PREFACE

This volume of the annual hydrologic data report of New Jersey is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each State, Puerto Rico, and the Trust Territories. These records of water quality provide the hydrologic information needed by state, local, and federal agencies, and the private sector for developing and managing our Nation's land and water resources.

Hydrologic data for New Jersey are contained in 3 volumes:

Volume 1. Surface-Water Data
Volume 2. Ground-Water Data
Volume 3. Water-Quality Data

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data and who typed, edited, and assembled the report. The authors had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to U.S. Geological Survey policy and established guidelines. The following individuals contributed significantly to the completion of the report.

J. Gibs R.D. Schopp

Word processing of the report was done by H.L. Hoppe and H.A. Heckathorn. W.H. Ellis, G.L. Simpson, and D.K. Sun drafted the illustrations.

The data were collected, computed, and processed by the following personnel:

G.A. Brown	R.E. Hickman	A.R. Protz	P.E. Stackelberg
G.L. Centinaro	G.K. Holzer	T.J.Reed	G.C. Steckroat
J.F. Dudek	W.D. Jones	K.M. Romanok	J.J. Trainor
J.M. Fischer	T.M. Moffett	J.C. Shvanda	A.F. Watson
K.L. Hibbs	B.S. Painter	A.B. Spehar	B.T. White

Some data were collected by the following N.J. Department of Environmental Protection personnel:

A. Altieri	R. Fenton	C. Kunz	J. Specht
P. Burt	J.Janda	R. Maruska	

This report was prepared in cooperation with the State of New Jersey and with other agencies under the general supervision of Robert G. Reiser, Chief of the Hydrologic Data Assessment Program; under the general supervision of David A. Stedfast, Associate District Chief; Richard H. Kropp, District Chief, New Jersey; and Catherine L. Hill, Regional Hydrologist, Northeastern Region.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
May 2004

3. REPORT TYPE AND DATES COVERED
Annual--Oct.1, 2002 to Sept. 30, 2003

4. TITLE AND SUBTITLE
Water Resources Data-New Jersey, Water Year 2003, Volume 3
Water-Quality Data

5. FUNDING NUMBERS

6. AUTHOR(S)
Michael J. DeLuca, Heidi L. Hoppe, Heather A. Heckathorn, Melissa L. Riskin, Bonnie J. Gray, Emma-Lynnn Melvin, Nicholas A. Liu

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Geological Survey, Water Resources Division
Mountain View Office Park
810 Bear Tavern Road, Suite 206
West Trenton, NJ 08628

8. PERFORMING ORGANIZATION REPORT NUMBER
USGS-WRD-NJ-03-3

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Geological Survey, Water Resources Division
Mountain View Office Park
810 Bear Tavern Road, Suite 206
West Trenton, NJ 08628

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
USGS-WRD-NJ-03-3

11. SUPPLEMENTARY NOTES
Prepared in cooperation with the New Jersey Department of Environmental Protection and with other agencies.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
No restriction on distribution. This report can be purchased from the National Technical Information Services, Springfield, Virginia 22161.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
Water-resources data for the 2003 water year for New Jersey are presented in three volumes, and consists of records of stage, discharge, and water-quality of streams; stage and contents of lakes and reservoirs; and water levels and water-quality of ground water. Volume 3 contains a summary of surface- and ground-water hydrologic conditions for the 2003 water year, a listing of current water-resources projects in New Jersey, a bibliography of water-related reports, articles, and fact sheets for New Jersey completed by the Geological Survey in recent years, water-quality records of chemical analyses from 123 continuing-record surface-water stations, 35 ground-water sites, records of daily statistics of temperature and other physical measurements from 20 continuous-recording stations, and 5 special-study sites consisting of 2 surface-water sites, 1 spring site, and 240 ground-water sites. Locations of water-quality stations are shown in figures 21-25. Locations of special-study sites are shown in figures 49-53. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating federal, state, and local agencies in New Jersey.

14. SUBJECT TERMS
New Jersey, hydrologic conditions, hydrologic data, surface-water analysis, ground-water analysis, streambed-material analysis, suspended-sediment concentration, continuing-record station, continuous-recording station, special-study site.

15. NUMBER OF PAGES
684

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS--Continued

TABLES

WATER-QUALITY STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME

Note.--Data for miscellaneous sites for surface- and ground-water quality are published in separate sections of the data report.

[Letter after station name designates type of data: (c) general chemical, (m) microbiological, (s) suspended sediment, (t) continuous physical measurements, (w) whole-water-recoverable metals, (v) volatile organic compounds, (p) pesticide, (h) bed material, (WMA #) NJDEP watershed management area]

WATER-QUALITY STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME--Continued

WATER-QUALITY STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME--Continued

WATER-QUALITY STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME--Continued

DISCONTINUED CONTINUOUS WATER-QUALITY STATIONS

The following stations have been discontinued as continuous water-quality stations. Daily records of temperature, specific conductance, pH, dissolved oxygen or sediment were collected and published for the period of record shown for each station.

Station name	Station number	Drainage area (mi^2)	Type of record	Period of record (water years)
Passaic River at Millington, NJ	01379000	55.4	Temp	1997-98
Passaic River near Chatham, NJ	01379500	100	Sed	1964-68
			Temp	1967-68
Rockaway River at Longwood Valley, NJ	01379680	22.1	Temp	1997-98
Green Pond Brook at Picatinny Arsenal, NJ	01379773	7.65	Temp, SC, DO, pH	1984-86
Green Pond Brook at Wharton, NJ	01379790*	12.6	Temp, SC, DO, pH	1984-85
Passaic River at Two Bridges, NJ	01382000	361	Temp,	1963-74
			SC, DO, pH	1969-74
Wanaque River at Wanaque, NJ	01387000	90.4	Temp	1964-80
Ramapo River near Mahwah, NJ	01387500	120	Sed	1964-65
Pompton River near Two Bridges, NJ	01389000	372	Temp, SC, DO, pH	1969-74
Passaic River at Little Falls, NJ	01389500	762	Sed	1964-65
			Temp, SC	1981-86
Saddle River at Ridgewood, NJ	01390500	21.6	Temp	1997-98
Rahway River at Morris Avenue, at Springfield, NJ	01394200	25.5	Temp	1997-98
South Branch Raritan River near High Bridge, NJ	01396500	65.3	Temp	1961-79
			SC	1969-79
Mulhockaway Creek at Van Syckel, NJ	01396660	11.8	Temp	1997-98
Spruce Run at Clinton, NJ	01396800	41.3	Temp	1969, 1971-80
South Branch Raritan River at Stanton, NJ	01397000	147	Temp, SC	1969-79
			Sed	1960-63
Neshanic River at Reaville, NJ	01398000	25.7	Temp	1997-98
South Branch Rockaway Creek, at Whitehouse, NJ	01399690	13.2	Temp, SC	1977-78
			Sed	1977
Rockaway Creek at Whitehouse, NJ	01399700	37.0	Temp, SC	1977-78
Raritan River near Manville, NJ	01400510	497	Temp, SC, DO, pH	1968-74
Baldwins Creek at Baldwin Lake, near Pennington, NJ	01400932	2.52	Temp	1963-66
			Sed	1963-69
Stony Brook at Princeton, NJ	01401000	44.5	Temp	1957-70, 1997-98
			Sed	1960-70
Beden Brook near Rocky Hill, NJ	01401600	27.0	Temp	1997-98
Millstone River near Manville, NJ	01402900	287	Temp, SC, DO, pH	1968-74
Raritan River at Queens Bridge, at Bound Brook, NJ	01403300	804	Temp	1997-98
Bound Brook at Middlesex, NJ	01403900	48.4	Temp, SC	1996-98
Raritan River near South Bound Brook, NJ	01404100	874	Temp, SC, DO, pH	1969-77
Manasquan River at Squankum, NJ	01408000	44.0	Temp, SC, DO, pH	1969-74
Toms River near Toms River, NJ	01408500	123	Temp,	1964-66, 1975-81
			SC	1975-81
Oyster Creek near Brookville, NJ	01409095	7.00	Temp, DO	1975-76
			SC, pH	1975-77
West Branch Wading River near Jenkins, NJ	01409810	84.1	Temp, SC	1978-81
Great Egg Harbor River at Sicklerville, NJ	01410784	15.1	Temp, SC	1996-98
Great Egg Harbor River trib. at Sicklerville, NJ	01410787	1.64	Sed	1974-78
Fourmile Branch at New Brooklyn, NJ	01410810	7.74	Sed	1974-78
Great Egg Harbor River at Folsom, NJ	01411000	57.0	Temp	1961-75, 1977-80
			SC	1969-75, 1977-80
			Sed	1966-70, 1979
Delaware Bay at Ship John Shoal Lighthouse, NJ	01412350	--	Temp	1970-86
Maurice River at Norma, NJ	01411500	112	Temp	1967-68, 1980-87, 1993-94
			SC	1980-87, 1993-94

DISCONTINUED CONTINUOUS WATER-QUALITY STATIONS--Continued

Station name	Station number	Drainage area (mi^2)	Type of record	Period of record (water years)
			pH	1993-94
			Sed	1965-68
Delaware River at Port Jervis, NY	01434000	3,076	Temp	1957-60, 1973-94 1999-2001
Delaware River at Montague, NJ	01438500	3,480	Temp	1956-57
			SC, pH	1956-73
Delaware River at Dingmans Ferry, PA	01439000	3,542	Temp, SC, pH	1950-53
Delaware River near East Stroudsburg, PA	01440090	3,830	Temp, SC, DO	1966-78
			pH	1972-78
Delaware River at Dunnfield, NJ	01442750	4,150	Temp	1967-76
			Sed	1964-76
Delaware River near Richmond, PA	01444800	4,378	Temp	1944-47, 1962-63
			SC	1962-63
Delaware River at Easton, PA	01446700	4,636	Temp, SC, DO, pH	1967-77
Jordan Creek near Schnecksville, PA	01451800	53.0	Temp	1999, 2001
Delaware and Raritan Canal Feeder at Raven Rock, NJ	01460300	--	Temp, SC, Turb	1998-99
Delaware and Raritan Canal Feeder at Lower Ferry Road at Trenton, NJ	01460400	--	Temp, SC, Turb	1998-99
Delaware and Raritan Canal Feeder at Port Mercer, NJ	01460440	--	Temp, SC, Turb	1998-99
Delaware and Raritan Canal Feeder at Griggstown, NJ	01460530	--	Temp, SC, Turb	1998-99
Delaware and Raritan Canal Feeder at Ten Mile Lock near Manville, NJ	01460565	--	Temp, SC, Turb	1998-99
Delaware and Raritan Canal Feeder at New Brunswick, NJ	01460600	--	Temp, SC, Turb	1998-99
Delaware River at Trenton, NJ	01463500	6,780	Sed	1949-82
Delaware River at Marine Terminal, at Trenton, NJ	01464040	6,870	Temp, SC	1973-76
Crosswicks Creek near Extonville, NJ	01464500	81.5	Temp	1967-70
			Sed	1965-70
Delaware River at Bristol, PA	01464600	7,163	Temp	1954-75, 1979-80
			DO	1961-75, 1978-80
			SC, pH	1967-75, 1978-80
Little Neshaminy Creek at Valley Road, near Neshaminy, PA	01464907	26.8	Temp	1999, 2001
McDonalds Branch in Lebanon State Forest, NJ	01466500	2.35	Temp	1960-92
			SC	1968-92
			pH, DO	1984-92
Rancocas Creek at Willingboro, NJ	01467016	327	Temp, SC,	1969-74
			DO	1970-72
			pH	1970-74
Delaware River at Torresdale Intake, at Phildelphia, PA	01467030	7,781	Temp	1956-57, 1960-81
			DO	1961-81
			SC	1963-81
			pH	1968-81
Delaware River at Palmyra, NJ	01467060	7,850	Sed	1962-64
Delaware River at Lehigh Avenue, at Philadelphia, PA	01467100	7,935	Temp, SC, DO, pH	1949-68
Cooper River at Haddonfield, NJ	01467150	17.0	Temp	1968-69, 1999-2001
			Sed	1968-69
Delaware River at Wharton Street, at Philadelphia, PA	01467300	7998	Temp, SC, DO, pH	1949-68
Delaware River at League Island, at Philadelphia, PA	01467400	8059	Temp, SC, DO, pH	1949-68
French Creek near Phoenixville, PA	01472157	59.1	Temp	1999-2001
Schuylkill River at Philadelphia, PA	01474500	1893	SC	1999
			Temp	1999-2001
Delaware River at Eddystone, PA	01476200	10190	Temp, SC, DO, pH	1949-68
Raccoon Creek near Swedesboro, NJ	01477120	26.9	Temp	1966-73, 1999-2001
			Sed	1966-69
Delaware River at Marcus Hook, PA	01477200	10360	Temp, SC, DO, pH	1949-77

DISCONTINUED CONTINUOUS WATER-QUALITY STATIONS--Continued

Station name	Station number	Drainage area (mi^2)	Type of record	Period of record (water years)
Delaware River at Delaware Memorial Bridge, at Wilmington, DE	01482100	11,030	Temp	1956-81
			SC	1963-81
			DO	1962-81
			pH	1968-81

* Unpublished records are available in the files of the District office.
Type of record: Temp (water temperature); SC (specific conductance); DO (dissolved oxygen); pH; Sed (sediment concentration); -- (not determined)

INTRODUCTION

The Water Resources Division of the U.S. Geological Survey (USGS), in cooperation with Federal, State, and local agencies, collects a large amount of data pertaining to the water resources of New Jersey each water year. These data, accumulated over many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the USGS, the data are published annually in this report series, titled “Water Resources Data-New Jersey.”

This report series includes records of stage, discharge, and water quality in streams; stage, contents, and water quality in lakes and reservoirs; and water levels and water quality in ground-water wells. This volume contains water-quality records, containing various chemical analyses from 123 continuing-record surface-water stations and 35 ground-water sites. Locations of these stations are shown in figures 21-25. Additional water-quality data were collected at 5 special-study sites that are not part of the systematic data collection program. The special-study sites include 2 surface-water sites, 1 spring site, and 240 ground-water sites. Locations of these sites are shown in figures 49-53. The data in this report represent that part of the National Water Information System (NWIS) data collected by the USGS and cooperating Federal, State, and local agencies in New Jersey.

This series of annual reports for New Jersey began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning in 1975, surface water, water-quality, and ground-water data were combined in one volume. Beginning with the 1977 water year, these data were published in two volumes based on drainage basins. Beginning with the 1990 water year, the format was changed to include all surface-water discharge and surface-water quality records in Volume 1 and all ground-water level and ground-water quality records in Volume 2. Beginning with the 1998 water year, the format has changed to include surface-water discharge records in Volume 1, ground-water level records in Volume 2, and surface- and ground-water-quality records in Volume 3.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for New Jersey were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title “Surface-Water Supply of the United States, Part 1B.” For water years 1961 through 1970, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for water years 1941 through 1970 were published annually under the title “Quality of Surface Waters of the United States,” and water levels for water years 1935 through 1974 were published under the title “Ground-Water Levels in the United States.” The above-mentioned Water-Supply Papers can be consulted in the libraries of the principal cities of the United States and can be purchased from U.S. Geological Survey, Branch of Information Services, Box 25286, Denver, CO 80225-0286, (303) 202-4610.

Publications similar to this report are produced annually by the USGS for all States. These reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as “U.S. Geological Survey Water-Data Report NJ-03-3.” For archiving and general distribution purposes, the reports for water years 1971 through 1974 also are identified as water-data reports. Water-data reports are available for purchase in paper copy or in microfiche from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports can be obtained from the District Chief, USGS, New Jersey District, at the address given on the back of the title page of this report or by telephone ((609) 771-3900).

COOPERATION

The U.S. Geological Survey and agencies of the State of New Jersey have had joint-funding agreements for the collection of water-resource records since 1921. Organizations that assisted in collecting the data in this report through joint-funding agreements with the USGS are--

New Jersey Department of Environmental Protection, Bradley M. Campbell, Commissioner

North Jersey District Water Supply Commission, Michael Barnes, General Manager

Passaic Valley Water Commission, Joseph A. Bella, Executive Director

Delaware River Basin Commission, Carol R. Collier, Executive Director

New Jersey Water Supply Authority, Henry Patterson, Executive Director

The New Jersey Department of Environmental Protection aided in collecting records.

Organizations that supplied data are acknowledged in station descriptions.

SUMMARY OF HYDROLOGIC CONDITIONS

Yearly Trend of Precipitation, Stream Discharge, and Physical Water-Quality Characteristics Monitored at Several Index Stations

The drought New Jersey has been experiencing for more than four water years has diminished. The State received a total of 59.09 inches of precipitation during the 2003 water year (October 2002 to September 2003), making it the fifth wettest water year since 1896. This was quite a reversal from the third driest water year experienced in 2002. Precipitation was above the 1895-2002 mean for 8 months during the 2003 water year (fig. 1) (Statewide Monthly Precipitation 1895-2003, Climate Data, N.J. State Climatologist, Rutgers University; accessed at http://climate.rutgers.edu/stateclim/data/index.html). The monthly total for June (8.61 inches) was the highest for any June since 1896. During 4 additional months, surpluses greater than 1.5 inches occurred. January, April, May, and July had below average precipitation; however, no deficit greater than 0.65 inches occurred. Overall, precipitation was 14.35 inches (32 percent) above average during the 2003 water year. Streamflow was near or above normal throughout much of the year. Monthly mean discharge values for June and September set new maximum monthly mean values for the period of record at index stations Folsom and Trenton, respectively (fig. 2). All three index stations recorded above normal streamflow during the last one-third of the water year.

The precipitation and streamflow surpluses during water year 2003 and their diluting effects on solute concentrations are evident in the plot of monthly mean values of specific conductance (SC) at the continuous water-quality monitoring station on the Delaware River at Trenton (fig. 3). Monthly mean SC values, an indicator of solute concentrations, were below long-term (1968-2002) monthly mean values during 5 months. The correlation between streamflow and SC is less significant than that between precipitation and SC during winter months because even small precipitation events can carry salt used to deice roads, sidewalks, and parking lots into streams and result in higher solute concentrations. Therefore, when monthly mean SC values are expected to be low during high flow in winter months, the opposite is observed. During water year 2003, no long-term extremes for the period of record were exceeded.

Water year 2003 was the 29th coldest year since 1896 with an average ambient temperature of 51.5 ^{o}F (28.6 ^{o}C), 0.6 ^{o}F (0.3 ^{o}C) below the long-term (1968-2002) mean for the State (Statewide Monthly Precipitation 1895-2003, Climate Data). Monthly mean ambient temperatures during 8 months were at or below the long-term mean. Monthly mean water temperature values measured at the Delaware River at Trenton were below the long-term mean monthly values every month during water year 2003 (fig. 4). The monthly mean value for June established a new minimum for the period of record of 17.7 ^{o}C, 1.1 ^{o}C lower than the previous June minimum.

Dissolved oxygen (DO) concentrations generally exhibit an inverse relation to water temperature. As water temperature decreases, oxygen concentration increases; as water temperature increases, oxygen concentration decreases. DO, therefore, varies seasonally; yearly maximums occur in winter, and yearly minimums occur in summer. As expected, the highest monthly median of daily maximum DO concentrations, 16.0 milligrams per liter (mg/L), occurred in February when the monthly mean water temperature was at its lowest, 1.0 ^{o}C (fig. 5). The lowest monthly median of daily minimum DO concentrations, 7.4 mg/L, and the highest monthly mean water temperature, 24.6 ^{o} C, occurred in July. During water year 2003, no monthly medians of DO minimums and maximums exceeded long-term extremes for the period of record.

Ambient Stream Monitoring Network

The United States Geological Survey (USGS), in cooperation with the New Jersey Department of Environmental Protection (NJDEP), operates the cooperative Ambient Stream Monitoring Network (ASMN), which is designed to determine statewide water-quality status and trends, measure water quality near the downstream end of each NJDEP Watershed Management Area (WMA), define background water quality in each of the four physiographic provinces of New Jersey, and measure nonpoint source contributions from major land-use areas and atmospheric deposition.

The ASMN consists of 116 stations located throughout the 20 WMAs. Four stations are located on the Delaware River main stem—the border between New Jersey and Pennsylvania—and are excluded from the following statistical plots of the ASMN data. The remaining 112 stations are segregated into 4 distinct types that together are used to define the surface-water quality in the State. Six background stations are located on reaches of streams that remain relatively unaffected by human activity, in order to develop a baseline water-quality database. Twenty-three Watershed Integrator (WI) stations are located near the farthest downstream point, not affected by tide, in one of the large drainage basins in each WMA, except 5, 9, and 16. The WI stations provide information on large drainange areas that integrate the effects of different types of land use and point and nonpoint contributions to surface-water quality within each WMA. Land Use Indicator (LUI) stations are used to monitor the effects of the dominant land use in each WMA and provide data on nonpoint source loading of contaminants to streams. Of the 43 LUI stations, 15 are designated undeveloped, 9 agriculture, 13 urban, and 6 mixed. Forty-two statewide status (SS) stations, at least two in each WMA, are chosen randomly to obtain a statistical basis that can be used to estimate values of water-quality indicators statewide. Individual tables of chemical constituents are located in the Surface-Water-Quality Station Records section of this report. In water year 2003, two of the SS stations were co-located at existing WI or LUI stations. Water-column samples were collected at each station to assess water-quality constituents that can be used as environmental indicators statewide. In addition to the regularly scheduled samples, a Watershed Reconnaissance study is devised annually according to specific project needs. The purpose of the Watershed Reconnaissance study in water year 2003 was to assess 3-day diurnal physical measurements and constituent concentrations at 12 network stations. This is discussed further in “Ambient Stream Monitoring Network Reconnaissance Study” in this summary.

Distribution of Selected Constituents in Filtered and Unfiltered Surface Water from Stations in the ASMN

Physical characteristics and concentrations of total and filtered nutrients, filtered common ions, filtered organic carbon, and biochemical oxygen demand were determined in samples from 112 stations in the ASMN. Samples were collected at each station four times a year during the periods November to December, February to March, May to June, and August to September. The analyzing laboratory used two different methods and reporting conventions for establishing the minimum concentration above which a quantitative measurement could be made. These reporting conventions were laboratory reporting level (LRL) and minimum reporting level (MRL). LRL was computed as twice the long-term method detection level (LT-MDL). Values reported less than the LRL or MRL were included in each distribution as a value equal to the LT-MDL or one-half the MRL, respectively. Values reported as “E”—estimated to be greater than the LT-MDL but less than the LRL—were included in the plots. Refer to the Definition of Terms section of this report for further explanation of these reporting conventions.

The plots in figure 6 illustrate the relation between land use and water quality. Streams that drain urban and agricultural areas seem to be negatively affected by wastewater discharges and overland runoff, respectively. In contrast, streams that drain background areas have the highest DO concentrations and streams that drain background and undeveloepd areas have the lowest concentrations of most other constituents, except DOC. The lowest median DO concentration, 74 percent of saturation; the highest median total dissolved solids (TDS) concentration, 234 mg/L; the highest median ammonia concentration, 0.10 mg/L; and the highest median chlorophyll a concentration, 0.5 µg/L, occurred at urban LUI stations. In contrast, the highest median DO concentration, 95.8 percent of saturation; the lowest median TDS concentration, 61 mg/L; the lowest median ammonia concentration, 0.015 mg/L; and the lowest median chlorophyll a concentration, 0.5 µg/L, occurred at background stations. The highest median BOD concentration, 1.3 mg/L; the highest median turbidity, 8.1 NTU; and the highest median nitrite plus nitrate concentration, 1.49 mg/L, occurred at agriculture LUI stations. In contrast, the lowest median BOD concentration, 0.50 mg/L, and the lowest nitrite plus nitrate concentration, 0.065 mg/L, occurred at undeveloped stations; the lowest turbidity, 0.75 NTU, occurred at background stations. Dissolved organic carbon (DOC) is a heterogeneous mixture of many organic materials, mostly high molecular weight organic acids that result from the oxidation of organic matter. Organic matter can originate from anthropogenic or natural sources. Streams in urban areas have been found to have high levels of organic carbon caused by nutrient enrichment. Streams in undeveloped areas have been found to have high levels caused by naturally occurring organic matter. The highest median concentration of DOC, 9.2 mg/L, occurred at undeveloped stations; the lowest median concentration occurred at agriculture LUI stations.

Distribution, Detection Frequency, and Concentration of Recoverable Trace Elements in Whole Water and Bed Sediment, Nutrients and Organic Compounds in Bed Sediment, Volatile Organic Compounds in Whole Water, and Pesticides in Filtered Samples from Selected Stations in the ASMN

Water samples for analysis of trace elements, volatile organic compounds (VOCs), and pesticides were collected during the period when the constituents were most likely to have been detected, during August and September, February and March, and May and June, respectively. Samples of bed sediment were collected in low-water conditions during August and September. For ease of discussion, only those constituents detected in one or more samples are shown in the figures or tables on pages 12 through 16. A detected constituent is one whose value is reported to be greater than or equal to the laboratory LRL or MRL. Values reported by the analyzing laboratory as "<"—less than the LRL or MRL—were considered to be not detected and were excluded from the plots. Values reported as "E"—estimated below the LRL or MRL—were included in the plots. Refer to the Definition of Terms section of this report for more information about MRLs and LRLs.

Samples for the analysis of whole-water-recoverable trace elements were collected at 6 background stations to develop a baseline with which to compare the water quality at other stations and at 42 SS stations to provide a general overview of water quality statewide and of the aerial distribution of these compounds. All 15 trace elements analyzed in samples at the USGS National Water Quality Laboratory were detected in one or more samples and, therefore, were included in figure 7. Barium, boron, iron, lead, manganese, and nickel were detected in 100 percent of the samples, and copper, selenium, and zinc were detected in all but one of the samples. Chromium, mercury, and silver had the lowest percentages of detection, 33, 27, and 2, respectively. Arsenic, chromium, mercury, and silver were not detected at any background station. In general, median concentrations were smaller in samples from background stations, which are located on reaches of streams that remain relatively unaffected by human activity.

Bed-sediment samples for the analysis of nutrients, trace elements, polycyclic aromatic hydrocarbons (PAHs), and total polychlorinated biphenyls (PCBs) were collected at 2 background and 20 SS stations. Two of the six background stations are sampled for bed sediment each year and are resampled every third year. In water year 2003, 20 of the 46 SS stations were selected for sampling on the basis of the availability of bed sediment. Ammonia plus organic nitrogen, phosphorus, and total carbon were detected in all samples (fig. 8). Selenium was the only element in the laboratory schedule not detected in any sample. Cadmium, cobalt, iron, lead, and nickel were detected in 100 percent of the samples (fig. 9). Arsenic and mercury had the lowest percentages of detection, 23 and 9, respectively. Mercury, the only element not detected at either of the background stations, was detected at only two of the SS stations. Of the 30 PAHs and PCBs in the laboratory schedule, only those compounds with surface-water-quality standards are presented in the figure and table. Pyrene was the most frequently detected compound at 91 percent of the stations (fig. 10). Dibenz(a,h)anthracene was the least detected compound at 45 percent of the stations. Four compounds were not detected at either of the background stations, and seven compounds were detected at only one of the background stations. PCBs were detected at estimated concentrations at nine of the SS stations and at none of the background stations (table 1).

Samples from 6 background and 42 SS stations were analyzed for 34 VOCs. Seven compounds were detected in more than one sample (fig. 11), and four compounds were detected only once (table 2). The most frequently detected VOCs in 48 samples were methyl tertiary butyl ether (MTBE), in 54 percent of samples; chloroform, in 21 percent; and tetrachloroethylene, in 17 percent. Chloroform and toluene were the only two compounds detected in samples from background stations.

Filtered samples from 6 background and 42 SS stations were analyzed for 52 pesticides by use of laboratory schedule 2001. Only compounds detected in one or more samples are included in figure 12 and tables 3 and 4. Refer to "Laboratory Measurements" in the Explanation of Water-Quality Records section of this report for the complete list of compounds and the LRL for each compound. Twenty-four pesticides were detected in low concentrations and were widely distributed throughout the State. All 24 compounds were detected at one or more SS stations, but only five compounds were detected at background stations. Seven of the detected compounds were insecticides—Azinphos-methyl, Carbaryl, Carbofuran, Diazinon, Dieldrin, Malathion, and cis-Permathrin. The remaining

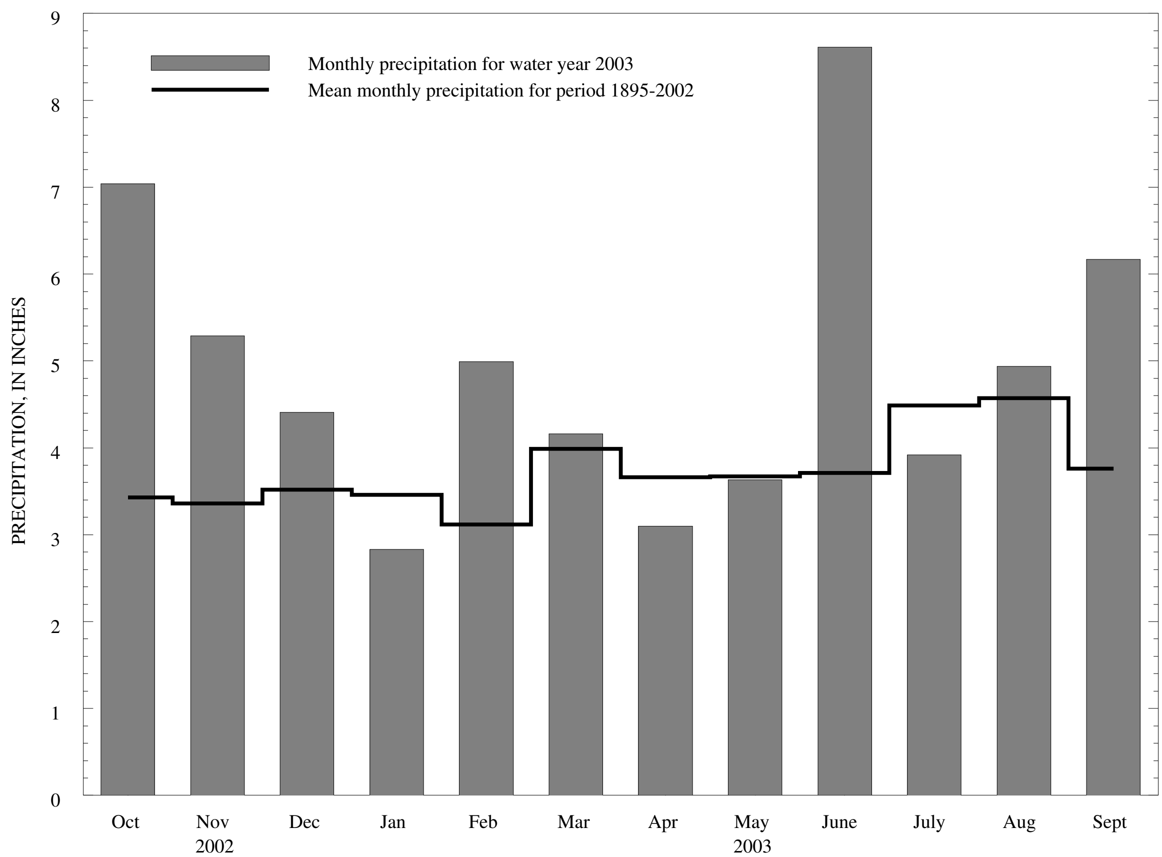
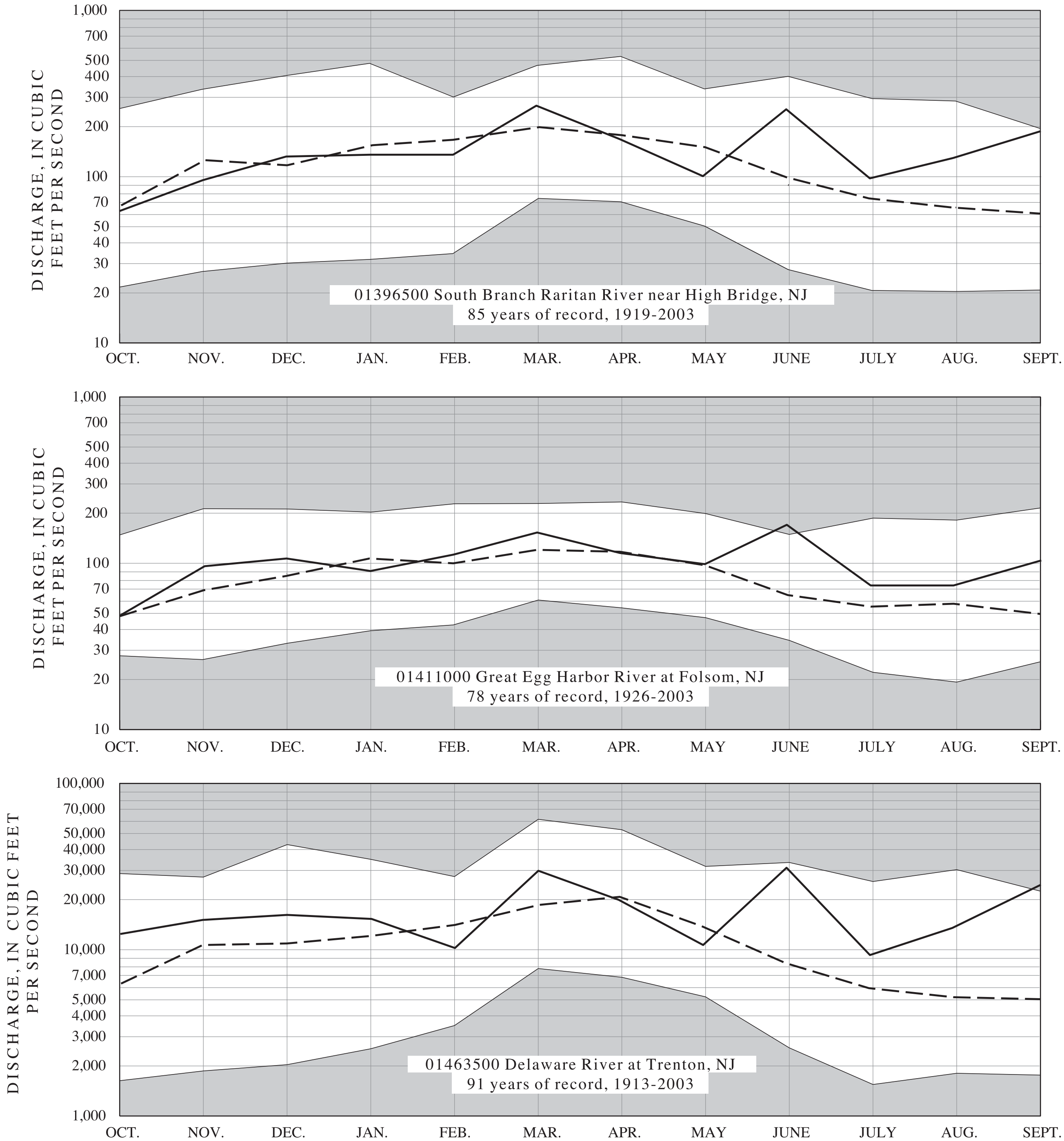


Figure 1. Monthly precipitation for water year 2003 and mean monthly precipitation for 1895-2002.
[Mean monthly and monthly precipitation are spatially weighted averages of several dozen stations throughout the State]



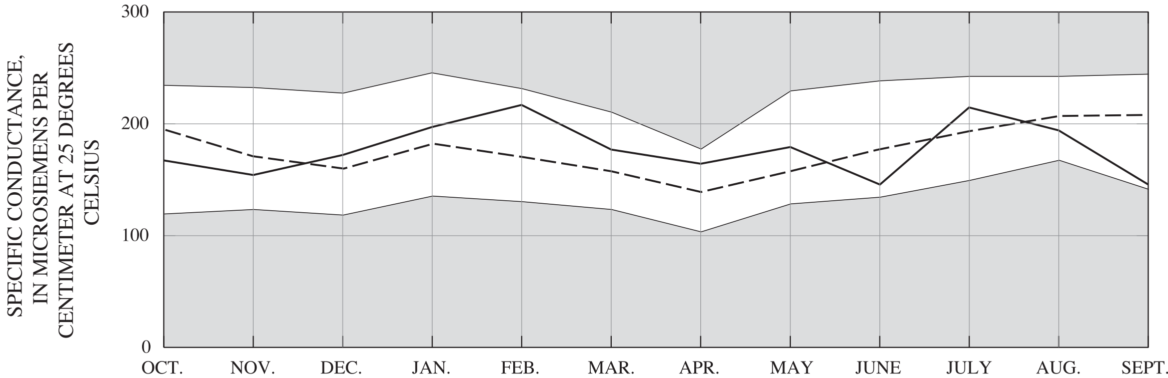
EXPLANATION

UNSHADED AREA--Indicates range between highest and lowest mean discharge recorded for the month, prior to 2003 water year

BROKEN LINE--Indicates normal discharge (median of the monthly means) for the standard reference period, 1971-2000

SOLID LINE--Indicates observed monthly mean discharge for the 2003 water year

Figure 2. Monthly mean discharge at index gaging stations, water year 2003.



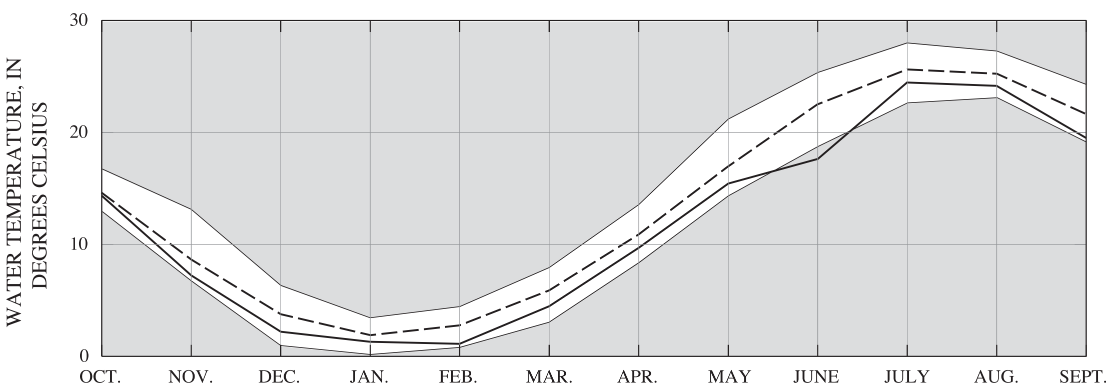
EXPLANATION

UNSHADED AREA--Indicates the range between the highest monthly mean values and the lowest monthly mean values, water years 1968-2002.

SOLID LINE--Indicates the monthly mean values for water year 2003.

BROKEN LINE--Indicates the mean monthly values for water years 1968-2002.

Figure 3. Monthly mean specific conductance at Delaware River at Trenton, New Jersey, water year 2003.



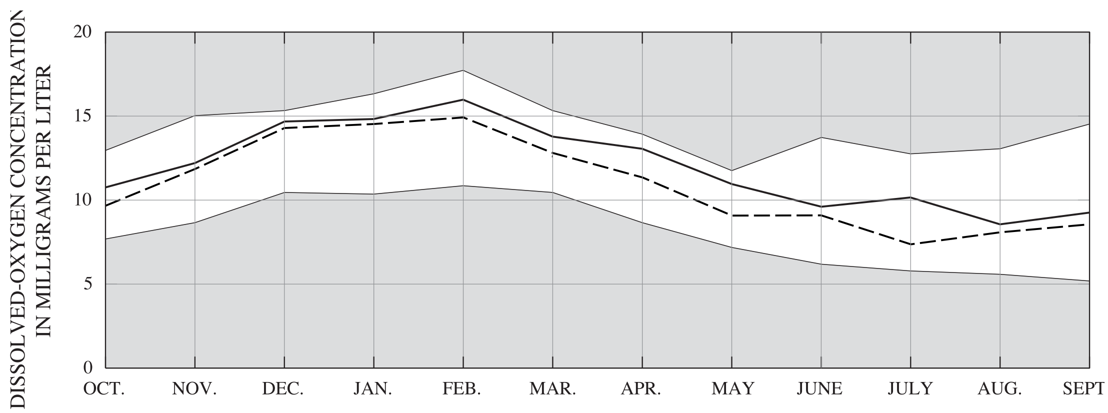
EXPLANATION

UNSHADED AREA--Indicates the range between the highest monthly mean values and the lowest monthly mean values, water years 1968-2002.

SOLID LINE--Indicates the monthly mean values for water year 2003.

BROKEN LINE--Indicates the mean monthly values for water years 1968-2002.

Figure 4. Monthly mean water temperature at Delaware River at Trenton, New Jersey, water year 2003.



EXPLANATION

UNSHADED AREA--Indicates the range between the highest monthly median of daily maximum values and the lowest monthly median of daily minimum values, water years 1968-2002.

SOLID LINE--Indicates the monthly median of daily maximum values for water year 2003.

BROKEN LINE--Indicates the monthly median of daily minimum values for water year 2003.

Figure 5. Monthly medians of daily maximum and minimum dissolved oxygen concentrations at Delaware River at Trenton, New Jersey, water year 2003.

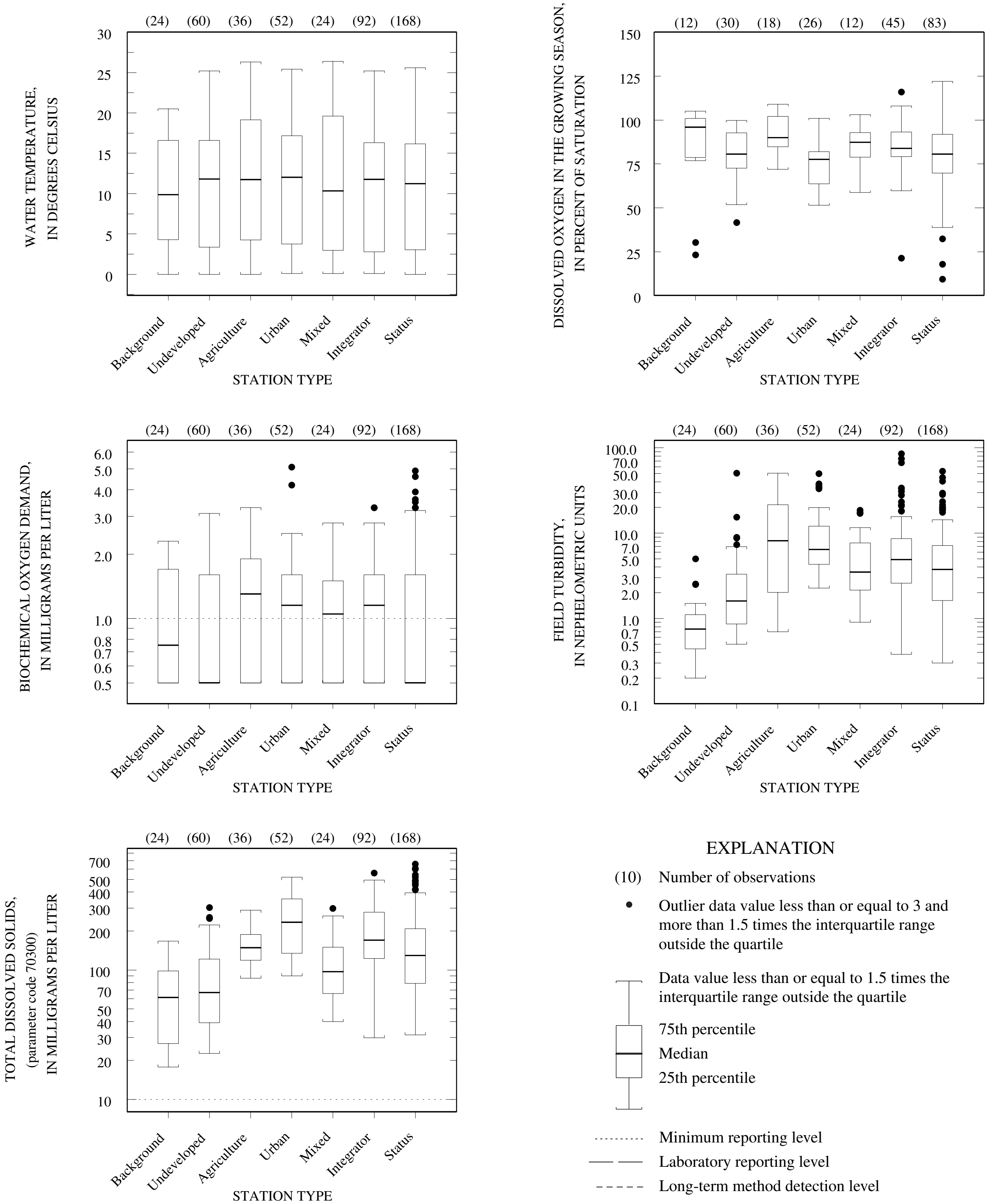


Figure 6. Distribution of physical characteristics of, and constituent concentrations in, samples from 112 stations in the Ambient Stream Monitoring Network, water year 2003.

[Two of the status stations are colocated at other station types; data are included in both distributions. “Less-than” values are shown as equal to the long-term method detection level or one-half the minimum reporting level; excludes data from Delaware River main stem stations 01438500, 01443000, 01457500, and 01461000]

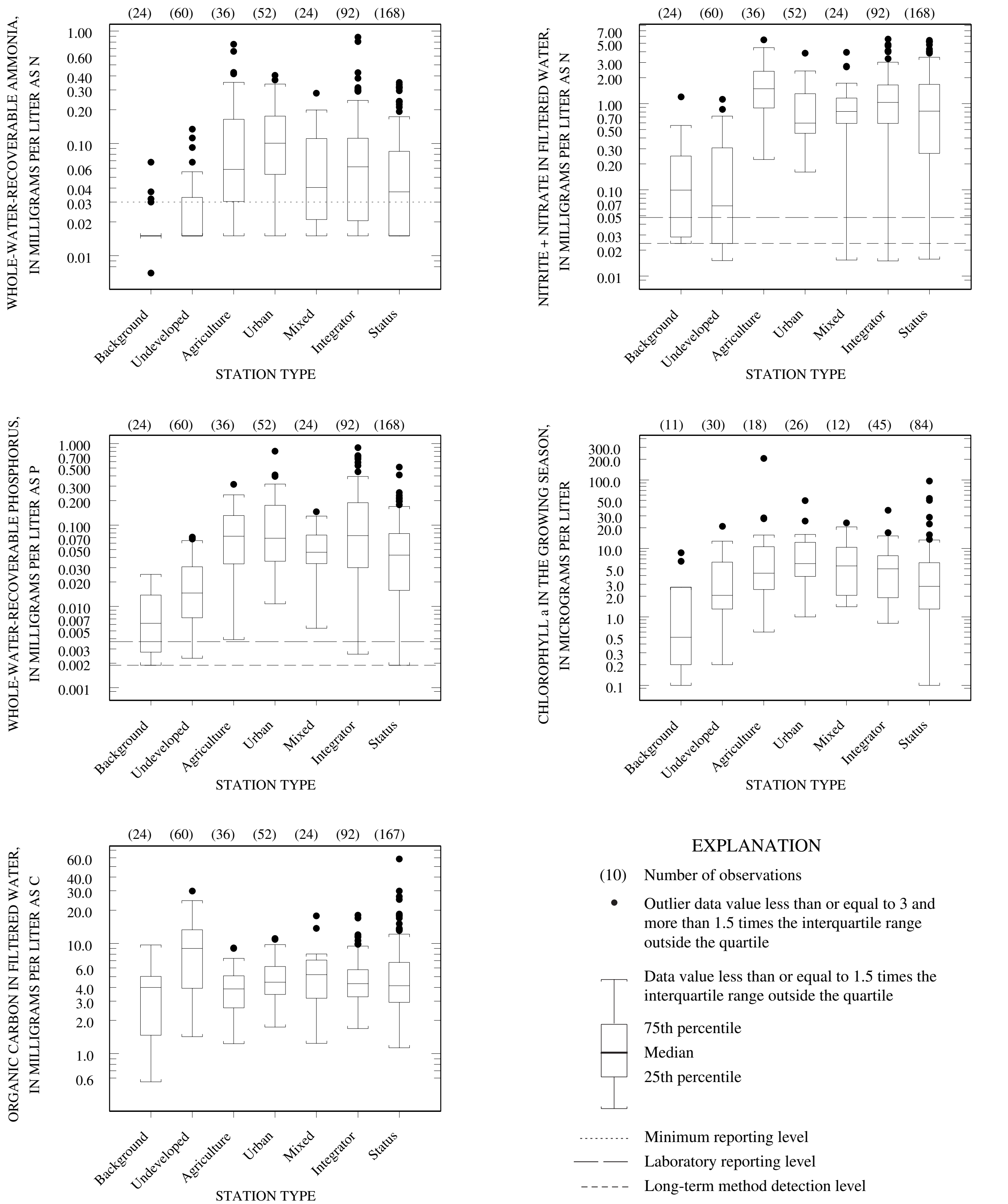


Figure 6. Distribution of physical characteristics of, and constituent concentrations in, samples from 112 stations in the Ambient Stream Monitoring Network, water year 2003--continued.

[Two of the status stations are colocated at other station types; data are included in both distributions."Less-than" values are shown as equal to the long-term method detection level or one-half the minimum reporting level; excludes data from Delaware River main stem stations 01438500, 01443000, 01457500, and 01461000]

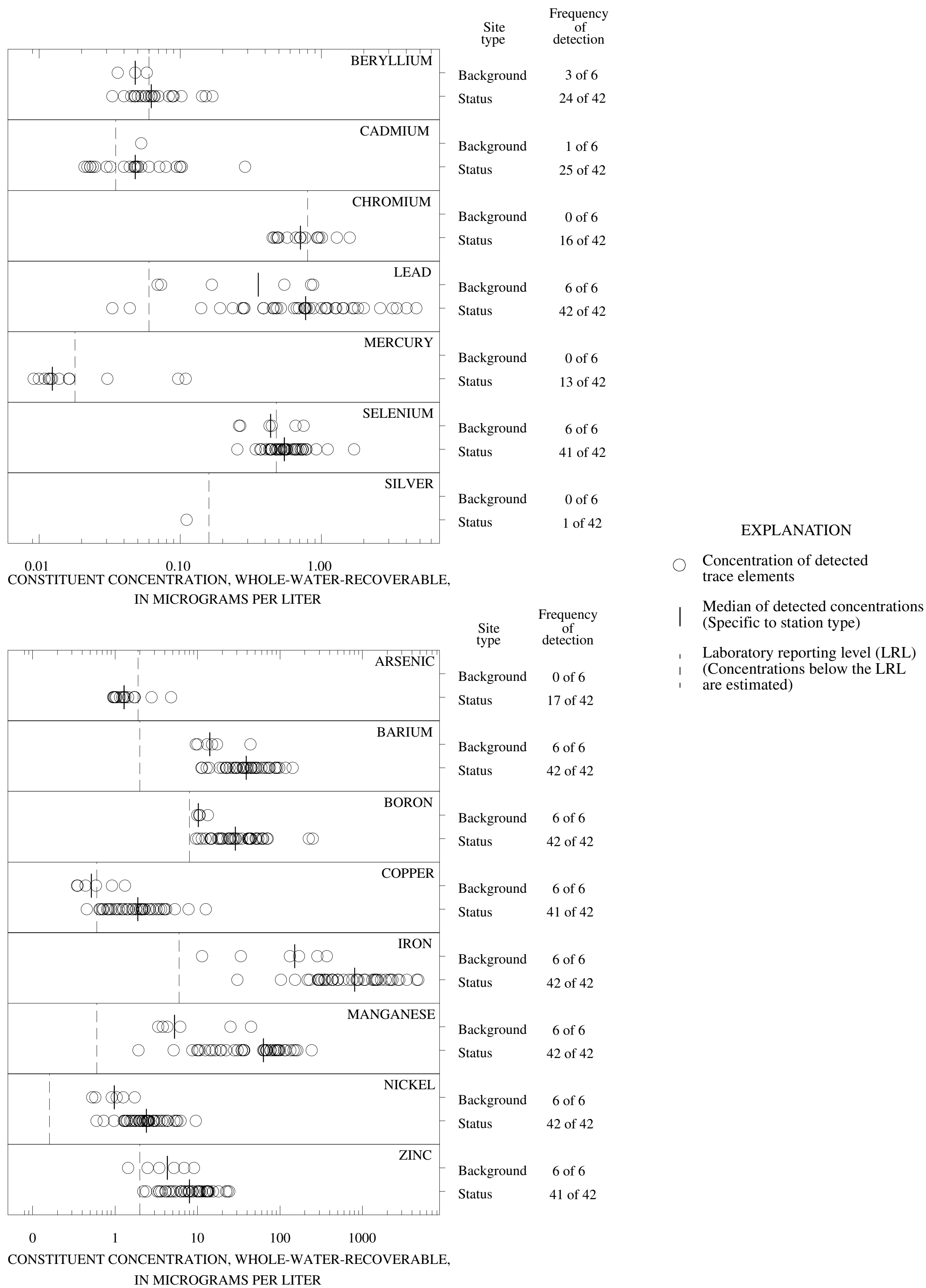


Figure 7. Concentration and detection frequency of whole-water-recoverable trace elements detected in samples from 48 stations in the Ambient Stream Monitoring Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the LRL are considered to be not detected]

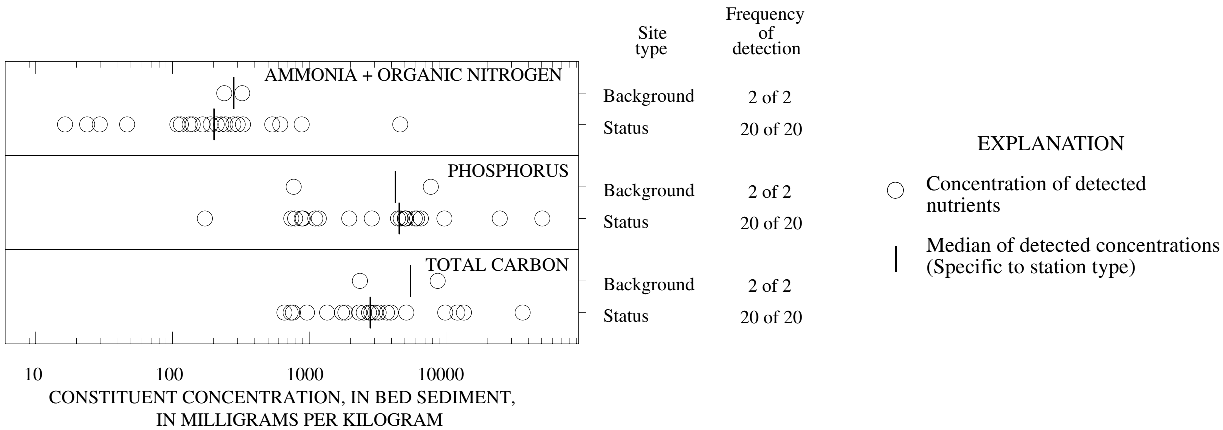


Figure 8. Concentration and detection frequency of nutrients detected in bed-sediment samples from 22 stations in the Ambient Stream Monitoring Network, water year 2003.

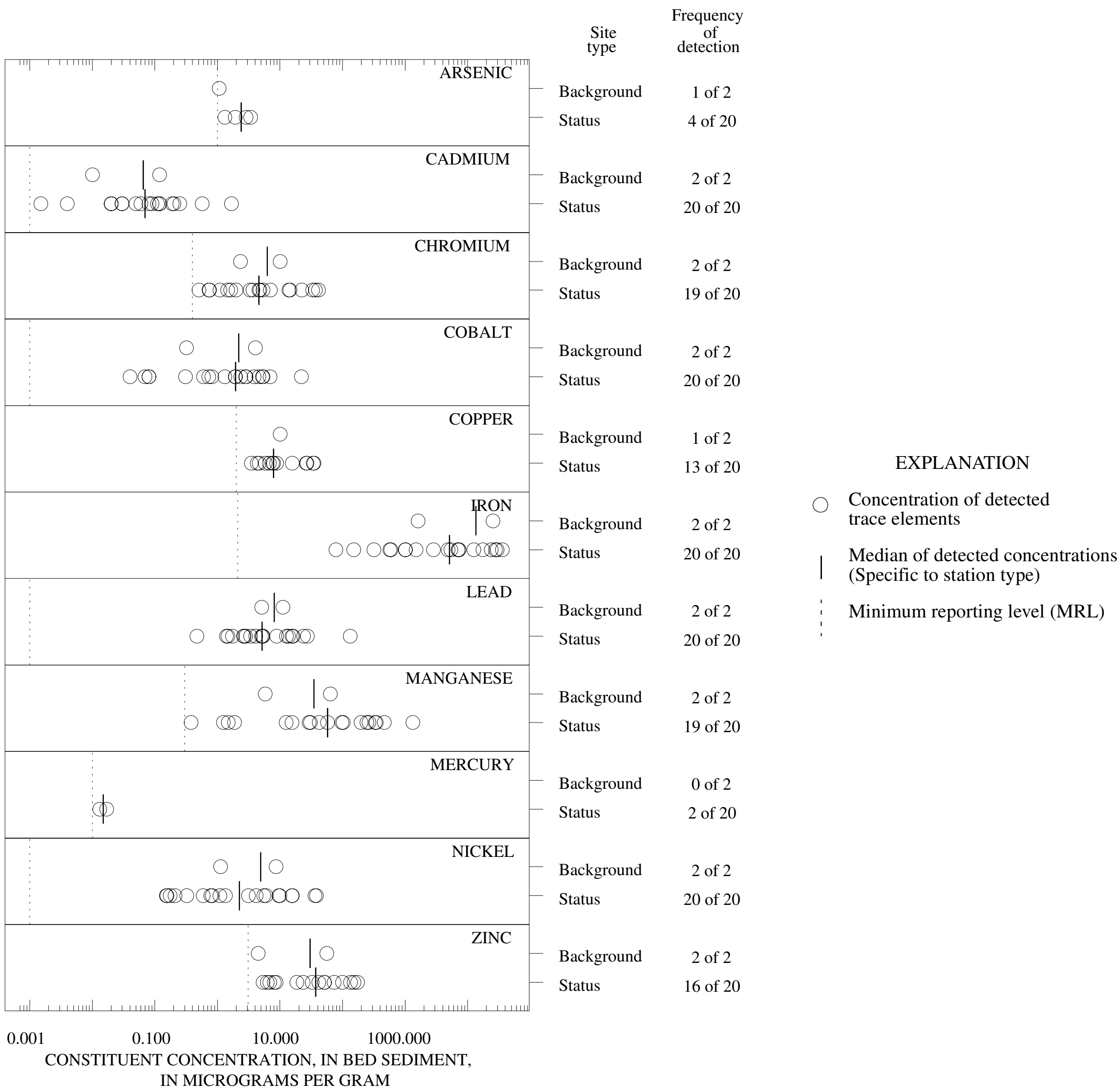


Figure 9. Concentration and detection frequency of trace elements detected in bed-sediment samples from 22 stations in the Ambient Stream Monitoring Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the MRL are considered to be not detected]

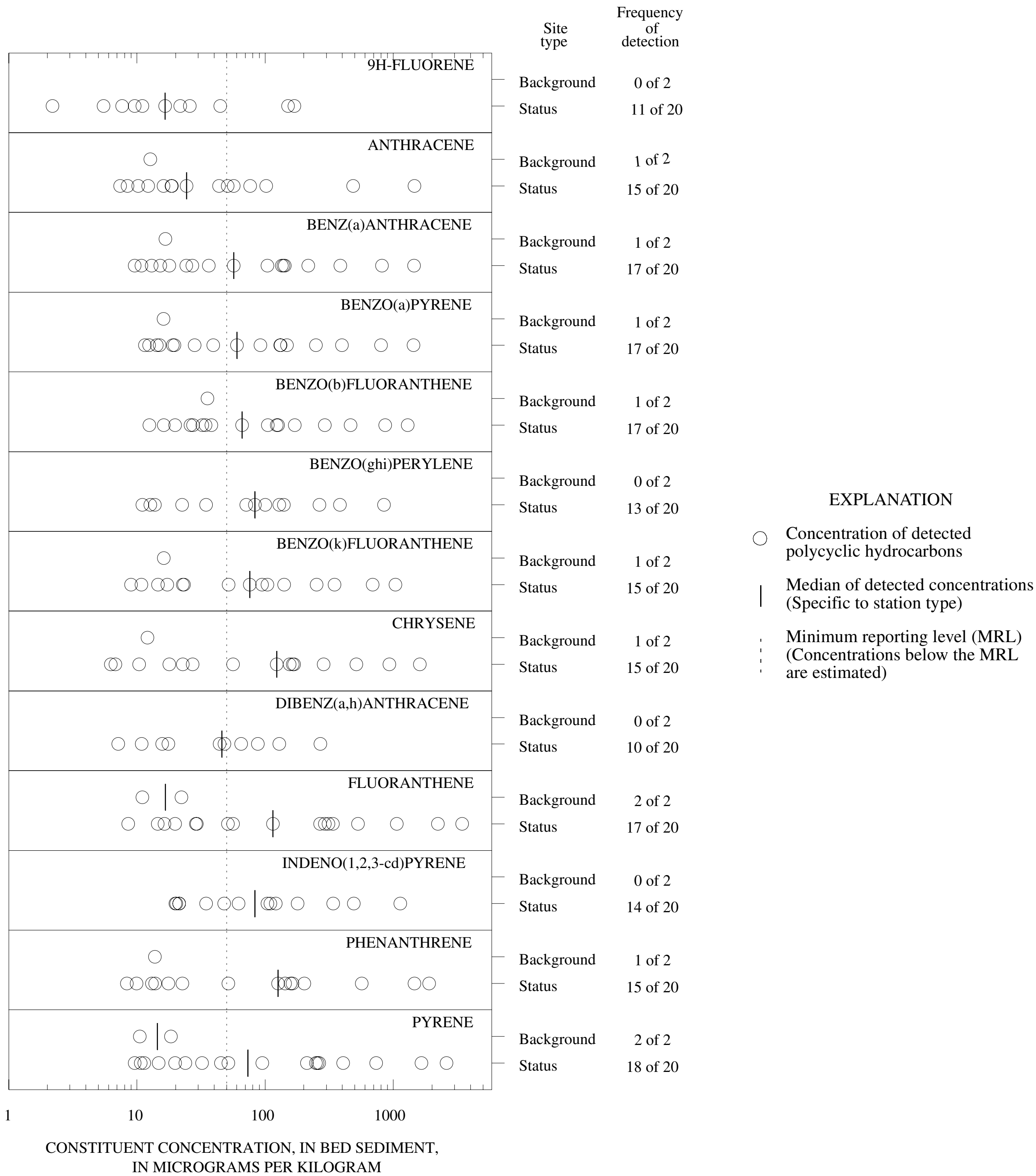


Figure 10. Concentration and detection frequency of selected polycyclic aromatic hydrocarbons detected in bed-sediment samples from 22 stations in the Ambient Stream Monitoring Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the MRL are considered to be not detected]

Table 1. Detection frequency of selected organic compounds in bed-sediment samples from 22 stations in the Ambient Stream Monitoring Network, water year 2003
[All values are estimated due to poor recovery or poor precision]

CONSTITUENT	STATEWIDE STATUS	BACKGROUND
TOTAL POLYCHLORINATED BIPHENYLS (PCBs)	9 of 20	0 of 2

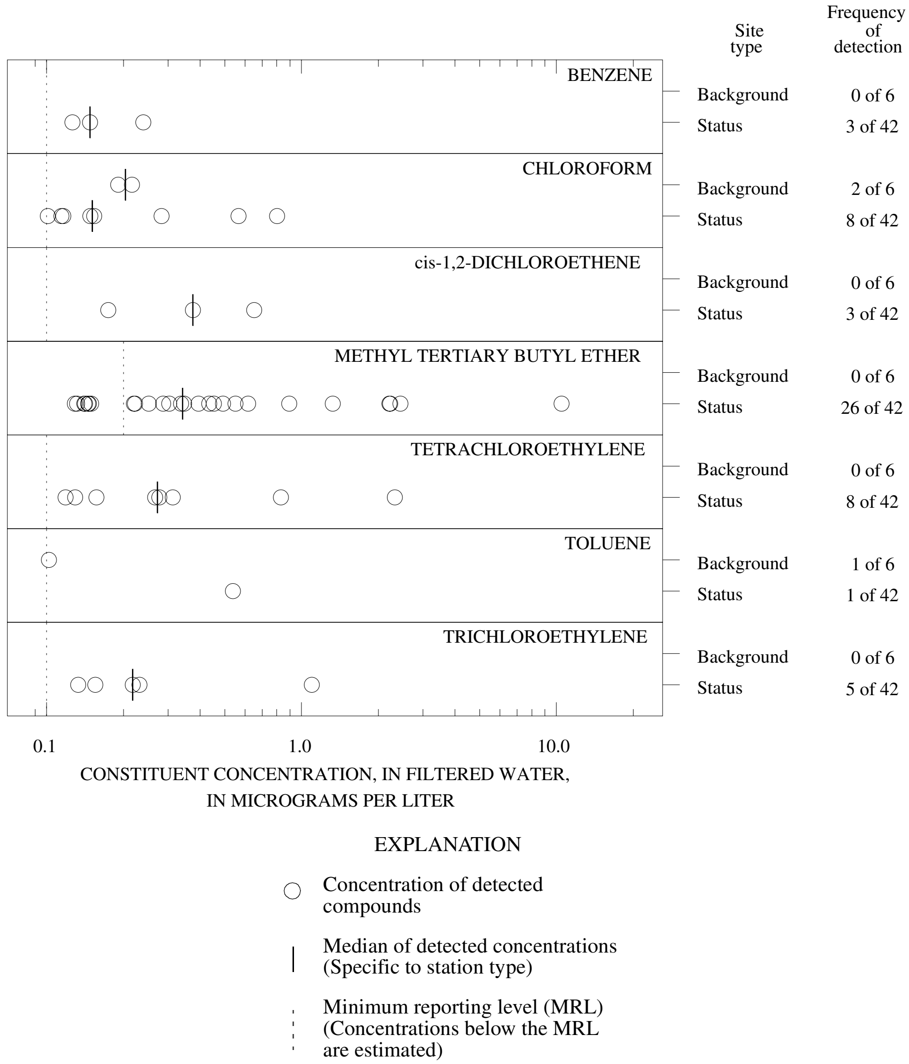


Figure 11. Concentration and detection frequency of selected volatile organic compounds detected in samples from 48 stations in the Ambient Stream Monitoring Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the MRL are considered to be not detected]

Table 2. Concentration of volatile organic compounds detected only once in samples from 48 stations in the Ambient Stream Monitoring Network, water year 2003
[SS, statewide status]

CONSTITUENT	CONCENTRATION (micrograms per liter)	STATION TYPE
1,1,1-TRICHLOROETHANE	0.4	SS
1,1-DICHLOROETHANE	0.2	SS
BROMODICHLOROMETHANE	0.2	SS
ETHYL ETHER	0.1	SS

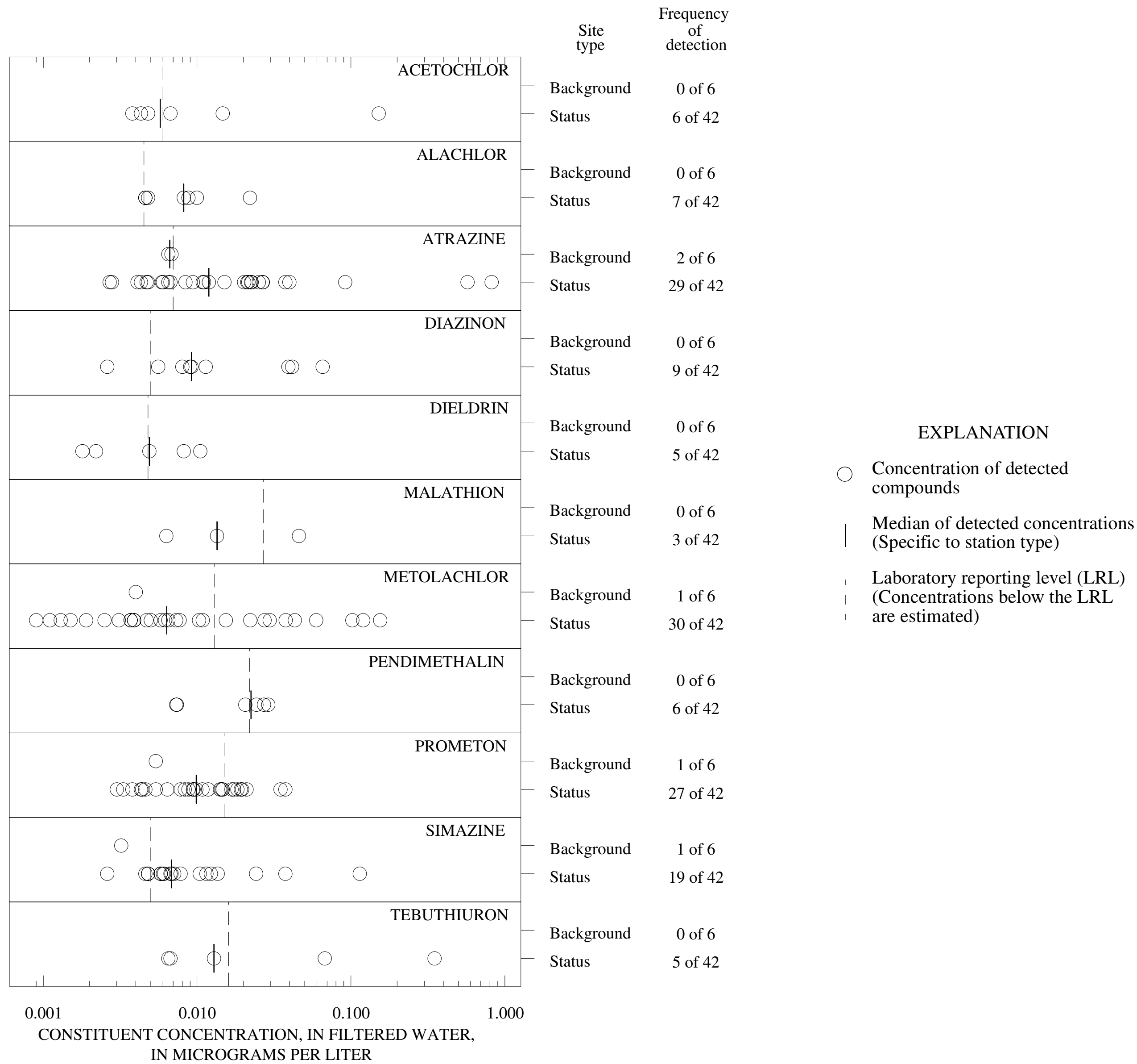


Figure 12. Concentration and detection frequency of selected pesticides detected in filtered samples from 48 stations in the Ambient Stream Monitoring Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the MRL or LRL are considered to be not detected]

Table 3. Detection frequency of selected pesticides in filtered samples from 48 stations in the Ambient Stream Monitoring Network, water year 2003
[All values are estimated due to poor recovery or poor precision; CIAT, 2-Chloro-4-isopropylamino-6-amino-s-triazine]

CONSTITUENT	STATEWIDE STATUS	BACKGROUND
AZINPHOS-METHYL	3 of 42	0 of 6
BENFLURALIN	3 of 42	0 of 6
CARBARYL	19 of 42	0 of 6
CARBOFURAN	4 of 42	0 of 6
CIAT	22 of 42	2 of 6
TERBACIL	5 of 42	0 of 6
TRIFLURALIN	6 of 42	0 of 6

Table 4. Concentration of pesticides detected only once in filtered samples from 48 stations in the Ambient Stream Monitoring Network, water year 2003
[SS, statewide status; E, estimated]

CONSTITUENT	CONCENTRATION (micrograms per liter)	STATION TYPE
BUTYLATE	0.002	SS
DACTHAL	E0.002	SS
EPTC	E0.002	SS
METRIBUZIN	0.006	SS
NAPROPAMIDE	E0.004	SS
cis-PERMATHRIN	E0.005	SS

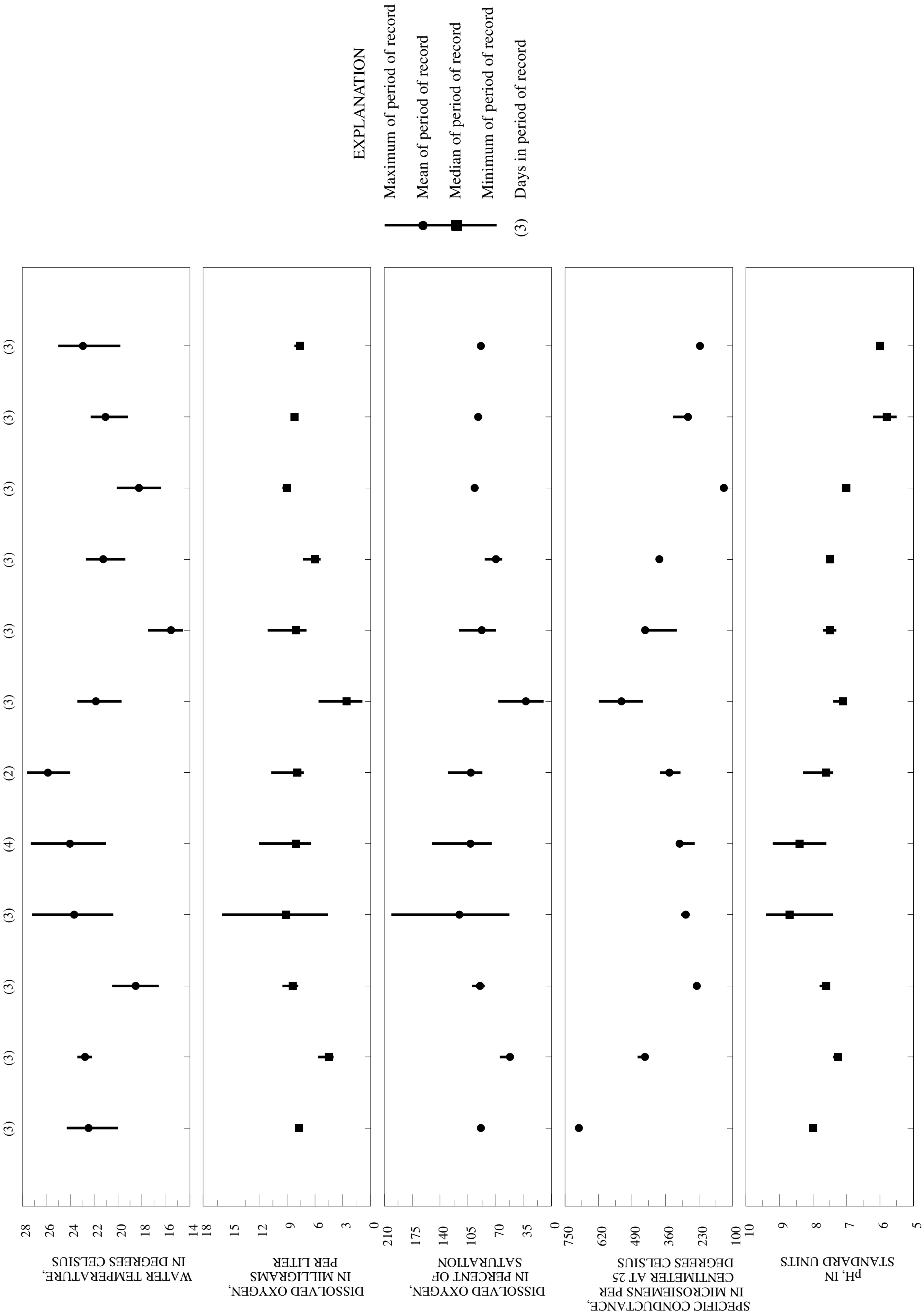


Figure 13. Field characteristics and constituent concentrations in surface water at selected stations in the Ambient Stream Monitoring Network during July, August, or September 2003.

compounds were herbicides. The most frequently detected pesticides in 48 samples were Metolachlor, in 67 percent of samples; Atrazine, in 65 percent; and Prometon, in 58 percent. The five compounds detected at background stations are commonly used herbicides.

Ambient Stream Monitoring Network Reconnaissance Study

The water year 2003 reconnaissance study continuously monitored water temperature, DO concentration, DO percent of saturation, specific conductance, and pH at 12 network stations during summer baseflow conditions. In-situ multi-constituent sensors, or monitors, recorded the occurrence and magnitude of diurnal variations that could not be observed when instantaneous samples were collected during quarterly station visits. Instantaneous values generally were collected between the hours of 8 a.m. and 2 p.m. The monitors were deployed for a 3-day period at each station during July, August, or September. Statistical summaries for the periods of record for all stations are shown in figure 13; graphs of hourly values for each of the stations are included in the Surface-Water-Quality Station Records section of this report (figs. 25-26, 32-39, and 43-44).

Reconnaissance stations were selected on the basis of previous occurrences of DO supersaturation (greater than 120 percent of saturation) or DO undersaturation (less than 60 percent of saturation). Three stations—01398000, 0140500, and 01403300— recorded maximum dissolved oxygen above 120 percent of saturation—201, 150, and 130, respectively. Three stations—01367770, 01398000, and 01443250—recorded minimum values below 60 percent of saturation—47, 53, and 10, respectively. The greatest diurnal variance of water temperature, dissolved oxygen, and pH occurred at stations 01398000 and 01400500.

Ambient Ground-Water-Quality Network

The USGS, in cooperation with the NJDEP, operates the cooperative Ambient Ground-Water-Quality Network (AGWQN), which is designed to assess the status of ground-water quality by examining the concentrations of various constituents that can be used as environmental indicators, assess long-term water-quality trends, determine the effects of land use on shallow ground-water quality, identify threats from nonpoint sources of contamination, and identify emerging or new environmental issues of concern to the public. The network consists of 150 shallow ground-water wells distributed throughout New Jersey within three land-use types. Sixty wells are located in agricultural areas, 60 in urban/suburban areas, and 30 in undeveloped areas within New Jersey’s five watershed management regions (WMRs)–the Passaic, the Raritan, the Upper Delaware, the Lower Delaware, and the Atlantic Coastal. These five WMRs are further divided into 20 watershed-management areas (WMAs).

Thirty-five shallow wells were sampled in water year 2003. Four wells are located in the Passaic WMR in WMAs 3 and 6. Twenty-one are located in the Raritan WMR in WMAs 7-10. Nine are located in the Upper Delaware WMR in WMAs 1 and 11. One is located in the Lower Delaware WMR in WMA 20. The wells have 2-inch polyvinyl-chloride casings; range in depth from 17 to 208 feet; and represent 3 land-use types, 6 water-chemistry types, and 10 hydrogeologic units (table 5). Samples from the wells were analyzed for physical characteristics, major ions, nutrients, trace elements, organic constituents, and gross alpha and beta radioactivity. A summary of the water chemistry of the 35 wells is listed in table 5. Individual tables of chemical constituents are located in the Ground-Water-Quality Site Records section of this report.

Distribution, Detection Frequency, and Concentration of Selected Constituents in Filtered Samples from 35 Sites in the AGWQN

Field measurements were made of physical and chemical characteristics of water samples from 35 wells in the AGWQN. Analyses then were conducted to determine concentrations of major ions, filtered nutrients, organic carbon, trace elements, VOCs, and pesticides. The effect of land use on the proportions of the major ions in water samples from the wells can be observed in the data presented in the trilinear (Piper) diagrams (figs. 14-16). The diagrams depict major cations (calcium, sodium, magnesium, potassium) and anions (bicarbonate, chloride, sulfate,

Table 5. Hydrogeologic unit and land use at 35 wells sampled as part of U.S.Geological Survey-N.J. Department of Environmental Protection (cooperative) Ambient Ground-Water-Quality Network, water year 2003.

[WMA, Watershed Management Area; VOCs, volatile organic compounds; mg/L, milligrams per liter; NO2+NO3, nitrite plus nitrate; <, less than; ft bls, feet below land surface; 112SFDF, Stratified Drift; 211EGLS, Englishtown Formation; 211ODBG, Old Bridge Sand Member Of Magothy Formation; 227PSSC, Passaic Formation; 231LCKG, Lockatong Formation; 360KTTN, Kittatinny Limestone; 400PCMB, Precambrian Erathem; 111HPPM, Undifferentiated Holocene, Pleistocene, and Miocene; 364JKBG, Jacksonburg Limestone; 371ALNN, Allentown Dolomite; ---, data not available.]

NJ-WRD well number	WMA number	Hydrogeologic unit aquifer code	Predominant land use[1]	Water type (dominant cation-anion)	Dissolved oxygen (mg/L)	Nitrogen NO2+NO3 dissolved (mg/L)	Total dissolved solids (mg/L)	Number of pesticides detected[2]	Number of VOCs detected[2]	Number of trace elements detected[2]	Well depth (ft bls)
410389	1	371ALNN	Agricultural	Calcium-bicarbonate	9.0	11.16	301	6	2	9	158.0
190450	11	227PSSC	Agricultural	Sodium-bicarbonate	0.2	3.41	250	0	0	7	208.0
410390	1	364JKBG	Agricultural	Sodium-chloride	8.8	4.81	938	5	0	11	76.0
350138	8	227PSSC	Agricultural	Calcium-bicarbonate	0.9	2.43	200	1	0	11	36.0
410459	1	371ALNN	Agricultural	Calcium-bicarbonate	4.3	0.66	331	2	0	8	100.0
410460	1	112SFDF	Agricultural	Calcium-bicarbonate	11.0	4.20	225	4	0	6	52.0
190453	8	231LCKG	Agricultural	Calcium-bicarbonate	2.0	1.77	167	0	0	8	60.0
190452	8	227PSSC	Agricultural	Calcium-bicarbonate	6.9	5.79	285	5	0	7	119.0
190455	8	227PSSC	Agricultural	Calcium-bicarbonate	2.0	8.84	290	2	1	9	41.0
231371	10	111HPPM	Agricultural	Calcium-chloride	1.4	16.50	310	3	3	12	23.0
370474	1	112SFDF	Agricultural	Sodium-bicarbonate	8.6	24.24	645	4	0	7	22.0
350139	10	227PSSC	Agricultural	Calcium-bicarbonate	4.6	7.67	222	2	0	6	40.0
51507	20	211EGLS	Agricultural	Sodium-chloride	1.0	0.21	430	0	0	11	24.0
190451	8	400PCMB	Agricultural	Magnesium-bicarbonate	4.1	9.18	269	2	0	7	37.0
210612	11	111HPPM	Agricultural	Sodium-chloride	0.8	0.59	651	0	1	12	27.5
190456	8	227PSSC	Agricultural	Calcium-bicarbonate	2.4	4.26	172	2	0	6	37.0
272068	6	112SFDF	Undeveloped	Calcium-bicarbonate	6.7	E.038	100	0	2	5	55.0
272062	6	112SFDF	Undeveloped	Calcium-bicarbonate	0.6	E.031	368	0	0	7	20.0
310184	3	112SFDF	Undeveloped	Calcium-bicarbonate	3.4	0.14	126	0	0	8	29.0
272063	8	112SFDF	Undeveloped	Magnesium-bicarbonate	4.0	E.046	41	0	0	7	30.0
231366	9	211ODBG	Urban	Sodium-chloride	---	<.060	132	0	0	12	55.0
231367	7	227PSSC	Urban	Calcium-bicarbonate	1.8	<.060	237	0	0	9	27.0
350142	8	227PSSC	Urban	Calcium-chloride	4.2	5.69	800	0	0	8	76.5
410461	1	360KTTN	Urban	Magnesium-bicarbonate	6.8	4.28	245	3	2	8	160.0
231368	9	211ODBG	Urban	Calcium-sulfate	8.7	3.24	56	0	0	11	37.8
272060	8	112SFDF	Urban	Calcium-chloride	2.8	0.65	426	0	4	10	25.0
231365	9	211ODBG	Urban	Sodium-chloride	0.5	<.060	322	0	0	10	37.0
390500	7	227PSSC	Urban	Calcium-bicarbonate	0.3	0.55	225	4	2	10	17.0
272061	6	112SFDF	Urban	Sodium-chloride	0.6	0.14	820	1	14	8	26.0
231370	9	227PSSC	Urban	Calcium-chloride	5.4	<.060	415	2	2	9	51.0
210609	10	227PSSC	Urban	Calcium-bicarbonate	3.8	0.13	302	1	0	10	35.0
390501	9	112SFDF	Urban	Calcium-bicarbonate	4.0	4.12	455	0	2	8	23.0
231369	9	227PSSC	Urban	Calcium-bicarbonate	3.0	2.47	238	0	0	7	27.5
190454	11	227PSSC	Urban	Sodium-chloride	6.8	3.41	266	2	1	8	22.5
130184	7	227PSSC	Urban	Calcium-chloride	1.6	7.44	1170	1	4	8	36.5

[1] Land use based on New Jersey geographic information system (New Jersey Department of Environmental Protection, 1996).

[2] Includes compounds with estimated concentrations, defined as positive detections of a compound, but measured as less than the laboratory's reporting levels.

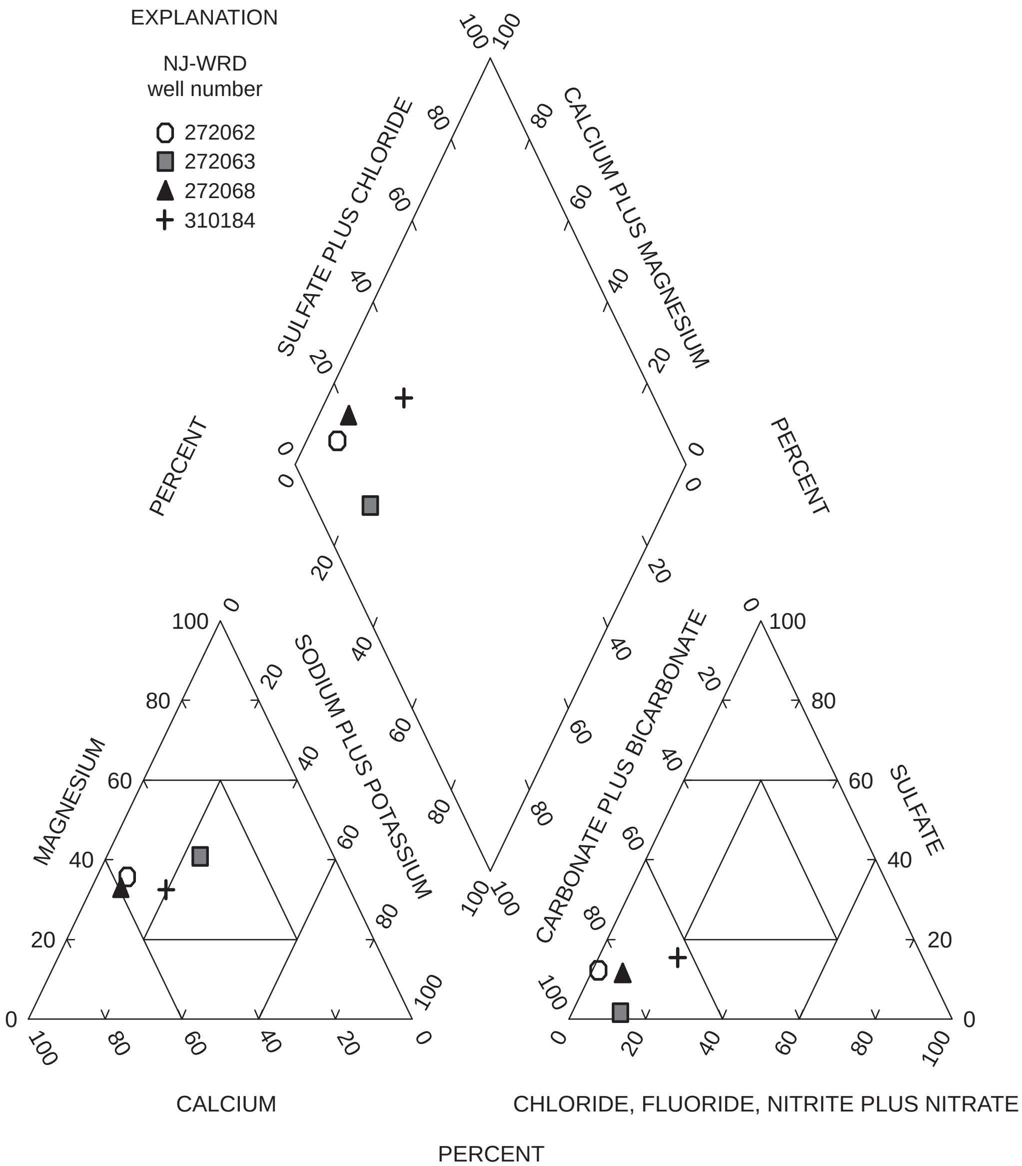


Figure 14. Trilinear diagram showing the distribution of major ions in filtered samples from four sites in undeveloped land-use areas in the Ambient Ground-Water-Quality Network, water year 2003.

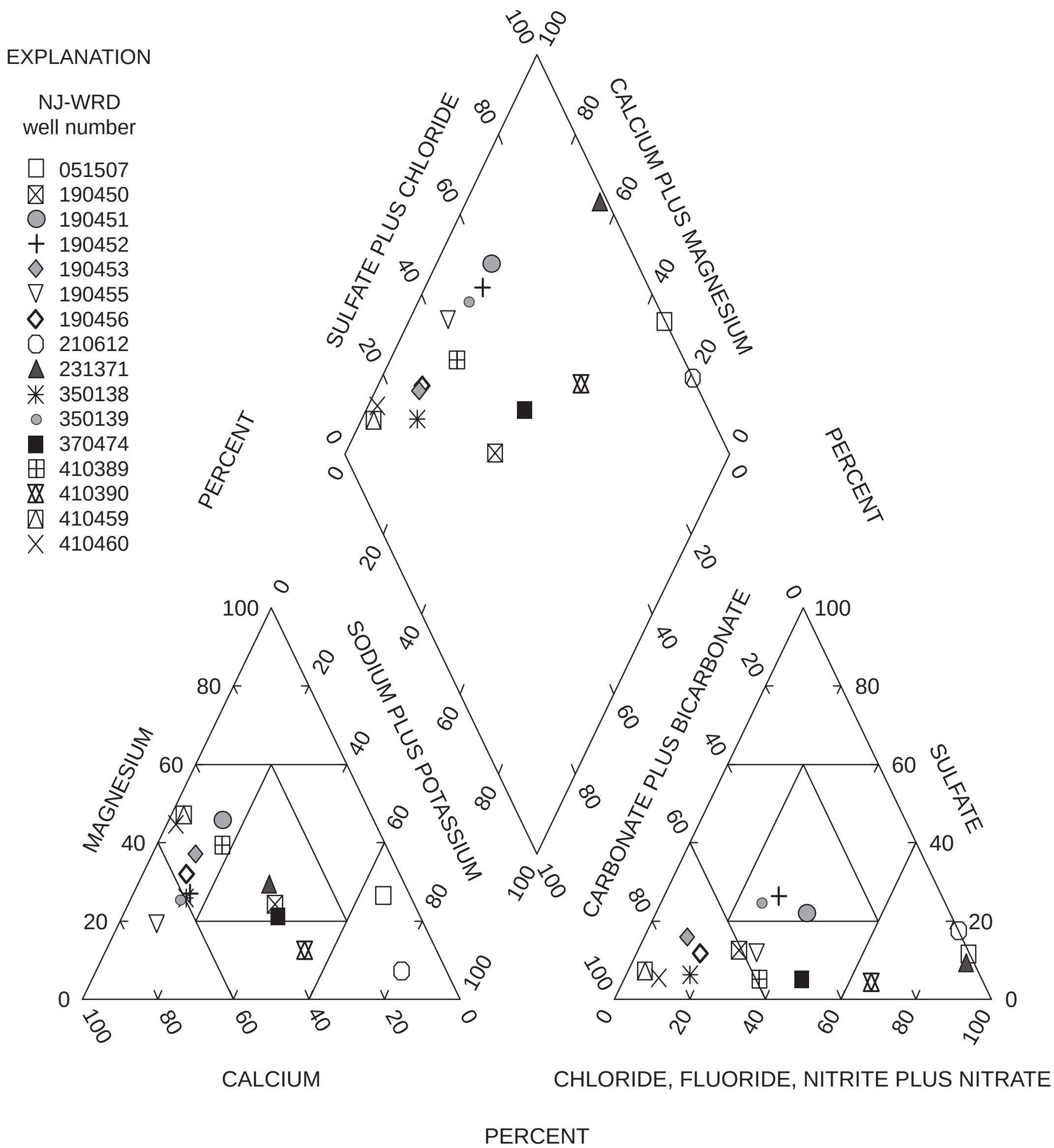


Figure 15. Trilinear diagram showing the distribution of major ions in filtered samples from 16 sites in agriculture land-use areas in the Ambient Ground-Water-Quality Network, water year 2003.

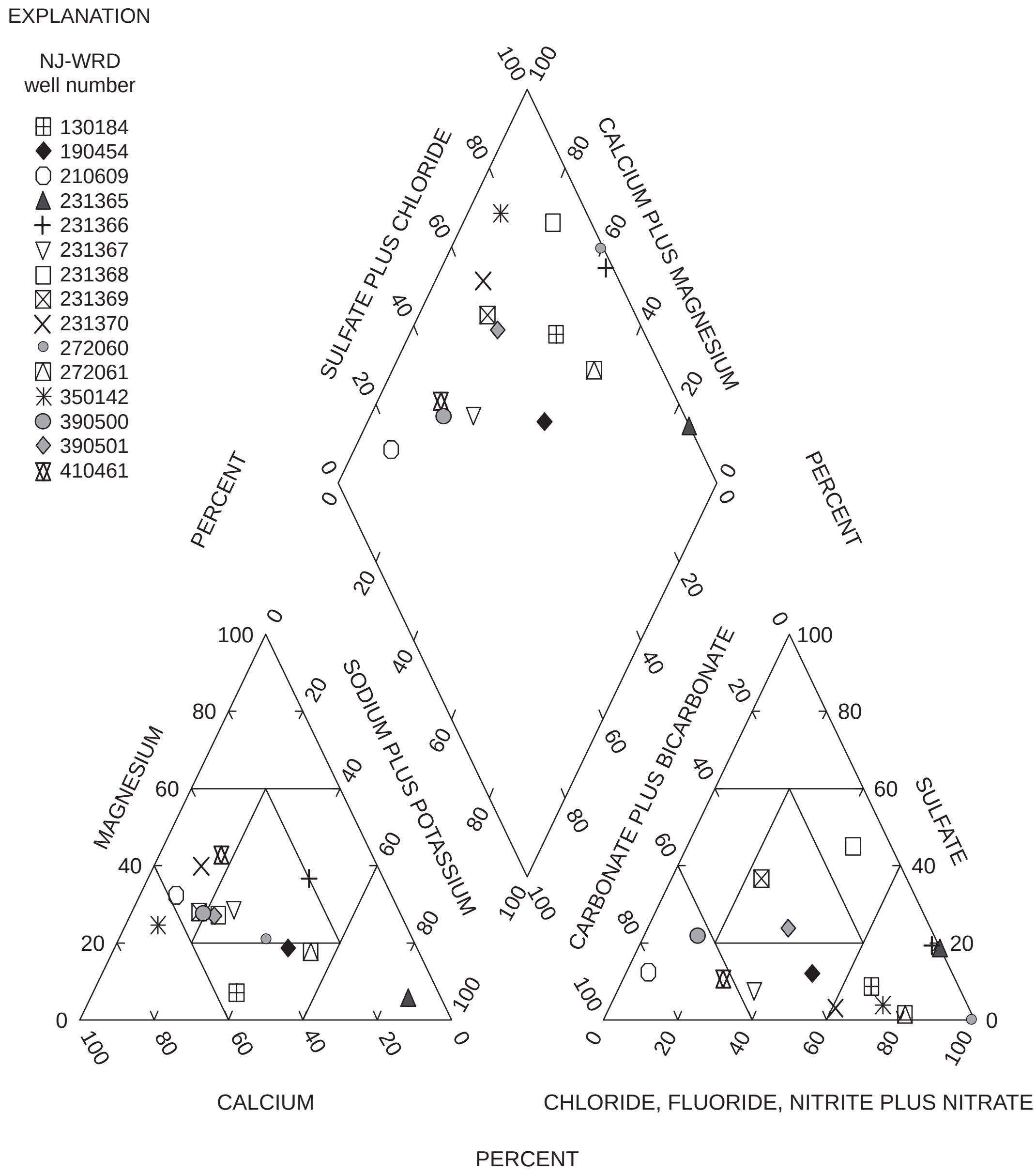


Figure 16. Trilinear diagram showing the distribution of major ions in filtered samples from 15 sites in urban land-use areas in the Ambient Ground-Water-Quality Network, water year 2003.

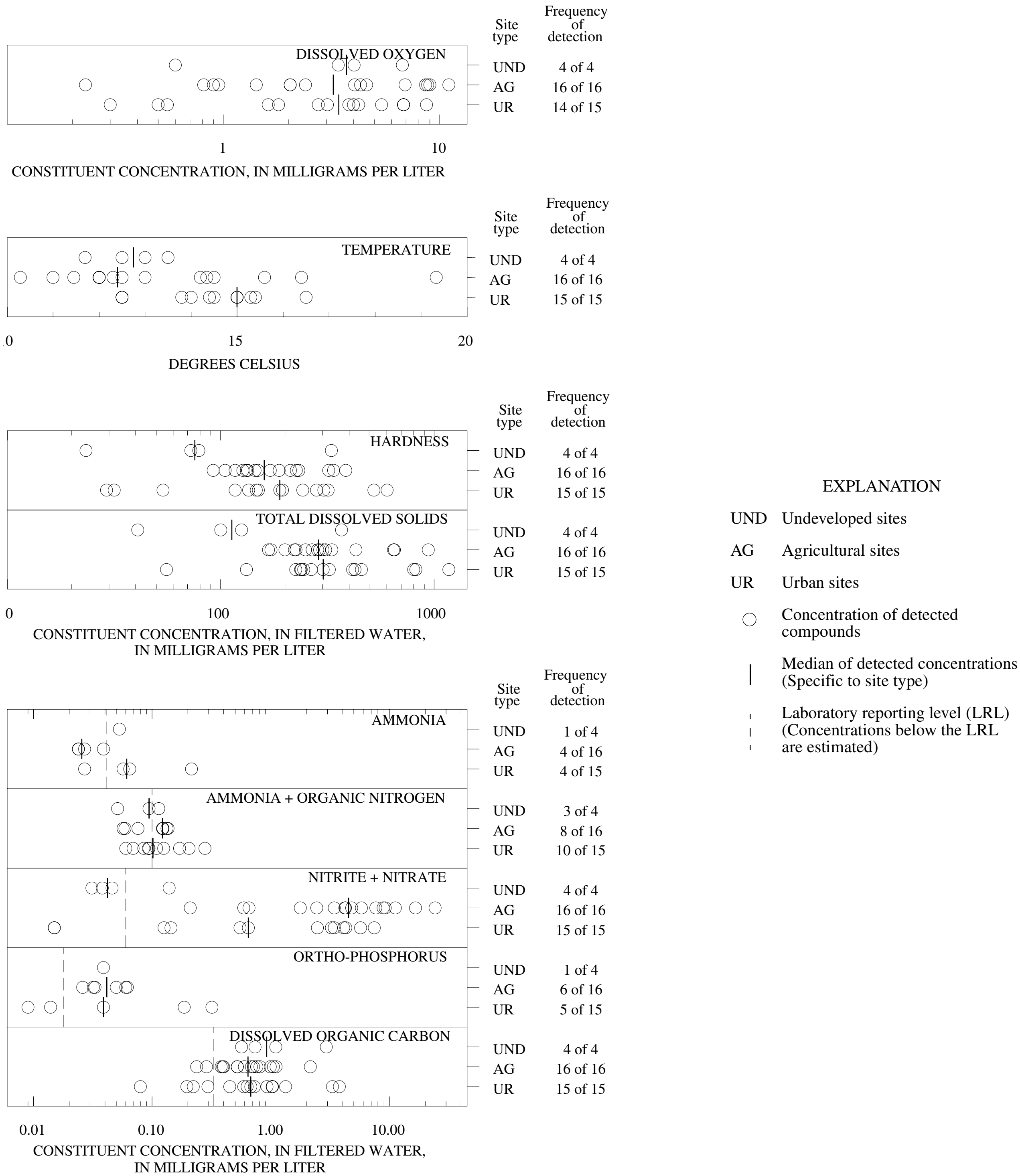


Figure 17. Concentration and detection frequency of selected constituents in samples from 35 sites in the Ambient Ground-Water-Quality Network, water year 2003.

[Constituents whose values were reported by the laboratory as less than the LRL are considered to be not detected]

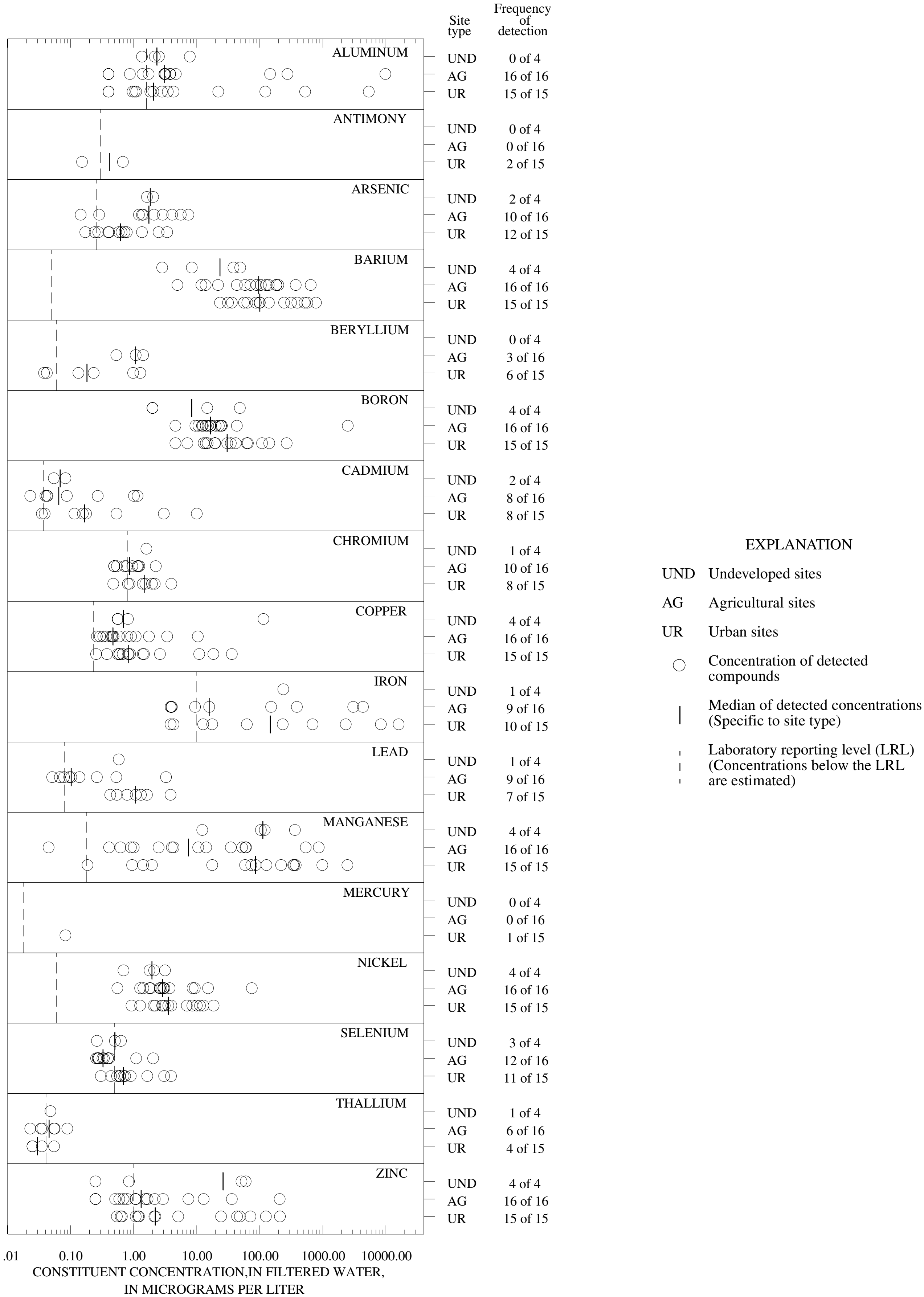


Figure 18. Concentration and detection frequency of trace elements detected in filtered samples from 35 sites in the Ambient Ground-Water-Quality Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the LRL are considered to be not detected]

Table 6. Detection frequency of volatile organic compounds detected in samples from 35 sites in the Ambient Ground-Water-Quality Network, water year 2003
[UND, undeveloped; AG, agriculture; UR, urban]

	SITE TYPE		
CONSTITUENT	UND	AG	UR
1,1,1-TRICHLOROETHANE	0 of 4	0 of 16	1 of 15
1,1-DICHLOROETHANE	0 of 4	0 of 16	1 of 15
BENZENE	0 of 4	0 of 16	1 of 15
BROMODICHLOROMETHANE	0 of 4	0 of 16	2 of 15
cis-1,2-DICHLOROETHENE	0 of 4	0 of 16	2 of 15
ETHYLBENZENE	0 of 4	0 of 16	1 of 15
m-XYLENE PLUS p-XYLENE	1 of 4	0 of 16	1 of 15
o-XYLENE	0 of 4	0 of 16	1 of 15
METHYL TERT-BUTYL ETHER	1 of 4	3 of 16	5 of 15
TETRACHLOROETHENE	0 of 4	0 of 16	2 of 15
TRICHLOROETHENE	0 of 4	1 of 16	2 of 15
TRICHLOROFLUOROMETHANE	0 of 4	0 of 16	1 of 15
TRICHLOROMETHANE	1 of 4	0 of 16	4 of 15

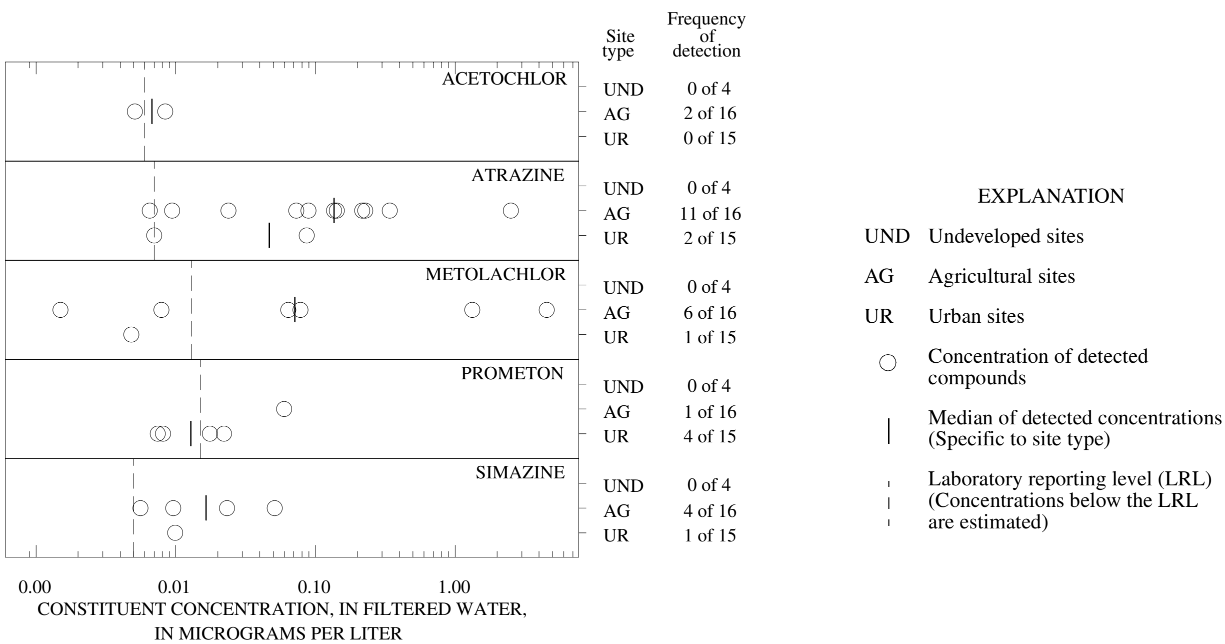


Figure 19. Concentration and detection frequency of selected pesticides detected in filtered samples from 35 sites in the Ambient Ground-Water-Quality Network, water year 2003.
[Constituents whose values were reported by the laboratory as less than the LRL are considered to be not detected]

Table 7. Detection frequency of selected pesticides in filtered samples from 35 sites in the Ambient Ground-Water-Quality Network, water year 2003
[All values are estimated due to poor recovery or poor precision; CIAT, 2-Chloro-4-isopropylamino-6-amino-s-triazine; UND, undeveloped; AG, agriculture; UR, urban]

	SITE TYPE		
CONSTITUENT	UND	AG	UR
CIAT	0 of 4	12 of 16	1 of 15

Table 8. Concentration of pesticides detected only once in filtered samples from 35 sites in the Ambient Ground-Water-Quality Network, water year 2003
[AG, agriculture; UR, urban; E, estimated]

CONSTITUENT	CONCENTRATION (micrograms per liter)	SITE TYPE
ALACHLOR	0.270	AG
CYANAZINE	0.045	AG
DESULFINYLFIPRONIL	0.007	UR
DIAZINON	0.014	UR
DIELDRIN	0.037	UR
DESULFINYLFIPRONIL-AMIDE	E.005	UR
FIPRONILSULFIDE	E.004	UR
FIPRONILSULFONE	E.006	UR

fluoride, nitrate) as percentages of milliequivalents in the two base triangles. The total cations and anions in milliequivalents are set to equal 100 percent. The individual points then are projected to the quadrilateral along parallel lines following the magnesium and sulfate axes. The relative proportions of major ions in an individual sample can be inferred by the position of the well symbol in the diagram. Similarity or dissimilarity between samples can be inferred from the clustering or scattering of symbols in the diagram.

Concentrations and frequencies of detection are summarized in scatter plots and tables on pages 23-25. Values reported by the analyzing laboratory as “<“—less than the LRL—were considered to be not detected and were excluded from the plots. Values reported as “E”—estimated below the LRL—were included in the plots. Refer to the Definition of Terms section of this report for further explanation of these reporting conventions. Samples from wells in undeveloped areas have the lowest median concentrations of hardness, TDS, nitrite plus nitrate, barium, and boron and the highest median concentrations of DOC and zinc (figs. 17-18). Samples from wells in urban areas have the highest median concentrations of boron, cadmium, chromium, iron, nickel, and selenium. Samples from wells in agriculture areas have the highest median concentrations of nitrite plus nitrate, and aluminum. Barium, boron, copper, manganese, nickel, and zinc were detected in 100 percent of the samples. Mercury and antimony were the least frequently detected trace elements, 3 and 6 percent, respectively, and both were detected only in samples from wells in urban areas.

Concentration and Detection Frequency of Selected Organic Constituents in Filtered Samples from 35 Sites in the AGWQN

Samples from 35 wells were analyzed for 34 VOCs. Only those detected in one or more samples are listed in table 6. Samples from wells in urban areas had the most detections; samples from undeveloped areas had the fewest. The most frequently detected VOCs in samples from wells located in all land-use areas were Methyl tert-butyl ether, 26 percent; trichloromethane, 14; and trichloroethene, 9.

Filtered samples from 35 wells were analyzed for 52 pesticides by use of USGS National Water Quality Laboratory schedule 2001. Only pesticides detected in one or more samples are included in figure 19 or tables 7 and 8. Refer to “Laboratory Measurements” in the Explanation of Water-Quality Records section of this report for the complete list of those pesticides and the LRL for each compound. Fourteen pesticide compounds were detected in samples from the 35 wells. The most frequently detected pesticides in samples from wells located in all land-use areas were the herbicides Atrazine and 2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT)—a degradation product of Atrazine—in 23 percent each; Metolachlor, in 20 percent; and Prometon and Simazine, in 14 percent each. Insecticides were present in samples from only three urban wells. Diazinon and Dieldrin were detected once each in separate wells. Fipronil and several of its degradation products were detected in the third well.

DOWNSTREAM ORDER AND STATION NUMBER

Since October 1, 1950, hydrologic-station records in USGS reports have been listed in order of downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary entering between two main-stream stations is listed between those stations. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary on which a station is located with respect to the stream to which it is immediately tributary is indicated by an indention in that list of stations in the front of this report. Each indentation represents one rank. This downstream order and system of indentation indicates which stations are on tributaries between any two stations and the rank of the tributary on which each station is located.

As an added means of identification, each hydrologic station and partial-record station has been assigned a station number. These station numbers are in the same downstream order used in this report. In assigning a station number, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list composed of both types of stations. Gaps are consecutive. The complete 8-digit (or 10-digit) number for each station such as 01396500, which appears just to the left of the station name, includes a 2-digit part number “01” plus the 6-digit (or 8-digit) downstream order number “396500.” In areas of high station density, an additional two digits may be added to the station identification number to yield a 10-digit number. The stations are numbered in downstream order as described above between stations of consecutive 8-digit numbers.

NUMBERING SYSTEM FOR WELLS AND MISCELLANEOUS SITES

The USGS well and miscellaneous site-numbering system is based on the grid system of latitude and longitude. The system provides the geographic location of the well or miscellaneous site and a unique number for each site. The number consists of 15 digits. The first 6 digits denote the degrees, minutes, and seconds of latitude, and the next 7 digits denote degrees, minutes, and seconds of longitude; the last 2 digits are a sequential number for wells within a 1-second grid. In the event that the latitude-longitude coordinates for a well and miscellaneous site are the same, a sequential number such as “01,” “02,” and so forth, would be assigned as one would for wells (see fig. 20). The 8-digit, downstream order station numbers are not assigned to wells and miscellaneous sites where only random water-quality samples or discharge measurements are taken.

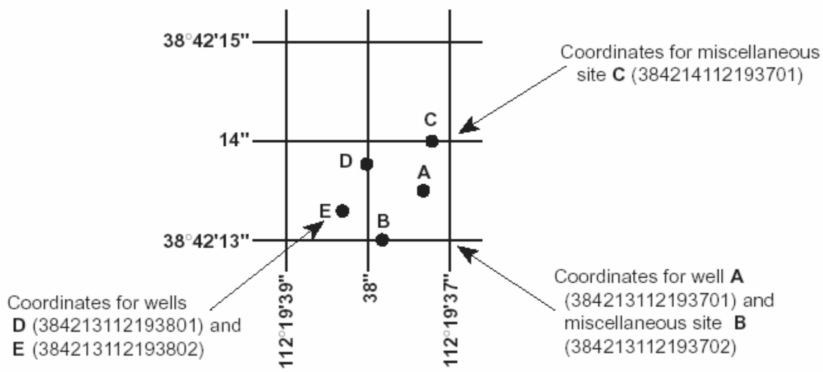


Figure 20. System for numbering wells and miscellaneous sites (latitude and longitude).

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Benchmark Network is a network of 61 sites in small drainage basins in 39 States that was established in 1963 to provide consistent streamflow data representative of undeveloped watersheds nationwide, and from which data could be analyzed on a continuing basis for use in comparison and contrast with conditions observed in basins more obviously affected by human activities. At selected sites, water-quality information is being gathered on major ions and nutrients, primarily to assess the effects of acid deposition on stream chemistry. Additional information on the Hydrologic Benchmark Program may be accessed from *http://water.usgs.gov/hbn/*.

National Stream-Quality Accounting Network (NASQAN) is a network of sites used to monitor the water quality of large rivers within the Nation’s largest river basins. From 1995 through 1999, a network of approximately 40 stations was operated in the Mississippi, Columbia, Colorado, and Rio Grande River basins. For the period 2000 through 2004, sampling was reduced to a few index stations on the Colorado and Columbia Rivers so that a network of 5 stations could be implemented on the Yukon River. Samples are collected with sufficient frequency that the flux of a wide range of constituents can be estimated. The objective of NASQAN is to characterize the water quality of these large rivers by measuring concentration and mass transport of a wide range of dissolved and suspended constituents, including nutrients, major ions, dissolved and sediment-bound heavy metals, common pesticides, and inorganic and organic forms of carbon. This information will be used (1) to describe the long-term trends and changes in concentration and transport of these constituents; (2) to test findings of the National Water-Quality Assessment

(NAWQA) Program; (3) to characterize processes unique to large-river systems such as storage and re-mobilization of sediments and associated contaminants; and (4) to refine existing estimates of off-continent transport of water, sediment, and chemicals for assessing human effects on the world's oceans and for determining global cycles of carbon, nutrients, and other chemicals. Additional information about the NASQAN Program may be accessed from *http://water.usgs.gov/nasqan/*.

The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) is a network of monitoring sites that provide continuous measurement and assessment of the chemical constituents in precipitation throughout the United States. As the lead Federal agency, the USGS works together with over 100 organizations to provide a long-term, spatial and temporal record of atmospheric deposition generated from this network of 250 precipitation-chemistry monitoring sites. The USGS supports 74 of these 250 sites. This long-term, nationally consistent monitoring program, coupled with ecosystem research, provides critical information toward a national scorecard to evaluate the effectiveness of ongoing and future regulations intended to reduce atmospheric emissions and subsequent impacts to the Nation's land and water resources. Reports and other information on the NADP/NTN Program, as well as data from the individual sites, may be accessed from *http://bqs.usgs.gov/acidrain/*.

The USGS National Water-Quality Assessment (NAWQA) Program is a long-term program with goals to describe the status and trends of water-quality conditions for a large, representative part of the Nation's ground- and surface-water resources; to provide an improved understanding of the primary natural and human factors affecting these observed conditions and trends; and to provide information that supports development and evaluation of management, regulatory, and monitoring decisions by other agencies.

Assessment activities are being conducted in 42 study units (major watersheds and aquifer systems) that represent a wide range of environmental settings nationwide and that account for a large percentage of the Nation's water use. A wide array of chemical constituents is measured in ground water, surface water, streambed sediments, and fish tissues. The coordinated application of comparative hydrologic studies at a wide range of spatial and temporal scales will provide information for water-resources managers to use in making decisions and a foundation for aggregation and comparison of findings to address water-quality issues of regional and national interest.

Communication and coordination between USGS personnel and other local, State, and Federal interests are critical components of the NAWQA Program. Each study unit has a local liaison committee consisting of representatives from key Federal, State, and local water-resources agencies, Indian nations, and universities in the study unit. Liaison committees typically meet semiannually to discuss their information needs, monitoring plans and progress, desired information products, and opportunities to collaborate efforts among the agencies. Additional information about the NAWQA Program may be accessed from *http://water.usgs.gov/nawqa/*.

The USGS National Streamflow Information Program (NSIP) is a long-term program with goals to provide framework streamflow data across the Nation. Included in the program are creation of a permanent Federally funded streamflow network, research on the nature of streamflow, regional assessments of streamflow data and databases, and upgrades in the streamflow information delivery systems. Additional information about NSIP may be accessed from *http://water.usgs.gov/nsip/*.

LOCAL NETWORKS AND PROGRAMS

The Ambient Stream Monitoring Network (ASMN) and Ambient Ground Water Quality Network (AGWQN) are USGS/New Jersey Department of Environmental Protection (NJDEP) cooperative networks designed to meet the expanding need for surface- and ground-water-quality data in the State of New Jersey. The major objectives of the networks are to (1) support the National Environmental Performance Partnership System agreement (a program set up to control long-term environmental planning) and the watershed-management process; (2) to work synergistically with the NJDEP Ambient Biomonitoring Network, and atmospheric, ground-water, and coastal water-quality networks; (3) determine statewide water-quality status and trends; (4) measure water-quality near the downstream end of each Watershed Management Area (WMA); (5) define background water quality in each of the four physiographic provinces of New Jersey; (6) measure nonpoint source contributions from major landuse areas, atmospheric deposition, and ground-water; (7) facilitate response of state and local water-management officials to emerging or watershed-specific water-quality issues.

The Ambient Stream Monitoring Network consists of 116 stations located in 20 WMA's (fig. 21). These stations are segregated into five distinct types that together are used to define the surface-water-quality in the State. Background stations are located on reaches of streams that have remained relatively unaffected by human activity, to develop a baseline water-quality data base (fig. 22). Data from these stations are used in the development of water-quality standards and initiatives. Watershed Integrator stations are located near the furthest downstream point possible in each WMA to provide information on the combined water-quality effects within each WMA. Land Use Indicator stations are used to monitor the effects of the dominant land use in each WMA and provide data on nonpoint-source loading of contaminants to streams. Statewide Status stations are chosen randomly each year within the 20 WMA's to obtain a statistical basis that can be used to estimate water-quality indicators statewide. Five stations are located on the Delaware Main Stem—the border between New Jersey and Pennsylvania. Watershed Reconnaissance stations are also selected annually on the basis of specific project needs, determined by a committee of USGS and NJDEP personnel.

The stream-monitoring network is sampled in four periods throughout the water year: November to December, February to March, May to June, and August to September. Samples for the analyses of nutrients, major ions, biochemical oxygen demand, and suspended solids are collected for the entire network each sampling period. Samples for the analysis of water-column volatile organic compounds during February and March, filtered organic pesticides during May and June, and whole-water-recoverable trace elements during August and September are collected at all Statewide Status and Background stations. Samples for the analyses of trace elements and polyaromatic hydrocarbons in streambed sediments are also collected in August and September at 20 Statewide Status stations and 2 Background stations. Samples for the analyses of fecal coliform, E. coli, and enterococcus bacteria are collected synoptically—5 times in a 30-day period during the summer.

The Ambient Ground-Water-Quality Network is a long-term monitoring network with goals to assess the status of ground-water quality by examining the concentrations of various constituents that can be used as environmental indicators, assess water-quality trends by examining data collected on a 5-year cycle, determine the effects of land use on shallow ground-water quality, identify threats from nonpoint sources of contamination, and identify emerging or new environmental issues of concern to the public. The ground-water network consists of 150 wells distributed throughout the State of New Jersey within three land-use types. Sixty wells are located in agricultural areas, 60 in urban/suburban areas, and 30 in undeveloped areas. These areas are located throughout New Jersey's five Watershed Management Regions (WMR), which are further divided into 20 watershed-management areas (WMA) (fig. 23). The Passaic Region encompasses WMAs 3-6; the Lower Delaware Region, WMAs 17-20; the Raritan Region, WMAs 7-10; the Upper Delaware Region, WMAs 1, 2, and 11; and, the Atlantic Coastal Region, WMAs 12-16.

The Long Island-New Jersey Coastal Plain (LINJ) and **The Delaware River Basin (DELR)** are two NAWQA study units currently opperating in the New Jersey District. The LINJ study unit conducted intensive sampling from 1996 through 1998 and the DELR study unit from 1999 through 2001. Both study units are currently in low-intensity phases. The LINJ study unit is slated to resume intensive sampling starting in 2006 and the DELR study unit in 2010. LINJ-NAWQA fixed stations published in this report are: Raritan River at Queens Bridge, at Bound Brook, NJ (01403300) and Bound Brook at Middlesex, NJ (01403900) (fig. 24). DELR-NAWQA fixed stations published in this report are: Delaware River at Trenton, NJ (01463500); Little Neshaminy Creek at Valley Rd. near Neshaminy, PA (01464907); French Creek near Phoenixville, PA (01472157); and Schuylkill River at Philadelphia, PA (01474500) (fig. 25).

One **Hydrological Benchmark Network** station is currently operating in New Jersey—McDonald's Branch in Lebanon State Forest, 01466500. In addition to the sampling requirements of the ASMN, the station is sampled several times a year during periods of shanging stage for analysis of physical parameters, major cations and anions, nutrients, and aluminum.