Water Resources Data for
Massachusetts and Rhode Island, 2001

By R.S. Socolow, C.R. Leighton, J.F. Whitley, and D.J. Ventetuolo

INTRODUCTION

The Water Resources Discipline of the U.S. Geological Survey (USGS), in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Massachusetts and Rhode Island each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the States. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data-Massachusetts and Rhode Island."

Hydrologic data are also available through the Massachusetts–Rhode Island District Home Page on the World Wide Web (http://ma.water.usgs.gov). Historical data and real-time data (for sites equipped with satellite gage-height telemeter) are also available. The home page also contains a link to the U.S. Geological Survey National Home Page where streamflow data from locations throughout the United States can be retrieved. Please be advised that hydrographs for surface-water discharge stations and ground-water-level observation wells, published in the Massachusetts–Rhode Island Annual Water Data Report for water year 2000, are not included in this printed edition. However, improved versions of these hydrographs are now available on-line in page-sized pdf format for water year 2001 through the USGS Web page at: http://water.usgs.gov/pubs/wdr/.

This report series includes records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and water levels of ground-water wells. This volume contains discharge records for 93 gaging stations; stage records for 1 gaging station; month-end contents of 4 lakes and reservoirs; water quality for 31 gaging stations; water levels for 139 observation wells; ground-water quality for 24 water-supply wells; and stage records for 1 pond. Locations of these sites are shown in figures 1 and 2. Short-term water-quality data were collected at 26 gaging stations and are shown in figure 3. Locations of ground-water-quality sites are not shown for homeland security reasons. Hydrologic data were collected at many sites that were not involved in the systematic data-collection program and are published as miscellaneous discharge measurements, miscellaneous surface-water-quality, and miscellaneous ground-water-quality data. The data in this report represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Massachusetts and Rhode Island.

This series of annual reports for Massachusetts and Rhode Island 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 with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Massachusetts and Rhode Island 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, Parts 1A and 1B." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1939 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from U.S. Geological Survey, Information Services, Box 25286, Denver Federal Center, Box 25425, Denver, CO 80225-0286.

Publications similar to this report are published annually by the USGS for all States. These official Survey 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 MA-RI-01-1." For archiving and general distribution, the reports for 1971–74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. Additional information, including current prices, for ordering specific reports may be obtained from the District Office at the address given on the back of the title page or by telephone (800) 696-4042.
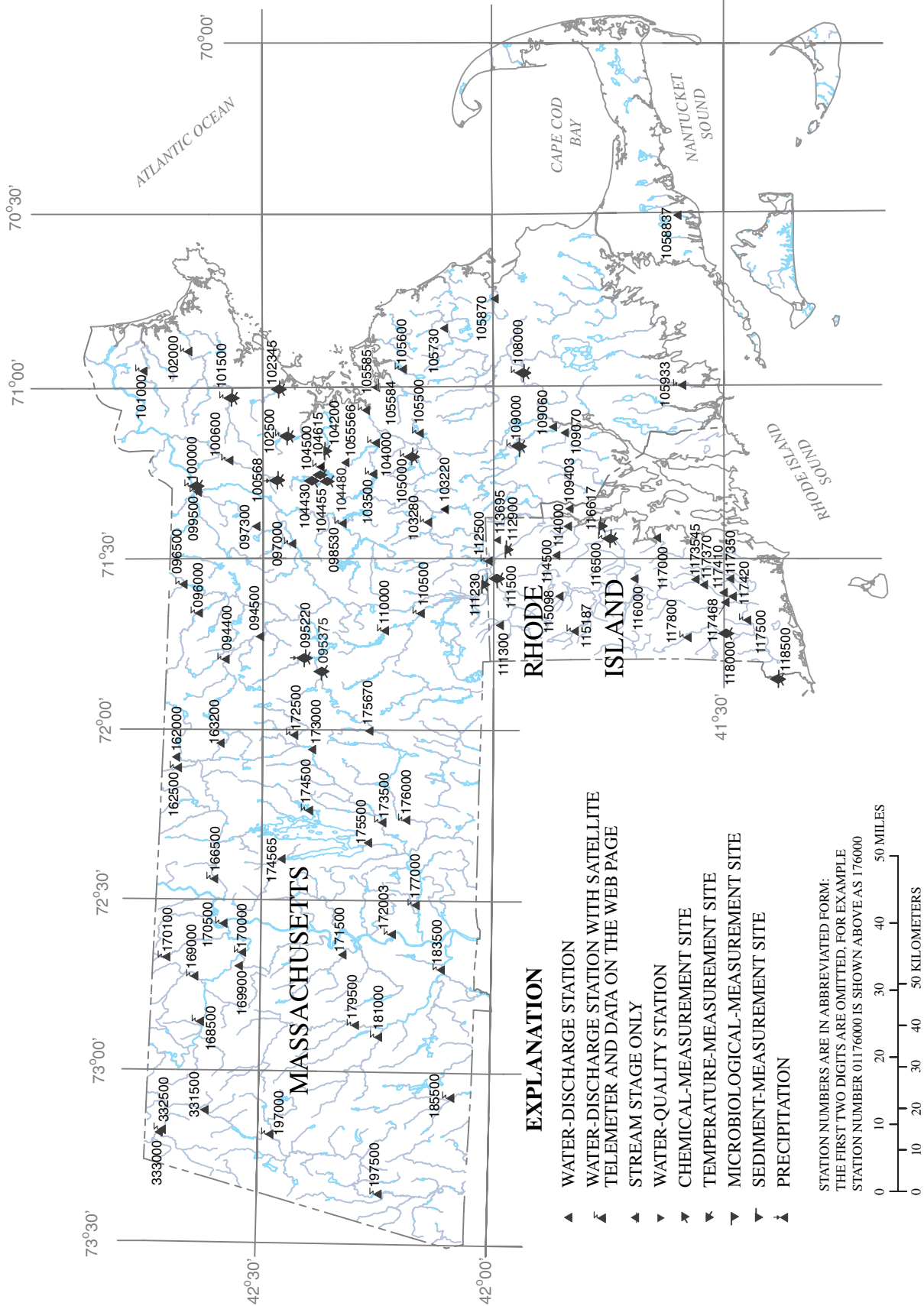
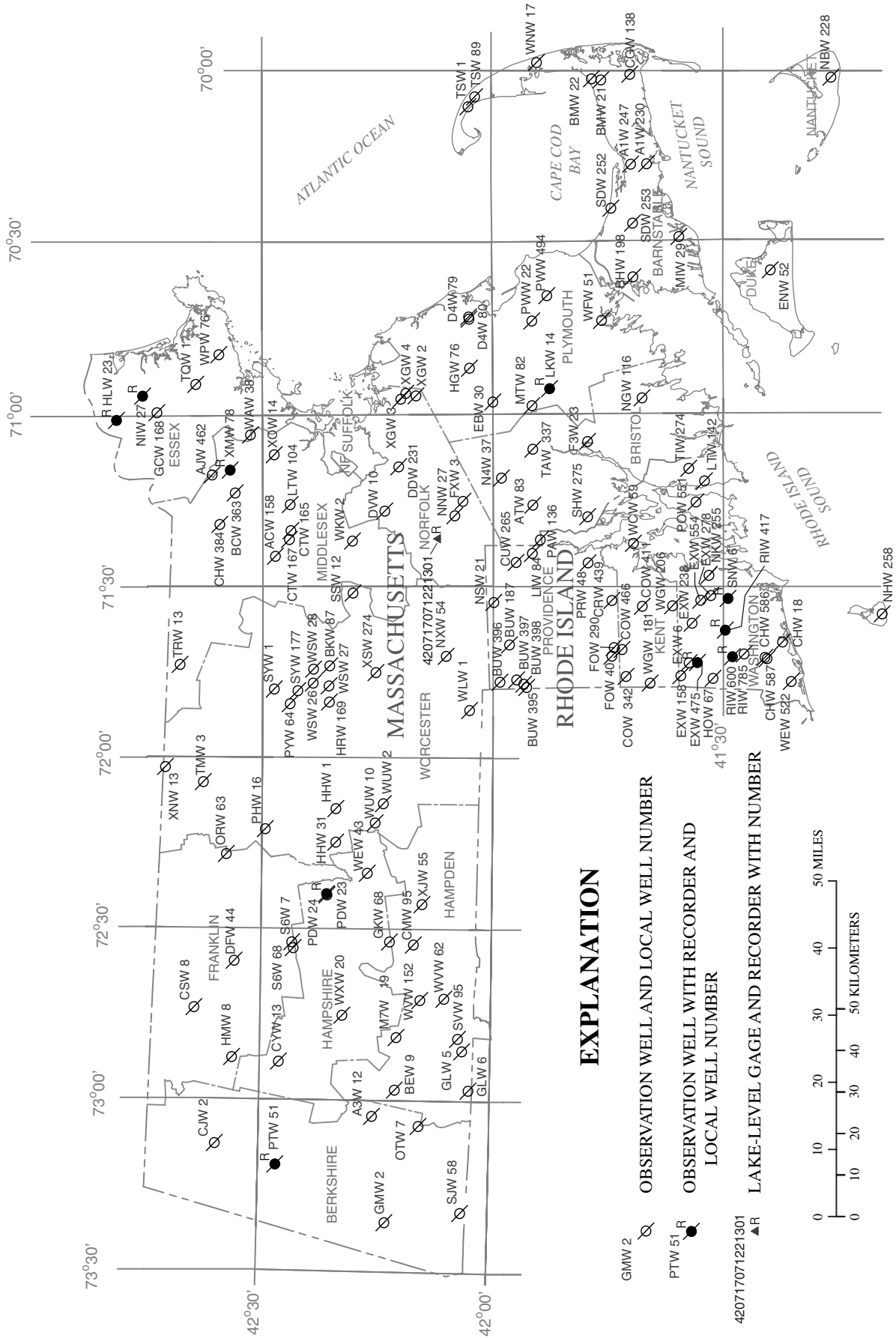**Figure 1.** Location of gaging stations.

EXPLANATION

GMW 2   ⌀   OBSERVATION WELL AND LOCAL WELL NUMBER

PTW 51 R ●   OBSERVATION WELL WITH RECORDER AND
                LOCAL WELL NUMBER

420717071221301
        ▲R   LAKE-LEVEL GAGE AND RECORDER WITH NUMBER

Figure 2. Location of observation wells.

Map No.	Station No.	Latitude	Longitude
1.	01096544	423704	0712408
2.	01096710	421946	0713748
3.	011032058	420711	0712710
4.	01106468	420201	0705821
5.	01112262	420227	0713056
6.	01115098	415109	0713624
7.	01115110	415048	0713644
8.	01115170	415027	0713506
9.	01115183	414751	0713507
10.	01115187	414907	0714220
11.	01115190	414920	0714203
12.	01115265	414726	0714157
13.	01115275	414657	0714031
14.	01115280	414814	0713901
15.	01115297	414553	0713810
16.	01095220	422439	0714730
17.	01100000	423845	0711756
18.	01101500	423410	0710139
19.	01102345	422810	0710028
20.	01102500	422650	0710822
21.	01105000	421039	0711205
22.	01109000	415651	0711038
23.	01112900	415816	0712814
24.	01115500	414358	0713301
25.	01096720	422029	0713659
26.	01105504	420931	0710919

EXPLANATION

SHORT-TERM WATER QUALITY SAMPING SITES USED IN 2001

WATER-DISCHARGE STATION

WATER-DISCHARGE STATION WITH SATELLITE
TELEMETER AND DATA ON THE WEB PAGE

WATER-QUALITY STATION

CHEMICAL-MEASUREMENT SITE

TEMPERATURE-MEASUREMENT SITE

MICROBIOLOGICAL-MEASUREMENT SITE

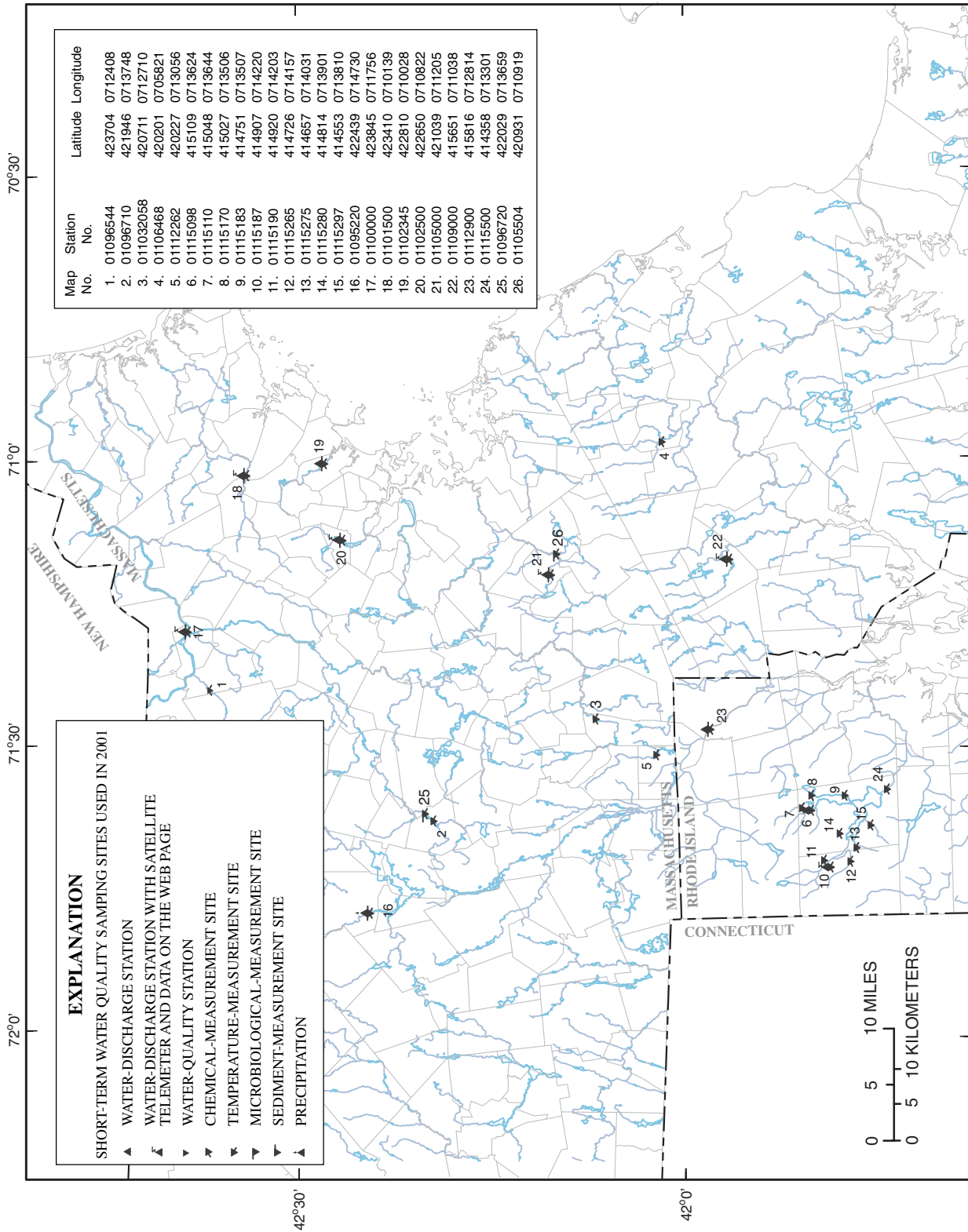SEDIMENT-MEASUREMENT SITE

PRECIPITATION

Figure 3. Location of stort-term water-quality sampling sites.

COOPERATION

The USGS and agencies of the States of Massachusetts and Rhode Island have had cooperative agreements for the collection of streamflow records since 1909 and 1941, respectively, and for water-quality records since 1954. Organizations that assisted in collecting the data in this report through cooperative agreement with the Survey are:

Massachusetts:

Department of Environmental Management,
   P. Webber, Commissioner
Division of Resource Conservation,
   Michael Gildesgame, Director;
Department of Environmental Protection,
   L.A. Liss, Commissioner
Office of Watershed Management,
   Glenn Haas, Director
Metropolitan District Commission,
   D.B. Balfour, Jr., Commissioner
Division of Watershed Management,
   J.M. McGinn, Director
Division of Parks, Engineering, and Construction,
   F.D. Faucher, Director
Town of Dartmouth,
   Manuel Branco, Water Superintendent
Town of Franklin
   W.A. Fitzgerald, Director, Department of Public Works

Rhode Island:

State Water Resources Board,
   M. Paul Sams, General Manager
   D.W. Varin, Chairman
Department of Environmental Management,
   J.H. Reitsma, Director,
   E.S. Szymanski, Associate Director
Providence Water Supply Board,
   Robert Kilduff, General Manager and Chief Engineer
   A. Parillo, Chairman

Assistance in the form of funds or services was given by the Corps of Engineers, U.S. Army, in collecting records for three gaging stations published in the report. Assistance in the form of services was given by the Cape Cod Commission, Barnstable County, Nantucket Land Council, Nantucket County, and Cooperative Extension, Martha's Vineyard, Dukes County, Massachusetts, in measuring observation wells on Cape Cod, Nantucket Island, and Martha's Vineyard Island, Massachusetts.

SUMMARY OF HYDROLOGIC CONDITIONS

Streamflow

Runoff for the 2001 water year was generally normal (between the lowest 25 percent of record and highest 25 percent of record) at stations in Massachusetts and Rhode Island. Runoff was above normal (highest 25 percent of record) for eastern Massachusetts and all of Rhode Island in March, all of Massachusetts and Rhode Island in April, and western and eastern Massachusetts and northern Rhode Island in June. Annual peak flows occurred primarily during storms on December 17 and from April 10 through 15 at most sites in west-central and western Massachusetts.

Annual peak flows occurred during the two weeks from March 22 to April 4 in central and eastern Massachusetts and all of Rhode Island. The March-to-April peak-flow event resulted from a combination of approximately 5 inches of rainfall onto a snow pack that ranged from approximately 24 to 36 inches deep in Massachusetts to approximately 12 to 24 inches deep in Rhode Island. New peak flows for period-of-station records were recorded at two stations with five or more years of record (Ipswich River at South Middleton, MA, operated since June 1938; and Aberjona River at Winchester, MA, operated since April 1939. Peak flows at both stations indicated recurrence intervals of 100 years. A table showing peak-flow information for those stations in eastern Massachusetts and Rhode Island most affected by the March flood appears in the "Floods" section following the "Ground-Water Levels" section.

Monthly and yearly discharges for the 2001 water year, and median monthly and yearly discharges for the 30-year reference period 1971–2000, for three index gaging stations are compared in figure 4. Maps showing monthly surface-water conditions during the 2001 water year in Massachusetts and Rhode Island are shown in figure 5. The maps show areas of normal, above-normal (within the highest 25 percent of record), or below-normal (within the lowest 25 percent of record) runoff for each month and are based on records for many of the streamflow-gaging stations contained in this report. Additional statistics for each gaging station are provided with the tables of daily mean discharge.

Reservoir Storage

During the 2001 water year, month-end storage of Quabbin Reservoir in central Massachusetts ranged from 90 percent of usable capacity at the end of January and February to 98 percent of usable capacity at the end of April. Month-end storage of Borden Brook/Cobble Mountain Reservoir in western Massachusetts ranged from 73 percent of usable capacity at the end of October, January, and February to 94 percent of usable capacity at the end of May and June. Storage values for Quabbin and Borden Brook/Cobble Mountain Reservoirs were provided by the Metropolitan District Commission, Division of Watershed Management. The month-end storage of Scituate Reservoir in central Rhode Island ranged from 72 percent of usable capacity at the end of November to 104 percent of usable capacity at the end of March and June. Storage values were provided by the Providence Water Supply Board.

Water Quality

Specific conductance and water temperature were recorded at 4 surface-water sites in Massachusetts and 11 surface-water sites in Rhode Island. In Massachusetts three sites were operating before the 2001 water year (Stillwater River, Quinapoxet River, and Hobbs Brook) and one site was started in the 2001 water year (Stony Brook, Unnamed Tributary 1, near Waltham, MA). In Rhode Island, 11 sites were operating before the 2001 water year. Of those sites, only Wood River at Hope Valley was operated for 10 or more years
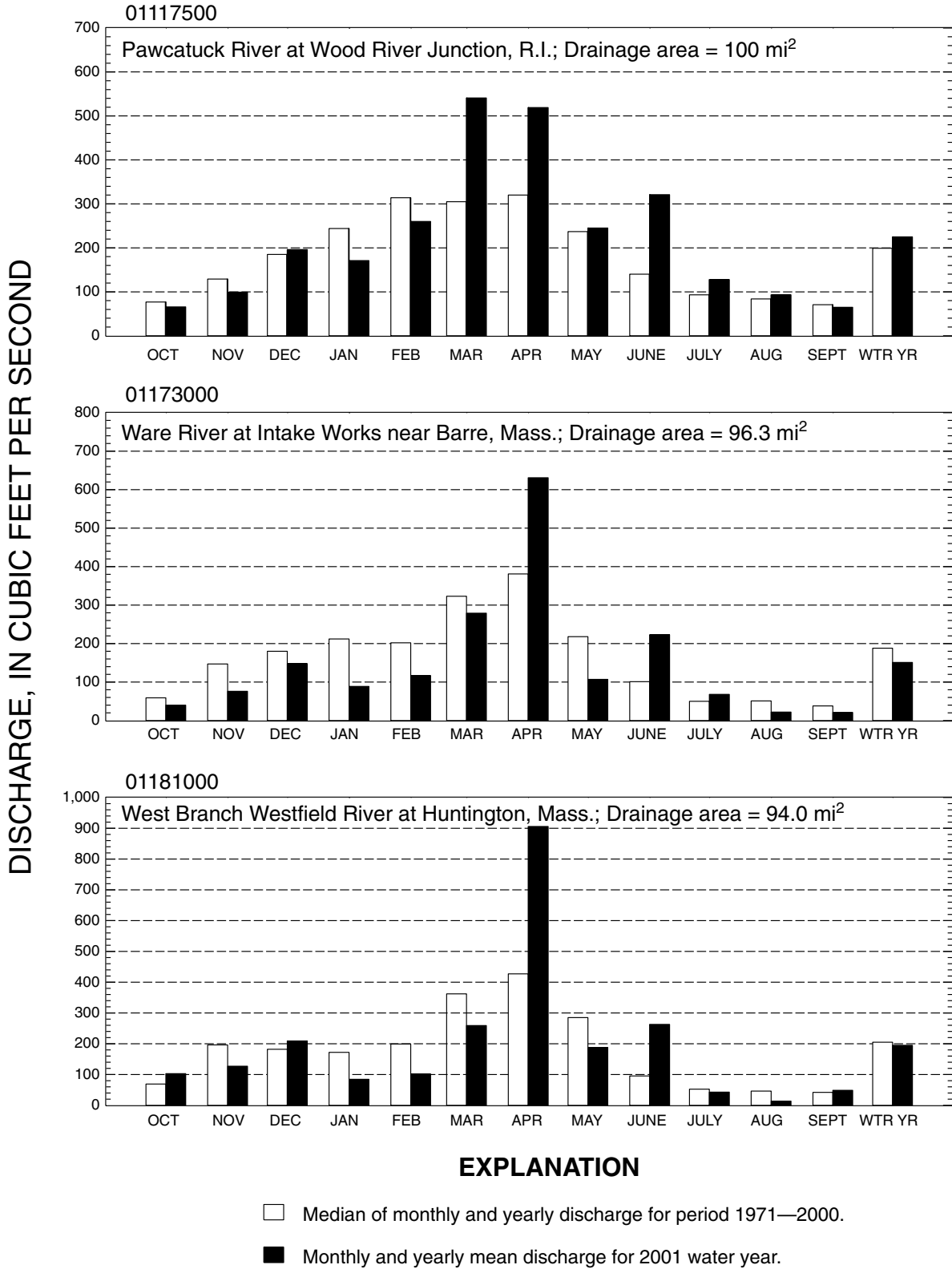
Figure 4. Comparison of discharge at three long-term index stations during the 2001 water year with median discharge for 1971–2000.
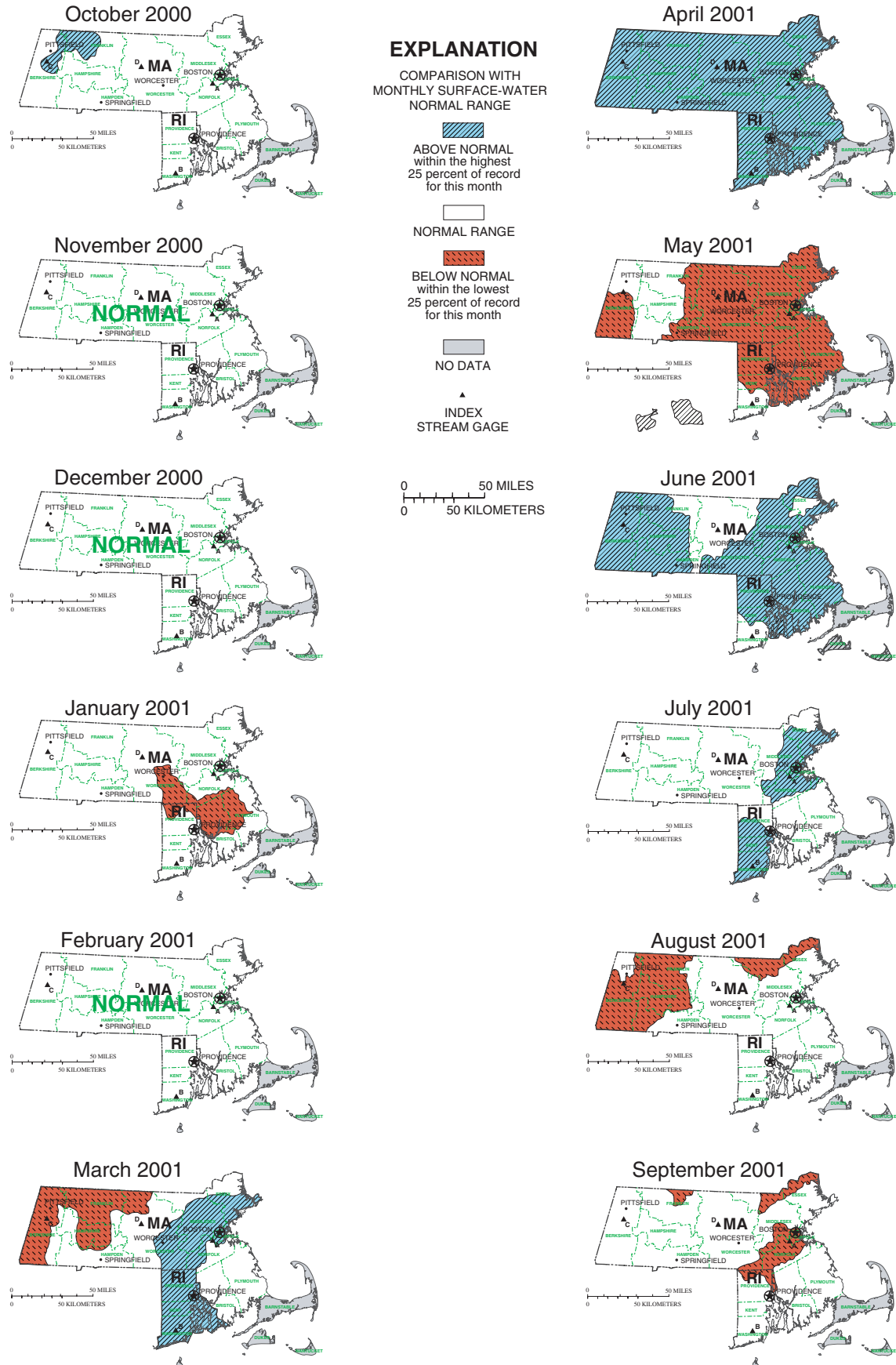
Figure 5. Monthly surface-water conditions during the 2001 water year in Massachusetts and Rhode Island.

(since October 1977). The remaining 10 sites were started in the 2000 water year (see table of contents, Pawtuxet River Basin, Scituate Reservoir).

New maximum specific conductance and minimum water-temperature values were recorded at Hobbs Brook below Cambridge Reservoir near Kendall Green, MA (1,940 µs/cm, Mar. 20; 0.2˚C, Jan. 18). A new minimum water-temperature value was recorded at Quinapoxet River at Canada Mills near Holden, MA (-0.8˚C, Feb. 19). All readings of specific conductance and water temperature at the continuous- recording monitoring stations on the Stillwater River near Sterling, MA, and Wood River at Hope Valley, R.I., were within the previous extreme values for the period of daily record.

Ground-Water Levels

From October through March, new historical high ground-water levels were measured at six wells, all of which were measured in March. The record-high levels resulted from high surface- and ground-water conditions present at that time due to a large snowpack and heavy rainfall on or about March 22, 2001. Also from October through March, 12 new monthly high-water levels and 52 new monthly low-water levels (including historical high levels) were measured at wells in Massachusetts and Rhode Island. Of the 12 new monthly high-water levels, 9 occurred in March. Of the 46 new monthly low-water levels, 37 occurred in January and February.

From April through September, new historical high ground-water levels were measured at four wells, three of which were measured in May and one was measured in April. During that same period, 42 new monthly high-water levels and 6 new monthly low-water levels were measured at wells in Massachusetts and Rhode Island. Of the 42 new monthly

high-water levels, 27 occurred in May and June. Wells with water-level records that started before 1997 in Massachusetts and Rhode Island are included in this summary.

Monthly water levels and median, maximum, and minimum monthly water levels for periods of record for three index-observation wells in Massachusetts and Rhode Island are compared in figure 6. Maps showing monthly ground-water conditions during the 2001 water year in Massachusetts and Rhode Island are shown in figure 7. The maps show areas of normal, above-normal, and below-normal ground-water levels for each month. From October 2000 through September 2001, ground-water levels for part or all of Cape Cod were below normal. From June through September 2001, ground-water levels for most of Massachusetts and Rhode Island were above normal.

## Floods and Droughts

Floods

A major flood occurred in central and eastern Massachusetts and all of Rhode Island during the period from March 22 to April 3 and resulted from approximately 5 inches of rain on March 22 and 23 that fell on a snowpack ranging from approximately 24 to 36 inches in Massachusetts and approximately 12 to 24 inches in Rhode Island. Flood recurrence intervals during this period ranged from 5 to 100 years (peaks having a 1 in 5 to 1 in 100 chance of occurring in any one year). The following table shows 2001 water-year data and historical peak-flow and peak-stage data for those stations most affected by the March 2001 flood:

Additional information and photographs related to the March 2001 flood can be found on the USGS Massachusetts–Rhode Island District Flood Web page at: http://ma.water.usgs.gov/water_floods.htm.

Peak Discharge and Stage Data for Flood of March 2001 and Historical Flow Data for Selected Stations

| Station No.	Date of peak	Peak flow (in ft^3/s)	Peak stage (in feet)	Flood recurrence interval (in years)	Peak flow for period of record (in ft^3/s)	Peak stage for period of record (in feet)	Date of record peak
01097000	3-23-01	2,090	6.41	10	4,250	8.94	8-20-55
01099500	3-25-01	4,150	8.96	10	5,410	9.60	1-28-79
01100600	3-23-01	1,580	9.87	25	1,850	10.49	10-22-96
01101000	3-23-01	641	6.32	25	833	7.82	10-22-96
01101500	3-23-01	1,200	8.39	100	1,200	8.39	3-23-01
01102000	3-24-01	3,040	8.88	25	3,550	9.43	4-08-87
01102500	3-22-01	1,590	16.90	100	1,590	16.90	3-22-01
01103500	3-25-01	2,130	6.97	10	3,220	9.24	8-23-55
01104500	3-23-01	2,190	5.42	5	4,150	6.54	2-03-76
01105500	3-22-01	686	4.72	5	1,790	8.18	8-19-55
01109000	3-23-01	701	9.64	5	1,460	11.47	3-19-68
01110500	3-22-01	3,260	9.22	5	16,900	16.74	8-20-55
01112500	3-23-01	10,300	11.65	10	32,900	21.80	8-19-55
01116000	3-23-01	1,070	3.90	5	1,980	5.30	6-06-82
01116500	3-31-01	3,120	11.86	10	5,440	14.50	6-07-82
01117500	4-01-01	1,120	5.99	5	1,860	8.75	6-07-82
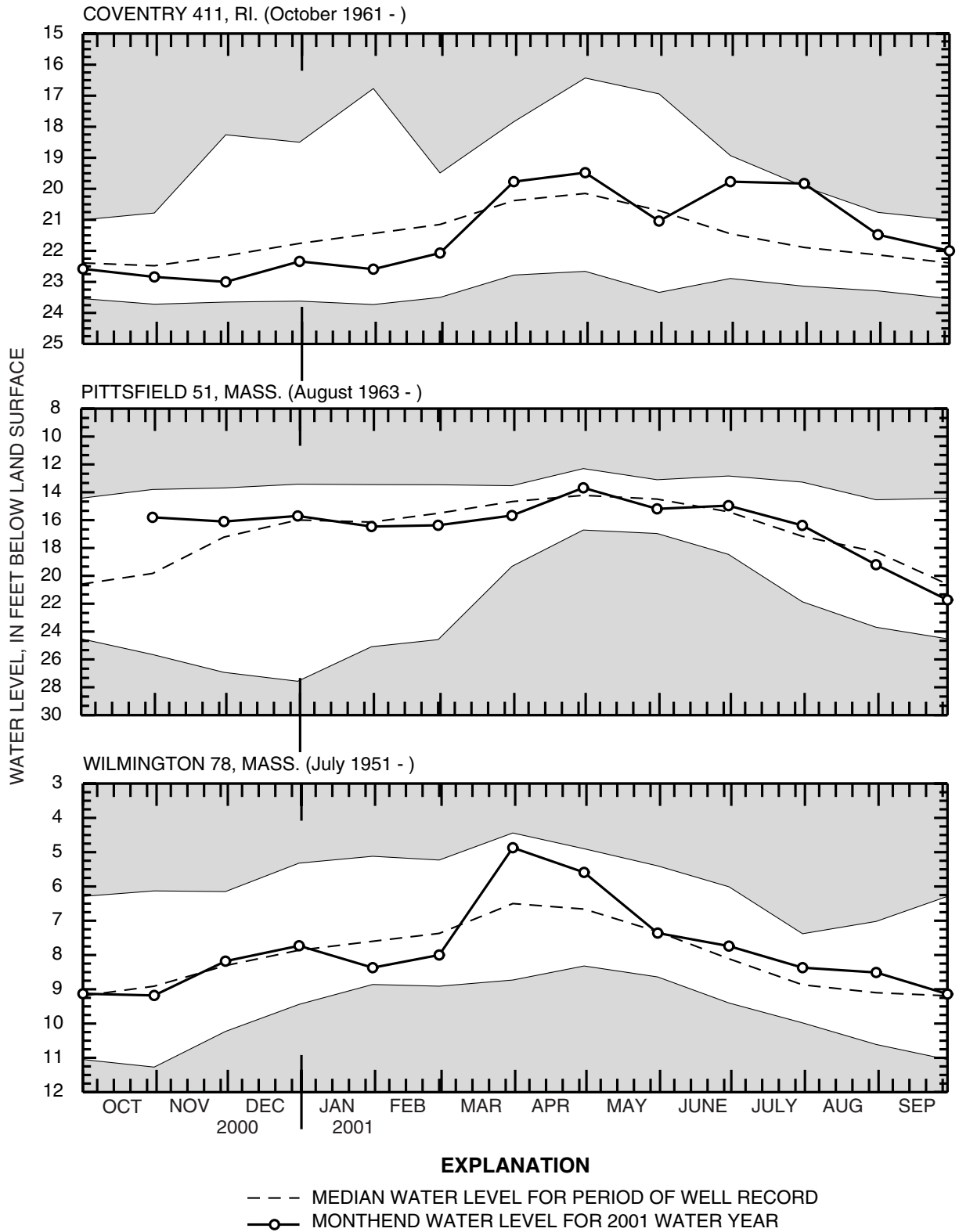
Figure 6. Comparison of monthly water levels in selected observation wells during the 2001 water year with average, maximum, and minimum monthly water levels for periods of record.
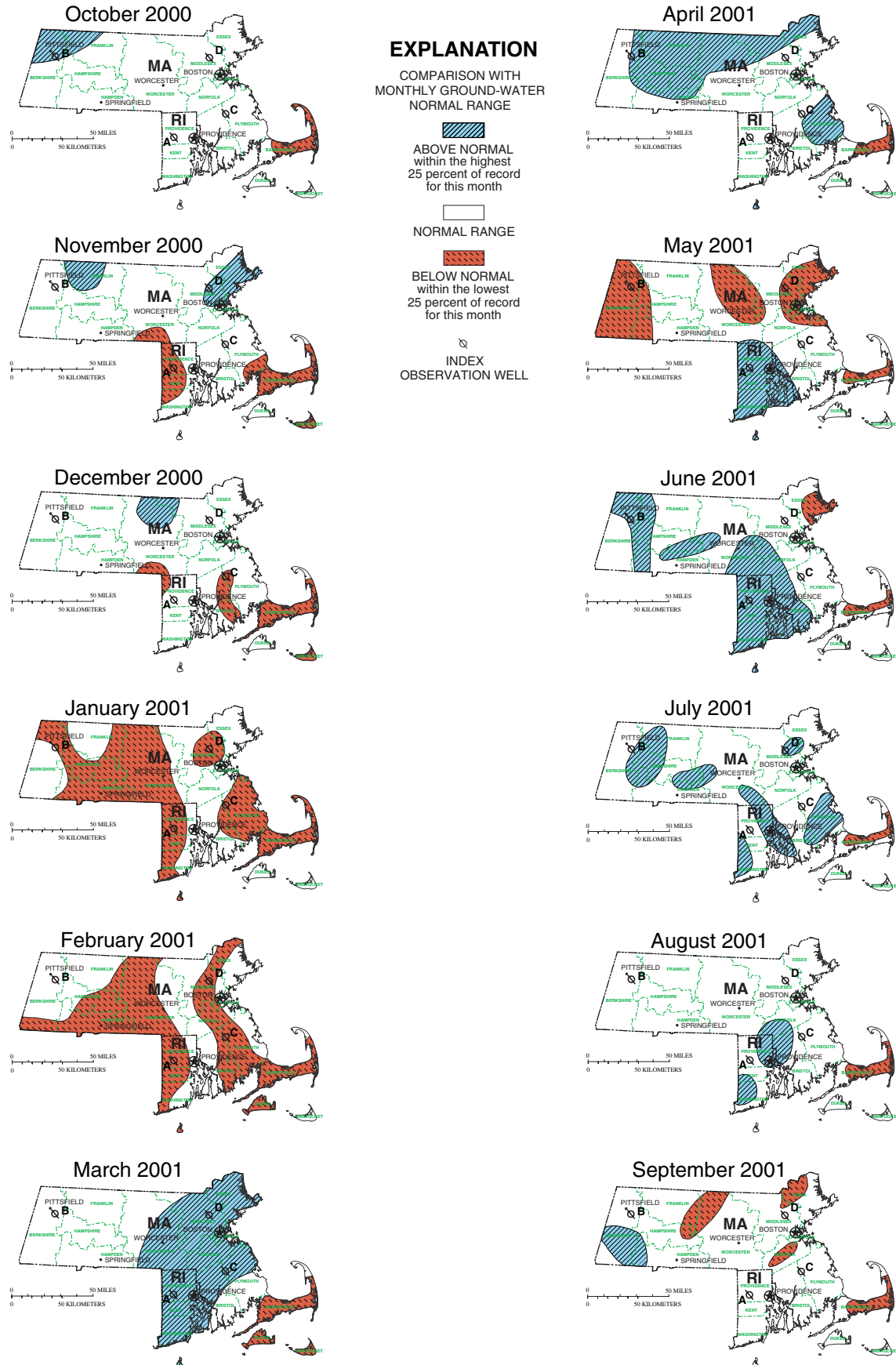
Figure 7. Monthly ground-water conditions during the 2001 water year in Massachusetts and Rhode Island.

Droughts

No significant droughts occurred during the year.

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Benchmark Network is a network of 50 sits in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by human activities.

National Stream-Quality Accounting Network (NASQAN) monitors the water quality of large rivers within four of the Nation's largest river basins—the Mississippi, Columbia, Colorado, and Rio Grande. The network consists of 39 stations. 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 to (1) describe the long-term trends and changes in concentration and transport of these constituents; (2) test findings of the National Water-Quality Assessment Program (NAWQA); (3) characterize processes unique to large-river systems such as storage and re-mobilization of sediments and associated contaminants; and (4) 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.

The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) provides continuous measurement and assessment of the chemical climate of precipitation throughout the United States. As the lead Federal agency, the USGS works together with over 100 organizations to accomplish the following objectives: (1) Provide a long-term, spatial and temporal record of atmospheric deposition generated from a network of 181 precipitation chemistry monitoring sites, (Provide the mechanism to evaluate the effectiveness of the significant reduction in SO_2 emissions that began in 1995 as implementation of the Clean Air Act Amendments (CAAA) occurred, and (3) Provide the scientific basis and nationwide evaluation mechanism for implementation of the Phase II CAAA emission reductions for SO2 and NOx scheduled to begin in 2000.

Data from the network, as well as information about individual sites, are available through the world wide web at: http://nadp.sws.uiuc.edu.

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey 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; provide an improved understanding of the primary natural and human factors affecting these observed conditions and trends; and 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 are 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 provides information for decision making by water-resources managers 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.

The New England Coastal Basins (NECB) NAWQA study unit encompasses 23,000 square miles (mi^2) in western and central Maine, eastern New Hampshire, eastern Massachusetts, most of Rhode Island, and a small part of eastern Connecticut. The NECB NAWQA routine surface-water quality monitoring locations in WY 2001 published in this report are: Stillwater River near Sterling, MA (01095220); Merrimack River below Concord River, at Lowell, MA (01100000); Ipswich River at South Middleton, MA (01101500); Saugus River at Saugus Ironworks at Saugus, MA (01102345); Aberjona River (head of Mystic River) at Winchester, MA (01102500); and Charles River above Watertown Dam at Watertown, MA (01104615). The NECB NAWQA also conducted a synoptic study on nutrient/chlorophyll relations in 13 streams.

Water samples were collected from 5 domestic wells and 19 public-supply gravel-packed wells as part of the NAWQA program during the 2001 water year. Sampling protocols were followed to obtain and evaluate accurate water-quality

data (Koterba and others, 1995).[1] Untreated water samples were collected from domestic bedrock wells using a sample line connected from domestic bedrock wells using a sample line connected to a faucet that is at the base of the pressure tank from inside the home. Untreated water samples were collected from public-supply gravel-packed wells using a sample line connected to a faucet either at the well head (where available) or at a nearby pump house.

Additional information about the NAWQA Program is available through the World Wide Web at: http://water.usgs.gov/nawqa.

EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 2000 water year that began October 1, 1999, and ended September 30, 2000. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for surface water, and ground-water-level data.

The locations of the stations and wells where the data were collected are shown in figures 1, 2, and 3. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

Station-Identification Numbers

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The systems used by the USGS to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for surface-water stations and the "latitude-longitude" system is used for wells.

Downstream Order System

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

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between continuous- record stations and other types of stations; therefore, the station number for a continuous-record station indicates downstream-order position in a list made up of all types of stations. Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete station number (usually eight digits, but sometimes nine or more if needed) appears just to the left of the station name. The first two digits indicate the Part number (formerly used in Water-Supply Papers to designate major river systems) and the last six or more digits indicate the downstream order within the Part. For example, in the station number 01094400, "01" is the Part number for "North Atlantic Slope Basins" and "094400" is the downstream order number.
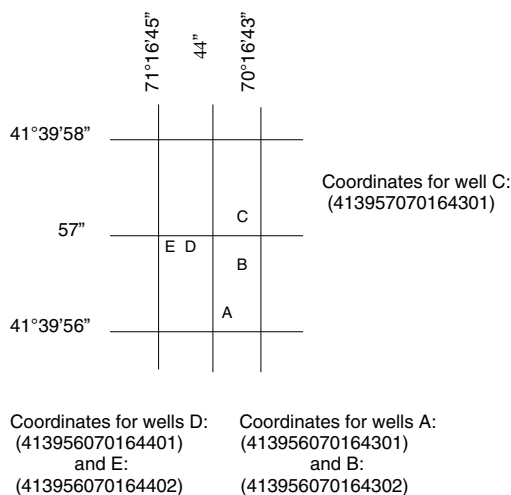
Latitude-Longitude System

The identification numbers for wells are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude is found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description. (See figure 7.)

Numbering System for Wells

A local well numbering system is also used in this report. The local well number consists of a 2-letter code for the town in which the well is located followed by a "W" signifying that it is a well, and a sequential number. The local number is used to identify the location of observation wells in figure 3.

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[1]Koterba, M.T., Wilde, F.D., and Lapham, W.W., 1995, Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program—Collection and documentation of water quality samples and related data: U.S. Geological Survey Open=File Report 95-399, 113 p.

Coordinates for well C:
(413957070164301)

Coordinates for wells D: Coordinates for wells A:
(413956070164401)   (413956070164301)
and E: and B:
(413956070164402)   (413956070164302)

Figure 8.--System for numbering wells
(latitude and longitude)

Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharges may be computed for any time, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-day contents commonly are published for such stations, they are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "Crest-stage partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. There were no crest-stage stations this year. Location of all complete-record stations for which data are given in this report are shown in figure 1; location of all partial-record stations for which data are given in this report are shown in figure 2.

Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with electronic recorders that log data at selected time intervals. Measurements of discharge are made with current meters using methods adopted by the USGS as a result of experience accumulated since 1880. These methods are described in standard textbooks; in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6; and in U.S. Geological Survey Water-Supply Paper 2175, "Measurement and Computation of Stream-flow: Volume 1--Measurement of Stage and Discharge (p. 1–284); Volume 2--Computation of Discharge (p. 285–631)" by S.E. Rantz and others (1982).

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of the current-meter measurements, the curves are extended using: (1) logarithmic plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow over dams or weirs; or (4) step-backwater techniques.

Daily mean discharge is computed by applying the daily mean stage (gage height) to the stage-discharge rating table or by applying each recorded stage in the day to the rating table and computing the mean from the sum of the individual discharges. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may obscure the stage-discharge relations. This requires daily mean discharges to be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations, the stage-discharge relation is affected by the backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as the lapsed time since the last survey increases. Discharges over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

For some gaging stations, there are periods when no gage-height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

Data Presentation

The records published for each continuous-record surface-water discharge station (gaging station) consist of four parts: the manuscript or station description; the data table of daily mean values of discharge for the current water year with summary data; a tabular statistical summary of monthly mean flow data for a designated period, by water year; and a summary statistics table that includes statistical data of annual, daily, and instantaneous flows, as well as data pertaining to annual runoff, 7-day low-flow minimums, and flow duration.

Station manuscript

The manuscript provides, under various headings, descriptive information, such as station location; period of record; historical extremes outside the period of record; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement," Bulletin 14, Revision of October 1968, prepared by the Water Resources Council, or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS--Because of new information, published records occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE--The type of gage in current use, the datum of the current gage referred to sea level (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS--All periods of estimated daily discharge will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily discharge table. (See next section, "Identifying Estimated Daily Discharge.") If a REMARKS paragraph is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the

records, to special methods of computation, and to conditions that affect natural flow at the station. In addition, information may be presented pertaining to average discharge data for the period of record; to extremes data for the period of record and the current year; and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

COOPERATION--Records provided by a cooperating organization or obtained for the USGS by a cooperating organization are identified here.

EXTREMES OUTSIDE PERIOD OF RECORD--Included here is information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the USGS.

REVISIONS--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the District Office (address given on the back of the title page of this report) to determine if the published records were ever revised after the station was discontinued. Of course, if the data for a discontinued station were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and in the inclusion of a skeleton stage-capacity table when daily contents are given.

Headings for AVERAGE DISCHARGE, EXTREMES FOR PERIOD OF RECORD, AND EXTREMES FOR CURRENT YEAR have been deleted and the information contained in these paragraphs, except for the listing of secondary instantaneous peak discharges in the EXTREMES FOR CURRENT YEAR paragraph, is now presented in the tabular summaries following the discharge table or in the REMARKS paragraph, as appropriate. No changes have been made to the data presentations of lake contents.

Data table of daily mean values

The daily table of discharge records for stream-gaging stations gives mean discharge for each day of the water year. In the monthly summary for the table, the line headed "TOTAL" gives the sum of the daily figures for each month; the line headed "MEAN" gives the average flow in cubic feet per second for the month; and the lines headed "MAX" and "MIN" give the maximum and minimum daily mean discharges, respectively, for each month. Discharge for the month also is usually expressed in cubic feet per second per square mile (line headed "CFSM"); or in inches (line headed "IN."); or in acre-feet (line headed "AC-FT"). Figures for cubic feet per second per square mile and runoff in inches or in acre-feet may be omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversion data or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

Statistics of monthly mean data

A tabular summary of the mean (line headed "MEAN"), maximum (line headed "MAX"), and minimum (line headed "MIN") of monthly mean flows for each month for a designated period is provided below the mean values table. The water years of the first occurrence of the maximum and minimum monthly flows are provided immediately below those figures. The designated period will be expressed as "FOR WATER YEARS _ - _, BY WATER YEAR (WY)," and will list the first and last water years of the range of years selected from the PERIOD OF RECORD paragraph in the station manuscript. It will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript.

Summary statistics

A table titled "SUMMARY STATISTICS" follows the statistics of monthly mean data tabulation. This table consists of four columns, with the first column containing the line headings of the statistics being reported. The table provides a statistical summary of yearly, daily, and instantaneous flows, not only for the current water year but also for the previous calendar year and for a designated period, as appropriate. The designated period selected, "WATER YEARS _ - _," will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript. All of the calculations for the statistical characteristics designated ANNUAL (See line headings below.), except for the "ANNUAL 7-DAY MINIMUM" statistic, are calculated for the designated period using complete water years. The other statistical characteristics may be calculated using partial water years.

The date or water year, as appropriate, of the first occurrence of each statistic reporting extreme values of discharge is provided adjacent to the statistic. Repeated occurrences may be noted in the REMARKS paragraph of the manuscript or in footnotes. Because the designated period may not be the same as the station period of record published in the manuscript, occasionally the dates of occurrence listed for the daily and instantaneous extremes in the designated-period column may not be within the selected water years listed in the heading. When this occurs, it will be noted in the REMARKS paragraph or in footnotes. Selected streamflow-duration-curve statistics and runoff data are also given. Runoff data may be omitted if there is extensive regulation or diversion of flow in the drainage basin.

The following summary-statistics data, as appropriate, are provided with each continuous record of discharge. Comments to follow clarify information presented under the various line headings of the summary statistics table.

ANNUAL TOTAL--The sum of the daily mean values of discharge for the year. At some stations the annual total discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes.

ANNUAL MEAN--The arithmetic mean of the individual daily mean discharges for the year noted or for the designated period. At some stations the yearly mean discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes.

HIGHEST ANNUAL MEAN--The maximum annual mean discharge occurring for the designated period.

LOWEST ANNUAL MEAN--The minimum annual mean discharge occurring for the designated period.

HIGHEST DAILY MEAN--The maximum daily mean discharge for the year or for the designated period.

LOWEST DAILY MEAN--The minimum daily mean discharge for the year or for the designated period.

ANNUAL 7-DAY MINIMUM--The lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1–March 31). The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

INSTANTANEOUS PEAK FLOW--The maximum instantaneous discharge occurring for the water year or for the designated period. Note that secondary instantaneous peak discharges above a selected base discharge are stored in District computer files for stations meeting certain criteria. Those discharge values may be obtained by writing to the District Office. (See address on back of title page of this report.)

INSTANTANEOUS PEAK STAGE--The maximum instantaneous stage occurring for the water year or for the designated period. If the dates of occurrence for the instanta-neous peak flow and instantaneous peak stage differ, the REMARKS paragraph in the manuscript or a footnote may be used to provide further information.

INSTANTANEOUS LOW FLOW--The minimum instantaneous discharge occurring for the water year or for the designated period.

ANNUAL RUNOFF--Indicates the total quantity of water in runoff for a drainage area for the year. Data reports may use any of the following units of measurement in presenting annual runoff data:

Acre-foot (AC-FT) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Cubic feet per second per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile area drained, assuming the runoff is distributed uniformly in time and area.

Inches (INCHES) indicates the depth to which the drainage area would be covered if all of the runoff for a given time period were uniformly distributed on it.

10 PERCENT EXCEEDS--The discharge that has been exceeded 10 percent of the time for the designated period.

50 PERCENT EXCEEDS--The discharge that has been exceeded 50 percent of the time for the designated period.

90 PERCENT EXCEEDS--The discharge that has been exceeded 90 percent of the time for the designated period.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage stations, and the second is a table of discharge measurements at low-flow partial-record stations. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated," or by listing the dates of the estimated record in the REMARKS paragraph of the station manuscript.

Accuracy of the Records

The accuracy of streamflow records depends primarily on (1) The stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of their true values; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft^3/s; to the nearest tenth between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to 3 significant figures for more than 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. Discharges listed for partial-record stations and miscellaneous sites are generally shown to three significant figures.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff, in inches, are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur if adjustments or losses are large in comparison with the observed discharge.

Other Records Available

Information used in the preparation of the records in this publication, such as discharge-measurement notes, gage-height records, temperature measurements, and rating tables is on file in the District Office. Also, most of the daily mean discharges are in computer-readable form and have been analyzed statistically. Information on the availability of the unpublished information or on the results of statistical analyses of the published records may be obtained from the Massachusetts-Rhode Island District Office at the address given on the back of the title page or by telephone (800) 696-4042.

Records of Surface-Water Quality

Records of surface-water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records," as used in this report, and "continuous recordings," which refers to a continuous graph or a series of discrete values recorded at short intervals on a digital or electronic data logger. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figure 1.

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence.

On-Site Measurements and Sample Collection

In obtaining water-quality data, a major concern needs to be assuring that the data obtained represent the in situ quality of the water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen, need to be made on-site when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory.

Procedures for on-site measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. A1, A3, and A4; Book 9, Chap. A1–A9. All of these references are listed under "PUBLICA-

TIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS" which appears at the end of the introductory text. Detailed information on collecting, treating, and shipping samples may be obtained from the Massachusetts–Rhode Island District Office.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. All samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals depends on flow conditions and other factors that must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. In the rare case where an apparent inconsistency exists between a reported pH value and the relative abundance of carbon dioxide species (carbonate and bicarbonate), the inconsistency is the result of a slight uptake of carbon dioxide from the air by the sample between measurement of pH in the field and determination of carbonate and bicarbonate in the laboratory.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record.

Water Temperature

Water temperatures are measured at most of the water-quality stations. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges. At stations where recording instruments are used, maximum, minimum, and mean temperatures for each day are published.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section, or a single sample may be obtained at a fixed point and a coefficient applied to determine the mean concentration in the cross sections.

During periods of rapidly changing flow or rapidly changing concentration, samples may have been collected more frequently (twice daily or, in some instances, hourly). The published sediment discharges for days of rapidly changing flow or concentration were computed by the subdivided-day method (time-discharge weighted average). Therefore, for those days when the published sediment discharge value differs from the value computed as the product of discharge times mean concentration times 0.0027, the reader can assume that the sediment discharge for that day was computed by the subdivided-day method. For periods when no samples were collected, daily discharges of suspended sediment were estimated on the basis of water discharge, sediment concentrations observed immediately before and after the periods, and suspended-sediment loads for other periods of similar discharge.

At other stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

In addition to the records of suspended-sediment discharge, records of the periodic measurements of the particle-size distribution of the suspended sediment and bed material are included for some stations.

Laboratory Measurements

Sediment samples, samples for biochemical oxygen demand (BOD), samples for indicator bacteria, and daily samples for specific conductance are analyzed locally. All other samples are analyzed in the USGS laboratory at the Denver Federal Center in Lakewood, CO. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1.

Methods used by the USGS laboratory are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4.

Analyses of pesticides in ground-water samples (schedule 2001)

Selected ground-water samples from NECB NAWQA study sites were analyzed for pesticides on National Water Quality Laboratory (NWQL) schedule 2001 during the 2001 water year. The following table lists the pesticides on the schedule, the unit of measure (micrograms per liter, µg/L), the U.S. Geological Survey National Water Information System parameter code, the NWQL compound name, and the minimum reporting level (MRL).

Estimated values for constituents in the 2001 schedule are preceded by an "E" to alert the data user to decreased confidence in accurate quantitation. Values for analytes in the 2001 schedule are preceded by an "E" in the following situations:

1. An analyte is determined outside the concentration range (upper concentration limits are to 20 mg/L for most compounds). The analyte is reported as greater than the highest calibration standard, and qualified with an "E". For example, a sample with a concentration of cyanazine determined as 41 mg/L from the calibration curve is reported as "E41."

2. The concentration is less than the MDL. The analyte meets all identification criteria to be positively identified, but the amount detected is below where it can be reliably quantified. The MDL's are used as the default reporting values when no analyte is detected in a sample.

3. An analyte demonstrated "poor" performance (that is, low and/or inconsistent recovery). These performance problems are related to either SPE or GC/MS procedures. The analyte is reported with an "E" code, to indicate that the concentration is an estimated measurement.

Only pesticides measured at or above the minimum reporting level for one or more samples are listed in the water-quality tables.

ANALYSES DESCRIPTION--Pesticides are partitioned from the filtered sample water by a C-18 Solid Phase Extraction (SPE) cartridge and analyzed by gas chromatography/mass spectrometry (GC/MS).

SAMPLE REQUIREMENTS--1 liter of water is filtered through a 0.7-micron glass-fiber depth filter, chilled at 4°C (packed in ice).

CONTAINER REQUIREMENTS--1 liter baked amber glass bottle (GCC) from USGS NWQL.

PCODE--The USGS parameter code.

COMPOUND NAME--IUPAC nomenclature.

COMMON NAME--Common or trade name(s) for constituent.

LRL--Laboratory reporting level.

PCode	Compound Name/(Common Name)	LRL (µg/L)
82660	2,6-Diethylanaline (Metabolite of Alachlor)	0.002
49260	Acetochlor (Harness Plus, Surpass)	0.004
46342	Alachlor (Lasso, Bullet)	0.002
39632	Atrazine (Atrex, Atred)	0.007

PCode	Compound Name/(Common Name)	LRL (µg/L)
82686	Azinphos, Methyl- (Guthion, Gusathion)	0.050
82673	Benfluralin (Benefin, Balan)	0.010
04028	Butylate (Genate Plus, Suntan+)	0.002
82680	Carbaryl (Sevin, Denapan)	0.041
82674	Carbofuran (Furandan, Curaterr)	0.020
38933	Chlorpyrifos (Brodan, Dursban)	0.005
04041	Cyanazine (Bledex, Fortrol)	0.018
82682	DCPA (Dacthal, Chlorthal-dimethyl)	0.003
34653	DDE,p,p′-	0.003
04040	Deethylatrazine, (Metabolite of Atrazine)	0.006
39572	Diazinon (Basudin, Diazatol)	0.005
39381	Dieldrin (Panoram D-31, Octalox)	0.005
82677	Disulfoton (Disyston, Frumin AL)	0.021
82668	EPTC (Eptam, Farmarox)	0.002
82663	Ethalfluralin (Sonalan, Curbit)	0.009
82672	Ethoprop (Mocap, Ethoprophos)	0.005
04095	Fonofos (Dyfonate, Capfos)	0.003
34253	HCH,alpha- (alpha-BHC, alpha-lindane)	0.005
39341	HCH,gamma- (Lindane, gamma-BHC)	0.004
82666	Linuron (Lorex, Linex)	0.035
39532	Malathion	0.027
39415	Metolachlor (Dual, Pennant)	0.013
82630	Metribuzin (Lexon, Sencor)	0.006
82671	Molinate (Ordram)	0.002
82684	Napropamide (Devrinol)	0.007
39542	Parathion, Ethyl- (Roethyl-P, Alkron)	0.007
82667	Parathion, Methyl- (Penncap-M)	0.006
82669	Pebulate (Tillam, PEBL)	0.002
82683	Pendimethalin (Prowl, Stomp, Pre-M)	0.010
82687	Permethrin,cis- (Ambush, Astro)	0.005
82664	Phorate (Thimet, Granutox)	0.011
04037	Prometon (Pramitol, Princep)	0.015
82676	Pronamide (Kerb) (Propyzamid)	0.004
04024	Propachlor (Ramrod, Satecid)	0.010
82679	Propanil (Stampede, Stam)	0.011
82685	Propargite (Omite, Alkyl sulfite)	0.023
04035	Simazine (Princep, Caliber 91)	0.011
82670	Tebuthiuron (Spike, Tebusan)	0.016
82665	Terbacil (Sinbar)	0.034
82675	Terbufos (Counter, Contraven)	0.017
82681	Thiobencarb (Bolero, Saturn)	0.005
82678	Triallate (Avadex BW, Far-Go)	0.002
82661	Trifluralin (Treflan, Gowan)	0.009

Analyses of volatile-organic compounds in ground-water samples (schedule 2020)

Selected ground-water samples from NECB NAWQA study sites were analyzed for volatile organic compounds (VOCs) in the 2001 water year. The NWQL created a method for accurate determination of VOCs in water in the nanogram per liter range, schedule 2020. The method described in USGS Open-File Report 97-829 (Connor and others) is similar to USEPA method 524-2 (Mund, 1995) and the method described by Rose and Schroeder (1995). Minor improvements to instrument operating conditions include the following: additional compounds, quantitation ions that are different from those recommended in USEPA Method 524.2 because of interferences from the additional compounds, and a data reporting strategy for measuring detected compounds extrapolated at less than the lowest calibration standard or measured at less than the reporting limit.

The following table lists the VOCs on the schedule, the unit of measure (micrograms per liter, µg/L), the USGS National Water Information System parameter code, the NWQL compound name, and the NWQL non-detection value (NDV). The NDV is a statistically defined reporting limit designed to limit false positives and false negatives to less than 1 percent. Positive detections measured at less than NDV are reported as estimated concentrations (E) to alert the data user to decreased confidence in accurate quantitation. Values for analytes in the 2020 schedule are preceded by an "E" in the following situations:

1. The calculated concentration is less than the lowest calibration standard. The analyte meets all identification criteria to be positively identified, but the amount detected is below where it can be reliably quantified.

2. A sample is diluted for any reason. The method reporting level is multiplied by the dilution factor to obtain the adjusted method reporting level. Values below the lowest calibration standard, multiplied by the dilution factor are qualified with an "E". For example, a value of 0.19 in a 1:2 dilution is reported as E0.1.

3. The set spike has recoveries out of the specified range (60-140%).

4. The analyte is also detected in the set blank. If the value in the sample is less than five times the blank value and greater than the blank value plus the long term method detection limit, the value is preceded by an "E" to indicate that the analyte is positively identified but not positively quantified because the analyte was also detected in the blank.

Only VOCs measured at or above the non-detection level for one or more samples are listed in the water-quality tables.

ANALYSES DESCRIPTION--The sample water is actively purged with helium to extract the volatile organic com-pounds. The volatile organic compounds are collected onto a sorbent trap, thermally desorbed, separated by a gas chromatographic capillary column, and determined by a full scan quadropole mass spectrometer. Compound identification is confirmed by the gas chromatographic retention time and by the resultant mass spectrum, typically identified by three unique ions.

SAMPLE REQUIREMENTS--Water is collected in vials placed in a stainless steel VOC sampler. Samples are preserved with 1:1 hydrochloric acid and chilled at 4°C (packed in ice).

CONTAINER REQUIREMENTS--40 milliliter baked amber septum glass vial, from USGS OCALA Water Quality Service Unit.

PCODE--The USGS parameter code.

COMPOUND NAME--USGS NWQL nomenclature.

LRL--Laboratory reporting level.

PCODE	COMPOUND NAME	LRL (µg/L)
77562	1,1,1,2-Tetrachloroethane	0.044
34506	1,1,1-Trichloroethane	0.032
34516	1,1,2,2-Tetrachloroethane	0.13
34511	1,1,2-Trichloroethane	0.064
77652	1,1,2-Trichlorotrifluoroethane	0.032
34496	1,1-Dichloroethane	0.035
34501	1,1-Dichloroethylene	0.044
77168	1,1-Dichloropropene	0.026
49999	1,2,3,4-Tetramethylbenzene	0.23
50000	1,2,3,5-Tetramethylbenzene	0.2
77613	1,2,3-Trichlorobenzene	0.27
77443	1,2,3-Trichloropropane	0.16
77221	1,2,3-Trimethylbenzene	0.12
34551	1,2,4-Trichlorobenzene	0.19
77222	1,2,4-Trimethylbenzene	0.056
82625	1,2-Dibromo-3-chloropropane	0.21
77651	1,2-Dibromoethane	0.036
34536	1,2-Dichlorobenzene	0.048
32103	1,2-Dichloroethane	0.13
34541	1,2-Dichloropropane	0.028
77226	1,3,5-Trimethylbenzene	0.044
34566	1,3-Dichlorobenzene	0.030
77173	1,3-Dichloropropane	0.12
34571	1,4-Dichlorobenzene	0.05
77170	2,2-Dichloropropane	0.078
81595	2-Butanone	1.6
77275	2-Chlorotoluene	0.026
77103	2-Hexanone	0.7
78109	3-Chloropropene	0.07
77277	4-Chlorotoluene	0.056

PCODE	COMPOUND NAME	LRL (µg/L)
77356	4-Isopropyl-1-methylbenzene	0.11
78133	4-Methyl-2-pentanone	0.37
81552	Acetone	5
34215	Acrylonitrile	1.2
34030	Benzene	0.1
81555	Bromobenzene	0.036
77297	Bromochloromethane	0.044
32101	Bromodichloromethane	0.048
32104	Bromoform	0.1
34413	Bromomethane	0.15
77342	Butylbenzene	0.19
77041	Carbon disulfide	0.37
34301	Chlorobenzene	0.028
34311	Chloroethane	0.12
32106	Chloroform	0.024
34418	Chloromethane	0.25
77093	cis-1,2-Dichloroethylene	0.038
34704	cis-1,3-Dichloropropene	0.09
32105	Dibromochloromethane	0.18
30217	Dibromomethane	0.05
34668	Dichlorodifluoromethane	0.14
34423	Dichloromethane	0.16
81576	Diethyl ether	0.17
81577	Diisopropyl ether	0.098
73570	Ethyl methacrylate	0.28
50004	Ethyl tert-butyl ether	0.054
34371	Ethylbenzene	0.03
39702	Hexachlorobutadiene	0.14
34396	Hexachloroethane	0.36
77223	Isopropylbenzene	0.032
85795	m- and p-Xylene	0.06
49991	Methyl acrylate	1.4
81593	Methyl acrylonitrile	0.57
77424	Methyl iodide	0.21
81597	Methyl methacrylate	0.35
34696	Naphthalene	0.25
77220	o-Ethyl toluene	0.1
77135	o-Xylene	0.06
77224	Propylbenzene	0.042
77350	sec-Butylbenzene	0.048
77128	Styrene	0.042
78032	tert-butyl Methyl ether	0.17
77353	tert-Butylbenzene	0.1
50005	tert-Pentyl methyl ether	0.11
34475	Tetrachloroethylene	0.1
32102	Tetrachloromethane	0.088
81607	Tetrahydrofuran	9
34010	Toluene	0.05

PCODE	COMPOUND NAME	LRL (µg/L)
34546	trans-1,2-Dichloroethylene	0.032
34699	trans-1,3-Dichloropropene	0.13
73547	trans-1,4-Dichloro-2-butene	0.7
39180	Trichloroethylene	0.038
34488	Trichlorofluoromethane	0.09
50002	Vinyl bromide	0.1
39175	Vinyl chloride	0.11

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance, pH, water temperature, dissolved oxygen, and suspended sediment then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, as appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

DRAINAGE AREA--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

PERIOD OF RECORD--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION--Information on instrumentation is given only if a water-quality monitor temperature record, sediment pumping sampler, or other sampling device is in operation at a station.

REMARKS--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION--Records provided by a cooperating organization or obtained for the USGS by a cooperating organization are identified here.

EXTREMES--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently because the true maximums or minimums may not have been

sampled. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of USGS water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates. The surface-water-quality records for partial-record stations and miscellaneous sampling sites are published in separate tables following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular dowstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this report:

Printed Output	Remark
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range; non-ideal colony count
L	Biological organism count less than 0.5 percent (organism may be observed rather than counted)
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant
V	Analyte was detected in both the environmental sample and the associated blanks.
M	Presence verified, not quantified.

Water Quality-Control Data

Data generated from quality-control (QC) samples are a requisite for evaluating the quality of the sampling and processing techniques as well as data from the actual samples themselves. Without QC data, environmental sample data cannot be adequately interpreted because the errors associated with the sample data are unknown. The various types of QC samples collected by this district are described in the following section. Procedures have been established for the storage of water-quality-control data within the USGS. These procedures allow for storage of all derived QC data and are identified so that they can be related to corresponding environmental samples.

Blank Samples

Blank samples are collected and analyzed to ensure that environmental samples have not been contaminated by the overall data-collection process. The blank solution used to develop specific types of blank samples is a solution that is free of the analytes of interest. Any measured value signal in a blank sample for an analyte (a specific component measured in a chemical analysis) that was absent in the blank solution is believed to be due to contamination. There are many types of blank samples possible, each designed to segregate a different part of the overall data-collection process. The types of blank samples collect in this district are:

Field blank—a blank solution that is subjected to all aspects of sample collection, field processing preservation, transportation, and laboratory handling as an environmental sample.

Trip blank—a blank solution that is put in the same type of bottle used for an environmental sample and kept with the set of sample bottles before and after sample collection.

Equipment blank—a blank solution that is processed through all equipment used for collecting and processing an environmental sample (similar to a field blank but normally done in the more controlled conditions of the office).

Sampler blank—a blank solution that is poured or pumped through the same field sampler used for collecting an environmental sample.

Filter blank—a blank solution that is filtered in the same manner and through the same filter apparatus used for an environmental sample.

Splitter blank—a blank solution that is mixed and separated using a field splitter in the same manner and through the same apparatus used for an environmental sample.

Preservation blank—a blank solution that is treated with the sampler preservatives used for an environmental sample.

Reference Samples

Reference material is a solution or material prepared by a laboratory whose composition is certified for one or more properties so that it can be used to assess a measurement method. Samples of reference material are submitted for analysis to ensure that an analytical method is accurate for the known properties of the reference material. Generally, the selected reference material properties are similar to the environmental sample properties.

Replicate Samples

Replicate samples are a set of environmental samples collected in a manner such that the samples are thought to be essentially identical in composition. Replicate is the general

case for which a duplicate is the special case consisting of two samples. Replicate samples are collected and analyzed to establish the amount of variability in the data contributed by some part of the collection and analytical process. There are many types of replicate samples possible, each of which may yield slightly different results in a dynamic hydrologic setting, such as a flowing stream. The types of replicate samples collected in this district are:

Sequential samples—a type of replicate sample in which the samples are collected one after the other, typically over a short time.

Split sample—a type of replicate sample in which a sample is split into subsamples contemporaneous in time and space.

Spike Samples

Spike samples are samples to which known quantities of a solution with one or more well-established analyte concentrations have been added. These samples are analyzed to determine the extent of matrix interference or degradation on the analyte concentration during sample processing and analysis.

Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers.

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table.

The secondary identification number is the local well number, an alphanumeric number, derived from a two-letter town code followed by the letter W to specify a well. Water-level records are obtained from direct measurements with a chalked steel tape, electric tape, or from digital water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the altitude of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported daily or for every fifth day and the end of each month (eom). Water levels are reported to as many significant figures as can be justified by

the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot or a larger unit.

Data Presentation

Each well record consists of three parts, the station description, the data table of water levels observed during the water year, and the hydrograph showing water-level fluctuations during the most recent five-year period. Hydrographs are based on end-of-month measurements, including those wells for which 5-day or more frequent water levels are published. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); a landline location designation; the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER--This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and additional information such as casing breaks, collapsed screen, and other changes since construction.

INSTRUMENTATION--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

DATUM--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base, and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) sea level; it is reported with a precision depending on the method of determination.

REMARKS--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the USGS and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the USGS, may be noted.

EXTREMES FOR PERIOD OF RECORD--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence. A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum. For most wells all taped measurements of water level are published. For wells equipped with digital recorders, tables of daily mean water levels and the means, highs, and lows for each month are published. Abbreviated tables are published for wells.

Records of Ground-Water Quality

Untreated water samples were collected from five domestic bedrock wells and 19 public-supply, gravel-packed wells between October 2000 and October 2001 in the Massachusetts and Rhode Island part of the New England Coastal Basins NAWQA study. Only one sample was collected from each well. These samples were collected as part of the NAWQA program to determine the occurrence and distribution of selected constituents in the ground waters of major aquifer systems and analyzed for major ions, nutrients, trace elements, radon gas, radionuclides, 48 pesticide compounds, and 86 volatile organic compounds (VOCs).

Arrangement of Records

Water-quality data for special study sampling sites appear in separate tables following the continuous ground-water records.

On-Site Measurement and Sample Collection

Sampling protocols were followed to obtain and evaluate accurate water-quality data (Koterba and others, 1995). For the domestic bedrock wells, the sample line was connected to the faucet that is at the base of the pressure tank from inside the home. For the public-supply gravel-packed wells, the sample line was connected to the faucet that is at the wellhead (where available) or at a nearby pump house.

Laboratory Measurements

Samples were analyzed locally (in the field) for alkalinity, specific conductance, dissolved oxygen, pH, and temperature. All other samples were analyzed in the U.S. Geological Survey's National Water-Quality Laboratories in Lakewood, Colorado. Methods used by the U.S. Geological Survey

laboratories are given in the TWRI Book 1, Chapter D2; Book 3, Chapter D2; and Book 5, Chapters A1, A3, A3, A4, and A5. These methods are consistent with ASTM standards and generally follow ISO standards.

ACCESS TO USGS WATER DATA

The USGS provides near real-time stage and discharge data for many of the gaging stations equipped with the necessary telemetry and historic daily-mean and peak-flow discharge data for most current or discontinued gaging stations through the World Wide Web (WWW). These data may be accessed at http://water.usgs.gov/.

Some water-quality and ground-water data also are available through the WWW. In addition, data can be provided in various machine-readable formats on magnetic tape or 3-1/2 inch floppy disk. Information about the availability of specific types of data or products, and user charges, can be obtained locally from each of the Water Resources Discipline District Offices (See address on the back of the title page.)

DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting English units to International System (SI) Units on the inside of the back cover.

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 ft^3 or about 326,000 gallons or 1,233 m^3.

Adenosine triphosphate (ATP) is an organic, phosphate-rich, compound important in the transfer of energy in organisms. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP, therefore, provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

Algae are mostly aquatic single-celled, colonial, or multicelled plants, containing chlorophyll and lacking roots, stems, and leaves.

Algal growth potential (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

Alkalinity is the capacity of solutes in an aqueous system to neutralize acid. This term designates titration of a "filtered" sample.

Annual runoff is the total quantity of water in runoff for a drainage area for the year. Data reports may use any of the following units of measurement in presenting annual runoff data:

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet, 325,851 gallons, or 1,233 cubic meters

Cubic foot per second per square mile [CFSM, $(ft^3/s)/mi^2$] is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming the runoff is distributed uniformly in time and area.

Inch (IN., in.) as used in this report, refers to the depth to which the drainage area would be covered with water if all of the runoff for a given time period were uniformly distributed on it.

Aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

Bacteria are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35°C plus or minus 1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal coliform bacteria are bacteria that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory, they are defined as all organisms that produce blue colonies within 24 hours when incubated at 44.5°C plus or minus 0.2°C on M-F° medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria found also in the intestine of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C plus or minus 1.0°C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Escherichia coli (E. coli) are bacteria present in the intestine and feces of warm-blooded animals. *E. coli* are a member species of the fecal coliform group of indicator bacteria. In the laboratory, they are defined as those bacteria that produce yellow or yellow-brown colonies on a filter pad saturated with urea substrate broth after primary culturing for 22 to 24 hours at 44.5°C on mTEC medium. Their concentrations are expressed as number of colonies per 100 mL of sample.

Base flow is flow in a channel sustained by ground-water discharge in the absence of direct runoff.

Bed material is the sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Benthic organisms (invertebrates) are the group of animals inhabiting the bottom of an aquatic environment. They include a number of types of organisms, such as bacteria, fungi, insect larvae and nymphs, snails, clams, and crayfish. They are useful as indicators of water quality.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by microorganisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter, and periphyton and benthic organisms in grams per square mile.

Dry mass refers to the mass of residue present after drying in an oven at 105°C for zooplankton and periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry-mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and ash mass and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Biomass pigment ratio is an indicator of the total proportion of periphyton that are autotrophic (plants). This is also called the Autotrophic Index.

Bottom material: See "Bed material."

Cells/volume refers to the number of cells of any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters or liters.

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common green pigments in plants.

Color unit is produced by 1 milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

Confined aquifer is a term used to describe an aquifer containing water between two relatively impermeable boundaries. The water level in a well tapping a confined aquifer stands above the top of the confined aquifer and can be higher or lower than the water table that may be present in the material above it. In some cases the water level can rise above the ground surface, yielding a flowing well.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

Continuous-record station is a site that meets either of the following conditions:

1. Stage or streamflow are recorded at some interval on a continuous basis. The recording interval is usually 15 minutes, but may be less or more frequent.

2. Water-quality, sediment, or other hydrologic measurements are recorded at least daily.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Control structure as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of salt water.

Cubic foot per second (ft^3/s) is the rate of discharge representing a volume of 1 ft^3 passing a given point during 1 second and is equivalent to 7.48 gal/s or 448.8 gal/min or 0.02832 m^3/s.

Cubic foot per second-day (CFS-DAY, Cfs-day, $[(ft^3/s)/d]$) is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, 1.9835 acre-feet, 646,317 gallons, or 2,447 cubic meters.

Cubic foot per second per square mile [CFSM, $(ft^3/s)/mi^2$] is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Daily record is a summary of streamflow, sediment, or water-quality values computed from data collected with sufficient frequency to obtain reliable estimates of daily mean values.

Daily record station is a site for which daily records of streamflow, sediment, or water-quality values are computed.

Datum, as used in this report, is an elevation above mean sea level to which all gage height readings are referenced.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment) that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Annual 7-day minimum is the lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

Dissolved refers to that material in a representative water sample that passes through a 0.45-mm membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Dissolved oxygen (DO) content of water in equilibrium with air is a function of atmospheric pressure, temperature, and dissolved-solids concentration of the water. The ability of water to retain oxygen decreases with increasing temperature or dissolved solids, with small temperature changes having the more significant offset. Photosynthesis and respiration may cause diurnal variations in dissolved-oxygen concentration in water from some streams.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from

precipitation normally drains by gravity into the stream above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise specified.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage datum is the elevation of the zero point of the reference gage from which gage height is determined as compared to sea level (see "Datum"). This elevation is established by a system of levels from known benchmarks, by approximation from topographic maps, or by geographical positioning system.

Gage height (G.H.) is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Gas chromatography/flame ionization detector (GC/FID) is a laboratory analytical method used as a screening technique for semivolatile organic compounds that are extractable from water in methylene chloride.

Ground-water level is the elevation of the water table or another potentiometric surface at a particular location.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is computed as the sum of equivalents of polyvalent cations and is expressed as the equivalent concentration of calcium carbonate ($CaCO_3$).

High tide is the maximum height reached by each rising tide. The high-high and low-high tides are the higher and lower of the two high tides, respectively, of each tidal day. *See NOAA Web site:*
http://www.co-ops.nos.noaa.gov/tideglos.html.

Hydrologic benchmark station is one that provides hydrologic data for a basin in which the hydrologic regimen will likely be governed solely by natural conditions. Data collected at a benchmark station may be used to separate effects of natural from human-induced changes in other basins that have been developed and in which the physiography, climate, and geology are similar to those in the undeveloped benchmark basin.

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an eight-digit number.

Land-surface datum (lsd) is a datum plane that is approximately at land surface at each ground-water observation well.

Low tide is the minimum height reached by each falling tide. The high-low and low-low tides are the higher and lower of the two low tides, respectively, of each tidal day. *See NOAA Web site:*
http://www.co-ops.nos.noaa.gov/tideglos.html.

Macrophytes are the macroscopic plants in the aquatic environment. The most common macrophytes are the rooted vascular plants that are usually arranged in zones in aquatic ecosystems and restricted in the area by the extent of illumination through the water and sediment deposition along the shoreline.

Measuring point (MP) is an arbitrary permanent reference point from which the distance to the water surface in a well is measured to obtain the water level.

Membrane filter is a thin microporous material of specific pore size used to filter bacteria, algae, and other very small particles from water.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

Methylene blue active substances (MBAS) are apparent detergents. The determination depends on the formation of a blue color when methylene blue dye reacts with synthetic anionic detergent compounds.

Micrograms per gram (µg/g) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the element per unit mass (gram) of material analyzed.

Micrograms per kilogram (UG/KG, µg/kg) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the constituent per unit mass (kilogram) of the material analyzed. One microgram per kilogram is equivalent to 1 part per billion.

Micrograms per liter (µg/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Microsiemens per centimeter (US/CM, µS/cm) is a unit expressing the amount of electrical conductivity of a solution as measured between opposite faces of a centimeter cube of solution at a specified temperature. Siemens is the International System of Units nomenclature. It is synonymous with mhos and is the reciprocal of resistance in ohms.

Milligrams per liter (mg/L) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in milligrams per liter and is based on the mass of dry sediment per liter of water-sediment mixture.

Miscellaneous site, or miscellaneous station, is a site where streamflow, sediment, and/or water-quality data are collected once, or more often on a random or discontinuous basis.

Multiple-plate samplers are artificial substrates of known surface area used for obtaining benthic invertebrate samples. They consist of a series of spaced, hardboard plates on an eyebolt.

National Geodetic Vertical Datum of 1929 (NGVD of 1929), is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Trends Network (NTN) is a 150-station network for sampling atmospheric deposition in the United States. The purpose of the network is to determine the variability, both in location and in time, of the composition of atmospheric deposition, which includes snow, rain, dust-particles, aerosols, and gases. The core from which the NTN was built was the already-existing deposition-monitoring network of the National Atmospheric Deposition Program.

National Water-Quality Assessment (NAWQA) Program of the USGS is a long-term program with goals to describe the status and trends of water-quality conditions for a large, diverse and geographically distributed part of the Nation's ground- and surface-water resources, and to identify, describe, and explain the major natural and human factors that affect these observed conditions and trends.

Assessment activities have begun in more than 50 of the 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 are 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 provides information for decision making by water-resources manag-

ers and a foundation for aggregation and comparison of findings to address water-quality issues of regional and national interest.

Nephelometric turbidity unit (NTU) is the measurement for reporting turbidity that is based on use of a standard suspension of Formazin. Turbidity measured in NTU uses nephelometric methods that depend on passing specific light of a specific wavelength through the sample.

Open or screened interval is the length of unscreened opening or of well screen through which water enters a well, in feet below land surface.

Organic carbon (OC) is a measure of organic matter present in aqueous solution, suspension, or bottom sediments. May be reported as dissolved organic carbon (DOC), suspended organic carbon (SOC), or total organic carbon (TOC).

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meter (m^2), acre, or hectare. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliter or liter. Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Organochlorine compounds are any chemicals that contain carbon and chlorine. Organochlorine compounds that are important in investigations of water, sediment, and biological quality include certain pesticides and industrial compounds.

Parameter Code is a 5-digit number used in the Survey's computerized data system, WATSTORE, to uniquely identify a specific constituent. The codes used in WATSTORE are the same as those used in the U.S. Environmental Protection Agency data system, STORET. The Environmental Protection Agency assigns and approves all requests for new codes.

Partial-record station is a particular site where limited streamflow and (or) water-quality data are collected systematically over a period of years for use in hydrologic analyses.

Particle size is the diameter, in millimeters, of a particle determined by either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in either distilled water (chemically dispersed) or in native water (the river water at the time and point of sampling).

Particle-size classification used in this report agrees with the recommendations made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

Classification	Size (mm)	Method of analysis
Clay	0.00024–0.004	Sedimentation
Silt	0.004–0.062	Sedimentation
Sand	0.062–2.0	Sedimentation or sieve
Gravel	2.0–64.0	Sieve

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic matter is removed, and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water. Chemical dispersion is not used for native-water analysis.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass, or volume.

Periodic station is a site where stage, discharge, sediment, chemical, or other hydrologic measurements are made one or more times during a year, but at a frequency insufficient to develop a daily record.

Periphyton is the assemblage of microorganisms attached to and living upon submerged solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms.

Pesticides are chemical compounds used to control undesirable organisms. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides.

pH of water is the negative logarithm of the hydrogen-ion activity. Solutions with pH less than 7 are termed "acidic," and solutions with a pH greater than 7 are termed "basic." Solutions with a pH of 7 are neutral. The presence and concentration of many dissolved chemical constituents found in water are, in part, influenced by the hydrogen-ion activity of water. Biological processes including growth, distribution of organisms, and toxicity of the water to organisms are also influenced, in part, by the hydrogen-ion activity of water.

Picocurie (PC, pCi) is one trillionth (1×10^{-12}) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields 3.7×10^{10} radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells per milliliter of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algae mats or floating "moss" in lakes. Their concentrations are expressed as number of cells per milliliter of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Polychlorinated naphthalenes (PCNs) are industrial chemicals that are mixtures of chlorinated naphthalene compounds. They have properties and applications similar to polychlorinated biphenyls (PCB's) and have been identified in commercial PCB preparations.

Precipitation is falling products of condensation in the atmosphere as rain, snow, sleet, and hail.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly, green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated by the plants (carbon method).

Primary productivity (carbon method) is expressed as milligrams of carbon per area per unit time [mg C/(m^2/time)] for periphyton and macrophytes or per volume [mg C/(m^3/time)] for phytoplankton. Carbon method defines the amount of carbon dioxide consumed as measured by radioactive carbon (carbon-14). The carbon-14 method is of greater sensitivity than the oxygen light and dark bottle method and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Primary productivity (oxygen method) is expressed as milligrams of oxygen per area per unit time [mg O/(m^2/time)] for periphyton and macrophytes or per volume [mg O/(m^3/time)] for phytoplankton. Oxygen method defines production and respiration rates as estimated from changes in the measured dissolved-oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Radioisotopes are isotopic forms of an element that exhibit radioactivity. Isotopes are varieties of a chemical element that differ in atomic weight, but are very nearly alike in chemical properties. The difference arises because the atoms of the isotopic forms of an element differ in the number of neutrons in the nucleus; for example, ordinary chlorine is a mixture of isotopes having atomic weights of 35 and 37, and the natural mixture has an atomic weight of about 35.453. Many of the elements similarly exist as mixtures of isotopes, and a great many new isotopes have been produced in the operation of nuclear devices such as the cyclotron. There are 275 isotopes of the 81 stable elements, in addition to more than 800 radioactive isotopes.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Recurrence interval, also referred to as return period, is the average time, usually expressed in years, between occurrences of hydrologic events of a specified type (such as exceedances of a specified high flow or non-exceedance of a specified low flow). The terms "return period" and "recurrence interval" do not imply regular cyclic occurrence. The actual times between occurrences vary randomly, with most of the times being less than the average and a few being substantially greater than the average. For example, the 100-year flood is the flow rate that is exceeded by the annual maximum peak flow at intervals whose average length is 100 years (that is, once in 100 years, on average); almost two-thirds of all exceedances of the 100-year flood occur less than 100 years after the previous exceedance, half occur less than 70 years after the previous exceedance, and about one-eighth occur more than 200 years after the previous exceedance. Similarly, the 7-day 10-year low flow ($7Q_{10}$) is the flow rate below which the annual minimum 7-day-mean flow dips at intervals whose average length is 10 years (that is, once in 10 years, on average); almost two-thirds of the non-exceedances of the $7Q_{10}$ occur less than 10 years after the previous non-exceedance, half occur less than 7 years after, and about one-eighth occur more than 20 years after the previous non-exceedance. The recurrence interval for annual events is the reciprocal of the annual probability of occurrence. Thus, the 100-year flood has a 1-percent chance of being exceeded by the maximum peak flow in any year, and there is a 10-percent chance in any year that the annual minimum 7-day-mean flow will be less than the $7Q_{10}$.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

River mile is the distance of a point on a river measured in miles from the river's mouth along the low-water channel.

River mileage is the linear distance along the meandering path of a stream channel determined in accordance with Bulletin No. 14 (October 1968) of the Water Resources Council.

Runoff in inches (IN., in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

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

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Mean concentration (sediment), is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L). The entire sample is used for the analysis.

Suspended-sediment discharge (tons/day) is the rate at which dry mass of sediment passes a section of a stream or is the quantity of sediment, as measured by dry mass or volume, that passes a section in a given time. It is calculated in units of tons per day as follows: concentration (mg/L) × discharge (ft^3/s) × 0.0027.

Suspended-sediment load is a general term that refers to material in suspension. It is not synonymous with either discharge or concentration.

Total sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry mass or volume, that passes a section during a given time.

Total sediment load or total load is a term that refers to the total sediment (bed load plus suspended-sediment load) that is in transport. The term needs to be qualified, such as "annual suspended-sediment load" or "sand-size suspended-sediment load," and so on. It is not synonymous with total sediment discharge.

7-day 10-year low flow (7Q10) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25˚C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Stable isotope ratio (per MILL/MIL) is a unit expressing the ratio of the abundance of two radioactive isotopes. Isotope ratios are used in hydrologic studies to determine the age or source of specific waters, to evaluate mixing of different waters, as an aid in determining reaction rates, and other chemical or hydrologic processes.

Stage-discharge relation is the relation between gage height (stage) and volume of water, per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Substrate is the physical surface upon which an organism lives.

Natural substrate refers to any naturally occurring immersed or submersed solid surface, such as a rock or tree, upon which an organism lives.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest USGS topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimetered. All areas shown are those for the stage when the planimetered map was made.

Surficial bed material is the part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of undissolved material in a water-sediment mixture. It is associated with the material retained on a 0.45-micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45-mm membrane filter has been digested by a method

(usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved, and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45-mm membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."

Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved, and (2) total concentrations of the constituent.

Synoptic studies are short-term investigations of specific water-quality conditions during selected seasonal or hydrologic periods to provide improved spatial resolution for critical water-quality conditions. For the period and conditions sampled, they assess the spatial distribution of selected water-quality conditions in relation to causative factors, such as land use and contaminant sources.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchical scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, Hexagenia limbata, is the following:

Kingdom	Animal
Phylum	Arthropoda
Class	Insecta
Order	Ephemeroptera
Family	Ephemeridae
Genus	Hexagenia
Species	limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the year.

Tons per acre-foot indicates the dry mass of dissolved solids in 1 acre-ft of water. It is computed by multiplying the concentration of the constituent, in milligrams per liter, by 0.00136.

Tons per day (T/DAY) is the quantity of a substance in solution or suspension that passes a stream section during a 24-hour period.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determined all of the constituent in the sample.)

Total discharge is the total quantity of any individual constituent, as measured by dry mass or volume, that passes through a stream cross-section per unit of time. This term needs to be qualified, such as "total sediment discharge," "total chloride discharge," and so on.

Total in bottom material is the total amount of a given constituent in a representative sample of bottom material. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total in bottom material."

Total length (fish) is the straight-line distance from the anterior point of a fish specimen's snout, with the mouth closed, to the posterior end of the caudal (tail) fin, with the lobes of the caudal fin squeezed together.

Total load refers to all of a constituent in transport. When referring to sediment, it includes suspended load plus bed load.

Total, recoverable is the amount of a given constituent that is in solution after a representative water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Tritium network is a network of stations which has been established to provide baseline information on the occurrence of tritium in the Nation's surface waters. In addition to the surface-water stations in the network, tritium data are also obtained at a number of precipitation stations. The purpose of the precipitation stations is to provide an estimate sufficient for hydrologic studies of the tritium input to the United States.

Turbidity is a measurement of the collective optical properties of a water sample that cause light to be scattered and absorbed rather than transmitted in straight lines; the higher the intensity of scattered light, the higher the turbidity. Turbidity is expressed in nephelometric turbidity units (NTU) or Formazin turbidity units (FTU) depending on the method and equipment used.

Volatile organic compounds (VOC's) are organic compounds that can be isolated from the water phase of a sample by purging the water sample with inert gas, such as helium, and subsequently analyzed by gas chromatography. Many VOCs are manmade chemicals that are used and produced in the manufacture of paints, adhesives, petroleum products, pharmaceuticals, and refrigerants. They are often components of fuels, solvents, hydraulic fluids, paint thinners, and dry cleaning agents commonly used in urban settings. VOC contamination of drinking-water supplies is a human health concern because many are toxic and are known or suspected human carcinogens (U.S. Environmental Protection Agency, 1996).

Water level is the water-surface elevation or stage of the free surface of a body of water above or below any datum (see "Gage height"), or the surface of water standing in a well, usually indicative of the position of the water table or other potentiometric surface.

Water table is the surface of a ground-water body at which the water is at atmospheric pressure.

Water-table aquifer is an unconfined aquifer within which is found the water table.

Water year in USGS reports dealing with surface-water supply is the 12-month period October 1 through September 30. The water year is designated by the calendar year in which it ends and that includes 9 of the 12 months. Thus, the year ending September 30, 1994, is called the "1994 water year."

WDR is used as an abbreviation for "Water-Data Report" in the REVISED RECORDS paragraph to refer to State annual hydrologic-data reports (WRD was used as an abbreviation for "Water-Resources Data" in reports published prior to 1976).

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

Well is an excavation (pit, hole, tunnel), generally cylindrical in form and often walled in, drilled, dug, driven, bored, or jetted into the ground to such a depth as to penetrate water-yielding geologic material and allow the water to flow or to be pumped to the surface.

WSP is used as an abbreviation for "Water-Supply Paper" in reference to previously published reports.

PUBLICATIONS OF TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The USGS publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, section A of book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the USGS, Information Services, Box 25286, Federal Center, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be made in the form of a check or money order payable to the "U.S. Geological Survey." Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and mention the "U.S. Geological Survey Techniques of Water-Resources Investigations."

Book 1. Collection of Water Data by Direct Measurement

Section D. Water Quality

1-D1.   *Water temperature— influential factors, field measurement, and data presentation*, by H.H. Stevens, Jr., J.F. Ficke, and G.F. Smoot: USGS–TWRI book 1, chap. D1. 1975. 65 p.

1-D2.   *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents*, by W.W. Wood: USGS–TWRI book 1, chap. D2. 1976. 24 p.

Book 2. Collection of Environmental Data

Section D. Surface Geophysical Methods

2-D1.   *Application of surface geophysics to ground-water investigations,* by A.A.R. Zohdy, G.P. Eaton, and D.R. Mabey: USGS–TWRI book 2, chap. D1. 1974. 116 p.

2-D2.   *Application of seismic-refraction techniques to hydrologic studies,* by F.P. Haeni: USGS–TWRI book 2, chap. D2. 1988. 86 p.

Section E. Subsurface Geophysical Methods

2-E1.   *Application of borehole geophysics to water-resources investigations,* by W.S. Keys and L.M. MacCary: USGS–TWRI book 2, chap. E1. 1971. 126 p.

2-E2.   *Borehole geophysics applied to ground-water investigations,* by W.S. Keys: USGS–TWRI book 2, chap. E2. 1990. 150 p.

Section F. Drilling and Sampling Methods

2-F1.   *Application of drilling, coring, and sampling techniques to test holes and wells*, by Eugene Shuter and W.E. Teasdale: USGS–TWRI book 2, chap. F1. 1989. 97 p.

Book 3. Applications of Hydraulics

Section A. Surface-Water Techniques

3-A1.   *General field and office procedures for indirect discharge measurements,* by M.A. Benson and Tate Dalrymple: USGS–TWRI book 3, chap. A1. 1967. 30 p.

3-A2.   *Measurement of peak discharge by the slope-area method,* by Tate Dalrymple and M.A. Benson: USGS–TWRI book 3, chap. A2. 1967. 12 p.

3-A3.   *Measurement of peak discharge at culverts by indirect methods,* by G.L. Bodhaine: USGS–TWRI book 3, chap. A3. 1968. 60 p.

3-A4.   *Measurement of peak discharge at width contractions by indirect methods,* by H.F. Matthai: USGS-TWRI book 3, chap. A4. 1967. 44 p.

3-A5.   *Measurement of peak discharge at dams by indirect methods,* by Harry Hulsing: USGS–TWRI book 3. chap. A5. 1967. 29 p.

3-A6.   *General procedure for gaging streams,* by R.W. Carter and Jacob Davidian: USGS–TWRI book 3, chap. A6. 1968. 13 p.

3-A7.   *Stage measurement at gaging stations,* by T.J. Buchanan and W.P. Somers: USGS–TWRI book 3, chap. A7. 1968. 28 p.

3-A8.   *Discharge measurements at gaging stations,* by T.J. Buchanan and W.P. Somers: USGS–TWRI book 3, chap. A8. 1969. 65 p.

3-A9.   *Measurement of time of travel in streams by dye tracing,* by F.A. Kilpatrick and J.F. Wilson, Jr.: USGS–TWRI book 3, chap. A9. 1989. 27 p.

3-AI0.   *Discharge ratings at gaging stations,* by E.J. Kennedy: USGS–TWRI book 3, chap. A10. 1984. 59 p.

3-A11.   *Measurement of discharge by the moving-boat method,* by G.F. Smoot and C.E. Novak: USGS–TWRI book 3, chap. A11. 1969. 22 p.

3-A12.   *Fluorometric procedures for dye tracing*, Revised, by J.F. Wilson, Jr., E.D. Cobb, and F.A. Kilpatrick: USGS–TWRI book 3, chap. A12. 1986. 34 p.

3-A13.   *Computation of continuous records of streamflow*, by E.J. Kennedy: USGS–TWRI book 3, chap. A13. 1983. 53 p.

3-A14.   *Use of flumes in measuring discharge,* by F.A. Kilpatrick and V.R. Schneider: USGS–TWRI book 3, chap. A14. 1983. 46 p.

3-A15.   *Computation of water-surface profiles in open channels,* by Jacob Davidian: USGS–TWRI book 3, chap. A15. 1984. 48 p.

3-A16.   *Measurement of discharge using tracers*, by F.A. Kilpatrick and E.D. Cobb: USGS–TWRI book 3, chap. A16. 1985. 52 p.

3-A17.   *Acoustic velocity meter systems,* by Antonius Laenen: USGS–TWRI book 3, chap. A17. 1985. 38 p.

3-A18.   *Determination of stream reaeration coefficients by use of tracers,* by F.A. Kilpatrick, R.E. Rathbun, Nobuhiro Yotsukura, G.W. Parker, and L.L. DeLong: USGS–TWRI book 3, chap. A18. 1989. 52 p.

3-A19. *Levels at streamflow gaging stations*, by E.J. Kennedy: USGS–TWRI book 3, chap. A19. 1990. 31 p.

3-A20. *Simulation of soluble waste transport and buildup in surface waters using tracers*, by F.A. Kilpatrick: USGS–TWRI book 3, chap. A20. 1993. 38 p.

3-A21 *Stream-gaging cableways,* by C. Russell Wagner: USGS–TWRI book 3, chap. A21. 1995. 56 p.

Section B. Ground-Water Techniques

3-B1. *Aquifer-test design, observation, and data analysis,* by R.W. Stallman: USGS–TWRI book 3, chap. B1. 1971. 26 p.

3-B2. *Introduction to ground-water hydraulics, a programed text for self-instruction*, by G.D. Bennett: USGS–TWRI book 3, chap. B2. 1976. 172 p.

3-B3. *Type curves for selected problems of flow to wells in confined aquifers*, by J.E. Reed: USGS–TWRI book 3, chap. B3. 1980. 106 p.

3-B4. *Regression modeling of ground-water flow,* by R.L. Cooley and R.L. Naff: USGS–TWRI book 3, chap. B4. 1990. 232 p.

3-B4. *Supplement 1. Regression modeling of ground-water flow --Modifications to the computer code for nonlinear regression solution of steady-state ground-water flow problems,* by R.L. Cooley: USGS–TWRI book 3, chap. B4. 1993. 8 p.

3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems—An introduction*, by O.L. Franke, T.E. Reilly, and G.D. Bennett: USGS–TWRI book 3, chap. B5. 1987. 15 p.

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3-B7. *Analytical solutions for one-, two-, and three-dimensional solute transport in ground-water systems with uniform flow,* by E.J. Wexler: USGS–TWRI book 3, chap. B7. 1992. 190 p.

3-B8. *System and boundary conceptualization in ground-water flow simulation,* by T.E. Reilly: USGS–TWRI book 3, chap. B8. 2001. 29 p.

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3-C1. *Fluvial sediment concepts,* by H.P. Guy: USGS–TWRI book 3, chap. C1. 1970. 55 p.

3-C2. *Field methods for measurement of fluvial sediment,* by T.K. Edwards and G.D. Glysson: USGS–TWRI book 3, chap. C2. 1999. 89 p.

3-C3. *Computation of fluvial-sediment discharge,* by George Porterfield: USGS–TWRI book 3, chap. C3. 1972. 66 p.

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Section A. Statistical Analysis

4-A1. *Some statistical tools in hydrology*, by H.C. Riggs: USGS–TWRI book 4, chap. A1. 1968. 39 p.

4-A2. *Frequency curves,* by H.C. Riggs: USGS–TWRI book 4, chap. A2. 1968. 15 p.

Section B. Surface Water

4-B1. *Low-flow investigations,* by H.C. Riggs: USGS–TWRI book 4, chap. B1. 1972. 18 p.

4-B2. *Storage analyses for water supply*, by H.C. Riggs and C.H. Hardison: USGS–TWRI book 4, chap. B2. 1973. 20 p.

4-B3. *Regional analyses of streamflow characteristics,* by H.C. Riggs: USGS–TWRI book 4, chap. B3. 1973. 15 p.

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4-D1. *Computation of rate and volume of stream depletion by wells*, by C.T. Jenkins: USGS–TWRI book 4, chap. D1. 1970. 17 p.

Book 5. Laboratory Analysis

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5-A1. *Methods for determination of inorganic substances in water and fluvial sediments,* by M.J. Fishman and L.C. Friedman, editors: USGS–TWRI book 5, chap. A1. 1989. 545 p.

5-A2. *Determination of minor elements in water by emission spectroscopy,* by P.R. Barnett and E.C. Mallory, Jr.: USGS–TWRI book 5, chap. A2. 1971. 31 p.

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5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples,* by L.J. Britton and P.E. Greeson, editors: USGS–TWRI book 5, chap. A4. 1989. 363 p.

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Section C. Sediment Analysis

5-C1. *Laboratory theory and methods for sediment analysis,* by H.P. Guy: USGS–TWRI book 5, chap. C1. 1969. 58 p.

Book 6. Modeling Techniques

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6-A1. *A modular three-dimensional finite-difference ground-water flow model,* by M.G. McDonald and A.W. Harbaugh: USGS–TWRI book 6, chap. A1. 1988. 586 p.

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6-A3. *A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 1: Model Description and User's Manual,* by L.J. Torak: USGS–TWRI book 6, chap. A3. 1993. 136 p.

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6-A5. *A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 3: Design philosophy and programming details,* by L.J. Torak: USGS–TWRI book 6, chap. A5, 1993. 243 p.

6-A6. *A coupled surface-water and ground-water flow model (MODBRANCH) for simulation of stream-aquifer interaction,* by Eric D. Swain and Eliezer J. Wexler: USGS–TWRI book 6, chap. A5,1996. 125 p.

Book 7. Automated Data Processing and Computations

Section C. Computer Programs

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7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water,* by L.F. Konikow and J.D. Bredehoeft: USGS–TWRI book 7, chap. C2. 1978. 90 p.

7-C3. *A model for simulation of flow in singular and interconnected channels,* by R.W. Schaffranek, R.A. Baltzer, and D.E. Goldberg: USGS–TWRI book 7, chap. C3. 1981. 110 p.

Book 8. Instrumentation

Section A. Instruments for Measurement of Water Level

8-A1. *Methods of measuring water levels in deep wells,* by M.S. Garber and F.C. Koopman: USGS–TWRI book 8, chap. A1. 1968. 23 p.

8-A2. *Installation and service manual for U.S. Geological Survey manometers,* by J.D. Craig: USGS–TWRI book 8, chap. A2. 1983. 57 p.

Section B. Instruments for Measurement of Discharge

8-B2. *Calibration and maintenance of vertical-axis type current meters,* by G.F. Smoot and C.E. Novak: USGS–TWRI book 8, chap. B2. 1968. 15 p.

Book 9. Handbooks for Water-Resources Investigations

Section A. National Field Manual for the Collection of Water-Quality Data

9-A1. *National Field Manual for the Collection of Water-Quality Data: Preparations for Water Sampling,* by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A1. 1998. 47 p.

9-A2. *National Field Manual for the Collection of Water-Quality Data: Selection of Equipment for Water Sampling,* edited by F.D. Wilde,

D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A2. 1998. 94 p.

9-A3. *National Field Manual for the Collection of Water-Quality Data: Cleaning of Equipment for Water Sampling*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A3. 1998. 75 p.

9-A4. *National Field Manual for the Collection of Water-Quality Data: Collection of Water Samples*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A4. 1999. 156 p.

9-A5. *National Field Manual for the Collection of Water-Quality Data: Processing of Water Samples*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A5. 1999, 149 p.

9-A6. *National Field Manual for the Collection of Water-Quality Data: Field Measurements*, edited by F.D. Wilde and D.B. Radtke: USGS–TWRI book 9, chap. A6. 1998. Variously paginated.

9-A7. *National Field Manual for the Collection of Water-Quality Data: Biological Indicators*, edited by D.N. Myers and F.D. Wilde: USGS–TWRI book 9, chap. A7. 1997 and 1999. Variously paginated.

9-A8. *National Field Manual for the Collection of Water-Quality Data: Bottom-material samples*, by D.B. Radtke: USGS–TWRI book 9, chap. A8. 1998. 48 p.

9-A9. *National Field Manual for the Collection of Water-Quality Data: Safety in Field Activities*, by S.L. Lane and R.G. Fay: USGS–TWRI book 9, chap. A9. 1998. 60 p.

Remark Codes

The following remark codes may appear with the water-quality data in this section:

PRINT OUTPUT	REMARK
E	Value is estimated.
>	Actual value is known to be greater than the value shown.
<	Actual value is known to be less than the value shown.
K	Results based on colony count outside the acceptance range (non-ideal colony count).
L	Biological organism count less than 0.5 percent (organism may be observed rather than counted).
D	Biological organism count equal to or greater than 15 percent (dominant).
M	Presence of material verified, but not quantified.
N	Presumptive evidence of presence of material.
U	Material specifically analyzed for, but not detected.
A	Value is an average.
V	Analyte was detected in both the environmental sample and the associated blanks.
S	Most probable value.

Dissolved Trace-Element Concentrations

NOTE-- Traditionally, dissolved trace-element concentrations have been reported at the microgram per liter (μg/L) level. Recent evidence, mostly from large rivers, indicates that actual dissolved-phase concentrations for a number of trace elements are within the range of 10s to 100s of nanograms per liter (ng/L). Data above the μg/L level should be viewed with caution. Such data may actually represent elevated environmental concentrations from natural or human causes; however, these data could reflect contamination introduced during sampling, processing, or analysis. To confidently produce dissolved trace-element data with insignificant contamination, the U.S. Geological Survey began using new trace-element protocols at some stations in water year 1994.

Change in National Trends Network Procedures

NOTE-- Sample handling procedures at all National Trends Network stations were changed substantially on January 11, 1994, in order to reduce contamination from the sample shipping container. The data for samples before and after that date are different and not directly comparable. A tabular summary of the differences based on a special intercomparison study, is available from the NADP/NTN Coordination Office, Colorado State University, Fort Collins, CO 80523 (Telephone: 303-491-5643).