30/2000	---	---	8.3	---	130	---	---	4.5	41	---	---	1.5J	---	---	5.6	---	---	---
12MW-05SR	2/28/2001	---	---	9	---	120	---	---	4.5	35	---	---	1.8J	83	---	<5	---	---	---
12MW-05SR	5/16/2001	---	---	8.5	---	130	---	---	4.4	32	---	---	1.3J	71	---	<5	---	---	---
12MW-05SR	8/29/2001	---	---	9.5	---	140	---	---	4.9	35	---	---	1.4J	73	---	<5	---	---	---
12MW-05SR	12/4/2001	---	<2	7.3	---	110	---	---	4.2	29	---	---	1.3J	68	---	<5	---	---	---
12MW-05SR	6/11/2002	---	1.2	7.5	---	120	---	---	4.1	28	---	---	1.3J	77	---	<5	---	---	---
12MW-05SR	9/10/2002	---	<1	6.3	---	120	---	---	3.8	27	---	---	1.1J	74	---	2.8	---	---	---
12MW-05SR	1/8/2003	---	<1.6	6.5	---	130	---	---	4	25	---	---	1.2J	77	---	4.6	---	---	---
12MW-05SR	4/10/2003	---	1.8	6	---	120	---	---	3.7	23	---	---	0.96J	66	---	4.2	---	---	---
12MW-05SR	7/17/2003	---	1J	7.3	---	130	---	---	4	25	---	---	1.1J	65	---	5.1	---	---	---
12MW-05SR	9/16/2003	---	---	5.7	---	110	---	---	3.4	21	---	---	1.2J	72	---	4	---	---	---
12MW-05SR	1/14/2004	---	---	6.1	---	120	---	---	3.4	25	---	---	1.4J	55	---	4J	---	---	---
12MW-05SR	4/27/2004	---	---	5.6	---	110	---	---	3.5	21	---	---	1.7J	57	---	5	---	---	---
12MW-05SR	8/18/2004	---	---	6.1	---	110	---	---	3.7	23	---	---	1.9	67	---	4.9	---	---	---
12MW-05SR	2/2/2005	---	---	5.8	---	100	---	---	3.4	---	---	---	1.4J	63	---	7.2	---	---	---
12MW-05SR	5/24/2005	---	---	5.6	---	95	---	---	3	22	---	---	1.1J	59	---	4.3	---	---	---
12MW-05SR	9/13/2005	---	---	5.3	---	91	---	---	2.8	20	---	---	1.1J	59	---	4.2	---	---	---
12MW-05SR	1/31/2006	---	---	---	---	77	---	---	---	---	---	---	---	---	---	4.4	---	---	---
12MW-05SR	6/20/2006	---	---	---	---	83	---	---	---	---	---	---	---	---	---	4.5	---	---	---
12MW-05SR	9/12/2006		---	---	---	75	---	---	---	---			---	---	---	4.3	---	---	---
12MW-06D	8/29/2000	---	---	---	65	---	---	14	---	810	0.15	6.4	---	---	2,250	22	<0.05	20.3	---
12MW-06D	11/29/2000	225	---	110	45	530	---	16	21	750	0.15	6.82	9.8	230	2,280	22	0.05	16.55	---
12MW-06D	2/27/2001	240	---	95	70	540	---	12	19	650	0.2	6.47	9.9	280	2,310	<25	<0.05	15.88	---
12MW-06D	5/14/2001	225	---	110	40	470	---	10	22	800	1	6.56	8.1	280	2,340	21	<0.05	18.77	---
12MW-06D	8/28/2001	275	---	34	50	460	---	15	17	280	<0.025	6.5	1.9J	250	2,180	<25	<0.05	23.8	---
12MW-06S	8/29/2000	---	---	---	200	---	---	26	---	270	0.025	5.35	---	---	1,730	17	0.25	21.88	---
12MW-06S	11/29/2000	<50	---	29	85	470	---	32.5	14	250	0.1	5.67	2.3	190	1,710	19	0.25	16.2	---
12MW-06S	2/27/2001	<10	---	29	180	500	---	22.5	15	250	0.3	5.01	2	260	1,810	30	0.25	13.81	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-06S	5/14/2001	<10	---	32	170	270	---	30	16	270	0.25	5.34	1.4J	230	1,690	22	0.15	18.93	---
12MW-06S	8/28/2001	50	---	120	100	580	---	30	23	840	<0.025	5.68	8.6	280	1,690	<25	0.2	24.42	---
12MW-06S	12/4/2001	100	<5	33	75	480	---	22.5	19	280	<0.025	6.17	1.8J	280	1,900	<13	0.6	17.08	---
12MW-06S	2/26/2002	<10	<10	67	90	1,000	---	75	55	550	<0.025	4.79	2.6	570	3,880	130	0.25	18.05	---
12MW-06S	6/11/2002	<10	3.2	61	325	980	---	75	45	480	<0.025	4.6	2.8	500	3,640	100	0.25	20.65	---
12MW-06S	9/9/2002	<10	<10	55	310	970	---	65	46	460	<0.025	4.53	3	730	3,870	100	0.15	22.71	---
12MW-06S	1/7/2003	<10	<5	38	205	570	---	37.5	19	320	<0.025	5.09	2.1	310	2,150	63	0.05	13.86	---
12MW-06S	4/8/2003	<10	<6	35	210	530	---	24.5	18	300	0.025	5.36	1.7J	260	1,860	30	<0.05	15.29	---
12MW-06S	8/19/2004	<10	---	---	150	510	---	20	---	---	<0.025	5.41	---	---	1,840	22	---	22.01	33.2
12MW-06S	5/23/2005	30	---	---	70	---	---	20	---	---	<0.025	6.58	---	---	1,800	---	0.3	18.94	---
12MW-06S	6/22/2006	-10	---	---	50	---	---	35			-0.025	5.17	---	---	1779	---	0.1	19.71	---
12MW-07D	8/28/2000	---	---	---	<100	---	---	4.8	---	190	0.15	6.62	---	---	1,620	26	<0.05	20.5	---
12MW-07D	11/29/2000	85	---	73	32	370	---	6	15	200	---	6.63	8.8	130	1,560	32	<0.05	18.08	---
12MW-07D	2/26/2001	120	---	65	35	290	---	5.5	13	190	0.5	6.74	8.1	150	1,327	22	<0.05	18.73	---
12MW-07D	5/14/2001	125	---	69	24	320	---	3	14	180	1.5	6.72	7	140	1,359	28	<0.05	19.65	---
12MW-07S	2/26/2001	100	---	12	37	94	---	1.5	3.3	84	0.1	6.07	1.5J	82	81	<5	0.15	17.18	---
12MW-07S	5/14/2001	80	---	15	25	67	---	2	4.2	110	0.5	6.42	1.4J	69	492	<5	<0.05	18.46	---
12MW-07S	8/29/2001	100	---	15	40	87	---	2	4.2	100	0.075	6.46	1.5J	76	490	<5	<0.05	22.96	---
12MW-07S	1/13/2004	---	---	---	---	---	---	---	---	---	---	6.96	---	---	516	---	---	16.73	---
12MW-07S	8/19/2004	45	---	---	27	---	---	2	---	---	<0.05	6.33	---	---	531	---	<0.05	22.35	3.3
12MW-08D	8/29/2000	---	---	---	32	---	---	2.5	---	130	0.15	6.97	---	---	1,469	11	<0.05	22.86	---
12MW-08D	11/28/2000	200	---	50	18	260	---	3.5	8.6	140	0.2	6.62	7.9	170	1,411	13	<0.05	18.45	---
12MW-08D	2/26/2001	225	---	48	30	230	---	1.5	8.4	130	1.5	7.06	8.1	220	1,419	10	<0.05	17.66	---
12MW-08D	5/14/2001	225	---	55	26	210	---	0.7	9.3	170	1	6.97	7.3	240	1,446	11	<0.05	19.93	---
12MW-08D	8/27/2001	300	---	52	27	250	---	2.5	9.3	150	0.2	7	7.5	240	1,434	10	<0.05	26.3	---
12MW-08S	8/28/2000	---	---	---	---	---	---	6.5	---	69	0.15	4.4	---	---	1,313	7.6	<0.05	24.86	---
12MW-08S	11/28/2000	<50	---	50	50	390	---	4	5.2	67	0.6	4.26	0.88J	59	1,270	<5	<0.05	17.88	---
12MW-08S	2/26/2001	<10	---	45	---	360	---	3	4.8	58	0.4	5.38	1.1J	160	218	<10	<0.05	16.94	---
12MW-08S	5/14/2001	<10	---	46	160	340	---	4	4.9	59	0.25	4.3	0.68J	150	1,238	<10	<0.05	18.6	---
12MW-08S	8/27/2001	<10	---	44	210	360	---	4	5	55	0.05	4.67	0.73J	140	1,029	<10	<0.05	23.91	---
12MW-09D	8/29/2000	---	---	---	70	---	---	12	---	600	0.1	6.43	---	---	3,770	5.4	<0.05	22.15	---
12MW-09D	11/29/2000	225	---	200	50	1,000	---	17.5	41	530	0.15	6.58	14	430	3,450	<5	<0.05	18.29	---
12MW-09D	2/27/2001	260	---	200	100	960	---	14	40	560	0.2	6.48	14	430	3,800	<25	<0.05	18.1	---
12MW-09D	5/15/2001	200	---	230	90	800	---	18	47	620	0.6	6.59	12	370	3,640	<25	<0.05	18.4	---
12MW-09D	8/29/2001	250	---	250	110	1,000	---	15	52	630	0.1	6.4	<0.54	390	3,490	<50	<0.05	22.49	---
12MW-09D	12/3/2001	250	<10	240	40	950	---	17.5	49	580	0.05	6.7	12	390	3,620	<25	<0.05	18.89	---
12MW-09D	2/26/2002	350	<10	250	70	1,000	---	22.5	50	620	<0.025	6.46	11	430	3,740	<25	<0.05	18.56	---
12MW-09D	6/10/2002	350	3.7	220	70	990	---	12	46	570	0.1	6.48	13	440	3,710	<50	<0.05	20.32	---
12MW-09D	9/10/2002	<10	<4	210	112	920	---	15	45	560	0.05	6.54	<0.39	400	3,720	<10	<0.05	20.61	---
12MW-09D	1/7/2003	<10	<10	220	100	960	---	16.5	44	560	0.09	6.15	13	420	30.8	<25	<0.05	17.69	---
12MW-09D	4/9/2003	<10	<8	210	100	810	---	9	43	520	0.3	6.62	13	400	3,630	<20	<0.05	16.93	---
12MW-09D	7/16/2003	250	<5	220	125	1,000	---	13	47	570	0.1	6.46	12	420	3,620	<13	<0.05	21.57	---
12MW-09D	8/16/2004	260	---	---	120	1,100	---	8.8	---	---	---	5.88	---	---	3,670	<13	<0.05	19.99	23.7
12MW-09S	8/29/2000	---	---	---	80	---	---	2.5	---	20	0.15	5.2	---	---	172	21	<0.05	21.3	---
12MW-09S	11/29/2000	<50	---	1.5	50	15	---	3.5	0.9	15	0.3	6.18	<0.41	34	196	23	<0.05	18.45	---
12MW-09S	2/27/2001	13	---	1.1	100	13	---	2.5	0.6	14	0.2	5.17	<0.54	290	166	22	<0.05	16.9	---
12MW-09S	5/15/2001	44	---	1	70	12	---	3	0.76	14	0.37	5.68	<0.54	33	200	17	0.1	17.81	---
12MW-09S	8/29/2001	37	---	1.3	128	12	---	3	0.79	15	0.1	5.56	<0.54	27	171	20	<0.05	22.39	---
12MW-09S	12/3/2001	19	<0.2	1.2	155	14	---	3.5	0.8	15	<0.025	5.37	<0.54	23	161	26	<0.05	19.85	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-09S	2/26/2002	40	<0.2	1.2	135	10	---	4	0.88	15	0.2	5.62	<0.54	28	154	24	---	18.18	---
12MW-09S	6/10/2002	<10	<0.5	0.96	150	11	---	3.5	0.71	12	0.05	5.16	<0.39	25	141	27	<0.05	20.49	---
12MW-09S	9/10/2002	32	<0.4	1.1	133	8.4	---	2.5	0.77	16	0.05	5.82	<0.39	29	187	18	0.08	23.09	---
12MW-09S	1/7/2003	65	<0.4	2.1	140	47	0.5	8.9	2.2	33	<0.025	5.98	0.52J	72	411	8.7	2.5	16.28	---
12MW-09S	4/8/2003	70	<0.4	1.8	120	26	---	6	2.2	33	<0.025	6.08	<0.48	55	346	20	0.9	15.71	---
12MW-09S	7/15/2003	45	<0.2	1	160	16	---	5.5	1.1	18	<0.025	5.57	<0.48	35	219	20	0.05	20.03	---
12MW-09S	9/17/2003	70	---	1.2	140	16	---	7	1.2	19	0.2	5.74	0.49J	48	312	19	0.3	22.22	---
12MW-09S	1/13/2004	20	---	0.96	35	12	---	6	0.87	14	0.1	5.51	<0.48	18	172	24	<0.05	15.68	4.9
12MW-09S	4/28/2004	20	---	1.3	110	12	2.1	5	1.1	24	0.1	5.17	0.73J	20	150	26	<0.05	16.86	42
12MW-09S	8/16/2004	14?	---	1.8	130	10	---	6.3	2.5	45	---	4.89	1.4J	25	144.5	26	<0.05	20.52	429
12MW-09S	5/25/2005	<10	---	0.74	32	11	---	2	0.63	8.8	0.1	5.66	<0.36	20	142.5	29	<0.05	17.4	3.4
12MW-09S	1/31/2006	---	---	---	---	24	---	1.4	---	---	0.5	5.2	---	---	169	30	---	16.48	19.8
12MW-09S	6/22/2006	-10	---	---	120	10	---	1.5	---	---	0.1	5.01	---	---	120	23	-0.05	19.47	---
12MW-09S	9/12/2006	<10	---	---	115	10	---	2	---	---	0.1	4.79	---	---	124	23	<0.05	20.48	---
12MW-10S	11/30/2000	<50	---	3.1	300	120	---	37.5	8.5	49	0.35	4.5	<0.41	---	496	<5	<0.05	22.5	---
12MW-10S	2/28/2001	<10	---	4.3	300	100	---	60	13	110	<0.025	4.4	1.4J	35	613	<5	0.2	17.91	---
12MW-10S	2/27/2002	<10	<1	2.6	250	100	---	22.5	6.4	28	<0.025	4.56	<0.54	38	357	3.4	0.8	15.37	---
12MW-10S	6/11/2002	<10	<0.5	1.4	255	73	2.36	2.5	3.8	15	0.35	3.87	<0.39	32	250	<5	<0.05	26.55	---
12MW-10S	9/10/2002	<10	<1	1.1	250	64	2.9	18	3.2	21	<0.025	4.5	<0.39	28	259	3.9	0.2	27.01	---
12MW-10S	1/8/2003	<10	<1	1.9	275	95	4.4	27.25	4.8	40	<0.025	4.63	<0.39	28	325	8.2	0.8	18.17	---
12MW-10S	4/10/2003	<10	<0.8	1.4	245	69	---	12	3.1	16	0.1	4.7	<0.48	27	193	10	0.9	15.5	---
12MW-10S	7/16/2003	<10	<0.4	2.1	260	67	5.8	12	4.3	14	0.1	4.72	<0.48	30	275	7.8	0.5	25.02	---
12MW-10S	9/16/2003	<10	---	1.2	275	53	3.9	5	2.6	15	0.1	4.67	<0.48	24	193	7.7	0.8	25.79	53
12MW-10S	1/14/2004	<10	---	1.7	130	41	2.8	8	2.5	14	0.1	4.65	<0.48	16	186	10	0.4	18.41	12.4
12MW-10S	4/27/2004	---	---	---	---	---	16	---	---	---	---	4.91	---	---	171	---	---	18.6	---
12MW-10S	8/18/2004	<10	---	1.1	20	40	3.1	8.1	2.6	12	0.1	4.56	0.62J	22	162	9.9	0.05	24.55	12.4
12MW-10S	2/2/2005	<10	---	1.1	90	32	---	5.5	2.4	---	0.15	4.8	<0.53	19	147.1	11	0.7	15.42	9.1
12MW-10S	2/3/2005	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12MW-10S	5/24/2005	<10	---	2.9	240	75	3.5	10	5.7	12	0.05	4.56	<0.36	31	303	10	0.35	21.21	0
12MW-10S	9/13/2005	<10	---	2.7	275	77	---	7.6	5.5	12	0.05	4.71	<0.36	29	249	7.3	0.9	25.4	2.9
12MW-10S	1/31/2006	---	---	---	---	29	---	3.65	---	---	-0.025	---	---	---	159	11	---	19.35	9.2
12MW-10S	6/21/2006	-10	---	3.8	275	80	---	10	7.2	---	0.1	4.55	---	---	342	9.2	0.25	24.42	---
12MW-10S	9/12/2006	<10	---	---	70	33	---	5	---	---	0.2	4.69	---	---	163	10	0.8	24.01	---
12MW-10SR	5/16/2001	---	---	2.5	---	89	---	---	6.8	33	---	---	<0.54	32	---	<5	---	---	---
12MW-10SR	8/29/2001	---	---	2.2	---	92	---	---	5.8	34	---	---	<0.54	32	---	<5	---	---	---
12MW-10SR	12/5/2001	---	<2	2.6	---	110	---	---	7.1	40	---	---	0.66J	44	---	<5	---	---	---
12MW-10SR	2/27/2002	---	<1	2.6	---	100	---	---	6.3	29	---	---	<0.54	36	---	4.1	---	---	---
12MW-11D	8/29/2000	---	---	---	120	---	---	16	---	370	0.05	6.14	---	---	3,070	38	<0.05	19.9	---
12MW-11D	11/29/2000	150	---	150	55	880	---	17.5	33	520	<0.025	6.3	7.4	330	3,050	47	<0.05	18.6	---
12MW-11D	2/27/2001	135	---	160	60	910	---	12	33	440	0.7	6.05	6.7	400	3,170	38	<0.05	17.43	---
12MW-11D	5/15/2001	130	---	160	90	780	---	13	37	530	0.25	6.33	6.5	390	3,290	<25	<0.05	21.4	---
12MW-11D	8/28/2001	130	---	170	158	900	---	16.5	39	590	<0.025	6.23	6.2	360	3,240	<40	<0.05	25.11	---
12MW-11D	12/4/2001	115	<10	180	125	920	---	22.5	43	710	<0.025	6.27	6.7	350	3,520	57	<0.05	18.88	---
12MW-11D	2/27/2002	135	<10	180	30	940	---	16	44	680	0.05	6.23	7.3	430	3,370	57	<0.05	14.81	---
12MW-11D	6/10/2002	130	3.7	170	75	1,000	---	22.5	41	720	0.5	5.98	7.3	400	3,600	68	<0.05	21.76	---
12MW-11D	9/9/2002	175	<8	160	60	840	---	18	36	520	---	6.12	7.1	410	3,320	37	---	22.37	---
12MW-11D	1/8/2003	125	<8	150	32	840	0.1	10.4	31	420	0.1	6.11	6.9	430	3,130	39	<0.05	15.8	---
12MW-11D	4/9/2003	150	<8	150	70	800	---	5.5	31	410	0.25	6.4	6.4	400	3,010	41	<0.05	16.77	---
12MW-11D	7/16/2003	165	<5	160	13	940	---	15	35	500	0.025	6.23	5.6	390	3,230	43	<0.05	22.78	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-11S	8/29/2000	---	---	---	70	---	---	3.5	---	80	0.2	5.82	---	---	1,104	5.6	---	21.28	---
12MW-11S	11/29/2000	175	---	35	70	330	---	3.5	11	130	0.75	6.27	2.5	160	1,630	8.4	<0.05	18.53	---
12MW-11S	2/27/2001	90	---	46	75	380	---	3.5	14	160	0.4	5.93	2.9	240	1,670	<25	<0.05	16.7	---
12MW-11S	5/15/2001	111	---	47	100	360	---	6.5	15	170	0.9	6.05	2.3	230	1,840	<25	<0.05	19.9	---
12MW-11S	8/28/2001	105	---	34	70	310	---	3	11	120	0.05	6.05	2.3	190	1,470	<10	<0.05	23.49	---
12MW-11S	1/8/2003	90	---	---	50	---	1	0.5	---	---	0.3	5.87	---	---	1,650	---	<0.05	15.19	---
12MW-11S	8/19/2004	125	---	---	50	380	---	5	---	---	0.2	6.1	---	---	1,680	8.1J	<0.05	22.74	85.5
12MW-11S	5/23/2005	100	---	---	30	---	---	4	---	---	0.15	7.07	---	---	1,346	---	<0.05	19.29	---
12MW-11S	6/20/2006	65	---	---	40	---	---	4.5	---	---	0.2	6.13	---	---	1598	---	-0.05	20.65	---
12MW-11SR	11/29/2000	---	---	32	---	330	---	---	10	120	---	---	2.6	230	---	9.2	---	---	---
12MW-12D	8/28/2001	175	---	100	12	490	---	0.2	22	290	0.4	7.2	5.9	260	2,030	70	<0.05	24.64	---
12MW-12D	8/18/2004	150	---	---	35	860	---	10	---	---	0.1	6.32	---	---	3,070	49	<0.05	22.8	3.3
12MW-12S	8/28/2001	80	---	20	155	190	---	1.5	6.4	78	0.15	5.83	1.6J	130	919	<10	<0.05	23.52	---
12MW-12S	12/4/2001	85	<4	19	148	220	1.4	0.8	7	71	0.35	6.15	1.8J	140	976	<10	<0.05	19.58	---
12MW-12S	2/27/2002	95	<4	36	35	290	---	0.2	11	130	0.25	6.25	2.7	200	1,378	11	<0.05	13.63	---
12MW-12S	6/10/2002	120	1.1	32	75	290	1.9	1.5	9.4	110	0.2	6.09	2.2	180	1,192	<10	<0.05	21.83	---
12MW-12S	9/9/2002	125	<2	32	60	290	---	1.5	9.6	120	0.15	6.07	2.3	180	1,176	8.4	<0.05	22.49	---
12MW-12S	1/8/2003	115	<2	28	50	230	2.4	0.35	8.3	97	0.7	6.28	2.5	180	1,204	7.6	<0.05	13.29	---
12MW-12S	4/10/2003	110	<2	27	60	220	1.6	0.25	7.9	93	0.35	5.8	1.9	160	1,078	16	<0.05	14.68	---
12MW-12S	4/26/2004	125	---	---	40	---	2.6	2	---	---	0.3	6.34	---	---	1,247	---	<0.05	18.26	---
12MW-12S	8/17/2004	110	---	29	40	250	---	1	8.6	100	<0.025	6.09	2.5	170	1,116	6.7	<0.05	21.65	0
12MW-12S	2/1/2005	100	---	31	22	260	2.4	1	9.1	---	0.4	5.84	2.1	190	1,170	6.7J	<0.05	16.49	31.2
12MW-12S	5/24/2005	120	---	27	110	220	2.1	0.9	7.9	92	0.1	5.97	1.7	180	964	5.9	<0.05	17.59	40.7
12MW-12S	9/12/2005	---	---	24	---	220	---	---	7.4	83	---	---	2.1	140	---	6.4	---	---	---
12MW-12S	9/16/2005	100	---	---	24	---	---	0.75	---	---	0.2	6.3	---	---	1,024	---	<0.05	21.72	3.8
12MW-12S	1/30/2006	---	---	---	---	200	---	0.3	---	---	0.5	6.5	---	---	968	5.1J	---	17.84	11.7
12MW-12S	6/20/2006	105	---	---	45	230	---	1	---	---	0.1	6.2	---	---	1050	6.7	-0.05	20.5	---
12MW-12S	9/11/2006	100	---	---	32	200	---	1	---	---	0.1	6.19	---	---	1,000	6.8	<0.05	21.98	---
12MW-13S	8/28/2001	<10	---	24	100	320	---	9	14	150	0.2	4.94	1.9J	140	1,139	18	<0.05	23.14	---
12MW-13S	12/4/2001	<20	<4	32	165	370	0.6	12.5	18	190	<0.025	5.53	2.2	160	1,388	22	<0.05	17.57	---
12MW-13S	2/26/2002	<10	<5	35	140	400	---	8	20	190	1.5	4.94	2.4	200	1,395	34	<0.05	17.64	---
12MW-13S	6/11/2002	<10	1.5	30	190	370	0.5	11	17	170	<0.025	5.17	2.4	180	1,461	28	<0.05	20.32	---
12MW-13S	9/10/2002	<10	<4	26	200	360	0.46	12.5	16	160	<0.025	5.02	2.1	170	1,424	26	<0.05	21.84	---
12MW-13S	1/7/2003	<10	<4	19	150	310	0.9	4.45	12	120	1.5	4.7	1.7	170	1,110	27	<0.05	14.69	---
12MW-13S	4/8/2003	<10	<2	18	150	280	8	6	11	120	0.15	5.02	1.5J	150	1,067	16	<0.05	15.49	---
12MW-13S	7/15/2003	<10	1.1J	16	210	280	4.4	7	10	110	0.1	5.09	1.2J	110	1,008	18	<0.05	21.07	---
12MW-13S	9/15/2003	<10	---	4.8	180	280	1.4	8	9.7	99	0.05	4.9	1.8	140	1,026	20	<0.05	22.68	---
12MW-13S	1/13/2004	<10	---	20	165	300	5.9	5.5	12	130	0.7	4.84	2.2	140	1,131	20	<0.05	15.85	8.5
12MW-13S	4/28/2004	<10	---	18	40	270	180	8	11	120	<0.025	4.83	1.9	120	1,047	17	<0.05	16.67	2.8
12MW-13S	8/17/2004	<10	---	18	170	290	1.5	7	12	120	<0.025	4.81	1.9	150	1,066	18	<0.05	21.83	0
12MW-13S	2/2/2005	<10	---	20	30	300	1.3	6	12	---	0.3	4.98	1.4J	170	1,078	17	<0.05	16.37	0
12MW-13S	5/24/2005	<10	---	19	170	300	1.1	4.5	11	120	0.1	4.76	1.5	160	1,061	17	<0.05	19.93	0
12MW-13S	9/12/2005	---	---	17	---	230	---	---	9.9	100	---	---	1.6	130	---	12	---	---	---
12MW-13S	9/16/2005	<10	---	---	70	---	---	6.6	---	---	0.1	5.2	---	---	1,016	---	<0.05	22.04	20
12MW-13S	1/30/2006	---	---	---	---	270	---	5.5	---	---	0.6	5.09	---	---	1013	13	---	17.01	16
12MW-13S	6/22/2006	-10	---	19	45	270	---	10	12	120	-0.025	5.08	---	120	1087	16	0.05	20.09	---
12MW-13S	9/11/2006	25	---	---	45	300	---	8	---	---	0.2	5.07	---	---	2,230	16	<0.05	22.2	---
12MW-13SR	5/24/2005	---	---	19	---	300	---	---	11	120	---	---	1.4	160	---	17	---	---	---
12MW-13SR	9/12/2005	---	---	17	---	190	---	---	10	110	---	---	1.6	120	---	14	---	---	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-13SR	1/30/2006		---	---	---	270	---	---	---	---	---	---	---	---	---	14	---	---	---
12MW-13SR	9/11/2006		---	---	---	310	---		---	---	---	---	---	---	---	19	---	---	---
12MW-14S	8/30/2001	30	---	54	100	830	---	12.5	41	940	1.5	---	4.4	490	---	29	<0.05	---	---
12MW-17S	9/10/2002	112	<2	63	105	420	1.12	5.5	18	220	<0.025	6.18	3	220	1,820	15	<0.05	21.44	---
12MW-17S	1/7/2003	125	<2	69	33	450	0.9	3.5	19	240	0.28	6	3.5	250	1,920	22	<0.05	15.69	---
12MW-17S	4/9/2003	125	<2	74	75	470	1.9	5.05	19	250	0.15	5.99	3.1	250	1,980	20	<0.05	16.01	---
12MW-17S	7/15/2003	140	<2.5	79	90	490	2	7.5	21	270	0.1	6.63	3.4	260	2,000	23	<0.05	20.63	---
12MW-17S	9/15/2003	115	---	75	70	450	1.8	---	20	260	0.2	6.22	3.6	250	1,990	18	<0.05	21.48	2.6
12MW-17S	1/13/2004	120	---	75	30	480	1.9	6	20	270	0.7	6.19	3.7	200	1,840	18	<0.05	17.28	5.7
12MW-17S	4/26/2004	130	---	75	1120	480	2.9	6	20	260	0.1	6.31	3.4	200	1,820	19	<0.05	17.01	0
12MW-17S	8/17/2004	135	---	85	110	570	1.2	7.6	23	300	<0.025	6.11	4.1	280	2,080	20J	<0.05	20.58	0
12MW-17S	2/1/2005	100	---	77	20	490	---	8	21	---	0.4	6.42	3.2	290	1,990	21	<0.05	16.61	11.6
12MW-17S	5/24/2005	---	---	---	---	---	2.5	---	---	---	---	---	---	---	---	---	---	---	---
12MW-17S	5/24/2005	110	---	75	120	490	---	9	21	270	0.1	6.53	3.4	290	1,870	21	<0.05	18.04	32.5
12MW-17S	9/12/2005	---	---	67	---	470	---	---	20	240	---	---	3.5	210	---	20	---	---	---
12MW-17S	9/16/2005	100	---	---	35	---	---	6.2	---	---	<0.025	6.27	---	---	1,830	---	<0.05	21.25	39.5
12MW-17S	1/31/2006	---	---	---	---	410	---	6	---	---	0.15	6.39	---	---	1718	19	---	17.81	15.9
12MW-17S	6/20/2006	110	---	---	25	530	---	9	---	---	0.15	6.23	---	---	2047	21	-0.05	19.65	---
12MW-17S	9/11/2006	120	---	---	27	500	---	10	---	---	<0.025	6.19	---	---	1,994	22	<0.05	21.24	---
12MW-18S	4/9/2003	70	<0.6	6.7	250	38	---	5.85	2.1	50	0.15	5.14	0.49J	52	303	7.9	2.5	16.64	---
12MW-18S	7/16/2003	50	0.42J	5.2	250	36	---	3.5	1.8	29	<0.025	5.49	0.63J	42	283	15	0.6	22.24	---
12MW-18S	9/17/2003	45	---	4.3	225	32	---	2.5	1.6	22	<0.025	5.34	0.77J	46	246	13	0.5	21.58	0.7
12MW-18S	1/14/2004	35	---	4	180	33	---	1.5	1.5	20	0.3	6.05	0.48J	32	266	16	0.15	17.98	0
12MW-18S	4/27/2004	50	---	4.1	225	31	---	2.5	1.6	19	0.1	5.47	0.95J	38	284	18	0.05	19.88	14.5
12MW-18S	8/19/2004	<10	---	4.9	350	26	---	2.5	1.9	21	0.075	5.18	1.2J	48	277	15	0.15	22.88	0
12MW-18S	2/3/2005	50	---	7.5	300	30	---	1.5	2.7	---	0.3	5.59	1.3J	55	341	11	0.05	17.21	5.6
12MW-18S	5/23/2005	70	---	---	275	38	---	2	---	---	0.1	5.41	---	---	328	12	0.1	21.62	2.7
12MW-18S	9/12/2005	65	---	---	220	42	---	1.5	---	---	0.1	5.63	---	---	351	9.9	0.1	23.43	---
12MW-18S	1/31/2006	---	---	---	---	43	---	1	---	---	0.2	5.93	---	---	332	10	---	15.78	---
12MW-18S	6/20/2006	40	---	---	215	51	---	1.5	---	---	0.2	5.52	---	---	329	10	-0.05	24.21	---
12MW-18S	9/11/2006	45	---	---	250	53	---	1.5	---	---	0.1	5.24	---	---	317	11	<0.05	25.12	---
12MW-19D	4/8/2003	200	<0.8	120	10	75	---	13.5	11	2400	0.17	6.57	11	390	1,920	<2	<0.05	17.44	---
12MW-19D	4/27/2004	150	---	27	<10	140	---	1	0.8	73	<0.025	8.4	5.3	230	1,216	<2.5	<0.05	20.64	30.2
12MW-19D	8/16/2004	135	---	16	<10	140	43,000	0.2	0.3	24	<0.025	9.18	3.8	190	969	<2	<0.05	23.23	3.6
12MW-19S	4/8/2003	190	<0.8	130	<10	70	---	13	12	2700	<0.025	7.01	11	330	1,890	<2	<0.05	16.76	---
12MW-19S	7/14/2003	130	1.7	120	<10	28	300,000	1.5	10	370	0.025	8.23	7.1	380	1,780	0.5	<0.05	22.52	---
12MW-19S	9/17/2003	300	---	130	<10	31	310,000	0.7	9.1	260	0.075	7.76	10	320	1,870	2.8	<0.05	23.83	3.4
12MW-19S	1/14/2004	110	---	66	<10	37	290,000	0.05	4.1	130	0.1	8.88	5.4	140	991	<0.5	<0.05	18.62	2.3
12MW-19S	4/27/2004	60	---	50	<10	33	---	<0.05	2.7	70	0.075	9.19	4.6	100	778	<0.75	<0.05	19.52	7
12MW-19S	8/19/2004	50	---	35	<10	33	---	<0.05	1.7	61	<0.025	9.26	3.6	66	503	<0.5	<0.05	23.78	5.1
12MW-19S	2/2/2005	33	---	16	<10	44	250,000	<0.05	0.52	---	<0.05	9.95	2	52	400	<0.5	<0.05	16.47	0
12MW-19S	5/25/2005	30	---	14	<10	45	260,000	<0.05	0.56	17	0.05	8.87	1.8	42	326	<0.75	<0.05	18.7	0
12MW-19S	9/13/2005	21	---	9.4	<10	51	---	<0.05	0.4	15	0.1	9.34	1.9	34	272	1J	<0.05	23.38	---
12MW-19S	1/31/2006	---	---	---	---	45	---	-0.05	---	---	0.1	9.53	---	---	255	-0.75	---	18.16	---
12MW-19S	9/12/2006	22	---	---	<10	40	---	0.1	---	---	0.1	9.42	---	---	199	<0.75	<0.05	23.23	---
12MW-20D	4/8/2003	200	<2	31	14	200	---	1.5	6.5	90	0.15	7.07	4.8	170	1,045	<5	<0.05	17.51	---
12MW-20D	7/15/2003	200	<1	45	25	290	---	1.5	9.1	100	0.25	6.86	5.3	210	1,321	4.4J	0.05	22.25	---
12MW-20D	9/16/2003	175	---	46	30	300	---	1.5	9.3	99	0.075	6.78	5.8	220	1,391	<5	0.1	22.15	1.4
12MW-20D	1/12/2004	175	---	52	25	380	---	1.5	10	120	0.1	6.78	6.3	200	1,437	<6.3	<0.05	18.54	2

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-20D	4/26/2004	200	---	55	30	320	---	1.5	11	120	0.15	6.93	6.6	180	1,464	<5	0.05	20.76	5.5
12MW-20D	8/16/2004	150	---	59	20	340	---	1	12	130	0.2	6.85	7	220	1,570	4J	0.3	22.99	0
12MW-20D	5/25/2005	250	---	47	24	280	---	0.9	9.3	96	0.15	6.95	5.8	250	1,364	<5	0.1	20.3	0
12MW-20D	6/21/2006	185	---	44	30	250	---	0.7	8.7	91	0.1	6.79	---	170	1284	-2.5	-0.05	22.91	---
12MW-20S	4/9/2003	40	<0.6	7.5	250	45	---	0.85	2.6	36	0.1	5.11	0.93J	54	310	15	0.05	16.83	---
12MW-20S	7/16/2003	50	0.85	43	325	41	---	17.5	16	230	<0.025	5.37	1.4J	100	835	2.2	0.6	21.45	---
12MW-20S	9/16/2003	<10	---	62	325	39	---	35	26	340	<0.025	5.21	2	170	1,104	2	0.8	22.94	5.5
12MW-20S	1/14/2004	180	---	44	250	40	---	38.2	19	250	<0.025	5.93	1.3J	160	1,030	<0.5	<0.05	18.17	13.8
12MW-20S	4/26/2004	260	---	26	275	41	---	22.5	11	150	0.1	6.22	0.98J	130	793	1J	0.6	19.01	19.8
12MW-20S	8/19/2004	225	---	16	200	45	---	15	6.9	91	0.05	6.02	1J	130	700	<0.75	0.15	22.38	24.5
12MW-20S	2/2/2005	175	---	8.4	35	53	---	7.5	3.4	---	0.075	6.52	<0.53	100	527	4.6	<0.05	16.91	24.1
12MW-20S	5/25/2005	130	---	9.7	50	68	---	5.5	3.1	44	0.05	6.4	<0.36	96	572	1J	<0.05	20.02	0
12MW-20S	9/13/2005	102	---	8	50	61	---	4	3.2	43	<0.025	6.38	0.39J	85	448	2.4	0.1	22.84	---
12MW-20S	1/31/2006	---	---	---	---	47	---	2	---	---	0.1	6.05	---	---	314	8.7	---	18.76	---
12MW-20S	6/22/2006	35	---	2.8	25	44	---	2.5	1.1	16	-0.025	6.16	---	47	296	2.7	-0.05	21.32	---
12MW-20S	9/11/2006	60	---	---	30	57	---	2.5	---	---	<<<	5.98	---	---	327	4.4	<0.05	23.25	---
12MW-21D	4/7/2003	150	<0.8	100	40	79	---	47.5	15	1900	0.14	6.67	10	370	1,950	<2	0.1	19.93	---
12MW-21D	7/15/2003	500	0.7J	95	60	71	4,100	17.5	15	750	<0.025	7	9.2	380	1,950	<1	<0.05	23.23	---
12MW-21D	9/16/2003	350	---	88	50	65	12,000	15	12	570	<0.025	7.18	9.8	370	1,850	<1	<0.05	23.79	18.8
12MW-21D	1/12/2004	250	---	71	33	71	46,000	9	9.3	320	<0.025	7.41	9.3	260	1,670	<1.3	<0.05	18.57	28.9
12MW-21D	4/27/2004	325	---	68	27	69	14,000	7.5	8.7	330	<0.025	7.39	9.9	270	1,650	<1.3	<0.05	19.02	27.1
12MW-21D	8/16/2004	500	---	49	25	74	4,900	3.5	7.4	170	0.025	7.58	9	300	1,384	<0.75	<0.05	23.1	23.1
12MW-21S	4/8/2003	110	<0.8	57	<10	87	---	4.45	7	320	<0.025	7.6	18	220	1,199	7.7	<0.05	17.34	---
12MW-21S	7/15/2003	112	1.2	77	<10	93	380,000	6.5	8.1	400	<0.025	7.34	16	230	1,286	3.5	<0.05	22.44	---
12MW-21S	9/15/2003	125	---	76	<10	94	500,000	3	7.7	330	<0.025	7.98	17	210	1,276	<1.5	<0.05	24.95	1.4
12MW-21S	1/13/2004	50	---	71	<10	90	410,000	2	4.7	140	0.1	8.4	15	170	1,154	<1.3	<0.05	16.31	9.9
12MW-21S	4/27/2004	75	---	76	<10	91	560,000	1.5	4.8	130	0.1	9.17	14	160	1,242	<1.5	<0.05	19.34	8.4
12MW-21S	8/18/2004	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12MW-21S	8/19/2004	65	---	62	<10	110	400,000	0.3	4.8	94	<0.025	8.03	11	130	923	<1.3	<0.05	24.02	0
12MW-21S	2/1/2005	50	---	68	<10	110	580,000	0.4	3.9	---	0.05	9.72	10	150	951	<1.3	<0.05	16.86	0
12MW-21S	2/3/2005	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12MW-21S	5/24/2005	---	---	---	---	---	220,000	---	---	---	---	---	---	---	---	---	---	---	---
12MW-21S	5/24/2005	70	---	84	<10	90	---	0.15	3	71	0.05	9.6	12	160	1,119	<1.3	<0.05	20.57	7.3
12MW-21S	9/13/2005	70	---	81	<10	94	---	0.5	2.5	93	0.05	9.52	12	110	1,051	<1.3	<0.05	24.07	4
12MW-21S	1/31/2006	---	---	---	--	86	---	0.35	---	---	-0.025	9.41	---	---	889	-1.3	---	19.29	0.1
12MW-21S	6/22/2006	50	---	60	-10	85	---	0.3	1.7	68	0.1	9.18	---	94	768	-1.3	-0.05	23.13	---
12MW-21S	9/11/2006	50	---	---	<10	96	---	0.15	---	---	0.05	9.43	---	---	750	<1.3	<0.05	24.68	---
12MW-21SR	4/8/2003	---	---	54	---	---	---	---	6.6	300	---	---	16	210	---	---	---	---	---
12MW-21SR	7/15/2003	---	1	75	---	93	---	---	7.9	380	---	---	17	220	---	3.5	---	---	---
12MW-21SR	9/15/2003	---	---	74	---	97	---	---	7.5	320	---	---	16	200	---	<1.5	---	---	---
12MW-21SR	2/1/2005	---	---	68	---	110	---	---	4	---	---	---	10	150	---	<1.3	---	---	---
12MW-22D	4/9/2003	205	<1.6	79	21	140	59	3	14	200	<0.025	6.45	7.6	170	1,182	<4	0.8	18.2	---
12MW-22D	7/14/2003	250	0.8J	100	60	130	14	3	21	280	<0.025	6.71	6.9	270	1,530	<1.5	0.5	21.57	---
12MW-22D	9/17/2003	375	---	99	70	120	8.8	3.5	20	270	0.15	6.32	8.8	250	1,660	<0.5	0.2	22.59	---
12MW-22D	1/12/2004	350	---	83	50	140	6.4	2	17	210	0.1	6.79	8.5	180	1,441	<2	0.2	19.05	11.8
12MW-22D	4/28/2004	550	---	88	60	130	120	1.9	18	220	0.15	7.06	8.5	200	1,550	<2	0.15	17.66	0
12MW-22D	8/17/2004	500	---	79	50	140	---	2	16	210	0.25	6.92	8.1	220	1,530	<1.8	<0.05	23.48	12.9
12MW-22D	5/25/2005	550	---	71	60	110	---	1.35	15	200	0.1	7.09	7.5	260	1,379	<1.5	<0.05	20.65	27.7
12MW-22D	6/21/2006	375	---	58	35	150	---	1.05	11	160	0.15	6.92	---	150	1097	-1.8	0.05	22.65	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-22S	4/10/2003	60	<1	14	60	96	2,100	7.5	5.3	94	0.3	5.75	1.7J	73	518	8	<0.05	16.23	---
12MW-22S	7/17/2003	70	<0.5	16	240	96	1,200	14	6.5	110	<0.025	5.77	1.7J	68	536	1.4J	0.6	22.28	---
12MW-22S	9/15/2003	<10	---	19	275	86	410	27.5	7.6	120	<0.025	5.88	2.1	79	---	1.3J	0.05	23.32	0
12MW-22S	1/14/2004	80	---	29	225	82	6.7	22.75	12	170	<0.025	6.63	2.1	78	741	<1.5	0.2	18.63	6.2
12MW-22S	4/28/2004	150	---	43	275	90	10	27	17	250	<0.025	6.26	2.1	85	924	<1.3	0.2	17.48	0
12MW-22S	8/17/2004	250	---	38	300	98	5.7	30	14	210	0.025	6.05	1.9J	100	918	<1.3	<0.05	23.49	8.5
12MW-22S	2/3/2005	250	---	42	4	99	2.7	20	15	---	0	6.41	1.9	110	884	<1.3	0.2	17	1.5
12MW-22S	5/24/2005	250	---	41	250	96	2.9	25	14	220	0.025	6.28	2.9	120	954	<1.3	0.1	19.07	40.8
12MW-22S	9/13/2005	225	---	33	250	100	---	19.5	12	160	0.05	6.25	1.5	81	846	<1.5	0.1	23.9	3.4
12MW-22S	1/31/2006	---	---	---	---	91	---	---	---	---	0.075	6.04	---	---	691	2.3J	---	19.11	65.8
12MW-22S	6/20/2006	225	---	30	160	99	2.6	15.75	11	150	0.05	6.18	---	89	821	-1.3	-0.05	22.97	---
12MW-22S	9/11/2006	200	---	---	170	90	---	13.6	---	---	<0.025	6.37	---	---	756	<1.3	0.05	24.09	---
12MW-23D	4/8/2003	140	<0.8	27	17	83	---	0.85	5.5	66	0.2	6.75	4.8	83	572	<2	<0.05	17.94	---
12MW-23D	7/14/2003	180	<0.5	33	18	99	---	1	6.7	84	0.15	6.73	4.5	74	682	3.3	<0.05	22.27	---
12MW-23D	9/17/2003	160	---	32	17	89	---	1.5	6.1	76	0.25	7.03	5	88	654	2.1J	<0.05	22.14	---
12MW-23D	1/12/2004	130	---	42	20	150	---	1	8.2	110	0.3	7.05	6.5	98	897	4	<0.05	19.22	1.8
12MW-23D	4/27/2004	185	---	32	15	93	---	1.3	6.3	79	0.15	7.11	5.7	98	655	2.4J	<0.05	20.27	7.4
12MW-23D	8/18/2004	140	---	39	16	140	---	1.5	8	98	0.15	7	6.1	110	815	2.7J	<0.05	23.86	6.9
12MW-23D	5/25/2005	175	---	36	25	110	---	0.6	7.2	87	0.15	7.15	5.7	100	773	<1.5	<0.05	20.08	0
12MW-23D	6/21/2006	200	---	42	22	130	---	0.65	8.4	100	0.15	6.95	---	95	848	-1.8	-0.05	22.72	---
12MW-23S	4/9/2003	145	0.97	12	60	66	3.8	2.5	3.6	73	0.2	5.92	1.9	130	705	56	<0.05	18.05	---
12MW-23S	7/16/2003	200	0.6J	15	155	71	2.4	5	4.4	94	0.15	6.34	2	120	735	55	<0.05	22.98	---
12MW-23S	9/17/2003	175	---	17	130	60	4.3	6	4.2	82	0.075	6.23	2.4	98	609	33	<0.05	24.36	8.4
12MW-23S	1/14/2004	130	---	15	55	52	2.8	1.35	3.8	70	0.9	6.87	2.4	60	474	13	<0.05	18.72	2.7
12MW-23S	4/27/2004	175	---	15	60	53	---	0.85	3.9	83	0.4	6.41	2.2	71	495	11	<0.05	20.16	9.3
12MW-23S	8/17/2004	160	---	16	85	51	2.2	4.5	4	71	0.025	6.17	2.4	72	472	5.9	<0.05	23.25	8.6
12MW-23S	2/1/2005	---	---	16	---	55	---	---	4	---	---	---	2.3	65	---	4.4	---	---	---
12MW-23S	2/3/2005	---	---	---	---	---	1.8	---	---	---	---	---	---	---	---	---	---	---	---
12MW-23S	2/5/2005	110	---	---	40	---	---	1.65	---	---	0.7	6.37	---	---	452	---	<0.05	18.66	4.3
12MW-23S	5/25/2005	120	---	15	100	61	42	1.8	4	92	0.075	6.31	2.2	74	502	4.4	<0.05	18.91	1.5
12MW-23S	9/12/2005	120	---	17	125	58	---	5	4.2	75	0.075	6.3	2.5	72	465	2.4	<0.05	23.93	4.6
12MW-23S	1/30/2006	---	---	---	---	59	---	2.1	---	---	0.5	6.16	---	---	449	2.9	---	19.69	1.4
12MW-23S	6/21/2006	110	460	16	110	58	---	3.95	4.3	97	---	6.02	---	66	476	2.3	-0.05	22.53	---
12MW-23S	9/12/2006	115	---	---	160	58	---	4.75	---	---	0.05	6.11	---	---	455	2	<0.05	22.71	---
12MW-24D	4/7/2003	180	<0.8	120	100	86	---	40	21	1400	0.12	6.53	8.7	130	1,300	<2	0.1	20.76	---
12MW-24D	7/16/2003	450	0.7J	170	145	92	400	45	23	1900	<0.025	6.64	10	120	1,590	<1.3	<0.05	22.41	---
12MW-24D	9/16/2003	500	---	160	135	84	18	35	21	1400	<0.025	6.96	12	130	1,580	<1.3	<0.05	23.27	---
12MW-24D	1/12/2004	400	---	180	60	78	89	27.5	30	1300	0.025	6.52	12	120	1,640	<1.3	<0.05	18.04	18.3
12MW-24D	4/27/2004	500	---	130	45	79	---	15	22	710	0.05	7.27	12	100	1,305	<1.3	<0.05	19.04	18.1
12MW-24D	8/16/2004	400	---	150	65	79	1,600	22.5	25	940	0.025	7.02	12	140	1,412	1.7J	<0.05	23.03	5.2
12MW-24S	4/7/2003	125	<0.6	100	100	65	---	43.5	22	1400	0.17	5.94	5.5	91	1,092	<1.5	0.3	20.57	---
12MW-24S	7/16/2003	425	0.91	160	190	53	8,600	50	30	1600	<0.025	6.47	6.8	100	1,427	<0.75	0.2	22.58	---
12MW-24S	9/16/2003	325	---	170	155	46	24,000	35	26	1300	0.1	6.8	9.9	110	1,510	<0.75	<0.05	23.96	---
12MW-24S	1/13/2004	400	---	110	70	42	5,000	15.25	17	710	<0.025	7.22	8.7	80	1,104	<0.75	<0.05	17.21	25
12MW-24S	4/27/2004	500	---	79	80	38	---	12.5	15	470	<0.025	6.89	7.4	80	972	0.87J	<0.05	19.79	10.3
12MW-24S	8/18/2004	325	---	62	60	39	---	15	12	350	<0.025	6.75	6.5	79	801	<0.75	<0.05	24.37	31.2
12MW-24S	2/1/2005	225	---	45	40	37	---	6.35	9.1	---	<0.025	6.95	5.2	75	674	<0.5	<0.05	16.95	15.3
12MW-24S	1/30/2006	---	---	---	---	48	---	2.55	---	---	-0.025	7.15	---	---	494	2.8	---	18.91	3.2
12MW-24S	6/21/2006	125	380	23	16	50	---	2.6	3.9	96	-0.025	6.93	---	58	466	-0.75	-0.05	22.76	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-24S	9/11/2006	110	---	---	15	56	---	1.8	---	---	<0.025	7.24	---	---	430	<0.75	<0.05	23.35	---
12MW-25D	7/15/2003	125	<1	40	14	140	---	1.5	6.3	90	0.15	7.15	5	110	861	5.6	0.3	21.37	---
12MW-25D	9/16/2003	190	---	50	18	140	10	1.5	8.4	120	0.1	7.07	5.9	130	460	<2	0.6	21.93	0
12MW-25D	1/12/2004	130	---	56	16	150	---	1.2	11	140	0.1	6.38	7.2	120	1,055	<2	0.9	17.78	0
12MW-25D	4/28/2004	125	---	89	25	150	---	2.5	18	220	0.05	6.66	8.4	120	1,213	<2.5	0.5	19.12	17.3
12MW-25D	8/16/2004	200	---	56	33	180	---	1.5	11	140	0.15	6.92	7.4	150	1,085	<2.3	0.15	22.12	14.5
12MW-25D	5/23/2005	250	---	90	70	150	---	2.5	19	350	0.1	6.85	8.4	160	1,202	<1.8	0.25	21.45	15.3
12MW-25D	6/21/2006	275	---	63	45	130	---	2.1	13	270	0.1	6.81	---	110	1049	-1.8	0.1	21.05	---
12MW-25S	4/9/2003	100	<0.6	18	30	48	2.6	2	4.3	66	0.1	6.26	2.3	62	410	2.7	<0.05	17.44	---
12MW-25S	7/15/2003	105	0.35J	16	45	49	5.5	2	4.1	59	0.1	6.77	2.3	58	405	1.7	<0.05	21.29	---
12MW-25S	9/17/2003	110	---	16	30	47	10	2	3.9	55	0.1	6.26	2.5	59	412	1J	0.1	21.32	5.5
12MW-25S	1/13/2004	115	---	17	30	49	8.5	1.6	4.1	59	0.1	6.72	2.5	47	420	<0.75	<0.05	16.18	1
12MW-25S	4/27/2004	120	---	21	40	48	---	1.75	5.1	72	0.3	6.5	3	57	469	<0.75	<0.05	18.73	19.7
12MW-25S	8/18/2004	160	---	25	40	49	3,100	2	6.2	85	0.15	6.3	3.3	69	506	<0.75	<0.05	22.72	28.9
12MW-25S	2/1/2005	225	---	30	60	48	---	2.2	7.3	---	0.075	6.4	3	79	588	<0.75	<0.05	17.78	5.3
12MW-25S	5/23/2005	210	---	34	85	48	---	2.3	8.4	110	0.075	6.52	3.1	87	630	<0.75	0.05	21.26	18.4
12MW-25S	9/12/2005	240	---	34	115	52	---	2.4	8.8	110	0.1	6.48	3.6	93	670	0.84J	<0.05	23.15	12.2
12MW-25S	1/30/2006	---	---	---	---	44	---	2.25	---	---	0.15	6.59	---	---	683	-0.75	---	18.76	7.7
12MW-25S	6/21/2006	260	560	42	100	47	---	2.55	10	130	0.1	6.37	---	90	697	1.3J	0.05	21.64	---
12MW-25S	9/11/2006	260	---	---	140	98	---	2.55	---	---	0.05	6.47	---	---	686	1.8J	<0.05	22.14	---
12MW-26S	4/8/2003	85	<0.6	20	30	51	---	1.9	4.7	67	0.1	6.55	2.8	56	403	<1.5	0.05	16.83	---
12MW-26S	7/16/2003	85	<0.3	33	45	50	---	4	7.9	120	<0.025	6.33	2.5	48	508	<0.75	0.3	22.33	---
12MW-26S	9/17/2003	125	---	25	60	48	---	2.5	5.7	83	<0.025	6.37	3.2	58	466	<0.75	0.05	23.82	8.9
12MW-26S	1/13/2004	110	---	24	60	52	---	3.1	5.5	85	<0.025	7.07	3.2	44	462	<0.75	0.05	17.72	0
12MW-26S	4/27/2004	110	---	21	60	53	---	3.15	4.9	72	---	6.38	2.8	48	423	<1	<0.05	18.54	4.7
12MW-26S	8/18/2004	70	---	20	120	68	---	3.5	5	71	<0.025	6.17	2.7	58	441	<1	0.05	24.28	8.3
12MW-26S	2/2/2005	100	---	21	115	79	---	4.45	5.5	---	0.075	5.89	2.6	61	486	1.1J	<0.05	15.78	12
12MW-26S	5/25/2005	40	---	---	25	84	---	7	---	---	0.05	7.08	---	---	509	<1	<0.05	19.65	0
12MW-26S	1/31/2006	---	---	---	---	110	---	6.5	---	---	0.1	5.96	---	---	590	-1.3	---	18.59	---
12MW-26S	7/5/2006	65	---	---	70	---	---	4	---	---	0.1	6.11	---	---	574	---	-0.05	22.33	'---
12MW-26S	9/12/2006	110	---	---	85	67	---	2	---	---	0.05	6.35	---	---	432	<1	<0.05	21.75	---
12MW-27D	4/8/2003	200	<2	47	33	220	---	2.15	9.5	110	0.2	6.75	6.4	170	1,185	6.2	<0.05	17.22	---
12MW-27D	7/15/2003	175	<1	52	22	280	---	2	11	120	0.15	6.86	6	190	1,298	7.9	<0.05	22.44	---
12MW-27D	9/16/2003	175	---	51	21	260	---	2	10	110	0.1	6.86	6.1	190	1,336	5.8J	<0.05	22.8	4
12MW-27D	1/12/2004	150	---	52	21	290	---	1	10	110	0.27	6.8	6.6	180	1,396	<6.3	<0.05	18.09	2.7
12MW-27D	4/28/2004	150	---	50	19	250	---	0.9	10	130	0.1	6.92	6.3	150	1,334	5J	<0.05	18.53	17.9
12MW-27D	8/18/2004	200	---	42	30	220	---	1.55	8.8	98	0.1	6.79	5.4	170	1,153	<2.5	0.1	24.14	0
12MW-27D	5/23/2005	225	---	1.6	37	270	---	1.5	1.4	11	0.1	6.99	<0.36	25	1,338	<5	<0.05	22.86	0.2
12MW-27D	6/21/2006	100	---	63	45	190	---	1.5	13	130	0.1	6.69	---	170	1373	-2.5	-0.05	23.35	---
12MW-27S	4/9/2003	<10	<0.6	4.3	155	32	---	1.4	1.8	33	0.3	4.67	0.67J	28	195	18	<0.05	16.24	---
12MW-27S	7/16/2003	<10	0.35J	3.2	200	37	---	3.5	1.6	29	<0.025	5	0.62J	24	195	17	<0.05	22.42	---
12MW-27S	9/16/2003	<10	---	2.8	200	34	---	5.5	1.5	25	0.075	5.03	0.63J	28	240	<2.5	<0.05	24.29	---
12MW-27S	1/14/2004	<10	---	3.1	---	37	---	0.8	1.5	25	0.55	5.39	0.48J	20	196	14	<0.05	17.23	0
12MW-27S	4/27/2004	<10	---	2.5	145	37	---	0.5	1.5	23	0.15	4.89	0.79J	22	193	16	<0.05	19.39	6.7
12MW-27S	8/18/2004	<10	---	2.2	190	36	---	2.45	1.4	17	0.1	4.7	0.94J	28	190	14	<0.05	24.58	0
12MW-27S	2/3/2005	<50	---	---	22	---	---	4	---	---	0.4	4.89	---	---	175	---	<0.05	16.89	8
12MW-27S	5/23/2005	<10	---	59	210	38	---	2.45	12	120	0.1	4.85	6.6	230	189	13	<0.05	21.62	0
12MW-27S	9/13/2005	<10	---	1.2	240	39	---	3.5	1.5	11	0.15	4.66	0.51J	25	202	12	<0.05	24.09	---
12MW-27S	1/31/2006	---	---	---	---	43	---	2	---	---	0.15	4.73	---	---	223	12	---	20.02	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12MW-27S	6/21/2006	-10	---	2.1	350	46	---	2.5	2.1	15	0.05	4.55	---	29	237	10	-0.05	23.43	---
12MW-27S	9/12/2006	<10	---	---	350	47	---	3	---	---	0.1	4.48	---	---	241	9.9	<0.05	23.55	---
12MW-28D	4/8/2003	50	<0.8	20	16	85	---	0.65	4.3	48	0.2	6.94	3.5	96	588	3	<0.05	18.53	---
12MW-28D	7/15/2003	100	0.55J	23	18	100	---	1.5	4.9	64	<0.025	6.94	4	95	647	3.8	<0.05	23.01	---
12MW-28D	9/17/2003	150	---	24	19	98	---	2	5	64	0.1	6.92	4.2	100	688	4.1	<0.05	22.77	5
12MW-28D	1/12/2004	175	---	36	17	150	---	1.25	7.5	96	0.15	6.61	5.6	110	888	<2	0.2	18.75	0
12MW-28D	4/26/2004	180	---	34	25	130	---	1.7	7.2	95	0.075	7.02	5.5	95	831	<2	0.1	20.98	12.1
12MW-28D	8/17/2004	240	---	41	30	150	---	2	8.8	110	0.15	6.92	6.3	140	928	<1.8	<0.05	23.44	15.2
12MW-28D	5/25/2005	200	---	52	40	120	---	1.5	11	140	0.1	6.68	6.5	160	1,028	<1.5	0.05	21.65	9.1
12MW-28D	6/22/2006	350	---	64	105	120	---	1.35	14	170	0.15	6.49	---	120	1067	-1.8	0.1	21.73	---
12MW-28S	4/9/2003	250	<1.6	110	70	130	2.3	4.5	12	140	0.15	6.11	2.3	70	1,047	15	<0.05	17.69	---
12MW-28S	4/28/2004	<10	---	24	220	110	18	0.8	6.3	60	0.15	5.56	1.6J	59	528	6.8	<0.05	18.61	0
12MW-28S	8/17/2004	35	---	20	250	110	3	4.5	5.8	64	0.3	5.26	64	64	521	5.5	<0.05	23.83	12.8
12MW-28S	2/2/2005	60	---	21	180	110	0.82	1.25	5.5	---	0.4	5.67	1.4J	61	511	4.5	<0.05	18.46	0
12MW-28S	5/24/2005	<10	---	20	210	120	0.98J	0.7	5.5	53	0.075	5.41	1.6	64	538	5.9	<0.05	21.2	12.6
12MW-28S	9/13/2005	<10	---	18	250	130	---	2.6	5.5	52	0.15	5.22	1.3J	69	533	8.6	<0.05	23.72	11.4
12MW-28S	1/31/2006	---	---	---	---	120	---	0	---	---	0	0	---	---	0	5.4	---	0	0
12MW-28S	6/20/2006	-10	---	18	250	140	1.2	0.95	5.9	54	0.1	5.12	---	68	553	7	-0.05	22.86	---
12MW-28S	9/12/2006	<10	---	---	275	120	---	2.4	---	---	0.15	5.22	---	---	538	4.1	<0.05	24.05	---
12MW-28SR	4/9/2003	---	<1.6	120	---	130	---	---	13	140	---	---	2.5	70	---	15	---	---	---
12MW-28SR	7/17/2003	---	<0.8	73	---	120	---	---	9.3	120	---	---	1.8	70	---	12	---	---	---
12MW-28SR	9/15/2003	---	---	42	---	120	---	---	7.2	81	---	---	1.7J	70	---	7.9	---	---	---
12MW-28SR	1/14/2004	---	---	32	---	120	---	---	5.8	61	---	---	1.7J	49	---	6.5	---	---	---
12MW-28SR	4/28/2004	---	---	24	---	120	---	---	6.3	60	---	---	1.5J	59	---	7.2	---	---	---
12MW-28SR	8/17/2004	---	---	20	---	110	---	---	5.9	64	---	---	63	63	---	5.9	---	---	---
12MW-28SR	2/2/2005	---	---	22	---	120	---	---	5.7	---	---	---	1.5J	64	---	5.4	---	---	---
12MW-28SR	5/24/2005	---	---	20	---	120	---	---	5.6	54	---	---	1.2J	65	---	5.8	---	---	---
12MW-28SR	9/13/2005	---	---	18	---	130	---	---	5.6	53	---	---	1.6	71	---	8	---	---	---
12MW-28SR	1/31/2006	---	---	---	---	120	---	---	---	---	---	---	---	---	---	5.4	---	---	---
12MW-28SR	6/20/2006	---	---	18	---	140	---	---	5.7	53	---	---	---	66	---	5.4	---	---	---
12MW-28SR	9/12/2006		---	---	---	120	---	---	---	---	---	---	---	---	---	4.1	---	---	---
12MW-29S	8/17/2004	50	---	4.2	40	90	2	0.8	2.3	17	0.05	5.73	1.5J	82	463	2J	<0.05	20.85	38.4
12MW-29S	2/2/2005	50	---	6.2	20	94	1.8	0.8	2.5	---	0.2	6.12	1.2J	88	478	1.4J	<0.05	17.35	0
12MW-29S	5/24/2005	65	---	6.5	70	86	1J	0.6	2.6	23	0.05	---	1.2J	85	478	1.8J	<0.05	18.1	9.2
12MW-29S	9/13/2005	<10	---	5.9	150	80	---	0.5	2.5	22	0.1	6.12	1.7	85	460	2J	<0.05	21.46	34.9
12MW-29S	1/31/2006	---	---	---	---	76	---	0.3	---	---	---	6.07	---	---	449	1.8J	---	17.28	6.3
12MW-29S	6/20/2006	70	---	---	115	80	---	0.5	---	---	0.2	5.96	---	---	476	1.9J	-0.05	20	---
12MW-29S	9/11/2006	65	---	---	30	77	---	0.8	---	---	0.1	5.97	---	---	471	1.8J	<0.05	21.32	---
12MW-29SR	8/17/2004	---	---	4.4	---	89	---	---	2.3	17	---	---	1.6J	82	---	2.2	---	---	---
12MW-29SR	5/24/2005	---	---	6.6	---	87	---	---	2.6	23	---	---	1.1J	85	---	1.7J	---	---	---
12MW-29SR	9/13/2005	---	---	6.1	---	84	---	---	2.6	23	---	---	1.5	86	---	1.9J	---	---	---
12MW-29SR	1/31/2006	---	---	---	---	76	---	---	---	---	---	---	---	---	---	1.6J	---	---	---
12MW-29SR	6/20/2006	---	---	---	---	79	---	---	---	---	---	---	---	---	---	1.7J	---	---	---
12MW-29SR	9/11/2006	---	---	---	---	77	---	---	---	---	---	---	---	---	---	1.7J	---	---	---
12MW-30S	8/18/2004	100	---	6.2	50	100	2.6	---	2.3	45	0.05	5.61	1.2J	81	500	6.9	<0.05	20.64	21.6
12MW-30S	5/24/2005	70	---	9.4	50	96	17	0.4	2.6	37	0.1	---	1.2J	88	505	1.7J	<0.05	19.84	11.4
12MW-30S	9/13/2005	65	---	11	40	88	---	0.4	2.6	38	0.2	5.99	1.5	89	494	2.5	<0.05	21.53	27.6
12MW-30SR	8/18/2004	---	---	6.2	---	97	---	---	2.3	46	---	---	1.4J	83	---	6.3	---	---	---
12PZ-03D	8/19/2004	90	---	46	80	580	---	24	19	370	0.1	5.58	4.6	310	2,200	58	<0.05	22.83	---

Appendix 4. Concentrations of inorganic constituents measured in ground water at Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, August 2000 to September 2006 (continued).

[mg/L, milligrams per liter; nM, nanomoles; µg/L, micrograms per liter; S.U., standard units, µS/cm, microsiemens per centimeter; NTU, Nephelometric turbidity units; R, replicate sample; ---. Data not collected; <, less than; J, estimated]

Well number	Sampling date	Alkalinity (mg/L)	Bromide (mg/L)	Calcium (mg/L)	Carbon Dioxide (mg/L)	Chloride (mg/L)	Hydrogen (nM)	Iron(II) I (mg/L)	Magnesium (mg/L)	Manganese (µg/L)	Dissolved Oxygen (mg/L)	pH (S.U.)	Potassium (mg/L)	Sodium (mg/L)	Specific Conductance (µS/cm)	Sulfate (mg/L)	Sulfide (mg/L)	Temperature (Celsius)	Turbidity (NTU)
12PZ-03D	2/1/2005	65	---	---	70	---	---	17.5	---	---	0.05	5.81	---	---	2,050	---	<0.05	14.56	190
12PZ-03D	5/23/2005	100	---	---	100	---	---	24	---	---	0.1	6.1	---	---	2,060	---	<0.05	---	---
12PZ-03D	6/22/2006	45	---	---	160	---	---	25	---	---	0.05	5.72	---	---	2059	---	-0.05	21.97	---

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER 12PRBDP

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
5						
10						
15						
20						

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER 12PRBDP21

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
5	0-5.5				CLAYEY SAND	
10 15	5.5-16				Zero-Valent Iron	
20						

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER 12PRBDP22

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
5	0-6.1				CLAYEY SAND	
10 15	16-Aug				Zero-Valent Iron	
20						

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER
	12PRBDP24

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
5	0-14				CLAY, gray to mottled reddish brown	
10						
15	14-16				SAND, gray, with CLAY at 15(?) to 15.2(?)	
					Boring terminated at 16 feet	
20						

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER 12PRBDP25

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. Corrected FID (ppm): *(Soil headspace)*
	0-6				SANDY CLAY, mottled brown with clasts	
5						
	6-6.8				CLAYEY SAND, grayish-brown	
	7.2-7.6				CLAY, gray	
	7.6-10.5				CLAYEY SAND, gray	
10						
	10.5-11.6				CLAY, grayish green	
	11.6-12.4(?)				SAND, brown with a 0.2-ft-thick layer of gray CLAY at 12 ft	
	12.4-13				lost core	
	13-14				SAND	
15	14-15				CLAY, with 0.2-ft-thick layer of black/gray SAND at 14.4-14.6 ft	
	15-16				CLAY, gray with -.2-ft-thick brownish-gray SAND layer at 15-15.8 ft	
					Boring terminated at 16 ft	
20						

]

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER
	12PRBDP26

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston	LOCATION : North Charleston, SC
ELEVATION :	DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology	
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006	LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
5, 10	0-14				CLAY	
15	14-16				SAND	
20						

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER 12PRBDP32

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston — LOCATION : North Charleston, SC
ELEVATION : — DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured — START : 5/1/2006 — END: 5/1/2006 — LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
	0-4				SAND and FILL	
5 10	4-12.8				CLAY No zero-valent iron was present	
15	13-16				SAND with thin layers of CLAYEY SAND	
20					Boring terminated at 16 feet	

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER
	12PRBDP35

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
5	0-6				CLAYEY SAND	
10 15	6-16				Zero-valent iron	
20					Boring terminated at 16 feet	

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER
	12PRBDP36

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
	0-2.1				CLAY. Fill	
5	2.1-6.2				CLAYEY SAND	
	6.2-8				Zero-Valent Iron	
10					Boring terminated at 8 feet	
15						
20						

Appendix 5
U.S Geological Survey

PROJECT NUMBER	BORING NUMBER
	12PRBDP37

SOIL BORING LOG

PROJECT : SWMU 12, Naval Weapons Station, Charleston LOCATION : North Charleston, SC
ELEVATION : DRILLING CONTRACTOR : Columbia Technologies
DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology
WATER LEVELS : Not Measured START : 5/1/2006 END: 5/1/2006 LOGGER : D Vroblesky

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. **Corrected FID (ppm):** ***(Soil headspace)***
	0-2.9				SANDY CLAY	
	2.9-4				CLAYEY SAND with SAND at 3.6 to 3.9	
5	4-8				CLAY, red to gray mottled, with shaved edge of zero-valent iron at 8 ft	
10 15	8-16				Zero-Valent Iron. At some depths, an edge of the core appears to be native soil	
20					Boring terminated at 16 feet	

Appendix 6A. Concentrations of volatile organic compounds measured in ground water from temporary wells, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, June 30, 2005

[all concentrations are in micrograms per liter; <, less than; J, estimated; PCE, tetrachloroethene;TCE, trichloroethene; cDCE, cis-1,2-dichloroethene; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; VC, vinyl chloride]

Sample number	PCE	TCE	cDCE	111TCA	11DCA	11DCE	VC
12PRBDP1	430J	1,200	990	1,300	2,000	4,600	170J
12PRBDP2	580	1,000	1,700	1,500	2,900	4,800	890
12PRBDP3	280	670	1,300	840	1,800	3,100	340
12PRBDP4	540	910	830	1,300	2,200	5,600	73J
12PRBDP5	1,200	810	880	2,100	3,000	8,500	87J
12PRBDP6	490	900	410	1,000	1,200	3,900	<53
12PRBDP7	680	860	390J	1,100	1,300	4,500	<53
12PRBDP8	3,600	3,300	1,900	4,900	5,300	15,000	160J
12PRBDP9	1,000	1,500	320J	1,500	1,000	5,400	<53
12PRBDP10	1,900	2,100	390J	2,400	1,400	7,800	<73
12PRBDP11	270J	1,200J	120J	380	190J	2,300	<27
12PRBDP12	<15	76	<20	<13	19J	480	<5.3

Appendix 6B. Concentrations of volatile organic compounds measured in ground water from temporary wells, Solid Waste Management Unit 12, Naval Weapons Station Charleston, North Charleston, South Carolina, May 1, 2006

[all concentrations are in micrograms per liter; <, less than; J, estimated; PCE, tetrachloroethene;TCE, trichloroethene; cDCE, cis-1,2-dichloroethene; 111TCA, 1,1,1-trichloroethane; 11DCA, 1,1-dichloroethane; 11DCE, 1,1-dichloroethene; VC, vinyl chloride]

Sample number	PCE	TCE	cDCE	111TCA	11DCA	11DCE	VC
12PRBDP14	2,980	2,590	1,240	3,130	3,670	12,600	90.6
12PRBDP15	3,270	4,070	633	3,040	2,030	11,600	42.7
12PRBDP16	359	979	145	294	196	1,850	14
12PRBDP17	8.57	58.4	19.2	7.1	19	578	1.67
12PRBDP18	<0.25	<0.25	<0.3	<0.3	3.99	86.3	<0.5
12PRBDP19	<0.25	<0.25	<0.3	<0.3	<0.3	<0.3	<0.5
12PRBDP27	18.2	39.5	177	37.6	270	495	429
12PRBDP28	67	591	46.4	82.2	71.9	1,510	<12.5
12PRBDP29	<0.25	<0.25	<0.3	<0.3	<0.3	0.777J	<0.5
12PRBDP30	<0.25	0.344J	<0.3	<0.3	<0.3	1.08	<0.5
12PRBDP31	<0.25	<0.25	<0.3	<0.3	<0.3	<0.3	<0.5

Prepared by:
USGS Enterprise Publishing Network
Raleigh Publishing Service Center
3916 Sunset Ridge Road
Raleigh, NC 27607

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Vroblesky and others—**Investigation of Ground-Water Contamination at SWMU12, Naval Weapons Station Charleston, SC**—USGS SIR 2006–5311