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

The U.S. Geological Survey Streamflow and Observation-Well Network in Massachusetts and Rhode Island

By PHILLIP J. ZARRIELLO and ROY S. SOCOLOW

Open-File Report 03-277

In cooperation with the
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL MANAGEMENT;
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION;
METROPOLITAN DISTRICT COMMISSION; WATER RESOURCES BOARD;
RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT;
PROVIDENCE WATER SUPPLY BOARD; and the
U.S. ARMY CORPS OF ENGINEERS

Northborough, Massachusetts
2003

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

U.S. GEOLOGICAL SURVEY
Charles G. Groat, Director

For additional information write to:

Chief, Massachusetts–Rhode Island District
U.S. Geological Survey
10 Bearfoot Road
Northborough, MA 01532

or visit our Web site at
http://ma.water.usgs.gov

Copies of this report can be purchased from:

U.S. Geological Survey
Branch of Information Services
Box 25286
Denver, CO 80225-0286

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, VERTICAL COORDINATE INFORMATION, HORIZONTAL COORDINATE INFORMATION, AND ACRONYMS

CONVERSION FACTORS

Multiply	By	To obtain
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

VERTICAL COORDINATE INFORMATION

Vertical coordinate information is referenced to the North American Vertical Datum of 1929 (NGVD 29). Elevation, as used in this report, refers to distance above NGVD 29.

HORIZONTAL COORDINATE INFORMATION

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

ACRONYMS

ACOE	U.S. Army Corps of Engineers
ADCP	Acoustic Doppler Current Profiler
ADVMS	Acoustic Doppler Velocity Meters
DCP	Digital Collection Platforms
EOEA	Massachusetts Executive Office of Environmental Affairs
MA–RI	Massachusetts and Rhode Island
MADEM	Massachusetts Department of Environmental Management
MADEP	Massachusetts Department of Environmental Protection
MWRA	Massachusetts Water Resources Authority
MDC	Metropolitan District Commission
MDC-DWM	Massachusetts Metropolitan District Commission Division of Watershed Management
NWIS	National Water Information System
NWS	National Weather Service
PWSB	Providence Water Supply Board
RIDEM	Rhode Island Department of Environmental Management
RIWRB	Rhode Island Water Resources Board
SAS	Statistical Analysis System
USGS	U.S. Geological Survey

The U.S. Geological Survey Streamflow and Observation-Well Network in Massachusetts and Rhode Island

By Phillip J. Zarriello *and* Roy S. Socolow

Abstract

The U.S. Geological Survey began systematic streamflow monitoring in Massachusetts nearly 100 years ago (1904) on the Connecticut River at Montague City. Since that time, hydrologic data collection has evolved into a monitoring network of 103 streamgage stations and 200 ground-water observation wells in Massachusetts and Rhode Island (2000 water year). Data from this network provide critical information for a variety of purposes to Federal, State, and local government agencies, engineering consultants, and the public. The uses of this information have been enhanced by the fact that about 70 percent of the streamgage stations and a small but increasing number of observation wells in Massachusetts and Rhode Island have been equipped with digital collection platforms that transmit data by satellite every 4 hours. Twenty-one of the telemetered streamgage stations are also equipped with precipitation recorders. The near real-time data provided by these stations, along with historical data collected at all stations, are available over the Internet at no charge.

The monitoring network operated during the 2000 water year was summarized and evaluated with respect to spatial distribution, the current uses of the data, and the physical characteristics associated with the monitoring sites. This report provides maps that show locations and summary tables for active continuous record streamgage stations, discontinued streamgage stations, and observation wells in each of the 28 major basins identified by the Massachusetts Executive Office of Environmental Affairs and five of the major Rhode Island basins. Metrics of record length, regulation, physiographic region and physical and land-cover characteristics indicate that the streamflow-monitoring network represents a wide range of drainage-area sizes, physiographic regions, and basin characteristics. Most streamgage stations are affected by regulation, which provides information for specific water-management purposes, but diminishes the usefulness of these stations for many types of hydrologic analysis. Only 26 of the 103 active streamgage stations operated by the U.S. Geological Survey in Massachusetts and Rhode Island are unaffected by regulation; of these, 17 are in Massachusetts and 9 are in Rhode Island. The paucity of unregulated stations is particularly evident when the stations are grouped into five drainage-area size classes; the fact that about half of these size classes have no representative unregulated stations underscores the importance of establishing and maintaining stations that are unaffected by regulation. The observation-well network comprises 200 wells; 80 percent of these wells are finished in sand and gravel, 19 percent are finished in till, and 1 percent are finished in bedrock. About 6 percent of the wells are equipped with continuous data recorders, and about half of these are capable of transmitting data in near real time.

INTRODUCTION

The U.S. Geological Survey (USGS) MA–RI District has collected streamflow and ground-water-level data in Massachusetts and Rhode Island for nearly 100 years. Data are collected through the operation of a network of streamflow gages and observation wells in cooperation with other Federal, State, and local government agencies. Data from this network provide critical information for water supply, the management and regulation of dam storage and release, the magnitudes and frequencies of flood flows and low flows, trends in hydrologic conditions associated with rapidly changing land use, and for many other purposes. The network also provides regional information from which estimates of hydrologic characteristics at ungaged sites can be obtained. Thus, the network serves the dual purpose of obtaining site-specific data and regional data. Often, however, site-specific data needs are incompatible with regional data requirements. For example, a station operated to monitor streamflow below a dam may not provide information useful for developing regional-flow equations. Streamgage stations and observation wells must be maintained to reflect a wide range of hydrologic conditions to meet the needs of the users of this information within the constraints of the resources available.

Measuring discharge on the Saugus River at the Saugus River Ironworks, Saugus, Massachusetts (01102345).

Purpose and Scope

This report provides a broad description and characteristics of the long-term streamgage and the observation-well network required to meet water-resource planning and management needs. The purpose of this report is to provide an overview of the existing continuously recording streamgage station and observation well network operated by the USGS MA–RI District office. This network is evaluated with respect to current uses of the data, spatial distribution, and physical characteristics of the gaged basins. The report also describes trends in the historical operation of the network, funding sources, and modernization with emphasis on the streamgage stations. Most conditions presented in this report are current as of the 2000 water year (October 1, 1999, to September 30, 2000); however, some conditions, such as equipment modernization, have been updated through the 2002 water year. The report includes maps and summary tables of active streamgage stations, discontinued streamgage stations, and observation wells for each of the 28 major basins identified by the Massachusetts Executive Office of Environmental Affairs (EOEA) and five major Rhode Island basins (Appendix 1).

Acknowledgments

The operation of the monitoring network in Massachusetts and Rhode Island is funded through cooperative agreements between the USGS and other Federal, State, and local government agencies. In the 2000 water year, the USGS received financial support from the U.S. Army Corps of Engineers (ACOE); State of Massachusetts—Department of Environmental Management (MADEM), Department of Environmental Protection (MADEP), Metropolitan District Commission (MDC), and the Towns of Dartmouth, Franklin, and Rockport; State of Rhode Island—Water Resources Board (RIWRB) Department of Environmental Management

(RIDEM), and the Providence Water Supply Board (PWSB). The USGS also receives non-monetary services from the Cape Cod Commission, the Cooperative Extension of Martha's Vineyard, and the Nantucket Land Council to support the observation-well network in those areas. The authors are grateful to USGS employees Peter Steeves and Tomas Smieszek for compiling geographic information for the hydrologic monitoring network.

Previous Studies

Much of the information in this report was compiled from information provided in the USGS annual data reports (for example, Socolow and others, 2001). The annual data reports contain information on station descriptions; hydrologic conditions for the year; daily-streamflow values; daily, bimonthly, or monthly ground-water-level data; and statistical information about the current year's data relative to the historical data collected at a site. Annual data reports also provide information on discontinued stations, partial record sites, and miscellaneous measurements made during the current water year, water-quality data, and information about how the data were collected. Partial-record sites and miscellaneous measurements provide data to augment the continuous monitoring network; partial-record sites are typically operated for specific hydrologic investigations for relatively short periods and, therefore, are not described further in this report.

The USGS does not operate a long-term water-quality monitoring network in Massachusetts or Rhode Island. Water-quality data are collected and published in annual data reports or in specific hydrologic investigation reports. The need for a consistent water-quality monitoring network for Massachusetts streams and ponds, and the scope and specifications of such a network are described by DeSimone and others (2001).

An evaluation of the national streamgage-monitoring network and its associated Federal interest was prepared for Congress (U.S. Geological Survey, 1999). The Federal interests of a hydrologic monitoring network are to quantify (1) interstate and international transfers of water, (2) flood warning and forecasting, (3) water budgets of major watersheds, (4) long-term hydrologic changes (trends), and (5) water quality. Although the need for streamflow data has continued to increase over time, the report for Congress pointed out the total number of streamgage stations has declined since the 1970s. In particular, the loss of streamgage stations with 30 or more years of record diminishes the ability to understand the long-term changes taking place in the environment or relations between climate, land use, and streamflow. Stations have been eliminated from the national network not because of their hydrologic value, but because of the financial constraints of cooperating agencies. The report to Congress also identified the need to modernize the streamgage network, harden streamgage installations from structural damage during floods, provide backup systems for near real-time dissemination of data, extend rating curves, and operate precipitation gages in conjunction with streamgage stations.

Streamgage station on the Ipswich River at South Middleton, Massachusetts (station number—01101500), during record high flows in March 2001.

Wahl and others (1995) described the national uses of streamflow data collected at 7,292 streamgage stations in operation as of 1994. The national evaluation indicated that most data were used for regional hydrologic or hydrologic system investigations and that data from 80 percent of the stations were used in two or more of nine principal-use categories. The national network is supported by over 600 Federal, State, and local agencies, which provide 50 percent or more of the funds needed to operate these stations. The USGS funds the remainder through the Federal-State Cooperative Program; fewer than 10 percent of the streamgage stations are funded entirely by USGS. Thomas and Wahl (1993) concluded that the national network was operated in an efficient and cost-effective manner.

A streamgage-network analysis in the MA–RI District was completed in the early to mid-1980s (Gadoury and others, 1985). This analysis focused on the cost effectiveness of the network and the potential for reducing the numbers of streamgage stations by estimating flow by unit-flow routing from upstream or downstream stations or regression models that estimate flow from physical basin characteristics. This analysis concluded that the alternative flow-estimation techniques examined could not provide the same level of accuracy as a continuous streamgage station. This conclusion would limit most uses of these data. Of seven sites identified by Gadoury and others (1985) as candidates for alternative flow estimation, only one site, Cadwell Creek near Belchertown (0117490) in central Massachusetts, was discontinued (in 1997). The report concluded that alternative routes for site visits would not produce appreciable costs savings in the operation of the streamgage network. The network analysis report identified a streamgage on Cape Cod (Herring River at North Harwich—01105880) that could be replaced with an alternative site less influenced by regulation and evaporation from an upstream pond. The Herring River station was subsequently replaced in 1988 with a station on the Quashnet River at Waquoit Village (011058837) on Cape Cod.

Measuring discharge from a cableway, Squannacook River near West Groton, Massachusetts (station number—01096000).

NETWORK OBJECTIVES

Streamgage stations and observation wells provide data for a variety of purposes for water-resources planning and design, hydrologic research, and operation of water-resources projects. To meet these needs, the monitoring network must provide consistent long-term data and provide ready access to the data. The process begins by employing a skilled staff to maintain and operate the network by using state-of-the-art equipment and culminates with storage of the data collected through the network in an accessible and dependable database.

Most hydrologic data collected by the USGS over the last 100 years is stored in the USGS National Water Information System (NWIS) database. In 2001, the NWIS database contained streamflow data for about 21,000 sites, water-level data from more than 1,000,000 wells, and chemical data from surface water and ground water at 338,000 sites (Brooks, 2001). In 1994, the Automated Data Processing System (ADAPS) part of NWIS (continuously recorded data) stored over 400,000 station-years of record (Wahl and others, 1995). ADAPS contains mean daily discharge data for 198 streams and rivers in Massachusetts and Rhode Island; these data represented about 6,000 station-years of record as of the 2000 water year. The NWIS database also includes the ground-water site inventory (GWSI), which contains about 31,000 sites (the GWSI contains all site locations and nonautomated ground-water-level measurements), and the water-quality database (QWDATA), which contains data from 4,500 sites in Massachusetts and Rhode Island. Data stored in NWIS is typically available at no charge, and most data can be directly accessed through the Internet.

> In my work, whether as a real estate broker in Berkshire Hills of western Massachusetts, as a Conservation Commissioner for my town of Stockbridge, or as a local watershed project coordinator for the Housatonic Valley Association, USGS map products and on-line web sites provide exceptional value for my tax dollar because they empower all of us to do far better work than we could do on our own. That's what I have always thought government was suppose to do, you-all have hit the mark dead center.
>
> *—Shepley W. Evans, Stockbridge, Massachusetts; in U.S. Geological Survey, 1999, p. 10*

Streamflow data in this report were categorized into 1 or more of 11 principal uses (fig. 1). Qualitative-use categories were determined from (1) cooperating agency's reported reasons for funding a station, (2) data requests, (3) hydrographers' knowledge, and (4) responses to questionnaires from Massachusetts EOEA Watershed

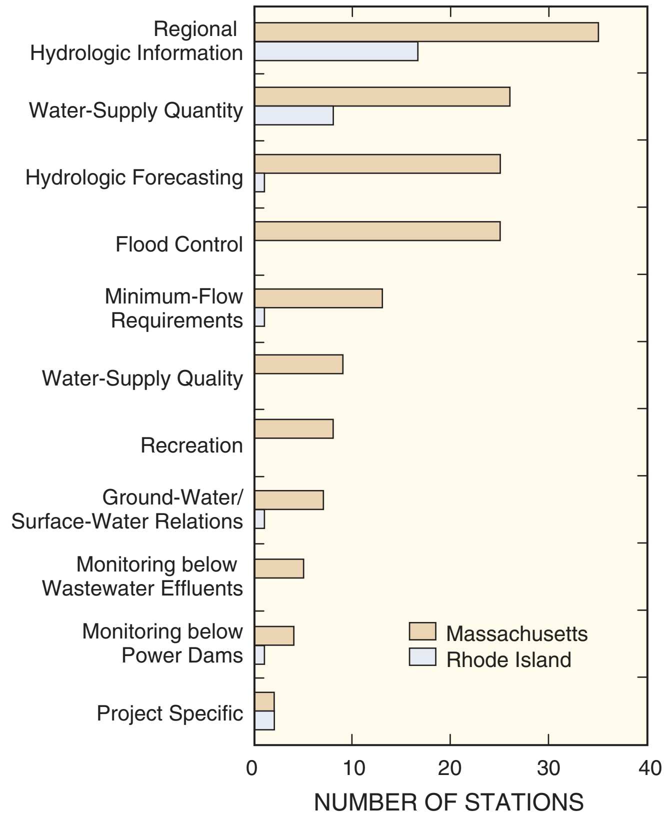


Figure 1. Number of U.S. Geological Survey streamgage stations operated in Massachusetts and Rhode Island by category of data use, 2000 water year.

Team leaders and cooperating agencies about how they use the data. The categories are generally listed in order of the number of stations in each use category.

The distribution of active stations in the 2000 water year among each of the 11 categories indicates that most data are used for regional hydrologic information (45 percent of all stations). Stations were not assigned exclusively to one use category; rather, the station was assigned to all use categories that apply to it. About 55 percent of all stations provide information for two or more categories. Eighteen stations in Massachusetts and one station in Rhode Island provide data for three or more use categories.

Regional hydrologic information: These stations provide data that can be used to develop relations between basin characteristics and hydrologic conditions, extrapolate short-term streamflow data to reflect long-term conditions, and assess long-term hydrologic trends. STREAMSTATS (Ries and others, 2000), an application for determining flow characteristics at ungaged sites in Massachusetts, is an example of regional hydrologic use of the streamgage data. Regional hydrologic analysis requires data that are unaffected, or are minimally affected, by regulation under flow conditions appropriate for the regional analysis under consideration. Thirty-five stations in Massachusetts and 17 stations in Rhode Island provide data for this type of use.

Water-supply quantity: These stations provide data to state agencies and water suppliers to assess public water supplies. These stations are on major tributaries to supply reservoirs or the outlet from the reservoir, or both, and in rivers that have surface-water withdrawals. Twenty-six stations in Massachusetts and eight stations in Rhode Island provide data for this type of use.

Hydrologic forecasting: Many stations provide information useful in flood forecasting and flood warning. These stations play a key role in efforts by Federal, State, and local agencies to protect the lives and welfare of the public. The National Weather Service (NWS) relies on these stations as part of their flood-forecasting system.

Stage-discharge control for monitoring flows for water supply in the Quabbin Reservoir on East Branch Swift River near Hardwick, Massachusetts (station number—01174500).

The streamflow-monitoring network provides critical information on peak flows essential for designing bridges and culverts, flood zoning, and land-use planning.

Historical streamflow data are used by the NWS to calibrate river-forecasting models. Flood stages identified by the NWS are displayed on the USGS Web pages to provide immediate access to users during floods. Twenty-five stations in Massachusetts and one station in Rhode Island provide data for this type of use.

Flood control: These stations are below flood-control dams and are used by water managers for making operational decisions on outflow from the dam. The ACOE is the principal user of these data. Twenty-five stations in Massachusetts and no Rhode Island stations provide data for this type of use.

Minimum-flow requirements: These stations are used to monitor streamflow affected by water-supply withdrawals. Streamflow data is increasingly important for habitat protection, and maintaining streamflow has become a focal issue for water-supply planners and managers since the passage of the Massachusetts Water Management Act of 1986 (Massachusetts Water Management Act, 1986, accessed July 17, 2002). Many of these stations have been established as a requirement for permitting new withdrawals and have been in operation for a relatively short time. Some stations in this category are used to monitor streamflow for fish migration. Thirteen stations in Massachusetts and one station in Rhode Island provide data for this type of use.

Flooding in Southbridge, Massachusetts, in August 1955 following back-to-back Hurricanes Connie and Diane that dropped about 20 inches of rain in the Quinebaug River basin in a 2-week period. [Photo taken by Jim Houghton, courtesy of Richard Whitney (dickwhitney@meganet.net).]

Damage caused by the August 1955 flood on Mechanic Street, Southbridge, Massachusetts. (Photo taken by Donald Whitney, courtesy of Richard Whitney.)

Water-supply quality: Streamflow data, along with the water-chemistry data, provide essential information for evaluating water-quality conditions in rivers and receiving-water lakes, reservoirs, and estuaries. Nine stations in Massachusetts and none in Rhode Island provide data for this type of use.

Recreation: Streamgage stations have not been operated solely for the purpose of recreational use; however, stations provide data to the commercial recreation industry, particularly white-water rafting adventure companies and for noncommercial recreational uses such as canoeists, rafters, and anglers. Noncommercial uses are difficult to estimate and are not included in this category; however, anecdotal information indicates that use of streamflow data for these purposes is extensive. Eight stations in Massachusetts and no stations in Rhode Island provide data for this type of use.

Ground-water/surface-water relations: Stations near observation wells could help provide data on the interaction between ground- and surface-water resources. Several project-specific water-resource investigations use data that relate ground-water conditions to streamflow; however, no continuous statewide programs exist to evaluate this relation. Seven stations in Massachusetts and one Rhode Island station provide data for this type of use.

Monitoring below wastewater effluents: These stations are on streams near effluents from wastewater-treatment plants. The stations provide data to help assess the impact of wastewater effluents on receiving waters, and in recent years, have become important for establishment of total maximum daily loads (TMDL) allocations to improve water-quality conditions of surface waters. Five stations in Massachusetts and none in Rhode Island provide data for this type of use.

Monitoring below power dams: These stations were established to satisfy a legal responsibility of the USGS or its cooperator to monitor streamflow below hydroelectric power-generating facilities for the Federal Energy Regulatory Commission (FERC). Four stations in Massachusetts and one Rhode Island station provide data for this type of use.

Project specific: Stations assigned to this category are typically short-term stations that have been installed to meet a specific project need. The number of active project stations varies from year to year. These stations are generally discontinued after the data needs of the project are satisfied. During the 2000 water year, two stations in Massachusetts and two stations in Rhode Island provided data for this type of use.

The streamgage station (stage sensor is in the pipe protruding from the cement retaining wall) below the fish ladder on Whitmans Pond outlet in East Weymouth, Massachusetts (station number—01105608), provides data to help determine water-supply availability and flow for spring and fall herring runs.

National Interests

The USGS has identified five core interests for its National Streamflow Information Program (NSIP). The NSIP interests are (Hirsch and Norris, 2001; U.S. Geological Survey, 1999):

- **Interstate and international waters:** Provide data to support interstate compacts, court decisions, and international treaties on rivers at state-line crossings, compact points and international boundaries.

- **Flood forecasting:** Provide real-time stage and discharge data required to support flood forecasting by the NWS.

- **River basin outflows:** Provide data for resource managers to account for streamflow from each of the Nation's 350 major river basins to the next downstream basin, estuary, ocean, or Great Lakes.

- **Sentinel watersheds:** Provide data that describe the changing status of streamflow as it varies in response to climate, land use, and water use in the 800 watersheds across the country that are relatively unaffected by flow regulation or diversion and typify major ecoregions and river basins.

- **Water quality:** Provide data to support three national USGS water-quality networks on (1) the major rivers of the Nation, (2) intermediate-sized rivers, and (3) small pristine watersheds.

The MA–RI District Office, in conjunction with the USGS Office of Surface Water, has identified 23 streamgage stations in Massachusetts and 2 streamgage stations in Rhode Island that meet NSIP interests (table 1, fig. 2). Three streamgage stations were identified for discharge information at interstate boundaries, 17 stations were identified for flood-forecasting needs, 4 stations were identified to provide water-budget data for major river basins, 3 stations were identified for monitoring long-term hydrologic trends, and 5 stations were identified to support USGS water-quality networks. Most potential NSIP stations are currently part of the existing streamflow-monitoring network, three new stations were identified for flood-forecasting purposes, and one discontinued station was identified for reactivation to collect discharge data at an interstate boundary.

Stations that meet one or more of the NSIP interests and are currently operated in cooperation with other Federal, State, and local agencies may be eligible for additional funding from the USGS in the future. The U.S. Congress has recognized that the disproportional decline in the number of long-term unregulated streamgage stations can adversely affect the achievement of the goals of this network and that new strategies are needed to fund the continued operation of priority stations (Hirsh and Norris, 2001).

Table 1. Streamgage stations in Massachusetts and Rhode Island identified for inclusion in the U.S. Geological Survey National Streamflow Information Program (NSIP)

[Status: A-Active, I-Inactive, N-New]

Station number	Station name	Status	Interstate boundary	Flood fore-casting	Basin water budgets	Long-term trend	Water quality
Massachusetts							
01095220	Stillwater River near Sterling	A					●
01096500	Nashua River at East Pepperell	A		●			
01097000	Assabet River at Maynard	A		●			
01099500	Concord River below River Meadow Brook at Lowell	A		●			
01100000	Merrimack River below Concord River at Lowell	A	●	●	●		●
01100561	Spicket River near Methuen	A		●			
01102500	Aberjona River at Winchester	A					●
01103500	Charles River near Dover	A		●			
01104500	Charles River at Waltham	A			●		
01104615	Charles River above Watertown Dam at Watertown	A					●
01105000	Neponset River at Norwood	A		●			
01110500	Blackstone River at Northbridge	A		●			
01162500	Priest Brook near Winchendon	A				●	
01170100	Green River near Colrain	A					●
01170500	Connecticut River at Montague City	A	●	●	●		
01172003	Connecticut River below Power Dam at Holyoke	A		●			
01177000	Chicopee River at Indian Orchard	A		●			
01183500	Westfield River near Westfield	A		●			
01197500	Housatonic River near Great Barrington	A		●		●	
01198125	Housatonic River near Ashley Falls	I	●				
MA 100	Merrimack River near Haverhill	N		●			
MA 101	Merrimack River above Lowell	N		●			
MA 102	Connecticut River below Montague City, above Holyoke	N		●			
Rhode Island							
01112500	Blackstone River at Woonsocket	A		●	●		
01117500	Pawcatuck River at Wood River Junction	A				●	

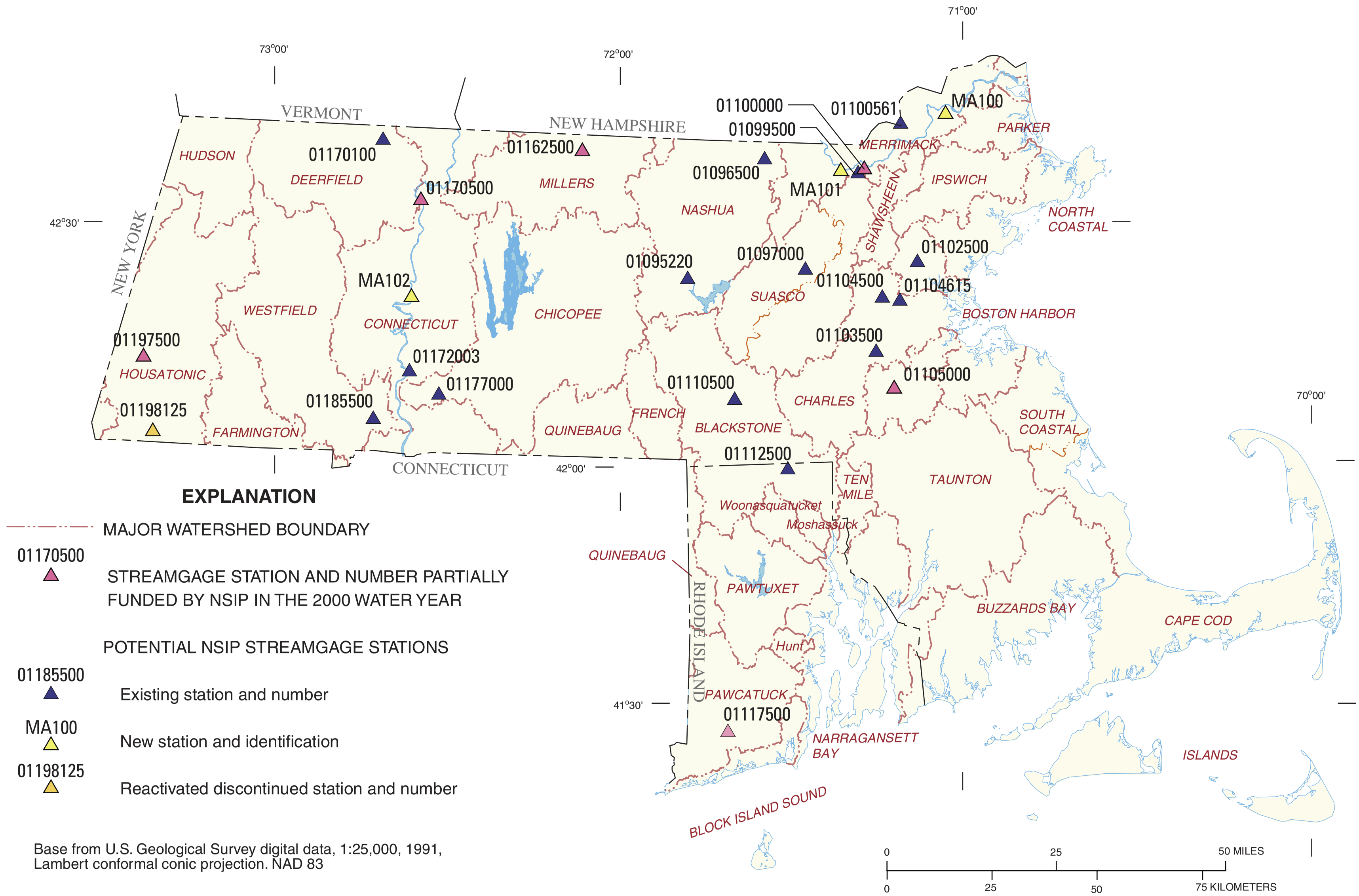


Figure 2. Locations of streamgage stations in Massachusetts and Rhode Island identified for inclusion in the U.S. Geological Survey National Streamflow Information Program (NSIP).

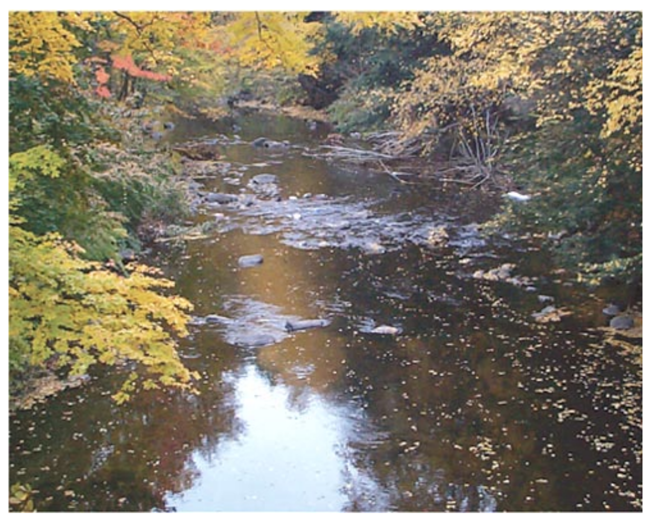
In the late 1980s, a network of streamgage stations was selected for study of surface-water conditions throughout the United States under fluctuations in the prevailing climatic conditions. These stations were designated as the Hydro-Climatic Data Network, or HCDN (Slack and others, 1992; 1994). This network consists of 1,659 streamgage stations throughout United States and its Territories and includes 17 stations in Massachusetts and 7 stations in Rhode Island (table 2). Stations selected for this network were thought to be largely unaffected by artificial diversions, storage, or other synthetic influences and, therefore, were suited to provide reliable data on natural hydrologic responses to fluctuations in climate. The HCDN network includes four stations (01165000, 01173000, 01175500, 01180500) that are appreciably affected by dam regulation or diversion, or both. Streamflow at these stations is likely affected by factors unrelated to climatic conditions. No additional funding has been provided for stations listed in the HCDN network.

Table 2. Streamgage stations in Massachusetts and Rhode Island included in the U.S. Geological Survey national Hydro-Climatic Data Network (HCDN)

Station number	Station Name
Massachusetts Stations	
01162500	Priest Brook near Winchendon
01165000[1]	East Branch Tully River near Athol
01165500	Moss Brook at Wendell Depot
01169000	North River at Shattuckville
01169900	South River near Conway
01170100	Green River near Colrain
01173000[1]	Ware River at Intake Works Near Barre
01174000	Hop Brook near New Salem
01174900	Cadwell Creek near Belchertown
01175500[1]	Swift River at West Ware
01176000	Quaboag River at West Brimfield
01180000	Sykes Brook at Knightville
01180500[1]	Middle Branch Westfield River at Goss Heights
01181000	West Branch Westfield River at Huntington
01198000	Green River near Great Barrington
01332000	North Branch Hoosic River at North Adams
01333000	Green River At Williamstown
Rhode Island Stations	
01106000	Adamsville Brook at Adamsville
01111300	Nipmuc River near Harrisville
01111500	Branch River at Forestdale
01117500	Pawcatuck River at Wood River Junction
01117800	Wood River near Arcadia
01118000	Wood River at Hope Valley
01118500	Pawcatuck River at Westerly

[1]Stations appreciably affected by dam regulation or diversion, or both.

The importance and uses of a national long-term ground-water-level-monitoring network have been described by Taylor and Alley (2002) and Grannemann (2001). An effort to fund a national water-level-monitoring network, referred to as the Collection of Basic Records (CBR), has been underway by the USGS since 1995 (U.S. Geological Survey, accessed July 17, 2002). Like NSIP, the CBR has identified the need for systematic long-term measurement of ground-water levels and the essential information these data provide to water-resources managers, planners, and regulators. Some important activities that use ground-water-level data are the evaluation of changes in ground-water levels over time, forecasts of trends, development of ground-water-flow models, and the design, implementation and monitoring of ground-water management and protection programs (Taylor and Alley, 2002). Observation wells identified for inclusion in the CBR include three wells in Massachusetts and one well in Rhode Island (table 3). Limited funding has been provided annually from the USGS NSIP program to support the operation of these wells.



Stations on unregulated streams provide important information for monitoring hydrologic responses to climatic and land-use changes and for other hydrologic investigations that require unaltered flow information.

Table 3. Observation wells in Massachusetts and Rhode Island included in the U.S. Geological Survey national Collection of Basic Records (CBR) observation-well network

Identi-fication number	Town and state	Period of record	Geologic Material
A1W 47	Barnstable, MA	1962–present	Sand and gravel
PTW 51	Pittsfield, MA	1963–present	Sand and gravel
XNW 13	Winchendon, MA	1939–present	Till
SNW 6	Kingston, RI	1947–present	Sand and gravel

State Interest

State environmental and water-management agencies in Massachusetts and Rhode Island support the monitoring network to aid in fulfilling their respective missions. State governments share many of the same interests as NSIP, but their interest also extends to drought analysis, watershed planning and management, water supply, and localized or stream-specific management or developmental issues. Suburban and urban development in Massachusetts and Rhode Island has placed demands on State agencies to monitor and manage water resources in basins stressed by urbanization, particularly the allocation of water resources to meet competing demands for water supply and environmental protection. The 1986 Massachusetts Water Management Act (2002) authorizes the MADEP to regulate the quantity of water withdrawn from surface- and ground-water supplies to ensure adequate water for current and future needs. When permitting new withdrawals and the reissuing of permits, the MADEP considers streamflow requirements to protect stream habitat and relies on data from the monitoring network to carry out this task.

The observation-well network provides essential information for the implementation of the Massachusetts Title 5 septic-system regulations (Massachusetts Department of Environmental Protection, 310 CMR 15.000, accessed July 17, 2002). In 1981, a technique was developed by the USGS to estimate high ground-water levels at a proposed septic-system site by comparing a one-time ground-water-level measurement at the proposed site to records at a nearby long-term observation well (Frimpter, 1981). In addition, observation-well, streamflow, and precipitation data are fundamental measures used by the States to evaluate drought conditions for deciding whether to issue drought warnings to ensure adequate public-water supplies.

The Massachusetts Water Resources Authority (MWRA), along with the Massachusetts Metropolitan District Commission Division of Watershed Management (MDC–DWM), is responsible for managing and protecting drinking-water supplies for more than 2 million residents in the Boston area. The MWRA and MDC–DWM funds the operation of eight streamgage stations to monitor flows into and out of the Quabbin and Wachusett Reservoirs (primary supplies) and the Sudbury Reservoir (back-up supply). The MDC, through its Division of Parks, Engineering, and Construction, funds the operation of six streamgages in the Charles River, Mystic River, and Boston Harbor Basins primarily for flood protection for the City of Boston and nearby suburbs.

The RIDEM, RIWRB, and the PWSB support the monitoring network in Rhode Island to help them meet their responsibilities for water-resource management and protection. The RIDEM funds eight streamflow stations, most of which are in northern Rhode Island. The RIWRB funds nine streamflow stations, most of which are in southern Rhode Island. The PWSB funds one streamflow station in central Rhode Island, on a tributary to the Scituate Reservoir, the State's principal water supply. RIDEM and the RIWRB equally support the observation-well network to help them evaluate sustainability of ground-water supplies and for estimating high ground-water-level measurements at proposed septic sites (Socolow and others, 1994).

Other Interest

Interest in streamflows and ground-water levels comes from a wide range of entities that include local government agencies, conservation commissions, watershed associations, consultants, academic research and teaching, developers and construction companies, owners of small hydro-electric dams, anglers, boaters, and private citizens. The MADEM and MADEP, under the direction of the EOEA, enacted the Massachusetts Watershed Initiative in 1995 (Executive Office of Environmental Affairs, accessed July 17, 2002) to address water-resources issues for localized river basins. Watershed Teams comprised of Federal and State agencies and community partners (non-profit organizations, municipal boards, and businesses) were formed to monitor water resources and develop protection strategies for each of the 27 major river basins in Massachusetts.

Whitewater rafting on the Deerfield River in western Massachusetts (photo courtesy of Zoar Outdoor).

An example of a local use of streamflow data is the commercial white-water rafting industry. These companies provide white-water adventures for about 25,000 people annually on the Deerfield, Millers, and Westfield Rivers. Discharge information provided by stations on these rivers is routinely used by white-water outfitters to determine whether there is sufficient flow in the Millers and Westfield Rivers, and to evaluate high-flow conditions. High-flow conditions are used to determine the class of the rapids, the size of the raft needed, and the ability and comfort level of their customers to run these rivers safely (Bruce Lessels, Zoar Outdoor, written commun., 2001).

Additional hydrologic-monitoring needs were assessed by a survey that was sent to EOEA Watershed Team Leaders and current cooperators. The survey asked participants to list additional stream-monitoring needs and their uses of existing station data. Thirty-three questionnaires were sent out and, of the responses received (about half), most indicated a need to obtain additional streamflow data in coastal streams with drainage basins under 25 mi^2 (table 4). Flow data from most of these stations are needed for regional hydrologic information, protection of anadromous fish, and water-supply regulation. In western Massachusetts, one discontinued station was recommended for reactivation to provide minimum-flow information, additional flood-warning capabilities, and monitoring below a hydroelectric facility.

Discharge measurements during winter conditions are especially important to define changes in the stage-discharge relation. A flow meter is lowered through holes drilled in the ice to measure discharge on the South River near Conway, Massachusetts (station number—01169900).

Table 4. Additional streamgage stations identified in a monitoring needs assessment survey

[FERC, Federal Energy Regulatory Commission]

Basin	Stream	Reason station is needed
Housatonic	West Branch Housatonic River	Watershed, stormwater, and lake management
Deerfield	Deerfield River near Rowe	Minimum flow information, flood warning, and FERC verification
	Clesson Brook	Regional hydrologic information and habitat protection
	Chickly Brook	Regional hydrologic information and habitat protection
	Cold Brook	Regional hydrologic information and habitat protection
Merrimack	Merrimack River	Flow between Lowell and Newburyport
Parker	Parker River at Georgetown	Regional hydrologic information and minimum flows for habitat protection
Ipswich	Maple Meadow Brook	Regional hydrologic information and minimum flows for habitat protection
	Ipswich River at Martins Brook	Regional hydrologic information and minimum flows for habitat protection
North Coastal	Small Pox Brook near Route 1 Salisbury	Support for reintroduction of anadromous fish
Cape Cod	Herring River near Harwich	Reactivate discontinued streamgage station (01105880) for minimum flow information
	Mashpee River near Mashpee	Regional hydrologic information and habitat protection (anadromous fish)
	Herring River near Wellfleet	Regional hydrologic information and habitat protection (anadromous fish). Replace rated staff gage
Buzzards Bay	Canoe River	Water-supply regulation
	Mill River	Water-supply regulation
Pawcatuck	Queen River at Route 2	Regional hydrologic information and water supply

TRENDS IN THE NETWORK

The first continuous streamgage station (01170500) in Massachusetts began operation in 1904 on the Connecticut River at Sunderland (moved to Montague City in 1929). During the early part of the century, a few stations were added to the network in Massachusetts each year until World War I (1916), when the number of stations leveled off at about 16 sites through the late 1920s (fig. 3). The first continuous streamgage station in Rhode Island began operating in 1915 on the Pawtuxet River at Fiskeville, but was discontinued 10 years later (fig. 3). Continuous streamgaging activity did not resume in Rhode Island until 1929 when the station on the Blackstone River at Woonsocket (01112500) began operation.

Stations were gradually added to the network in Massachusetts through the late 1930s. Severe flooding in 1936 and 1938 (Wandle and Lautzenheiser, 1991) prompted a marked increase in the number of stations during the late 1930s and early 1940s in Massachusetts and Rhode Island. The rate at which stations were added to the network was lower throughout the next 20 years until 1962, when a study began in cooperation with the Massachusetts Department of Public Works and the Federal Highway Administration to define streamflow characteristics of small rural streams (Wandle, 1983). About 30 sites were added to the network, mostly on streams with drainage areas of less than 10 mi^2, for peak-flow studies of small rural watersheds (Wandle, 1983). The total number of stations in Massachusetts and Rhode Island peaked at 114 in 1973 before most of the flood-study stations were discontinued.

After the early 1970s, the number of stations in Massachusetts steadily decreased through the early 1990s. In 1990, discharge records were no longer published at nine stations below flood-control dams operated in cooperation with the ACOE (not reflected in fig. 3). Although these stations are still operated for flood-control purposes, discharge records at these sites are not readily available because formal computation of the data, including estimating missing and erroneous records, is not routinely done. The number of stations in Massachusetts has increased in recent years because the MADEP, in the course of issuing water-management and water-withdrawal permits, has required those seeking permits to establish streamflow-monitoring stations to protect wildlife habitat and fisheries and to protect the natural integrity of rivers.

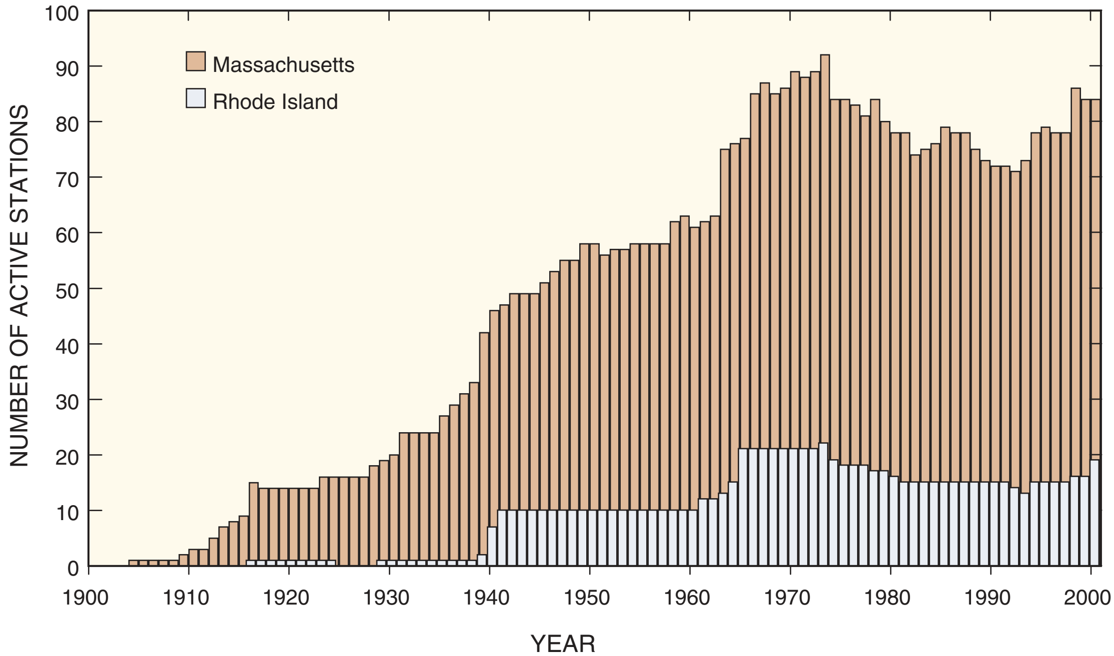


Figure 3. Number of continuous streamgage stations reported annually by the U.S. Geological Survey in Massachusetts and Rhode Island, 1900 to 2000.

Figure 3 includes all stations that were operated during each water year; this count includes stations operated for specific short-term research needs. Although these stations provide data for current research or water-resource investigations, they are typically operated for relatively short periods dictated by the requirements of a particular project; thus, they do not provide the long-term streamflow records needed for many hydrologic investigations. Of the 76 stations that have been discontinued in Massachusetts, 59 percent of these stations have less than 10 years of record, 20 percent have between 10 and 20 years of record, and 21 percent have more than 20 years of record. Of the 14 stations that have been discontinued in Rhode Island, 36 percent of these stations have less than 10 years of record, 57 percent have between 10 and 20 years of record, and 7 percent have more than 20 years of record.

Systematic observation-well measurements began in Massachusetts at Topsfield in 1936 and in Rhode Island at Providence in 1944. The number of observation wells in Massachusetts increased slowly until the early1960s, when about 50 wells were added to the network in a short time during and following the most severe drought of record (fig. 4). The number of observation wells in Massachusetts increased sharply again in the 1970s with the addition of 51 wells to the network on Cape Cod and the Islands. These observation wells were added to improve evaluation of water supplies and the effects of development pressure on sole-source aquifers. In Rhode Island, the number of observation wells increased slowly but steadily from the 1940s to the 1990s, when the number of wells nearly doubled because of a desire by the RIDEM to better represent ground-water levels in till.

Modernization of Streamflow Monitoring

The basic method for measuring streamflow by recording stream stage and relating the stage to flow by a stage-discharge relation has remained unchanged since the late 1800s, when streamgaging first began in this country. The equipment used to measure, record, and process streamflow data has changed considerably since that time, however. The earliest recording devices were graph-paper recorders that traced stream stage with time. A pen linked to a float suspended in a stilling well continuously traced stage on a paper chart that advanced by a mechanical clock driven by a weight. Hydrographers read the paper charts, made corrections to the time, or stage, or both, and converted the stage reading to a discharge from a stage-discharge rating developed from

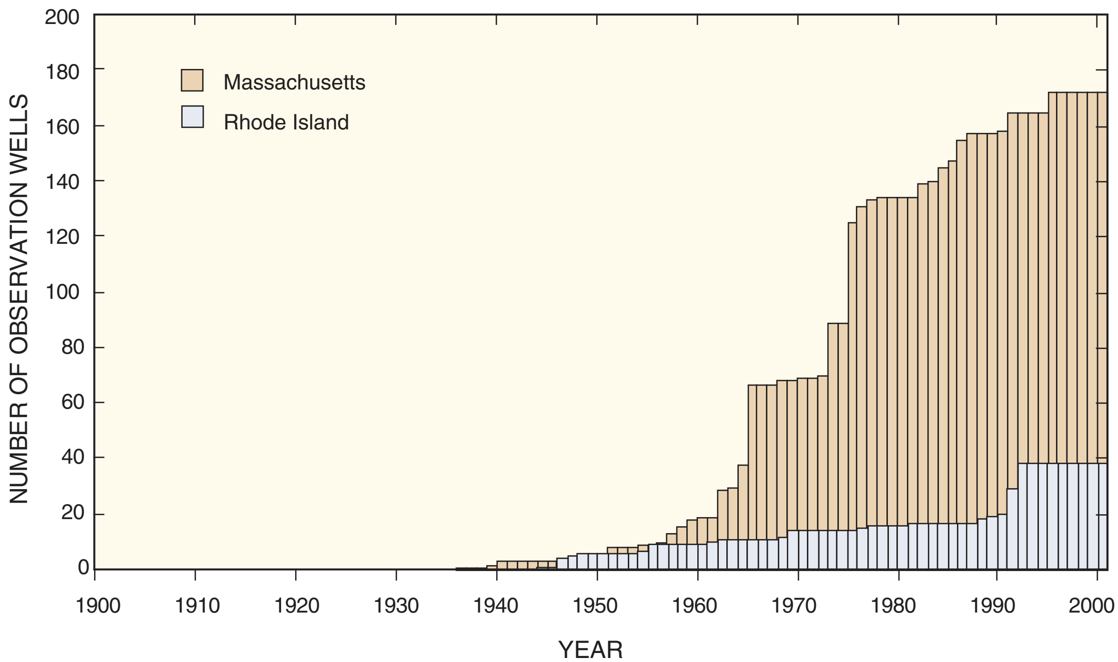


Figure 4. Number of observation well records reported annually by the U.S. Geological Survey in Massachusetts and Rhode Island, 1900 to 2000.

periodic streamflow measurements. In the early 1960s, recorders that punched stage readings into paper tapes at set time intervals gradually replaced this technology. Punched tapes allowed the automated processing of stage readings into electronic files, and thus ushered in the era of digital record processing. Mercury manometers (bubble gages) were developed about this time as an alternative to float-tape gages. Some stations were telemetered by synchronizing remote recorders with a transmitter or by phone-line dial-up impulse recorders (telemark gages). Modern stream-measuring technology evolved rapidly in the 1980s and 1990s with electronic stage sensors and recorders. Electronic recorders and sensors progressively replaced older equipment; and by 1994, all streamgage stations in Massachusetts and Rhode Island had been equiped with electronic recorders.

Current streamgaging equipment has improved the reliability of measurements; missing data have decreased from an average of about 5 percent per year when non-digital recorders were used to less than one percent per year at present. Electronic recording and processing have also vastly improved the dissemination of data. By the end of the 2001 water year, about 70 percent of all streamgage stations in Massachusetts and Rhode Island were

Digital recorder compiles flow meter readings and computes discharge measurements.

equipped with digital collection platforms (DCPs) that transmit data by satellite every 4 hours. Twenty-one of these stations are also equipped with precipitation recorders to allow near real-time transmission of streamflow and precipitation data. Data is downlinked to computers and stored in the NWIS database. These computers are networked within the USGS, and the data in NWIS is available to any user connected to the Internet (http://water.usgs.gov). In addition, many streamgage stations are equipped with telephone modems that allow transmission of real-time data (DCPs depend on the correct position of the satellite to transmit data, but are not affected by phone lines that could be down during severe storms).

The MA–RI District has made limited use of Acoustic Doppler Current Profiler (ADCP) technology to measure streamflow. The ADCP continuously measures water velocity and depth as it moves across the stream channel (Morlock and others, 2002). An ADCP was used to measure discharge in the Connecticut River during high flow because conventional boat measurements were not possible.

Data collected at stations have traditionally been published as a mean daily discharge printed in an annual data report. The widespread use of the Internet has enabled the USGS to provide streamflow, water-quality, and ground-water data on demand. Data available through the Internet include all historical mean daily streamflow records in addition to data collected as recently as the last hour. The NWIS database also contains unit-value discharge records for the 1988 water year, and from the 1990 water year to present; these are values that the streamgage records, typically at 15- or 60-minute intervals. Prior to this, only mean daily discharge values were saved electronically because of storage limitations. In addition, applications have been developed that allow users to view data in a variety of ways. As a result, the need to publish paper copies of the annual data report has diminished, and it is anticipated that printed copies of these reports will not be widely produced after the 2003 water year.

Streamgage station and precipitation gage on Hobbs Brook below the Cambridge Reservoir near Kendall Green, Massachusetts (station number—01104430).

Modernization of Ground-Water-Level Monitoring

Ground-water observation wells were traditionally measured manually at monthly intervals. These measurements were made by lowering a chalked steel tape to determine the depth to water. A problem with these infrequent measurements is that they may not provide enough information for the interpretation of ground-water-level changes in response to recharge, pumping, or surface-water interaction. The importance of the frequency of measurements is described by Taylor and Alley (2002).

In response to this need, streamflow-measuring equipment was adapted to provide continuous water-level records to delineate changes at short, regular intervals in observation wells. The types of ground-water recording equipment evolved as streamflow-monitoring equipment changed—from paper chart recorders, to paper punch tapes, to digital records, and DCPs that transmit data in near real time.

In 2001, the MADEP provided funding for a one-time capital improvement to upgrade four of the six recording wells and install DCPs in wells that were measured monthly. The benefits of real-time ground-water data are described by Cunningham (2001); these benefits include providing detailed and immediate ground-water-level data, improved data quality by minimizing equipment malfunctions, and potential operational cost savings. The ROBOWELL, an integrated ground-water-level and water-quality monitoring system, was developed by Granato and Smith (2002) to monitor sites where rapid changes in ground-water quality can occur. One ROBOWELL is currently used in the observation-well network in Truro, Mass., to monitor the position of the freshwater/saltwater interface in a water-supply well field.

Observation well equipped for continuous recording and satellite telemetry of ground-water-level data near Acton, Massachusetts (ACW 158).

CORRELATED STREAMGAGE STATIONS

Stations that are well correlated can often be used to estimate discharge records affected by equipment malfunctions, ice, or other causes. HYDCOMP, a Statistical Analysis System (SAS) macro, was developed to search the ADAPS daily-value records for the five best correlated stations (Curtis Sanders, U.S. Geological Survey, written commun., 2002). For each station, HYDCOMP regresses the log of the daily discharge values between two stations; independent station values are also lagged forward and backward from one to eight days from the dependent station values during the regression procedure. The five most correlated stations (index stations) are ranked from the lowest standard error of estimate and the highest correlation coefficient (r^2) values.

Correlations determined by HYDCOMP may identify index stations not previously considered in estimating missing records at a station and, if several stations are in physiographically similar areas and nearby one another, the list can be used to determine which ones are best correlated. HYDCOMP results should not be the sole basis for selecting index stations, however, because these stations could be in areas which are physiographically, climatically, or hydrologically dissimilar. Distant stations could be highly correlated strictly by chance; therefore, judgment is required to evaluate the goodness-of-fit with other criteria in identifying index stations.

Index stations were selected by HYDCOMP for most stations by using discharge records between April 1st and November 30th for the 1997 through 2001 water years. Eighteen stations were not included in this analysis: Merrimack River at Lowell, MA (01100000); Connecticut River at Montague City, MA, and at Holyoke, MA (01170500 and 01172003); Quashnet River at Waquoit Village, MA (011058837); Mother Brook at Dedham, MA (01104000); Town Brook at Quincy, MA, (01105585); and nine stations below reservoirs operated by the ACOE that have unpublished records (West River below West Hill Dam near Uxbridge, MA, 01111200; Quinebaug River below East Brimfield Dam near Fiskdale, MA, 01123360; Quinebaug River below Westville Dam near Southbridge, MA, 01123600; French River below Hodges Village Dam at Hodges Village, MA, 01124350; Little River near Oxford, MA, 01124500; French River at Webster, MA, 01125000; Millers River at South Royalston, MA, 01164000; East Branch Tully River near Athol, MA, 01165000; and Middle Branch Westfield River at Goss Heights, MA, 01180500), and three stations with less than 2 years of record or more than 30 days of missing record (Mill River near Rockport, MA, 01102029; Sawmill River near Rockport, MA, 011020308; and Charles River above Watertown Dam at Watertown, MA, 01104615). In general, most stations were paired with one or more highly correlated index stations. Correlated stations had a median-root-mean square error of 30 percent and lower and upper quartile ranges of 23 and 41 percent, respectively. The median correlation coefficient (r^2) was 92.8 percent and the lower and upper quartiles ranged from 88.9 to 94.5 percent. Index stations and their correlation statistics are listed in Appendix 2.

STREAMGAGE-STATION METRICS

Streamgage stations were evaluated for various measures that affect potential uses of the data. These metrics include record length, effects of regulation, distribution by physiographic region, drainage-basin size, physical basin characteristics, and combinations of these factors. These metrics do not provide an exhaustive measure of all factors that might be considered in evaluating the network; rather, they provide a general understanding of the types of basins represented and some of the limiting factors of the network. Summaries of various metrics are provided in the following section and information on these metrics can be found for individual stations in Appendix 1.

Record Length

Besides the need to know present flow conditions, streamflow data from stations operated continuously over many years enable the analysis of the magnitudes and expected recurrence intervals of flood flows and low flows, evaluation of trends in hydrologic conditions associated with changing land use such as increased peak flow and decreased base flow, and the development of relations between physical basin characteristics and flow. Most stations (active during the 2000 water year and discontinued) have less than 5 years of record or more than 50 years of record (fig. 5*A*). If the discontinued stations are excluded, about 55 percent of the stations active during the 2000 water year have more than 50 years of record (fig. 5*B*). This indicates that most discontinued stations were operated for 5 years or less, which reflects the short-term nature of the hydrologic investigations for which they were used.

The record lengths of active stations (during the 2000 water year) provide a better indication of the continuity of the network. In Massachusetts, 74 percent of the active stations have 30 or more years of record; in Rhode Island 52 percent of the active stations have 30 or more years of record. Collectively, 71 percent of the active stations in Massachusetts and Rhode Island have 30 or more years of record and most of these have more than 50 years of record. Record lengths of 30 or more years are considered most appropriate for analysis of hydrologic trends and flow-frequency analysis. Although

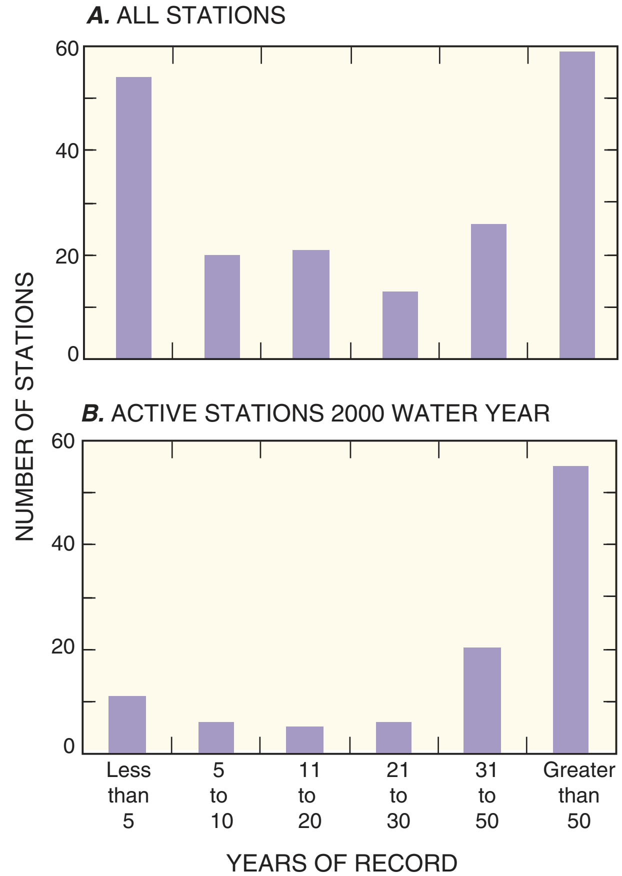


Figure 5. Record length of U.S. Geological Survey streamgage stations operated in Massachusetts and Rhode Island: (*A*) all stations (includes discontinued stations), and (*B*) stations active during the 2000 water year.

Massachusetts and Rhode Island are fortunate to have a high percentage of stations with long lengths of record, other factors need to be considered in the evaluation of the station record. For example, are records affected by regulation and do the stations represent a cross section of physiographic regions and basin characteristics?

Regulation

Regulation of flow upstream of a streamgage station can affect the potential use of its data. For example, flood-control reservoirs will likely dampen peak flows relative to a similar site without regulation; thus, data collected at a site downstream of a flood control reservoir would not be useful in a regional peak-flow study, but depending on how the reservoir storage is managed, the data could be used for other purposes. For example, a flood control reservoir that is normally empty except for the water that passes through it could still be useful in an analysis of low flows. Forms of regulation include water withdrawals, discharges from wastewater-treatment facilities, diversions, and controlled releases of reservoir storage. Regulation can also be caused by natural influences such as beaver activity or tidal fluctuations. Few, if any, streams and rivers in Massachusetts and Rhode Island are completely free of regulation; nevertheless, the extent to which regulation influences flow has been assessed for each gaging station. Each station was assigned to one of five classes of regulation: (1) minimally affected or not affected, (2) affected only at low flows, (3) affected only at high flows, (4) affected at all flows, and (5) effects are variable, such as a tidal fluctuation. These assignments were determined on the basis of remarks published in the annual data report (for example, Socolow and others, 2001).

About 21 percent of stations in Massachusetts and 43 percent of stations in Rhode Island active in the 2000 water year are considered unaffected, or minimally affected, by regulation. In Massachusetts, active stations are affected by regulation at low flows at 28 percent of stations, at all flows at 44 percent of stations, at variable flow at 6 percent of stations, and at high flows at 1 percent of stations. In Rhode Island, active streamflow stations are affected by regulation at low flows at 38 percent of stations, all flows at 14 percent of stations, and variable flow at 5 percent of stations (fig. 6).

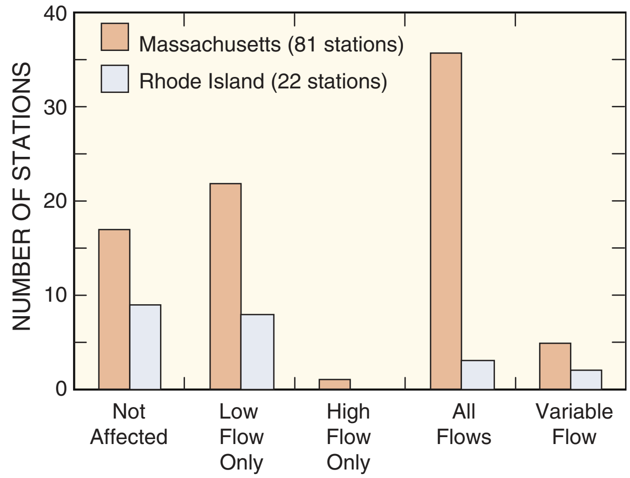


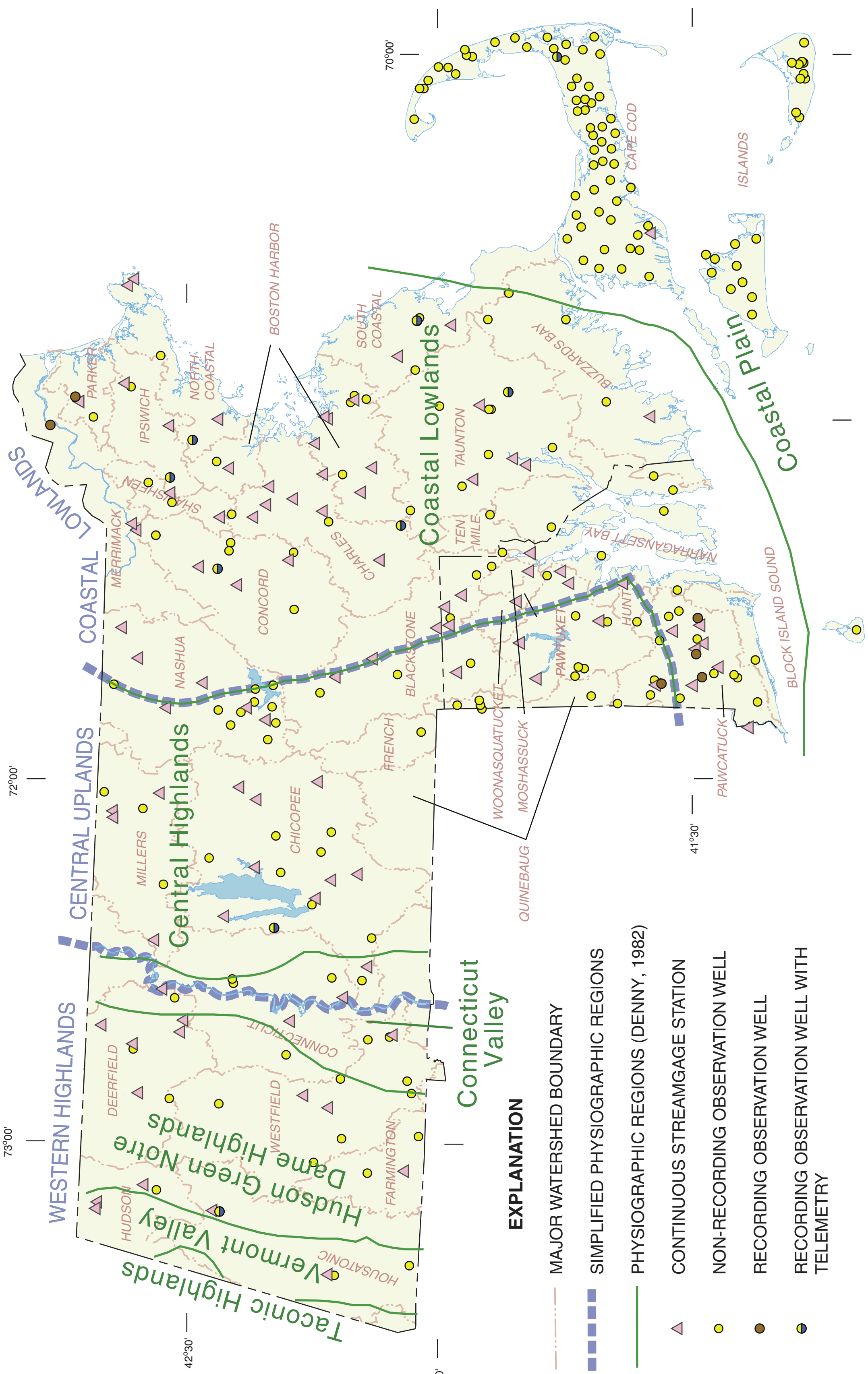
Figure 6. Number of streamgage stations in Massachusetts and Rhode Island affected by regulation, 2000 water year.

Physiographic Region

The hydrologic variability associated with different physiographic regions can be an important consideration in hydrologic analysis. Denny (1982) described seven physiographic regions in Massachusetts and Rhode Island; from east to west, these are the Coastal Plain, Coastal Lowlands, Central Highlands, Connecticut Valley, Hudson Green-Notre Dame Highlands, Vermont Valley, and the Taconic Highlands (fig. 7). For this evaluation, the physiographic regions described by Denny were simplified into three regions—Coastal Lowlands, Central Uplands, and the Western Highlands. Stations were assigned to the region that includes most of their drainage area. Stations on the Connecticut and Merrimack Rivers were not assigned to a physiographic region because these stations have large drainage basins, which are not representative of any one region.

The Coastal Lowlands include the Coastal Plain and Coastal Lowlands regions described by Denny (1982) and include part or all of the Nashua, Boston Harbor, Charles, Concord, Ipswich, Shawsheen, North Coastal, Parker, South Coastal, Buzzards Bay, Taunton, and Cape Cod and Islands drainage basins in Massachusetts, and part or all of the Narragansett Bay, Ten Mile, Woonasquatucket, Moshassuck, Blackstone, and the Pawcatuck drainage basins in Rhode Island. The Central Uplands includes stations with drainage basins in the Connecticut Valley region east of the Connecticut River. Basins in the Central Uplands include part or all of the Chicopee, Millers, Nashua, Quinebaug, French, and Blackstone drainage basins in Massachusetts, and the Pawtuxet, and Hunt drainage basins in Rhode Island. The Western Highlands, to the west of the Connecticut River, includes part or all of the Deerfield, Farmington, Housatonic, Hudson, and Westfield drainage basins.

Most of the active stations in Massachusetts and Rhode Island have drainage basins in the Coastal Lowlands (48 and 77 percent, respectively). Stations with drainage basins in the Central Uplands represent 35 and 23 percent of the active stations in Massachusetts and Rhode Island, respectively (fig. 8). In Massachusetts, 12 percent of the active stations have drainage basins in the Western Highlands and about 5 percent were not assigned to a physiographic region. Normalized for area, the density of stations with drainage areas in the Coastal Lowlands and the Central Uplands regions is similar (about one station for every 100 mi^2), but the density of stations is about half this value in the Western Highland region.



Base from U.S. Geological Survey digital data, 1:25,000, 1991, Lambert conformal conic projection. NAD 83

Figure 7. Physiographic regions, major river basins, and the U.S. Geological Survey streamflow station and observation-well network in Massachusetts and Rhode Island, 2000 water year.

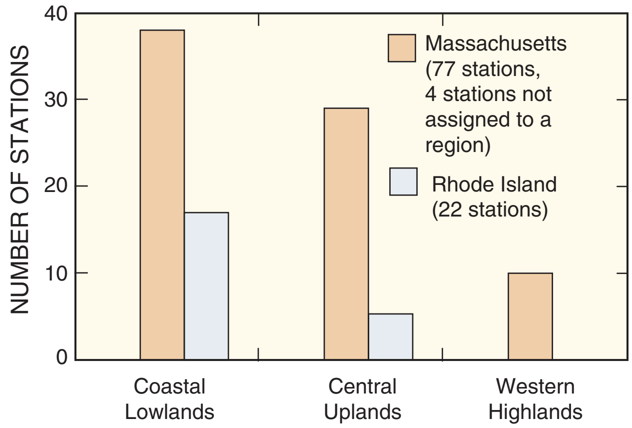


Figure 8. Distribution of U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by physiographic region, 2000 water year.

Basin Characteristics

The basin characteristics associated with streamgage stations include mean basin slope, mean basin elevation, stream-channel length, land cover (percent of basin cover as water, wetlands, forest, urban areas) and the percent of the basin area underlain by sand and gravel. Basin characteristics, other than drainage-area size, were not determined for five stations in Massachusetts: Merrimack River at Lowell (01100000), Connecticut River at Montague City and at Holyoke (01170500 and 01172003), Quashnet River at Waquoit Village (011058837), and Mother Brook at Dedham (01104000). Basin characteristics were not determined for these sites. The Merrimack and Connecticut River stations drain areas of 4,400 mi^2 or more, and Mother Brook is a diversion channel between the Charles and Neponset Rivers. Basin features for these streamgage stations were not considered particularly relevant. The basin characteristics for the Quashnet River are not included in the summary characteristics because its ground-water and surface-water drainage areas differ; basin characteristics, however, are given for each in Appendix 1. As part of this analysis, the drainage area for each station (except for the Connecticut, and Merrimack River stations) was digitized to provide a standard basin-boundary reference for future applications.

Basin slope and elevation were determined from 1:24,000-scale National Elevation Data (U.S. Geological Survey, accessed July 17, 2002). Channel length was determined from 1:24,000 or 1:100,000-scale hydrology digital line graph (DLG) data. Land-cover features were determined mostly from MassGIS (Massachusetts Geographic Information System, accessed July 17, 2002) and RIGIS (Rhode Island Geographic Information System, accessed July 17, 2002) digital land-use/land-cover maps, which generally reflect conditions of the early 1990s. Drainage areas outside of Massachusetts and Rhode Island were compiled from digital land-use/land-cover (LULC) maps from neighboring states by using 30-m National Land Cover Data (NLCD) described by Vogelmann and others (2001). All LULC maps were converted to NLCD classification and scale. Urban areas include LULC cover classified as high-intensity residential development, commercial, industrial, and transportation. Forest areas include LULC cover classified as deciduous, evergreen, and mixed forest. Agriculture areas include LULC cover classified as orchards, vineyards, pasture, and row crops. Other areas include LULC cover classified as low-intensity residential, quarries, gravel pits, bare rock and sand, shrub lands, and open urban. Basin characteristics are summarized for 98 stations in box plots (fig. 9) and are presented for individual stations in tables in Appendix 1.

Physical Characteristics

Drainage-basin size is typically the single most important explanatory variable in streamflow-estimation techniques. Therefore, regional analysis should include stations that represent a wide range of drainage-basin sizes. In Massachusetts, gaged basins ranged in size from 0.39 to 8,309 mi^2, with a median of 60 mi^2. In Rhode Island, gaged basins ranged in size from 3.55 to 417 mi^2, with a median size of 54 mi^2.

Stations with drainage areas under 10 mi^2 represent about 10 percent of the stations in Massachusetts and about 23 percent of the stations in Rhode Island (fig. 10*A*). Drainage areas between 10 and 100 mi^2 represent about 55 percent of the stations in Massachusetts and 64 percent of the stations in Rhode Island. About 22 percent of the stations in Massachusetts have drainage areas between 100 and 300 mi^2, and about 13 percent of the stations have drainage areas greater than 300 mi^2. In Rhode Island, only three stations have drainage areas greater than 100 mi^2 (none more than 500 mi^2). In general, the current streamflow-monitoring network represents a broad range of drainage-basin sizes.

About 60 percent of the discontinued stations in Massachusetts and about 70 percent of the discontinued stations in Rhode Island have drainage areas less than 10 mi^2 (fig. 10*B*). The high proportion of discontinued stations with drainage areas less than 10 mi^2 reflects the project-specific stations operated during the 1970s to estimate peak flows on small streams (Wandle, 1983).

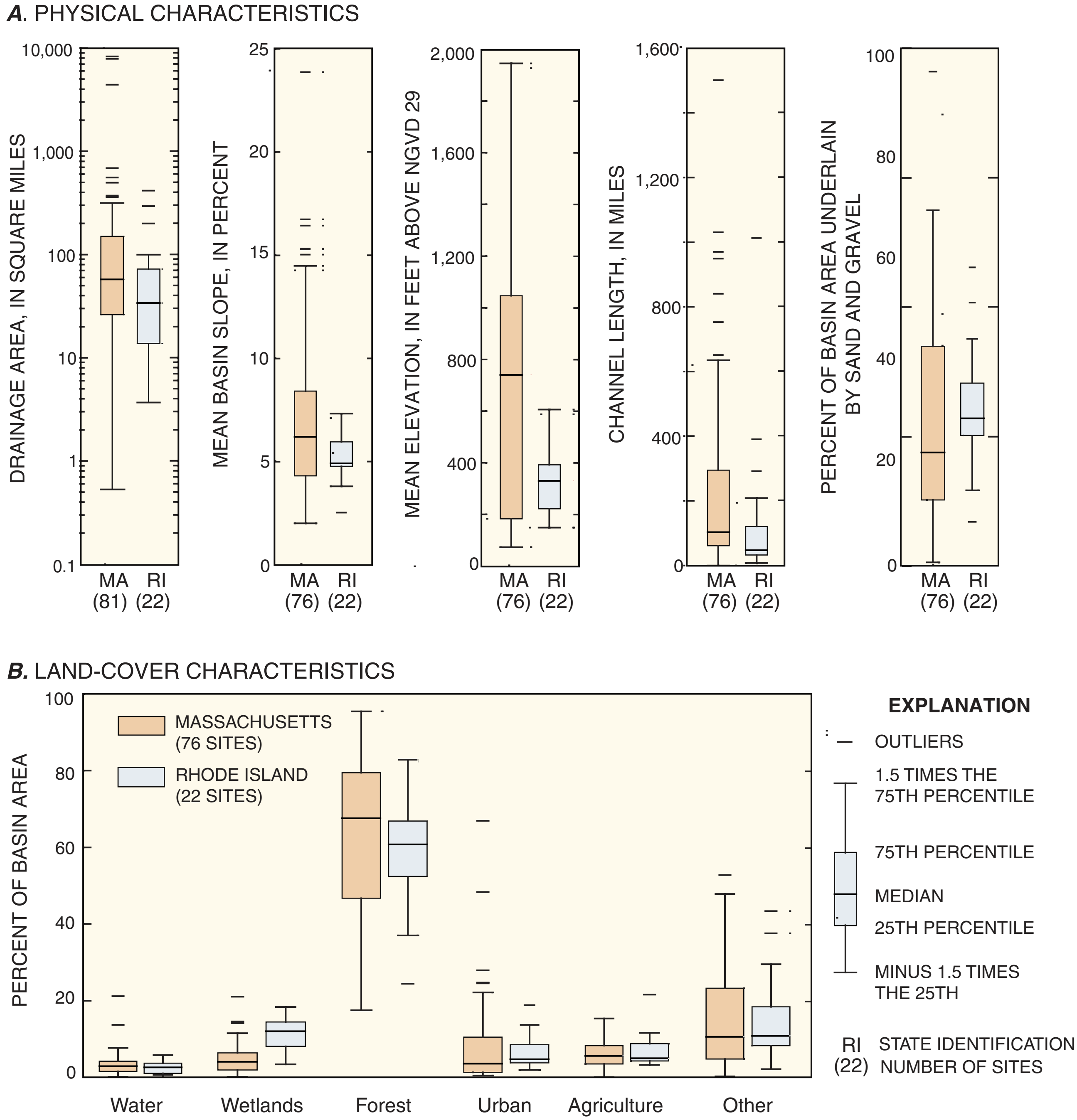


Figure 9. Summary of selected basin characteristics upstream of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island, 2000 water year: (*A*) physical characteristics, and (*B*) land-cover characteristics.

In Massachusetts, the mean basin slope ranged from about 2 to 24 percent with a median of 6.2 percent (fig. 9*A*). In Rhode Island, the mean basin slope ranged from 2.5 to 7.3 percent with a median of 4.9 percent. The mean basin slope for stations in the Western Highlands (median of 12.1 percent) was about twice that of the Central Uplands (median of 7.3 percent) and Coastal Lowlands (median of 4.7 percent). Similarly, the mean basin elevation was greatest for stations in the Western Highlands (median of 1,460 ft) and lowest for stations in the Coastal Lowlands (median of 211 ft). Stations that drain the Central Uplands had a median mean basin elevation of 885 ft. The median of the mean basin elevation for all stations in Massachusetts and Rhode

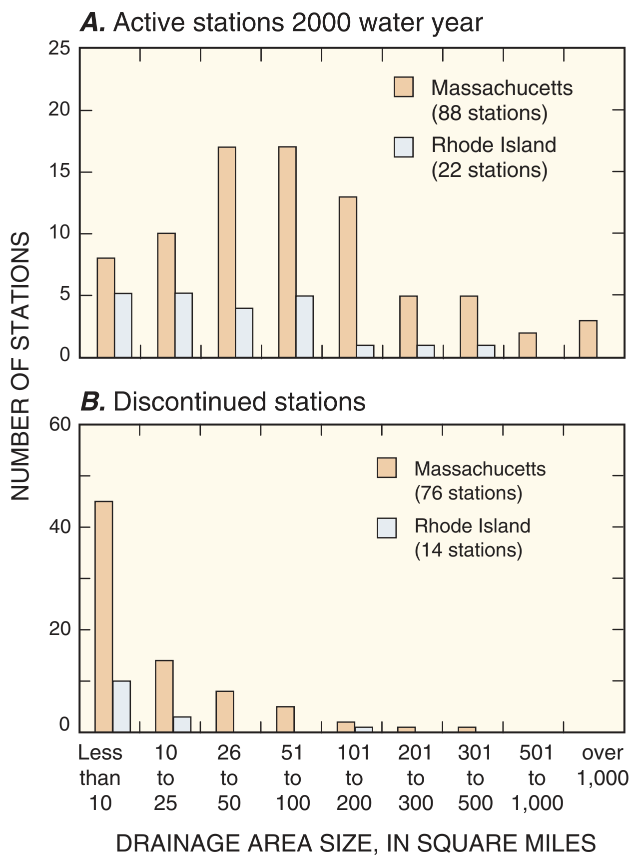


Figure 10. Number of U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by drainage-area size for (*A*) active stations during the 2000 water year, and (*B*) discontinued stations.

Island was 462 ft; the median elevation for Massachusetts basins (744 ft) was about twice that for Rhode Island basins (354 ft). The median channel length for Massachusetts stations (103 mi) was about twice that for Rhode Island stations (47 mi).

The percentage of the basin area underlain by sand and gravel is greatest in Coastal Lowland basins in Massachusetts (median of 42 percent of the basin area) and least in the Western Highlands (median of 11 percent of the basin area). In the Central Uplands, a median of 18 percent of the basin area was underlain by sand and gravel (fig. 9A). The areas underlain by sand and gravel were about the same for Rhode Island basins in the Coastal Lowlands and in the Central Uplands (29 and 25 percent of the basin area, respectively).

Land-Cover Characteristics

Land-cover characteristics indicate that gaged basins in Massachusetts and Rhode Island are mostly forested (median of 65 percent forest cover), but forest range from as little as 18 percent to as much as 95 percent of the basin area. Generally, basins are more forested in the Central Uplands (median 78 percent) and Western Highlands (median 81 percent) than in the Coastal Lowlands (median 52 percent). The Coastal Lowlands are generally more urbanized in Massachusetts (median of 10 percent) than in Rhode Island (median of 4 percent).

The percentage of gaged basin area classified as water, wetlands, and agriculture is generally small. The median basin area covered by water was 2.8 percent in Massachusetts and 2.5 percent in Rhode Island, but composed as much as 21 and 5.7 percent of the basin areas for Massachusetts and Rhode Island stations, respectively. The median basin area covered by wetlands was 3.9 percent in Massachusetts and 12 percent in Rhode Island, but composed as much as 21 and 18 percent of the basin area for Massachusetts and Rhode Island stations, respectively. The high percentage of wetland area in Rhode Island could be due, in part, to differences in the wetland covers from different sources. The median basin area in agriculture was 5.6 percent in Massachusetts and 5.0 percent in Rhode Island, but composed as much as 15 and 22 percent of the basin areas for Massachusetts and Rhode Island stations, respectively. Agricultural area tended to be slightly more prevalent in gaged basins in the Western Highlands (median of 7.6 percent) than in the other regions (median 5.2 percent). Land cover classified as “other” comprised about 12 percent of the basin areas in both Massachusetts and Rhode Island, and composed as much as 53 and 43 percent of the land cover in Massachusetts and Rhode Island basins, respectively.

Combined Metrics

Often, hydrologic analyses require streamflow data that satisfy multiple criteria. For example, development of regionalized equations that relate flow statistics to basin characteristics in STREAMSTATS (Ries and others, 2000) required stations with long records (generally 30 years or more), minimal regulation, and a wide variety of basin characteristics. Several of the metrics above were evaluated in combination to assess the distribution of stations with respect to multiple criteria commonly considered in hydrologic analyses.

Record length by region: Stations with record lengths of 10 years or less are mostly in the Coastal Lowlands, which reflects the introduction of these stations in recent years to monitor stressed basins (fig. 11). Stations with long-term records (greater than 30 years) are about equally distributed in the Central Highlands and Coastal Lowlands.

Regulation by region: In Massachusetts, regulation affects about 70 percent of the stations in the Coastal Lowlands, about 82 percent of the stations in the Central Uplands, and about 90 percent of the stations in the Western Highlands. In Rhode Island, regulation affects about 65 percent of the stations in the Coastal Lowlands and about 40 percent of the stations in the Central Uplands. Overall, in Massachusetts and Rhode Island, regulation affects about 70 percent of the stations in the Coastal Lowlands, mostly under low-flow conditions and to a slightly lesser extent under all flow conditions, and about 76 percent of the stations in the Central Uplands, mostly under all flow conditions (fig. 12).

Drainage area by region: In general, the number of stations decline as the drainage area decreases in each region. In the Coastal Lowlands, stations represent all drainage area ranges in Massachusetts and Rhode Island (fig. 13). Stations with the largest drainage basins are in the Coastal Lowlands because these stations generally have the greatest available upstream area. Few stations exist in the Central Uplands of Rhode Island, but these stations have drainage areas that are about equally distributed across the ranges less than 100 mi^2. In Massachusetts, about 16 percent of the stations in the Central Uplands have drainage areas less than 25 mi^2. No active stations in the 2000 water year in the Western Highland region of Massachusetts have drainage areas less than 25 mi^2.

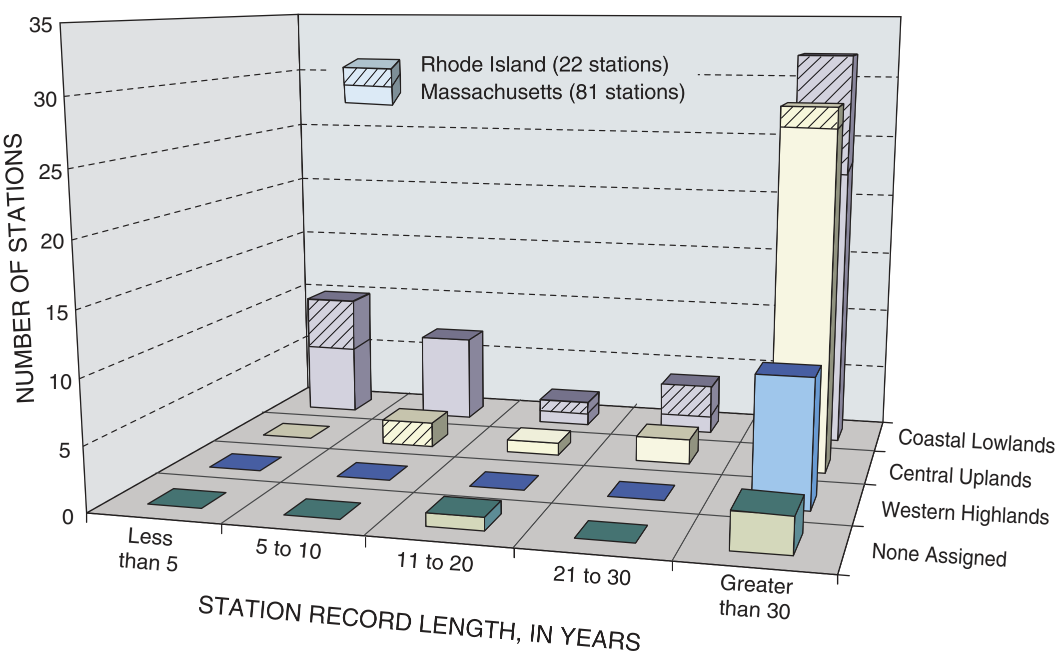


Figure 11. Number of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by physiographic region and years of record, 2000 water year.

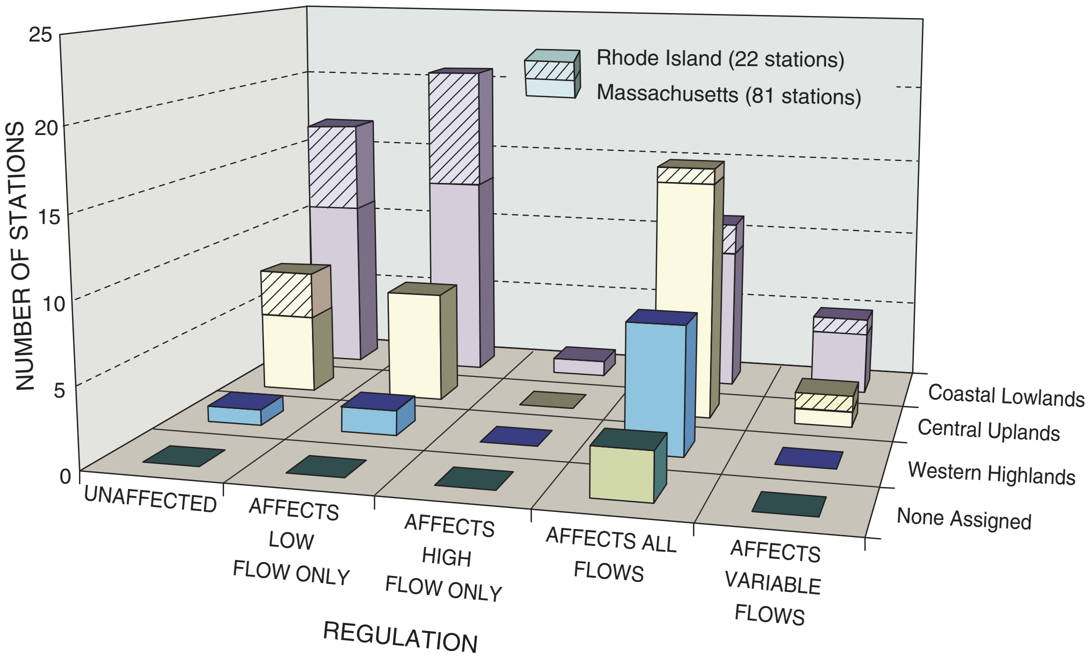


Figure 12. Number of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by physiographic region and regulation, 2000 water year.

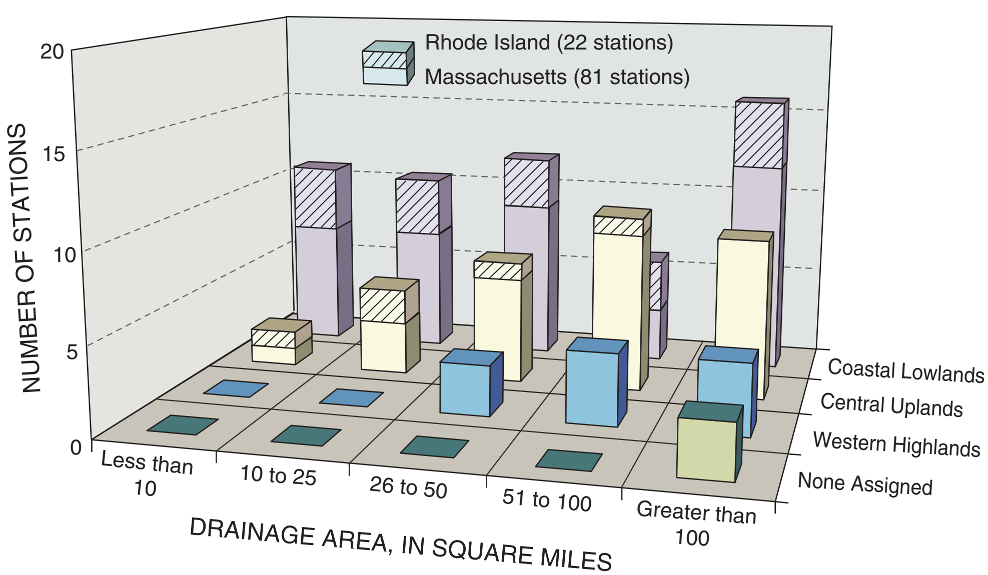


Figure 13. Number of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by drainage-area size and physiographic region, 2000 water year.

Regulation by record length: Massachusetts and Rhode Island stations with record lengths of 30 or more years are mostly affected by regulation (82 percent); about 50 percent of the stations are affected at all flows or variable flows, and about 32 percent of the stations are affected at low flows (fig. 14). Regulation affects 82 percent of Massachusetts stations with record lengths of 30 or more years; of these, about 52 percent are affected over all flows or variable flows, and about 30 percent are affected at low flows. Regulation affects about 83 percent of Rhode Island stations with record lengths of 30 or more years; of these, about 42 percent are affected over all flows or variable flows and about 41 percent are affected at low flow. About half of all stations with less than 10 years of record (52 percent) are affected by regulation; this percentage is less than the percentage of stations with long periods of record affected by regulation. Stations unaffected by regulation with less than 10 years of record represent about 9 percent of the stations in Massachusetts and Rhode Island, however. This underscores the importance of continuing the operation of stations unaffected by regulation for use in hydrologic analysis.

Record length by drainage area: Most stations in Massachusetts (74 percent) and about half of the stations in Rhode Island (54 percent) with drainage areas greater than 10 mi^2 have 30 or more years of record (fig. 15). Stations with drainage areas under 10 mi^2 are about equally distributed among the five record-length categories, but stations with the shortest record length (less than 5 years) are generally stations with the smallest drainage area.

Regulation by drainage-area size: The number of stations affected by regulation grouped by drainage area (fig. 16) indicate that nearly 93 percent of stations in Massachusetts with drainage basins larger than 100 mi^2 are affected by regulation; of these, 71 percent are affected at low flows. All four stations in Rhode Island with drainage areas greater than 100 mi^2 are affected by regulation. The number of stations affected by regulation over all flows in Massachusetts increases sharply as the drainage-area size increases. About 50 percent of all stations in Massachusetts and Rhode Island with areas less than 50 mi^2 are unaffected by regulation.

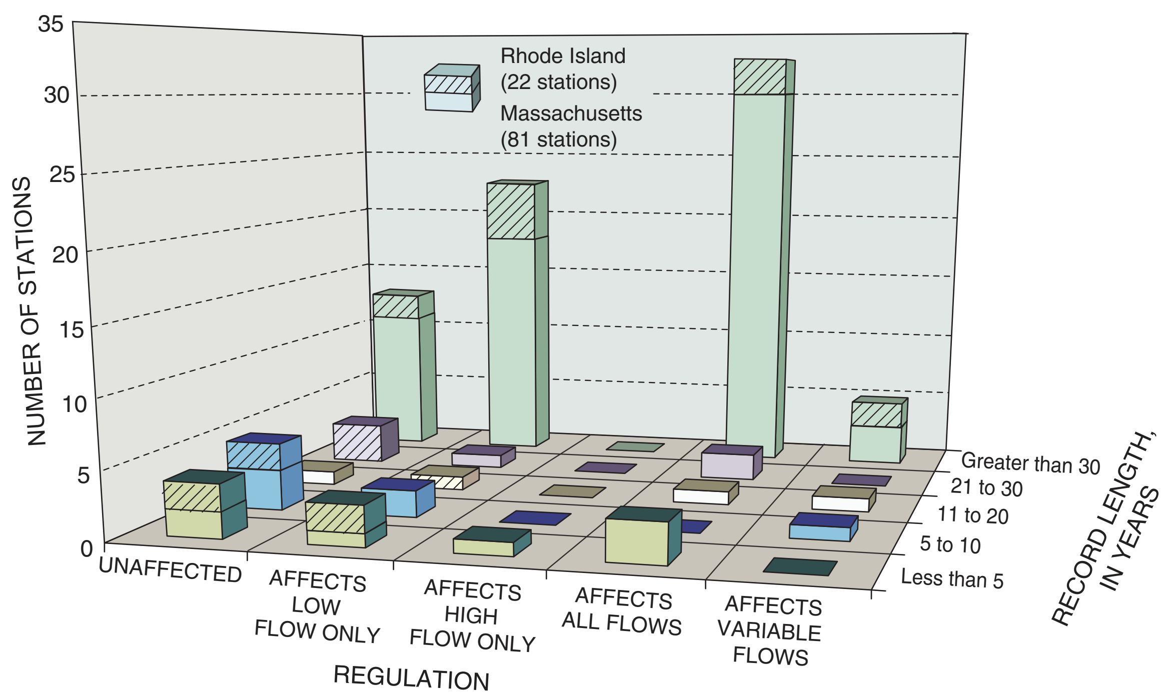


Figure 14. Number of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by regulation and record length, 2000 water year.

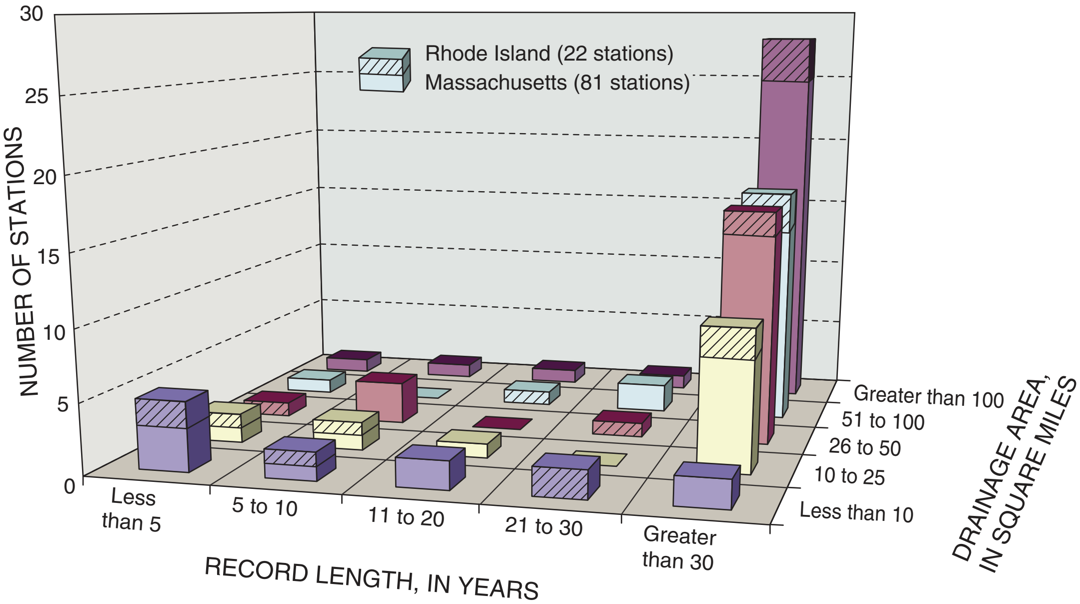


Figure 15. Number of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by record length and drainage-area size, 2000 water year.

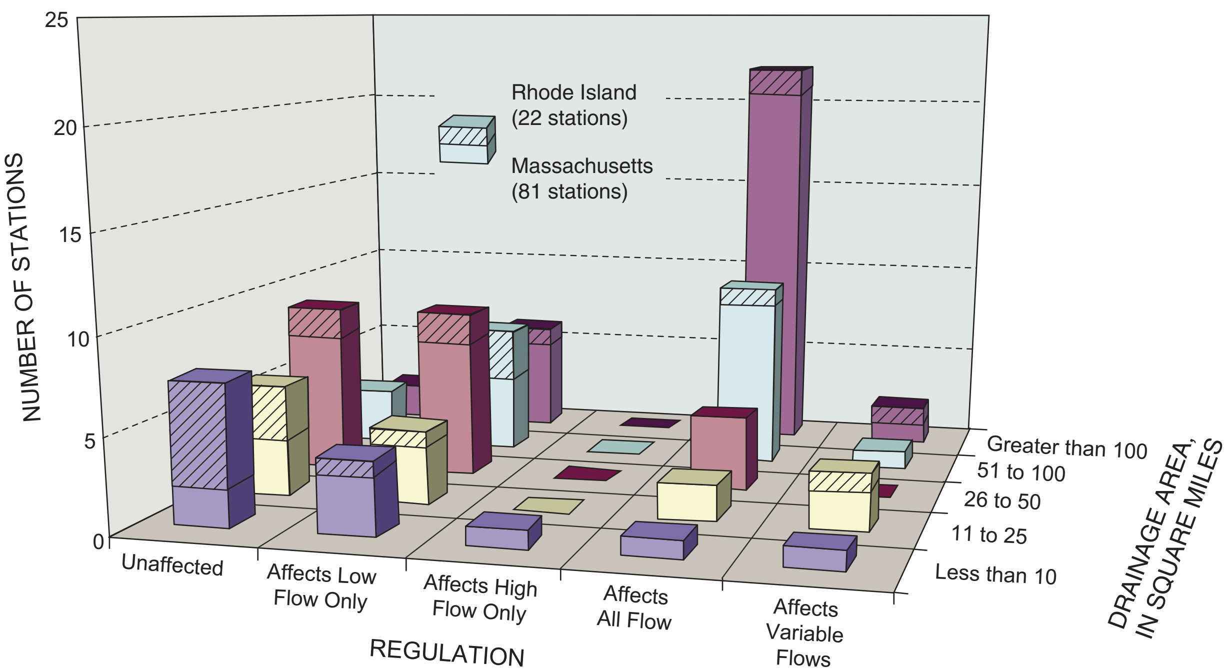


Figure 16. Number of active U.S. Geological Survey streamgage stations in Massachusetts and Rhode Island by drainage-area size and regulation, 2000 water year.

Regulation by drainage area and region: Only 26 of 103 active stations in Massachusetts and Rhode Island are unaffected by regulation; of these, 17 are in Massachusetts and 9 are in Rhode Island (table 5). About half the bins, (regions and various drainage-area-size classes) have no unregulated stations. The greatest number of unregulated stations is represented by drainage areas between 26 and 50 mi^2 in the Coastal Lowlands (total of six stations in Massachusetts and Rhode Island combined). Furthermore, only one unregulated station is operated in the Western Highlands, no unregulated stations are operated with drainage areas greater than 51 mi^2 in the Central Uplands, and only one unregulated station is operated with any drainage less than 10 mi^2 in the Central Uplands in either Massachusetts or Rhode Island. The number of stations currently in operation in each drainage-area range by region indicates a paucity of unregulated stations.

The number of stations suitable for low-flow analysis increases by one when stations affected by regulation at high flows only are considered; this station was in the Coastal Lowlands of Massachusetts with a drainage area less than 10 mi^2. The number of stations suitable for high-flow analysis (those affected at low flow only) increases slightly for each region and most drainage-area size classes (table 6). Thirty-four stations in Massachusetts and three stations in Rhode Island are unaffected by regulation at high flow, but 83 percent of these have drainage areas greater than 50 mi^2, and 37 percent of these are in the Central Uplands (table 6).

Table 5. Number of active U.S. Geological Survey streamgage stations unaffected by regulation, tabulated by drainage-area range and physiographic region in Massachusetts and Rhode Island, 2000 water year

Region	Drainage-area range in square miles				
	Less than 10	10 to 25	26 to 50	51 to 100	Greater than 100
Massachusetts					
Coastal Lowlands	2	0	5	2	2
Central Uplands	0	3	2	0	0
Western Highlands	0	0	0	1	0
Rhode Island					
Coastal Lowlands	3	2	1	0	0
Central Uplands	1	1	1	0	0

Table 6. Number of active U.S. Geological Survey streamgage stations unaffected by regulation at high flows, tabulated by drainage-area range and physiographic region in Massachusetts and Rhode Island, 2000 water year

Region	Drainage-area range in square miles				
	Less than 10	10 to 25	26 to 50	51 to 100	Greater than 100
Massachusetts					
Coastal Lowlands	1	2	2	0	6
Central Uplands	0	0	2	6	7
Western Highlands	0	0	1	3	4
Rhode Island					
Coastal Lowlands	0	0	0	0	0
Central Uplands	0	0	0	1	2

OBSERVATION-WELL METRICS

The observation-well network comprises 160 wells in Massachusetts and 40 wells in Rhode Island. In Massachusetts, the network includes 57 wells on Cape Cod, 10 wells on Martha's Vineyard, and 10 wells on Nantucket; the high proportion of observation wells on Cape Cod and the Islands reflects the importance of ground water as the sole source of drinking water. For this reason, observation-well metrics have been separately identified for Cape Cod and the Islands. The Rhode Island network includes two wells on Block Island.

About 6 percent of the observation wells in Massachusetts, mostly in the Coastal Lowlands, are equipped with continuous data recorders; of these, nine are telemetered. In Massachusetts, 73 percent of the observation wells are measured manually at monthly intervals; and 21 percent of the wells are measured bimonthly, all of which are on Cape Cod. In Rhode Island, most observation wells are measured manually at monthly intervals, but four were equipped with continuous recorders during the 2000 water year.

Record Length

The lengths of record for all observation wells in the Massachusetts network, range from 6 to 65 years, with a median of 26 years. For Cape Cod and the Islands, record lengths of observation wells range from 10 to

51 years and have a median of 26 years; 85 percent of these have more than 20 years of record, but only 11 have records that date back to 1962 or earlier, and are thus long enough to encompass the most severe drought of record in this region (fig. 17). Record lengths for mainland Massachusetts observation wells range from 6 to 65 years and have a median length of 36 years; nearly 70 percent of these have records from the 1960s drought. Record lengths of Rhode Island observation wells range from 9 to 57 years with a median length of 11 years.

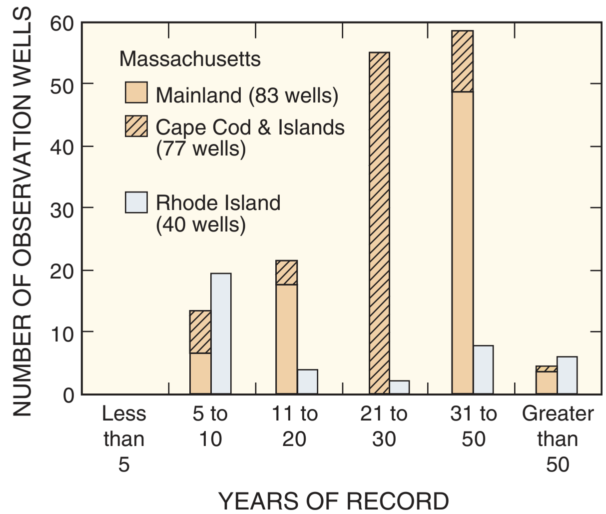


Figure 17. Record length of observation wells reported by the U.S. Geological Survey in Massachusetts and Rhode Island, 2000 water year.

Physiographic Region

Of the 200 observation wells in the Massachusetts and Rhode Island monitoring network, about two thirds (67 percent) are in the Coastal Lowlands, 24 percent are in the Central Uplands, and 9 percent are in the Western Highlands. Within mainland Massachusetts, about 46 percent of the observation wells are in the Coastal Lowlands, 33 percent are in the Central Uplands, and 21 percent are in the Western Highlands. In Rhode Island, 52 percent of the observation wells are in the Coastal Lowlands, and 48 percent are in the Central Highlands.

Geologic Material

Observation wells in Massachusetts and Rhode Island are mostly (80 percent) finished in sand and gravel, 19 percent are finished in till, and 1 percent (three wells) are finished in bedrock. In mainland Massachusetts, observation wells have a similar distribution—75 percent are finished in sand and gravel, 21 percent are finished in till, and 4 percent are finished in bedrock. Observation wells on the Cape and Islands are all finished in sand and gravel. In Rhode Island, half of the observation wells are finished in sand and gravel, and half are finished in till. The Rhode Island network does not have any wells finished in bedrock.

Observation wells in mainland Massachusetts and Rhode Island finished in sand and gravel are about three to four times more numerous than wells finished in till across each of the three physiographic regions (fig. 18). In the Massachusetts mainland Coastal Lowlands, Central Uplands, and Western Highlands, about 77, 68, and 83 percent of wells are finished in sand and gravel, respectively; 20, 25, and 17 percent of wells are finished in till, resepctively; and 3, 7 and 0 percent are finished in bedrock, respectively. In Rhode Island Coastal Lowlands and Central Uplands, about 62 and 37 percent of wells are finished in sand and gravel, respectively, and 38 and 63 percent of wells are finished in till, respectively.

Well Depth

Depths of observation wells below land surface in Massachusetts and Rhode Island range from 10 to 740 ft, with a median depth of 32 ft. In mainland Massachusetts, depths of observation wells below land surface range from 11 to 740 ft, with a median depth of 25 ft; well depths on Cape Cod and the Islands range from 10 to 294 ft, with a median depth of 53 ft. In Rhode Island, depths of observation wells below land surface range from 10 to 121 ft, with a median depth of 20 ft.

Depths of observation wells below land surface finished in sand and gravel (fig. 19A) range from 12 to 71 ft in mainland Massachusetts (median depth of 27 ft), 10 to 294 ft in the Cape and Islands (median depth of 53 ft), and 10 to 121 ft in Rhode Island (median depth of 28 ft). Depths of observation wells below land surface finished in till (fig. 19*A*) range from 11 to 39 ft in mainland Massachusetts (median depth of 21 ft) and 10 to 52 ft in Rhode Island (median depth of 18 ft). On average, observation wells in mainland Massachusetts and Rhode Island finished in sand and gravel are deeper than wells finished in till. Observation wells finished in bedrock are generally deeper than sand and gravel wells. Depths of observation wells across different physiographic regions and states are not distinctly different, except that wells on the Cape and Islands tend to be about twice the depth of wells in other regions (fig. 19*B*).

Installing a ground-water observation well by a rotary drill rig.

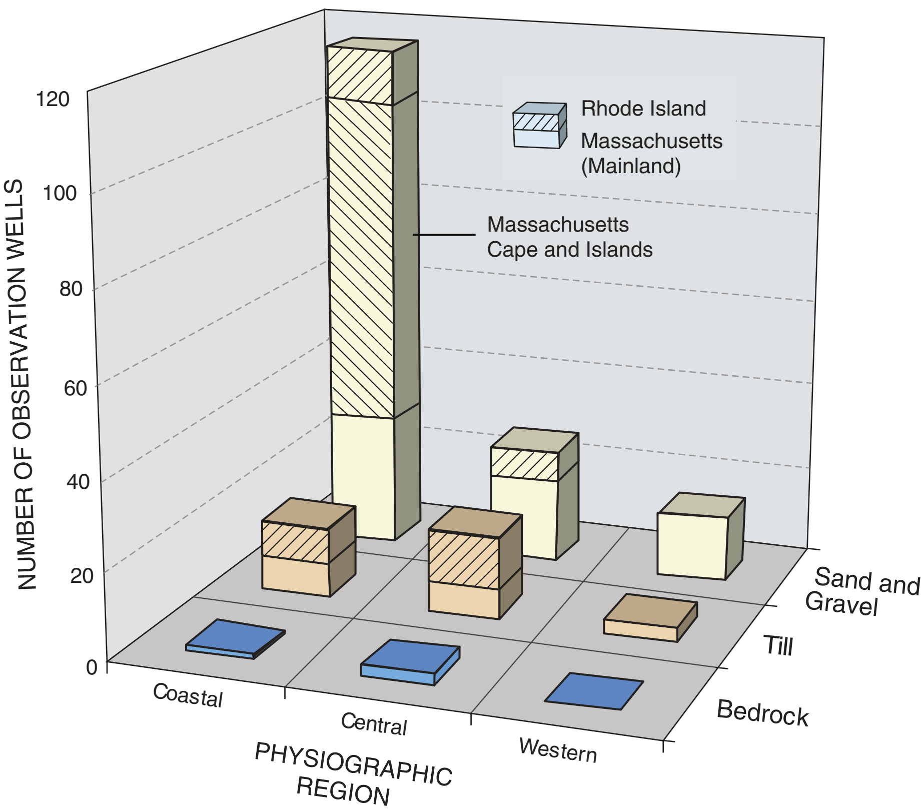


Figure 18. Number of observation wells in the 2000 water year by physiographic region and type of geologic material in which the well is finished.

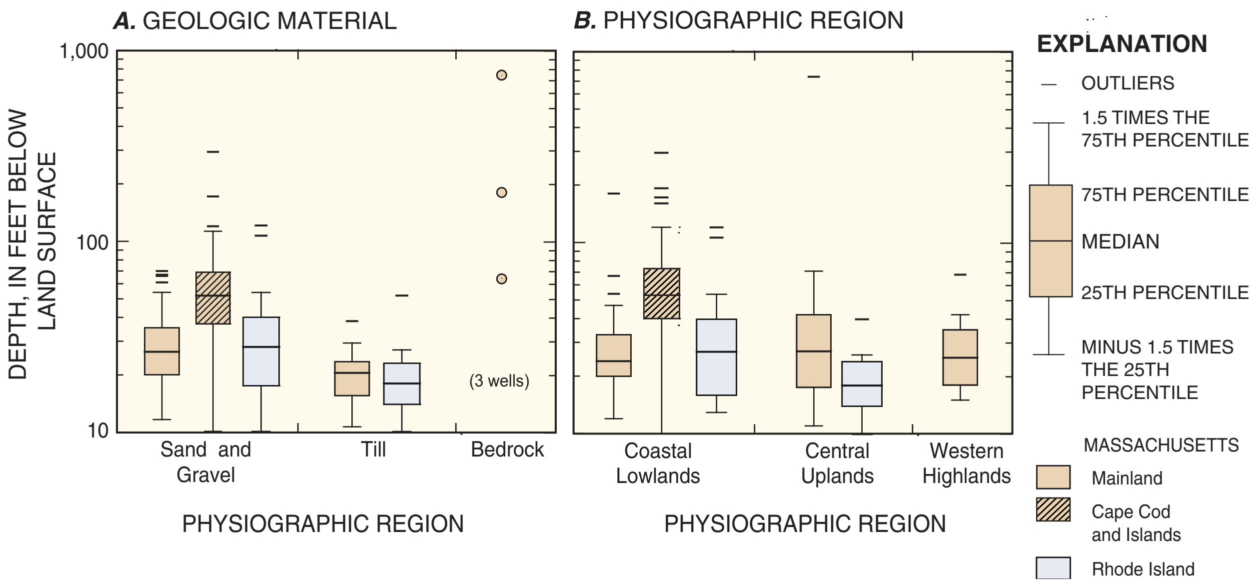


Figure 19. Depths of observation wells by (*A*) type of geologic material, and (*B*) physiographic region reported by the U.S. Geological Survey in Massachusetts and Rhode Island, 2000 water year.

FUTURE DIRECTIONS OF THE MONITORING NETWORK

For nearly 100 years, the streamflow and observation-well network of the USGS in Massachusetts and Rhode Island has provided hydrologic data for water-resources management, issuance of flood warnings, recreational, and numerous other purposes. Public and private interests have benefited from improvements in monitoring technology and from dissemination of historical and near real-time data through the Internet. The future monitoring network will continue to incorporate advances in technology to meet the needs of cooperators and the public.

The technology of the collection and distribution of near real-time hydrologic data has improved rapidly over the last decade. Future advances in technology will likely improve accuracy and reliability over a wide range of conditions. An example of one technology under investigation is non-contact stage and flow sensors, which have the potential to make streamflow measurements safer, cheaper, and at least as accurate as traditional measuring techniques. This technology would be especially beneficial for obtaining discharge measurements during flood conditions or in dangerous locations such as confined storm drains.

Acoustic Doppler Velocity Meters (ADVMs) have made it possible to produce accurate discharge records efficiently where conventional monitoring techniques yield unsatisfactory results because of variable backwater conditions or poor stage-discharge relations (Morlock and others, 2002). This technology could be cost-effective at stations that are regularly affected by beaver activity, where considerable time is spent correcting stage-discharge relations caused by dams only to yield records of poor or uncertain quality. In addition, the technology would eliminate the need to remove beavers in order to maintain a good-quality discharge record.

A near-term goal at streamgage stations is to completely equip them with DCPs and increase the frequency of transmission of data from every 4 hours to every hour at selected sites. This improvement would make data from the entire network available in near real time and could improve flood warnings that can save lives and prevent property damage.

Continued upgrades to the observation-well network are also anticipated in hydrologically sensitive areas in the near future. Improvements may include installation of continuous recording equipment, telemetry (DCPs), and use of the ROBOWELL (Granato and Smith, 2002) where near real-time water-quality monitoring is a consideration. Additional observation wells finished in bedrock are also likely as communities seek new sources of water supply in bedrock aquifers.

Cooperator needs evolve as development pressure puts greater strain on limited water resources. For example, increased demands for public and private water supplies will likely initiate additional State-mandated monitoring to provide minimum flow information in streams and rivers. Whereas these needs dictate the need for additional data in stressed basins, the continued operation and enhancement of stations that provide hydrologic information at unregulated sites is essential for regional hydrologic analysis. Applications like STREAMSTATS would not be possible without stations that provided a relation between partial record or short-term record sites to long-term unregulated stations. In an era of decreased financial resources and increasing demands for hydrologic information in stressed basins, the USGS and its cooperators will be challenged to maintain a balanced network that satisfies all these needs.

High-water discharge measurement made from a boat on the Housatonic River at Great Barrington, Massachusetts (station number—01197500).

Although the streamflow and observation-well network provides needed information on the hydrologic conditions of Massachusetts and Rhode Island, this network is generally viewed as two independent networks, despite the degree of hydraulic connection between ground-water and surface-water resources. It has become increasingly apparent, however, that ground water and surface water need to be managed as a single resource; information about the interconnection of ground and surface water is fundamental for their effective management (Winter and others, 1998). To assist managers in meeting this need, the existing streamflow and ground-water-level data could be analyzed for interactions between ground water and surface water and the influences they exert on each other. The design of future enhancements to the network could be based upon the understanding that surface water and ground water represent a single resource so that all appropriate data are collected for use by water-resource managers.

SUMMARY

Streamflow and ground-water-level data are used for a variety of purposes for water-resources planning and design, hydrologic research, and operation of water-resources projects. This data is routinely collected by the U.S. Geological Survey (USGS), in cooperation with other Federal, State and local government agencies through the operation of a network of 103 streamgage stations and 200 ground-water observation wells in Massachusetts and Rhode Island (active during the 2000 water year). Since continuous streamflow gaging began nearly 100 years ago (1904) on the Connecticut River at Sunderland (moved to Montague City in 1929) in Massachusetts, increases in the number of stations in the network usually followed floods or droughts; these events made clear the importance of this hydrologic information.

The collection, processing, and dissemination of hydrologic data collected by the USGS have continually improved over the century. In the 2000 water year, about 70 percent of streamgage stations and a few, but growing number of observation wells in Massachusetts and Rhode Island, have been equipped with digital collection platforms that transmit data by satellite every 4 hours. Twenty-one of the streamgage stations are also equipped with precipitation recorders. This near real-time data, along with most historical data collected at all stations, are available over the Internet at no charge.

The streamflow-monitoring network was evaluated with respect to several metrics that affect potential uses of the data. These metrics include record length, effects of regulation, distribution by physiographic region, drainage-basin size, physical basin characteristics and combinations of these factors. Collectively, 71 percent of the active stations in Massachusetts and Rhode Island have 30 or more years of record and most of these have more than 50 years of record. Most stations are affected by regulation; although data from stations affected by regulation are useful for specific water management purposes, it diminishes the usefulness of data from these stations for many types of hydrologic analysis. Only 26 of the 103 active streamgage stations operated by the USGS in Massachusetts and Rhode Island are in basins unaffected by regulation; of these, 17 are in Massachusetts and 9 are in Rhode Island. The paucity of stations in unregulated basins is particularly evident when distributed across five drainage-area ranges; there are no unregulated stations in about half of these ranges. This underscores the importance of establishing and maintaining stations that are unaffected by regulation. Streamgage stations in Massachusetts and Rhode Island are mostly in drainage basins in the Coastal Lowlands (48 and 77 percent, respectively); fewer are in drainage basins in the Central Uplands (35 and 23 percent, respectively) and 12 percent are in drainage basins in the Western Highlands (all in Massachusetts). Basin slopes are generally least for stations in the Coastal Lowlands and largest in the Western Highlands; slopes of stations in the Central Uplands are generally about half those of the stations in the Western Highlands and about twice those for stations in the Coastal Lowlands. Coastal Lowlands stations are in drainage basins that are generally more urbanized and underlain by a greater percentage of sand and gravel than stations in drainage basins in the Central Uplands or Western Highlands. Drainage-basin size is typically the single most important explanatory variable in streamflow estimation techniques. Drainage areas range from 0.39 to 8,309 mi^2, but most stations have drainage areas between 10 and 100 mi^2 (55 percent of the stations in Massachusetts and 68 percent of the stations in Rhode Island).

The observation-well network comprises 200 wells; 80 percent of these wells (3 wells) are in sand and gravel, 19 percent are in till, and 1 percent are in bedrock. About 6 percent of the wells are equipped with continuous data recorders and about half of these are capable of transmitting data in near real time. The record length for all observation wells ranged from 6 to 65 years; the median record length is 26 years for wells in mainland Massachusetts, 26 years for Cape Cod and Island wells, and 11 years for Rhode Island wells. The depth of all observation wells below land surface ranges from 10 to 740 ft. The median depth of observation wells is 26 ft for wells finished in sand and gravel, 21 ft for wells finished in till, and 181 ft for wells finished in bedrock. Generally, observation wells on Cape Cod and the Islands are about twice as deep as wells in other areas of the State.

The goal of the USGS streamgage station and observation-well network is to provide relevant and timely hydrologic information to the Nation, its cooperators, and to the public. Cooperator needs evolve as development pressure puts greater strain on limited water resources. Although this often requires additional data in stressed basins caused in part by the effects of regulation, the continued operation and enhancement of stations that provide hydrologic information at unregulated sites is essential for regional hydrologic analysis. In an era of decreased financial resources and increasing demands for hydrologic information in stressed basins, the USGS and its cooperators in Massachusetts and Rhode Island will be challenged to maintain a balanced network that satisfies all needs.

REFERENCES CITED

Brooks, M.H., 2001, Cooperative water program—A partnership in the Nation's water-resources program: U.S. Geological Survey Fact Sheet 128-01, 2 p.

Cunningham, W.L., 2001, Real-time ground-water data for the Nation: U.S. Geological Survey Fact Sheet 090-01, 2 p.

Denny, C.S. 1982, Geomorphology of New England: U.S. Geological Survey Professional Paper 1208, 18 p.

DeSimone, L.A., Steeves, P.A., and Zimmerman, M.J., 2001, Statewide water-quality network for Massachusetts: U.S. Geological Survey Water-Resources Investigations Report 01-4081, 76 p.

Frimpter, M.H., 1981, Probable high ground-water levels in Massachusetts: U.S. Geological Survey, Open-File Report 80-1205, 19 p.

Gadoury, R.A., Smath, J.A., and Fontaine, R.A, 1985, Cost-effectiveness of the U.S. Geological Survey's stream-gaging programs in Massachusetts and Rhode Island: U.S. Geological Survey Water-Resources Investigations Report 84-4097, 78 p.

Granato, G.E., and Smith, K.P., 2002, Robowell—Providing accurate and current water-level and water-quality data in real time for protecting ground-water resources: U.S. Geological Survey Fact Sheet FS-053-02, 6 p.

Grannemann, N.E., 2001, U.S. Geological Survey ground-water resources program, 2001: U.S. Geological Survey Fact Sheet 056-01, 2 p.

Hirsch, R.M, and Norris, M.J., 2001, NSIP Implementation Plan and Progress Report: U.S. Geological Survey Fact Sheet 048-01, 6 p.

Massachusetts Geographic Information System (MassGIS): accessed July 17, 2002, at http://www.state.ma.us/mgis/.

Massachusetts Water Management Act, 1986, General Laws of Massachusetts, Chapter 21g: accessed July 17, 2002, at http://www.state.ma.us/legis/laws/mgl/gl-21G-toc.htm

Executive Office of Environmental Affairs, Massachusetts Watershed Initiative, 1995, accessed July 17, 2002, at http://www.state.ma.us/envir/mwi/watersheds.htm

Massachusetts Department of Environmental Protection, 310 CMR 15.000—The state environmental code, title 5—standard requirements for the siting, construction, inspection, upgrade and expansion of on-site sewage treatment and disposal systems and for the transport and disposal of septage: accessed July 17, 2002, at http://www.state.ma.us/dep/brp/files/310cmr15.PDF

Morlock, S.E., Nguyen, H.T., and Ross, J.H., 2002, Feasibility of acoustic doppler velocity meters for the production of discharge records from U.S. Geological Survey streamflow-gaging stations: U.S. Geological Survey Water-Resources Investigations Report 01-4157, 59 p.

Rhode Island Geographic Information System (RIGIS): accessed July 17, 2002, at http://www.edc.uri.edu/rigis/.

Ries, K.G., III, Steeves, P.A., Freeman, Aleda, and Singh, Raj, 2000, Obtaining streamflow statistics for Massachusetts streams on the World Wide Web: U.S. Geological Survey Fact Sheet 104-00, 4 p.

Slack, J.R., and Landwehr, J.M., 1992, HCDN—A U.S. Geological Survey streamflow data set for the United States for the study of climate variations, 1874–1988: U.S. Geological Survey Open-File Report 92-129, 1 sheet.

Slack, J.R., Lumb, A.M., and Landwehr, J.M., 1994, Hydro-Climatic Data Network (HCDN)—Streamflow Data Set, 1874–1988: U.S. Geological Survey Water-Resources Investigations Report, 93-4076, CD-ROM.

Socolow, R.S., Frimpter, M.H., Turtora, Michael, and Bell R.W., 1994, A technique for estimating ground-water levels at sites in Rhode Island from observation-well data: U.S. Geological Survey Water-Resources Investigations Report, 94-4138, 43 p.

Socolow, R.S., Leighton, C.R., Whitley, J.S., and Ventetuolo, D.J., 2001, Water Resources Data for Massachusetts and Rhode Island, Water Year 2001: U.S. Geological Survey Water Data Report MA-RI-01-1, 328 p.

Taylor, C.J., and Alley, W.M., 2002, Ground water-level-monitoring and the importance of long-term water-level data: U.S. Geological Survey Circular 1217, 68 p.

Thomas, W.O., Jr., and Wahl, K.L., 1993, Summary of the nationwide analysis of the cost effectiveness of the U.S. Geological Survey stream gaging program: U.S. Geological Survey Water-Resources Investigations Report 93-4168, 28 p.

U.S. Geological Survey Collection of Basic Records (CBR): accessed July 17, 2002, at http://water.usgs.gov/ogw/CBR/Guidelns.html

U.S. Geological Survey National Elevation Data: accessed July 17, 2002, at http://gisdata.usgs.net/NED/default.asp

U.S. Geological Survey, 1999, Streamflow information for the next century—A plan for the National Streamflow Information Program of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 99-456, 12 p.

Vogelmann, J.E., Howard, S., Yang, Lynn, Larson, C.R., Wylie, B.K., and Van Driel, Nick, 2001, Completion of the 1990s national land cover data set for the conterminous United States from Landsat thematic mapper data and ancillary data sources: Photogrammetric Engineering and Remote Sensing, p. 650–662.

Wahl, K.L., Thomas, W.O., Jr., and Hirsch, R.M., 1995, Stream-gaging program of the U.S. Geological Survey: U.S. Geological Survey Circular 1123, 22 p.

Wandle, S.W., Jr., 1983, Estimating peak discharge of small rural streams in Massachusetts: U.S. Geological Survey Water-Supply Paper 2214, 26 p.

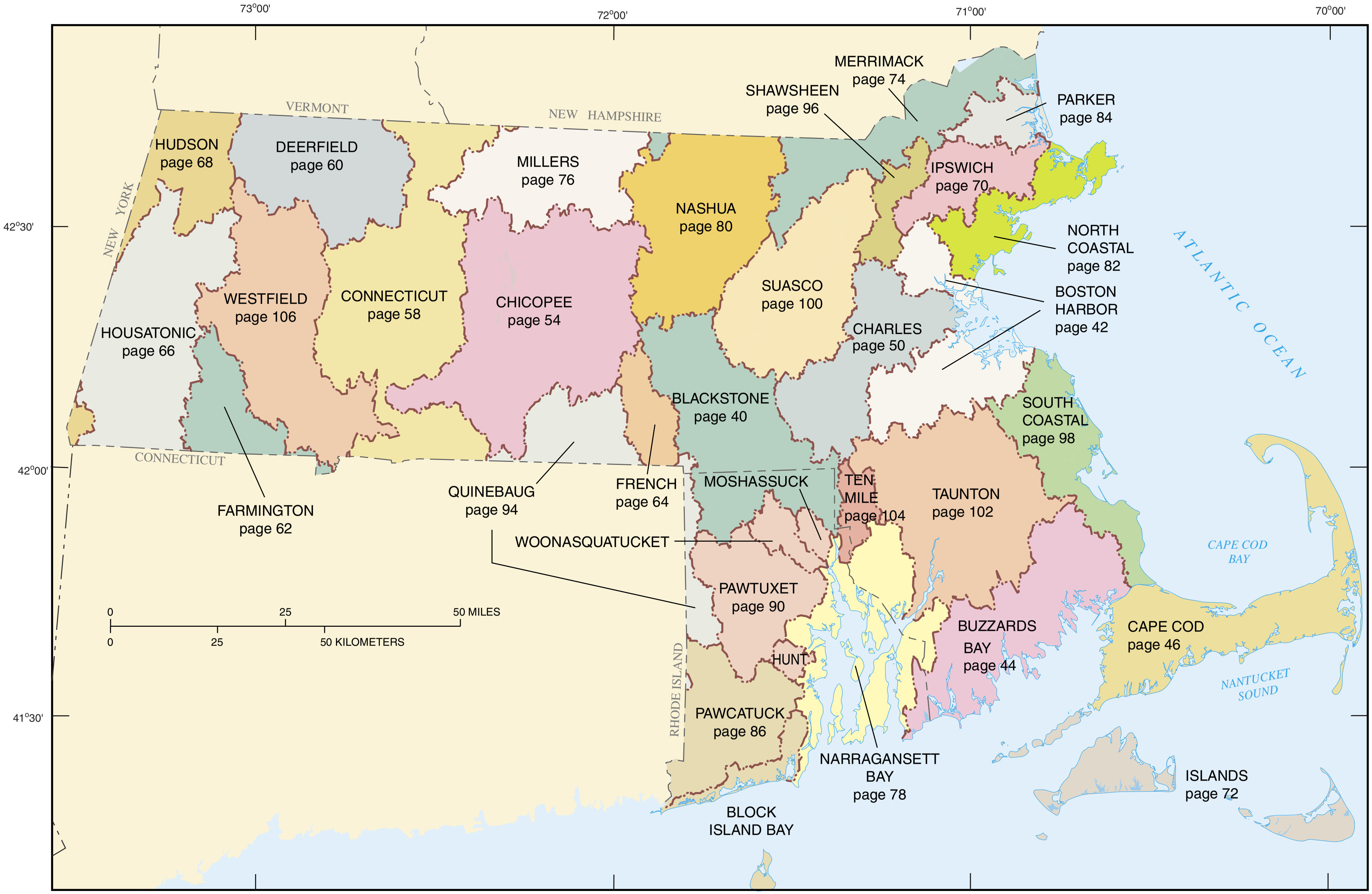
Wandle, W.S., Jr., and Lautzenheiser, R.E., 1991, National water summary 1988–89—floods and droughts—Massachusetts, in Paulson, R.W., Chase, E.B, Roberts, R.S., and Moody, D.W. (comps.), National Water Summary 1988–89, floods and droughts: U.S. Geological Survey Water-Supply Paper 2375, p 327–334.

Winter, T.C., Harvey, J.W., Franke, L.O., and Alley, W.M, 1998, Ground water and surface water a single resource: U.S. Geological Survey Circular 1139, 79 p.

APPENDIX 1: Streamgage Stations, Observation Wells, and Summary Tables by Major Basin in Massachusetts and Rhode Island

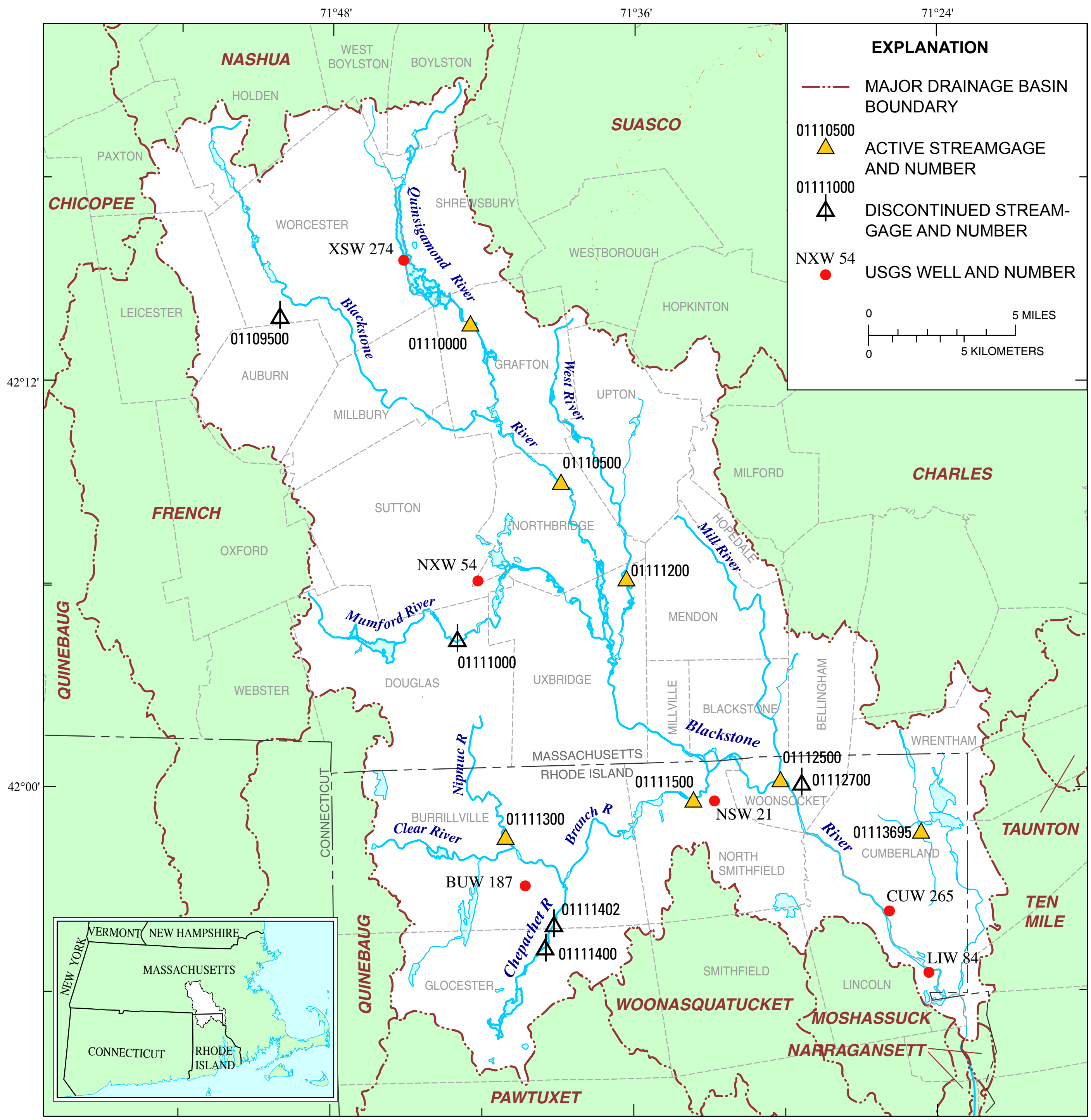
Maps and tables of the streamgage stations and observation-wells are provided in this appendix for each of the 27 Executive Office of Environmental Affairs (EOEA) basins in Massachusetts and five major basins in Rhode Island. Basin maps are arranged in alphabetical order. Each map includes information on: (1) major basin boundaries, (2) town boundaries, (3) location of active continuous-record streamgage stations during the 2000 water year, (4) location of active observation wells during the 2000 water year, (5) location of discontinued continuous-record streamgage stations, and (6) stations where water-quality samples have been collected. Each map is accompanied by three tables for (1) active streamgage stations, (2) discontinued streamgage stations, and (3) active observation wells. Tables for active streamgage stations within each basin include the USGS station identification number and name, first year of record and total years of record, regulation code, drainage area at the station, physiographic region code, and physical characteristics of the gaged basin. Tables for discontinued streamgage stations include station number and name, first and last year of record and total years of record, regulation (if known), drainage area, and physiographic region. Tables for observation wells include local well number and town location, first year of record and number of years of record, well depth, the type of material geologic material the well is finished in, the frequency of water-level measurements, and remarks.

INDEX TO DETAILED BASIN MAPS



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

BLACKSTONE RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

BLACKSTONE RIVER DRAINAGE BASIN

Table 1.1A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 3, all flows; 4 variable flows. **Region code**: CL, Coastal Lowlands; CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drain-age area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01110000	Quinsigamond River at North Grafton, MA	1939	62	1	25.6	CU	487	5.8	5.6	2.4	38	28	3.0	23	39
01110500	Blackstone River at Northbridge, MA	1939	62	1	139	CU	589	6.5	4.1	1.8	46	22	6.1	20	25
01111200	West River below West Hill Dam near Uxbridge, MA[1]	1962	29	3	27.9	CU	404	6.2	.9	6.3	72	1.3	8.6	11	25
01111300	Nipmuc River near Harrisville, RI	1964	37	4	16	CU	531	4.8	.5	3.6	83	1.4	3.9	7.6	.5
01111500	Branch River at Forrestdale, RI	1940	61	1	91.2	CL	495	5.8	5.8	4.6	67	4.1	4.5	14	5.8
01112500	Blackstone River at Woonsocket, RI	1929	72	3	416	CL	484	6.0	4.0	3.4	58	10	6.6	18	4
01113695	Catamint Brook at Cumberland, RI	2000	1	0	3.55	CL	296	7.3	2.4	3.3	53	4.6	8.7	28	2.4

[1]Not published since 1990

Table 1.1B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** CU, Central Uplands. mi^2, square miles]

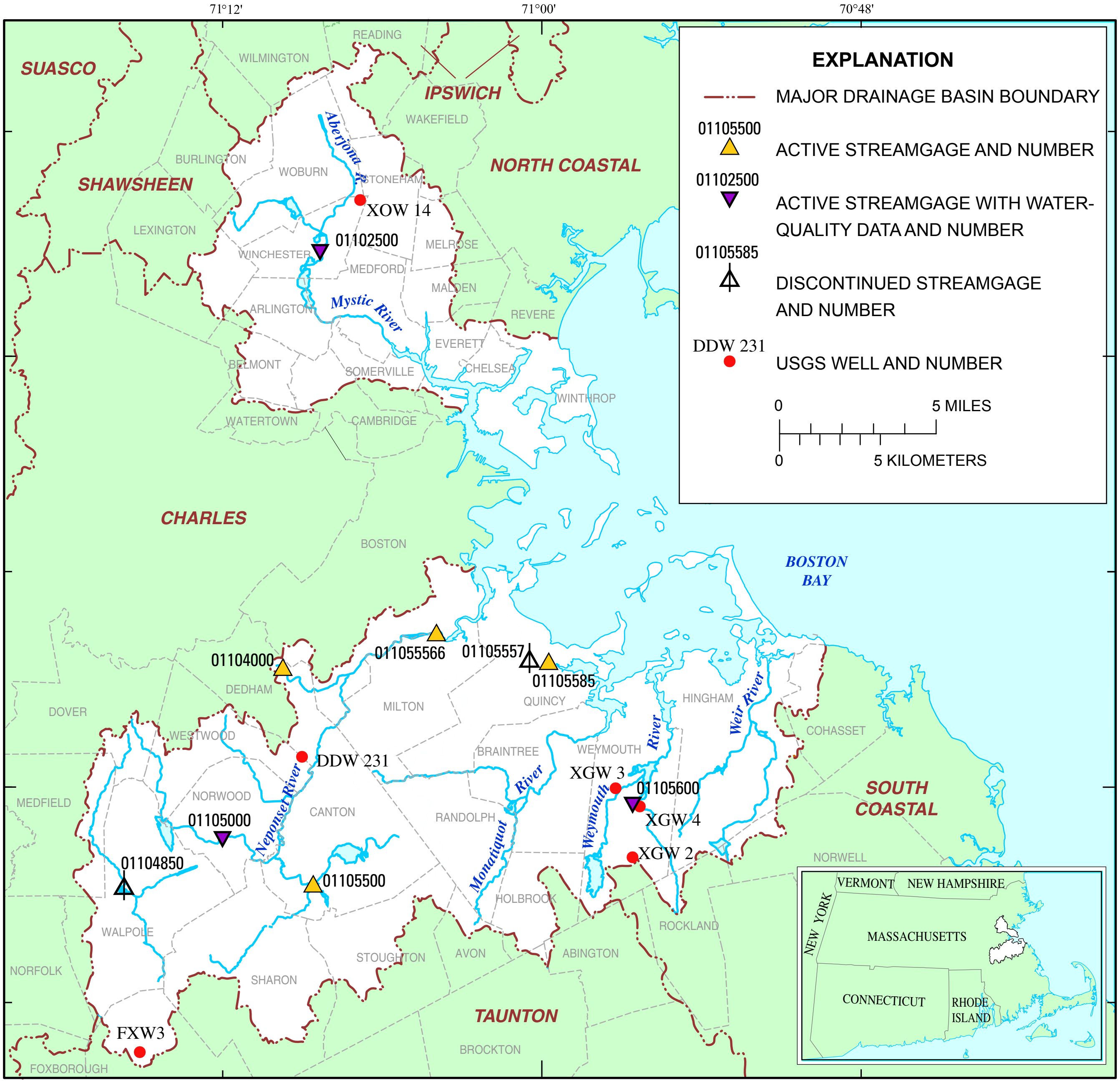
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01109500	Kettle Brook at Worcester, MA	1923	1978	56	3	31.6	CU
01111000	Mumford River at East Douglas, MA	1939	1951	13	unknown	29.1	CU
01111400	Chepachet River at Chepachet, RI	1965	1973	9	1	17.4	CU
01111402	Chepachet River at Gazzaville, RI	1973	1975	3	1	18.3	CU
01112700	Blackstone River Tributary at Woonsocket, RI	1965	1974	10	0	2.31	CU

Table 1.1C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
BUW 187	Burrillville, RI	1968	33	20	S&G	Monthly	
CUW 265	Cumberland, RI	1946	55	20	S&G	Monthly	
LIW 84	Lincoln, RI	1946	55	107	S&G	Monthly	Affected by Blackstone River at high-water levels
NSW 21	North Smithfield, RI	1947	54	16	S&G	Monthly	Affected by pumping, 1947-80
NXW 54	Northbridge, MA	1984	17	12	S&G	Monthly	
XSW 274	Worcester, MA	1965	36	55	S&G	Monthly	Affected by Lake Quinsigamond stage

BOSTON HARBOR DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

BOSTON HARBOR DRAINAGE BASIN

Table 1.2A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only; 3, all flows; 4, variable flows. **Region code:** CL, Coastal Lowlands. mi^2, square miles; --, not applicable]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01102500	Aberjona River (head of Mystic River) at Winchester, MA	1939	62	3	24.1	CL	118	4.9	2.1	1.9	18	24	2.0	52	44
01104000	Mother Brook at Dedham, MA	1931	70	3	diversion	CL	--	--	--	--	--	--	--	--	--
01105000	Neponset River at Norwood, MA	1939	62	1	34.7	CL	215	4.1	4.0	6.5	43	8.2	4.3	34	57
01105500	East Branch Neponset River at Canton, MA	1952	49	1	27.2	CL	214	3.4	5.1	6.3	38	11	1.6	38	61
011055566	Neponset River at Milton Village, MA	1996	5	4	101	CL	177	3.8	3.7	6.6	35	16	2.7	36	52
01105585	Town Brook at Diversion Tunnel at Quincy, MA	1999	2	2	4.11	CL	98	5.7	1.2	.6	19	67	.2	12	33
01105600	Old Swamp River near South Weymouth, MA	1966	35	1	4.5	CL	140	2.6	0	5.8	42	20	.4	32	27

Table 1.2B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01104850	Mine Brook at Walpole, MA	1967	1968	2	0	6.00	CL
01105557	Furnace Brook at Quincy, MA	1973	1980	8	0	3.81	CL

Table 1.2C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
DDW 231	Dedham, MA	1965	36	22	Till	Monthly	
FXW 3	Foxboro, MA	1965	36	32	S&G	Monthly	
XGW 2	Weymouth, MA	1965	36	30	Till	Monthly	
XGW 3	Weymouth, MA	1965	36	22	S&G	Monthly	Affected by pumping
XGW 4	Weymouth, MA	1965	36	23	S&G	Monthly	
XOW 14	Winchester, MA	1940	61	17	Till	Monthly	

BUZZARDS BAY DRAINAGE BASIN

Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

BUZZARDS BAY DRAINAGE BASIN

Table 1.3A. Continuous streamgage station active during the 2000 water year

[**Regulation code:** 0, none. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drain-age area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01105933	Paskamanset River near South Dartmouth, MA	1995	6	0	26.2	CL	96	2.3	0.8	21	60	12	6.2	0	41

Table 1.3B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01105885	Red Brook below Route 25 near Wareham, MA	1981	1986	6	0	9.14	CL
01105895	Weweantic River at South Wareham, MA	1970	1971	2	1	56.1	CL
01106000	Adamsville Brook at Adamsville, RI	1941	[1]1978	39	0	8.01	CL

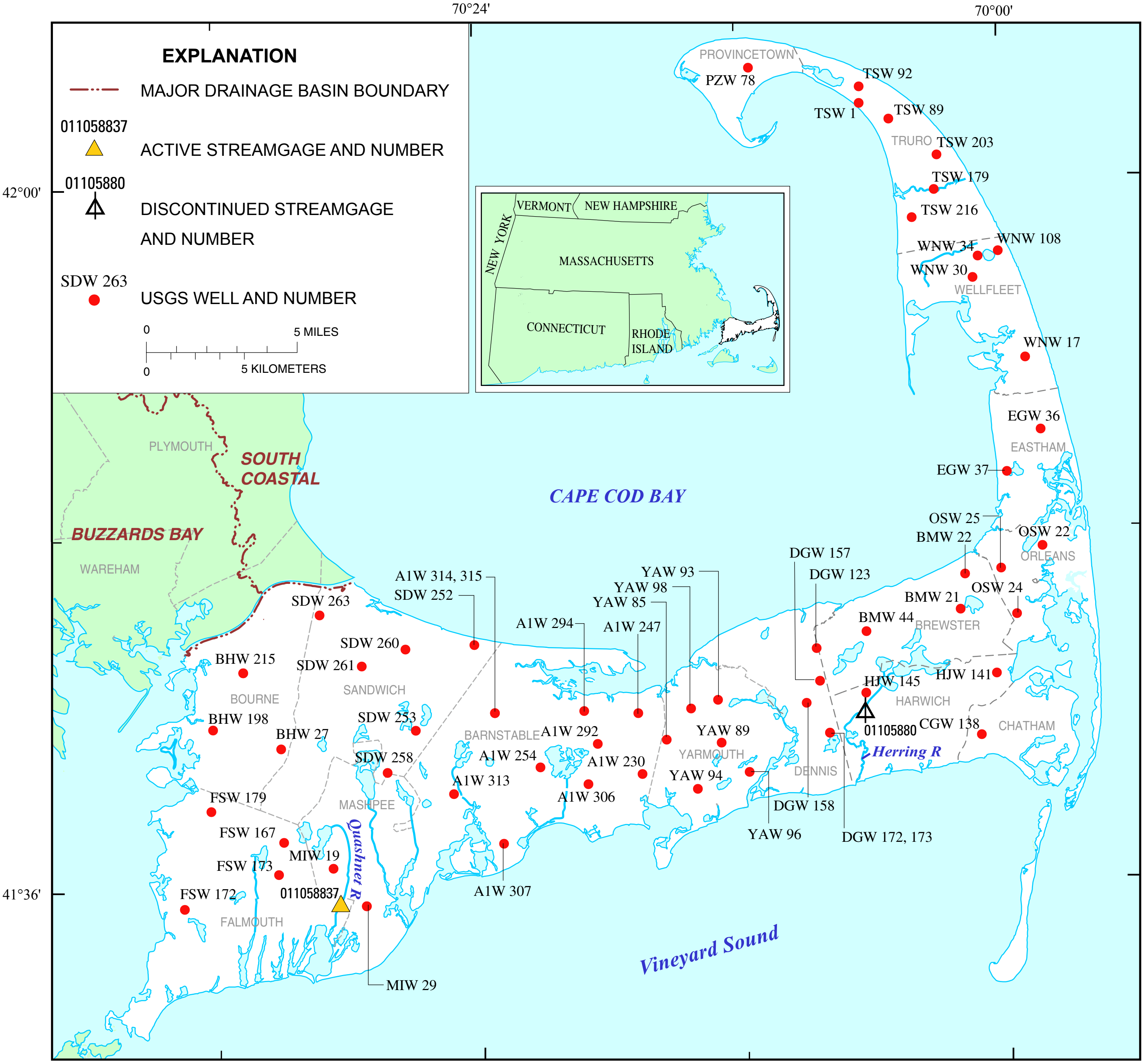
[1]Restarted and ended in 1987

Table 1.3C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
NGW 116	New Bedford, MA	1964	37	27	S&G	Monthly	
PWW 22	Plymouth, MA	1956	45	40	S&G	Monthly	
PWW 494	Plymouth, MA	1985	16	47	S&G	Monthly	
TIW 274	Tiverton, RI	1990	11	13	Till	Monthly	
WFW 51	Wareham, MA	1959	42	12	S&G	Monthly	

CAPE COD DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

CAPE COD DRAINAGE BASIN

Table 1.4A. Continuous streamgage station active during the 2000 water year

[**Regulation code**: 4 variable flows. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regulation code	Drainage area (mi^2)	Region code	Mean elevation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wetland	Forest	Urban	Agriculture	Other	Sand and gravel
011058837	Quashnet River at Waquoit Village, MA	1988	13	4	[1]5.64	CL	68	2.9	10	3.9	54	10	1.6	20.5	100
					[2]4.20		69	3.2	.3	.5	68	8.2	1.8	21.2	100

[1]Surface-water divide.

[2]Ground-water divide (72 percent area in common with the surface-water divide).

Table 1.4B. Discontinued continuous streamgage station

[**Regulation code:** 1, low flow only. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01105880	Herring River at North Harwich, MA	1966	1988	23	1	9.4	CL

Table 1.4C. Observation wells active in the 2000 water year

[Material: S&G, sand and gravel. NWIS, National Water Information System]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
A1W 230	Barnstable, MA	1958	43	36	S&G	Monthly	Published in monthly and annual reports
A1W 247	Barnstable, MA	1962	39	52	S&G	Monthly	Published in monthly and annual reports
A1W 2541	Barnstable, MA	1975	26	40	S&G	Bimonthly	
A1W 2921	Barnstable, MA	1975	26	51	S&G	Bimonthly	
A1W 2941	Barnstable, MA	1975	26	60	S&G	Bimonthly	
A1W 3061	Barnstable, MA	1975	26	33	S&G	Monthly	
A1W 3071	Barnstable, MA	1975	26	36	S&G	Bimonthly	
A1W 3131	Barnstable, MA	1975	26	63	S&G	Bimonthly	
A1W 3141	Barnstable, MA	1976	25	192	S&G	Bimonthly	
A1W 3151	Barnstable, MA	1976	25	75	S&G	Bimonthly	

Table 1.4C. Observation wells active in the 2000 water year—Continued

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
BHW 27[1]	Bourne, MA	1976	25	100	S&G	Bimonthly	
BHW 198	Bourne, MA	1962	39	50	S&G	Monthly	Published in monthly and annual reports
BHW 215[1]	Bourne, MA	1975	26	83	S&G	Bimonthly	
BMW 21	Brewster, MA	1962	39	25	S&G	Monthly	Published in monthly and annual reports
BMW 22	Brewster, MA	1962	39	52	S&G	Hourly	Telemetered; published in monthly and annual reports
BMW 44[1]	Brewster, MA	1975	26	73	S&G	Bimonthly	
CGW 138	Chatham, MA	1962	39	44	S&G	Monthly	Published in monthly and annual reports
DGW 123[1]	Dennis, MA	1975	26	58	S&G	Monthly	
DGW 157[1]	Dennis, MA	1975	26	48	S&G	Bimonthly	
DGW 158[1]	Dennis, MA	1975	26	58	S&G	Bimonthly	
DGW 172[1]	Dennis, MA	1976	25	294	S&G	Bimonthly	
DGW 173[1]	Dennis, MA	1976	25	172	S&G	Bimonthly	
EGW 36[1]	Eastham, MA	1975	26	62	S&G	Monthly	
EGW 37[1]	Eastham, MA	1975	26	27	S&G	Bimonthly	
FSW 167[1]	Falmouth, MA	1975	26	55	S&G	Monthly	
FSW 172[1]	Falmouth, MA	1975	26	73	S&G	Bimonthly	
FSW 173[1]	Falmouth, MA	1975	26	69	S&G	Bimonthly	
FSW 179[1]	Falmouth, MA	1975	26	52	S&G	Bimonthly	
HJW 141[1]	Harwich, MA	1975	26	75	S&G	Bimonthly	
HJW 145[1]	Harwich, MA	1975	26	45	S&G	Monthly	
MIW 19[1]	Mashpee, MA	1975	26	46	S&G	Bimonthly	
MIW 29	Mashpee, MA	1976	25	40	S&G	Monthly	Published in monthly and annual reports
OSW 22[1]	Orleans, MA	1975	26	52	S&G	Bimonthly	
OSW 24[1]	Orleans, MA	1975	26	68	S&G	Bimonthly	
OSW 25[1]	Orleans, MA	1975	26	78	S&G	Bimonthly	
PZW 78[1]	Provincetown, MA	1975	26	40	S&G	Bimonthly	
SDW 252	Sandwich, MA	1962	39	57	S&G	Monthly	Published in monthly and annual reports
SDW 253	Sandwich, MA	1962	39	70	S&G	Monthly	Published in monthly and annual reports
SDW 258[1]	Sandwich, MA	1975	26	84	S&G	Bimonthly	
SDW 260[1]	Sandwich, MA	1975	26	90	S&G	Bimonthly	

Table 1.4C. Observation wells active in the 2000 water year—Continued

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
SDW161[1]	Sandwich MA	1975	26	160	S&G	Bimonthly	
SDW 263[1]	Sandwich, MA	1975	26	111	S&G	Monthly	
TSW 1	Truro, MA	1950	51	68	S&G	Monthly	Affected by pumping, published in monthly and annual reports
TSW 89	Truro, MA	1962	39	22	S&G	Monthly	Published in monthly and annual reports
TSW 92[1]	Truro, MA	1972	29	64	S&G	Bimonthly	
TSW 179[1]	Truro, MA	1973	28	10	S&G	Bimonthly	
TSW 203[1]	Truro, MA	1973	28	35	S&G	Bimonthly	
TSW 216[1]	Truro, MA	1975	26	101	S&G	Bimonthly	
WNW 17	Wellfleet, MA	1962	39	42	S&G	Monthly	Published in monthly and annual reports
WNW 30[1]	Wellfleet, MA	1975	26	83	S&G	Bimonthly	
WNW 34[1]	Wellfleet, MA	1975	26	55	S&G	Monthly	
WNW 108[1]	Wellfleet, MA	1978	23	37	S&G	Monthly	
YAW 85[1]	Yarmouth, MA	1975	26	60	S&G	Bimonthly	
YAW 89[1]	Yarmouth, MA	1975	26	24	S&G	Monthly	
YAW 93[1]	Yarmouth, MA	1975	26	52	S&G	Bimonthly	
YAW 94[1]	Yarmouth, MA	1975	26	26	S&G	Bimonthly	
YAW 96[1]	Yarmouth, MA	1975	26	27	S&G	Bimonthly	
YAW 98[1]	Yarmouth, MA	1975	26	85	S&G	Bimonthly	

1Water-level measurements are stored in the NWIS database, but are not published in the annual data reports.

CHARLES RIVER DRAINAGE BASIN

Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

CHARLES RIVER DRAINAGE BASIN

Table 1.5A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 3, all flows. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drain-age area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (per-cent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01103280	Charles River at Medway, MA	1997	4	0	65.7	CL	287	4.1	1.5	5.1	51	9.6	4.8	28	37
01103500	Charles River at Dover, MA	1937	64	0	183	CL	225	4.4	2.3	7.1	47	6.4	6.2	31	46
01104200	Charles River at Wellesley, MA	1959	42	3	211	CL	215	4.4	2.5	7.0	45	10	5.5	30	47
01104430	Hobbs Brook below Cambridge Reservoir near Kendall Green, MA	1997	4	3	6.86	CL	214	4.9	14	4.9	42	18	3.2	18	31
01104480	Stony Brook Reservoir at Dam near Waltham, MA	1999	2	3	23.7	CL	198	5.5	6.6	4.9	40	10	5.5	33	45
01104500	Charles River at Waltham, MA	1931	70	3	227	CL	208	4.5	3.2	6.5	43	11	5.3	31	48
01104615	Charles River above Watertown Dam at Watertown, MA	1999	2	3	271	CL	204	4.6	2.9	6.1	41	14	5.0	31	47

Table 1.5B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 3, all flows. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

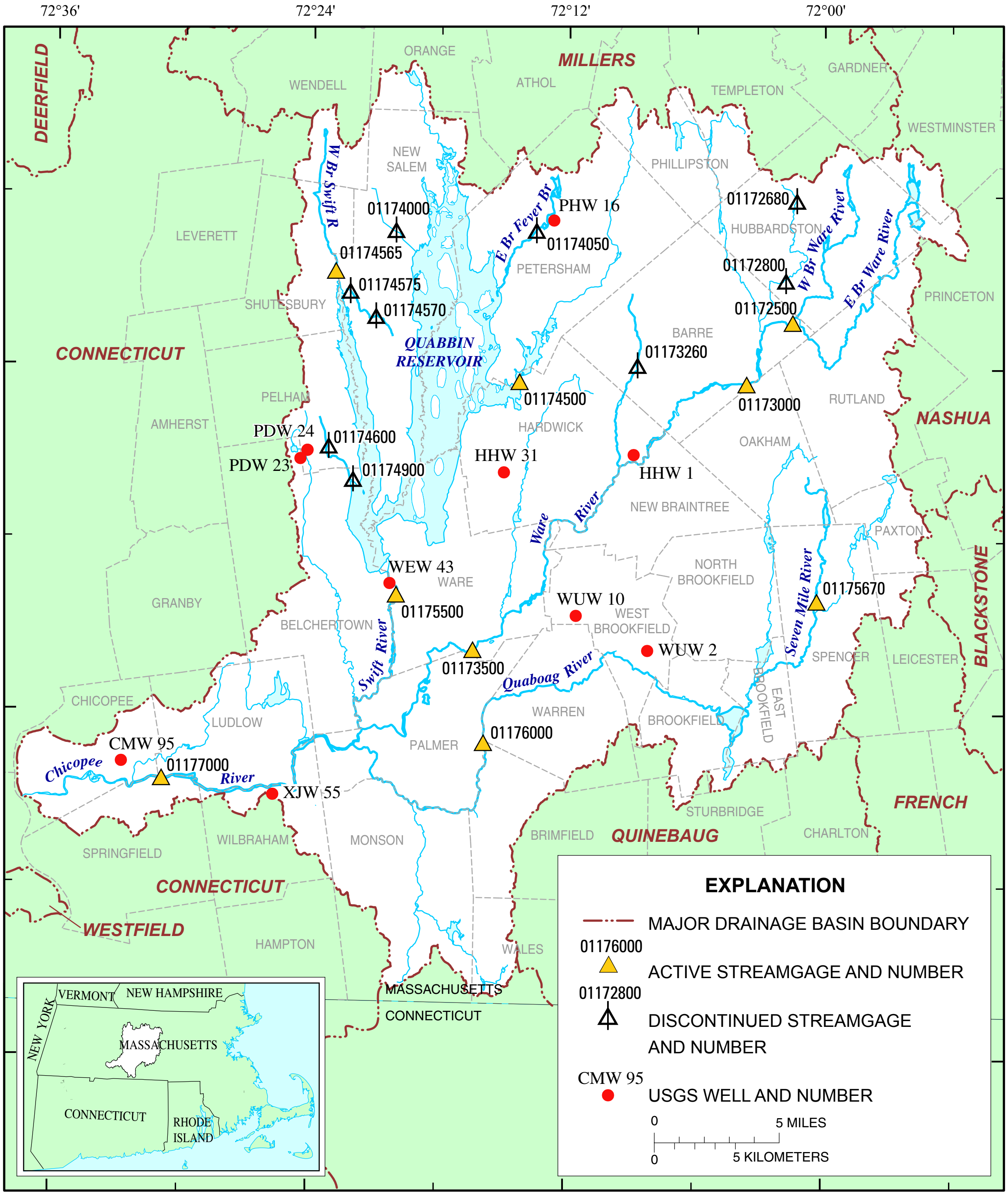
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01103305	Charles River near Millis, MA	1974	1980	7	0	84	CL
01104405	Hobbs Brook at Mill Steet near Lincoln, MA	1998	1999	2	0	2.16	CL
01104410	Cambridge Reservoir, Unnamed Tributary 1, near Lexington, MA	1998	1999	2	0	.35	CL
01104415	Cambridge Reservoir, Unnamed Tributary 2, near Lexington, MA	1998	1999	2	0	.41	CL
01104420	Cambridge Reservoir, Unnamed Tributary 3, near Lexington, MA	1998	1999	2	0	.73	CL
01104440	Hobbs Brook at Kendal Green, MA	1998	1999	2	3	8.47	CL
01104455	Stony Brook, Unnamed Tributary 1, near Waltham, MA	1998	1999	2	0	.48	CL
01104460	Stony Brook at Route 20 at Waltham, MA	1998	1999	2	0	22	CL

Table 1.5C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
DVW 10	Dover, MA	1965	36	54	S&G	Monthly	
LTW 104	Lexington, MA	1965	36	21	S&G	Monthly	
NNW 27	Norfolk, MA	1965	36	18	S&G	Hourly	Telemetered

CHICOPEE RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

CHICOPEE RIVER DRAINAGE BASIN

Table 1.6A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01172500	Ware River near Barre, MA	1946	55	3	55.1	CU	999	6.2	4.4	5.7	81	0.4	5.1	3.4	15
01173000	Ware River at Intake Works near Barre, MA	1928	73	3	96.3	CU	977	6.5	3.1	5.3	84	.3	5.2	2.1	18
01173500	Ware River at Gibbs Crossing, MA	1912	89	3	197	CU	885	7.4	2.1	4.7	77	.9	11	4.3	19
01174500	East Branch Swift River near Hardwick, MA	1937	64	0	43.7	CU	926	8.0	3.0	3.6	85	.3	5.7	2.4	14
01174565	West Branch Swift River near Shutesbury, MA	1983	18	0	12.6	CU	947	11	.7	.4	96	0	1.1	1.8	16
01175500	Swift River at West Ware, MA	1940	61	3	189	CU	776	8.3	21	1.6	73	.1	2.1	2.2	11
01175670	Sevenmile River near Spencer, MA	1960	41	1	8.81	CU	871	7.4	2.3	3.7	73	.2	14	6.8	13
01176000	Quaboag River at West Brimfield, MA	1912	89	1	150	CU	808	7.5	3.3	5.5	67	1.8	15	7.4	21
01177000	Chicopee River at Indian Orchard, MA	1928	73	3	689	CU	770	7.8	7.5	3.6	73	1.4	9.2	5.3	21

Table 1.6B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CU, Central Uplands. mi^2, square miles]

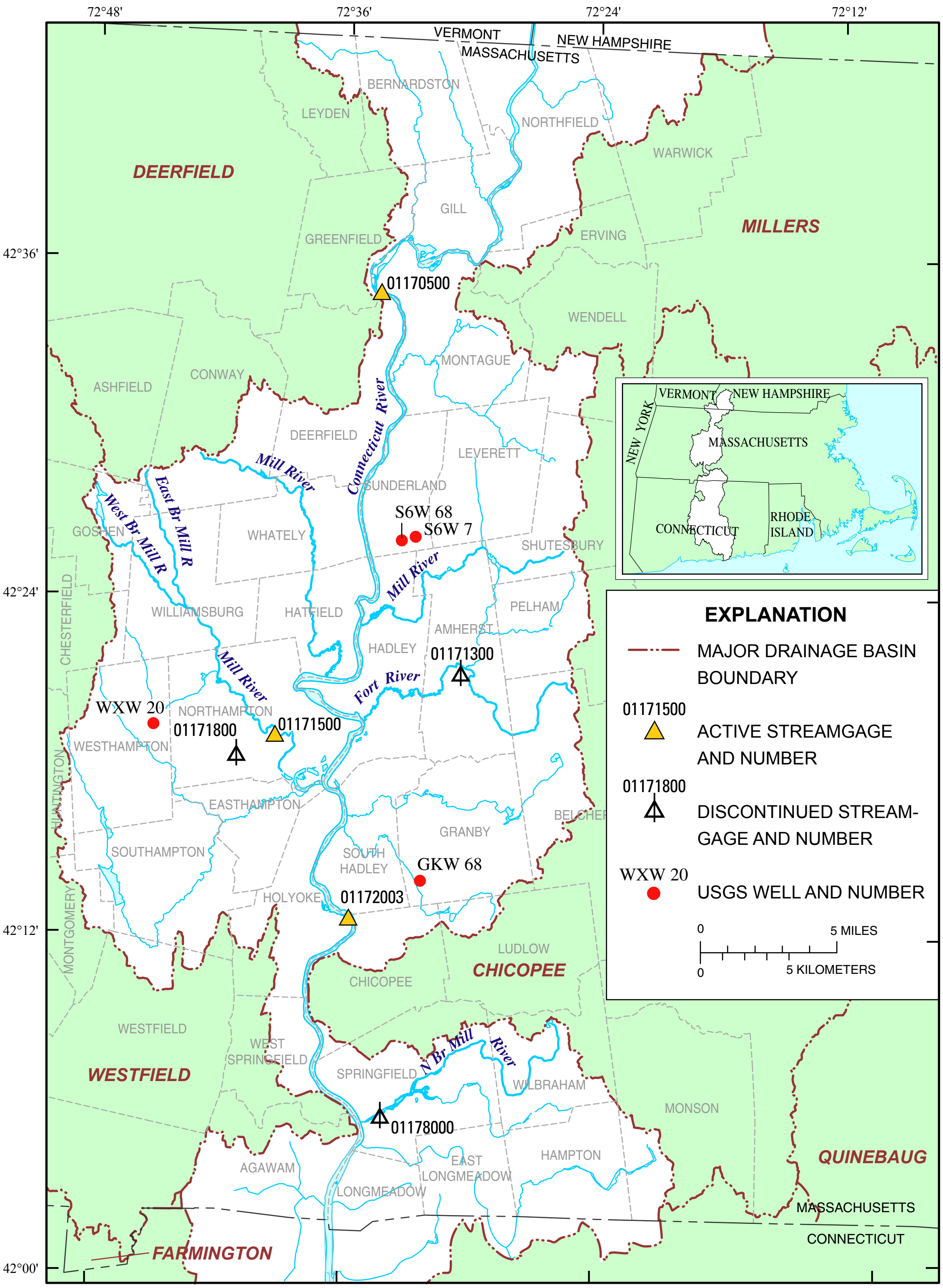
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01172680	Natty Pond Brook at Templeton Rd near Hubbardston, MA	1985	1988	4	0	1.63	CU
01172800	Natty Pond Brook near Hubbardston, MA	1985	1988	4	0	5.48	CU
01173260	Moose Brook near Barre, MA	1963	1974	12	0	4.63	CU
01174000	Hop Brook near New Salem, MA	1947	1982	36	0	3.39	CU
01174050	East Branch Fever Brook near Petersham, MA	1984	1985	2	0	4.85	CU
01174570	Dickey Brook near Cooleyville, MA	1985	1989	5	0	1.19	CU
01174575	Dickey Brook Tributary near Cooleyville, MA	1985	1989	5	0	1.06	CU
01174600	Cadwell Creek near Pelham, MA	1962	1994	33	0	.6	CU
01174900	Cadwell Creek near Belchertown, MA	1961	1997	37	0	2.55	CU

Table 1.6C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
CMW 95	Chicopee, MA	1984	17	34	S&G	Monthly	
HHW 1	Hardwick, MA	1965	36	33	S&G	Monthly	
HHW 31	Hardwick, MA	1984	17	71	S&G	Monthly	
PDW 23	Pelham, MA	1982	19	740	Bedrock	Hourly	Telemetered; Affected by earth, tide, and pumping
PDW 24	Pelham, MA	1984	17	25	S&G	Monthly	
PHW 16	Petersham, MA	1984	17	39	Till	Monthly	
WEW 43	Ware, MA	1965	36	27	S&G	Monthly	Affected by Swift River stage
WUW 2	West Brookfield, MA	1959	42	43	S&G	Monthly	
WUW 10	West Brookfield, MA	1970	31	64	Bedrock	Monthly	
XJW 55	Wilbraham, MA	1965	36	62	S&G	Monthly	

CONNECTICUT RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

CONNECTICUT RIVER DRAINAGE BASIN

Table 1.7A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only; 3, all flows. **Region code:** WH, Western Highlands; na, none assigned. mi^2, square miles; --, not determined]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean elevation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01170500	Connecticut River at Montague City, MA	1904	97	3	7,860	na	--	--	--	--	--	--	--	--	--
01171500	Mill River at Northampton, MA	1938	63	1	54	WH	841	11.1	1.0	0.9	81	3.1	6.8	7.2	16
01172003	Connecticut River below Holyoke Dam at Holyoke, MA	1983	18	3	8,309	na	--	--	--	--	--	--	--	--	--

Table 1.7B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CU, Central Uplands; WH, Western Highlands. mi^2, square miles]

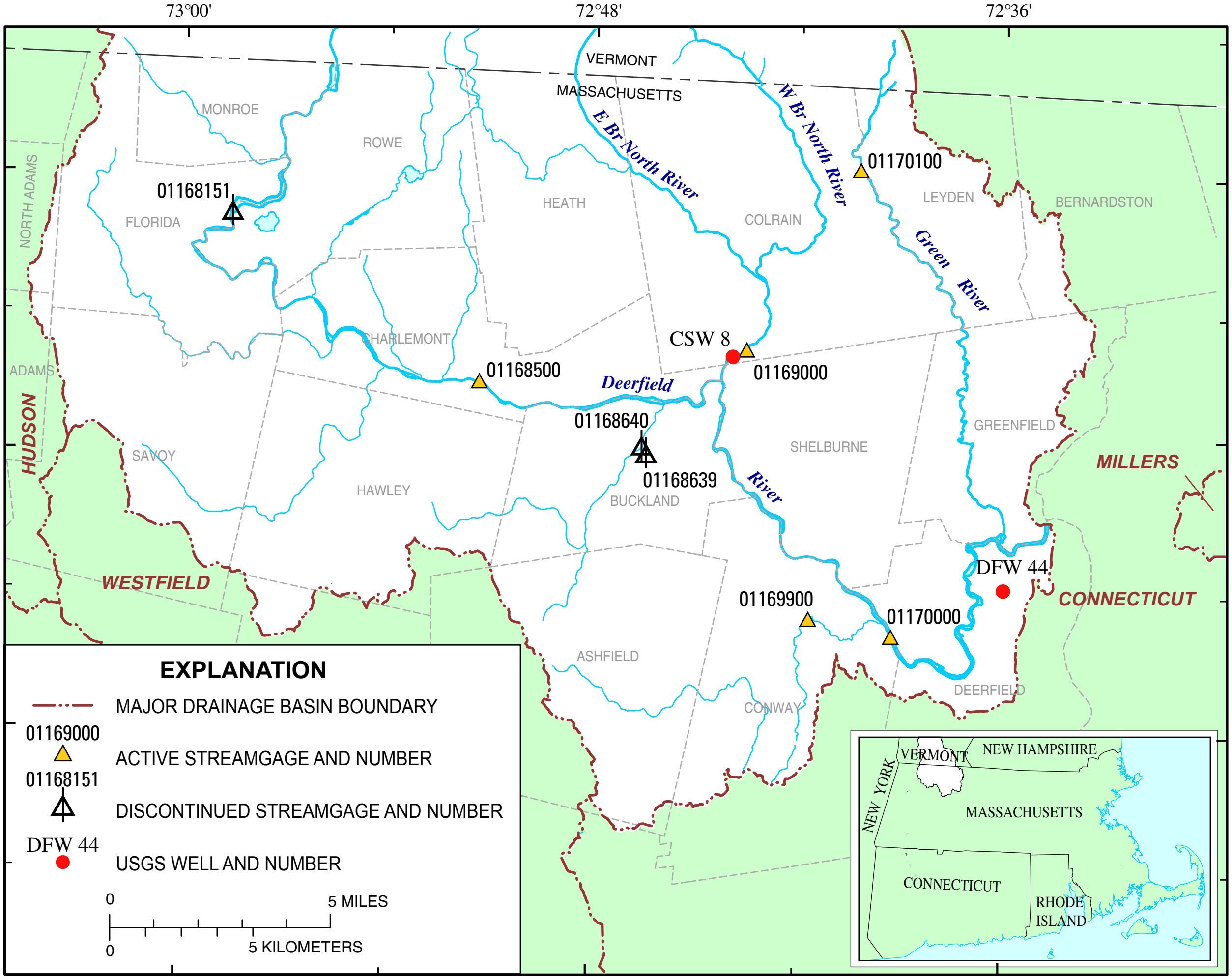
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01171300	Fort River near Amherst, MA	1966	1996	31	0	41.5	CU
01171800	Bassett Brook near Northampton, MA	1963	1974	12	0	5.56	WH
01178000	Mill River at Springfield, MA	1939	1951	13	unknown	33.2	CU

Table 1.7C. Observation wells active in the 2000 water year

[Material: S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
GKW 68	Granby, MA	1954	47	18	S&G	Monthly	
S6W 7	Sunderland, MA	1957	44	54	S&G	Monthly	Affected by pumping and Russellville Brook stage
S6W 68	Sunderland, MA	1983	18	28	S&G	Monthly	
WXW 20	Westhampton, MA	1986	15	42	S&G	Monthly	

DEERFIELD RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991, Lambert conformal conic projection. NAD 83

DEERFIELD RIVER DRAINAGE BASIN

Table 1.8A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** CU, Central Uplands. mi², square miles]

Station number	Station name	Record		Regu- lation code	Drainage area (mi²)	Region code	Mean el- evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet- land	Forest	Urban	Agri- culture	Other	Sand and gravel
01168500	Deerfield River at Charlemon, MA	1913	88	3	361	CU	1,948	15.3	2.4	0.8	90	0.5	3.4	2.9	3.4
01169000	North River at Shattuckville, MA	1939	62	1	89	CU	1,425	14.4	.4	.6	86	.3	10	2.7	5.9
01169900	South River near Conway, MA	1966	35	0	24.1	CU	1,126	14.5	.4	.3	78	.3	15	6.0	13
01170000	Deerfield River near West Deerfield, MA	1940	61	3	557	CU	1,686	15.3	1.8	.6	87	.5	6.5	3.6	5.80
01170100	Green River near Colrain, MA	1967	34	0	41.4	CU	1,352	16.4	.5	.5	91	.1	5.6	2.3	.5

Table 1.8B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 3, all flows. **Region code:** CU, Central Uplands. mi², square miles]

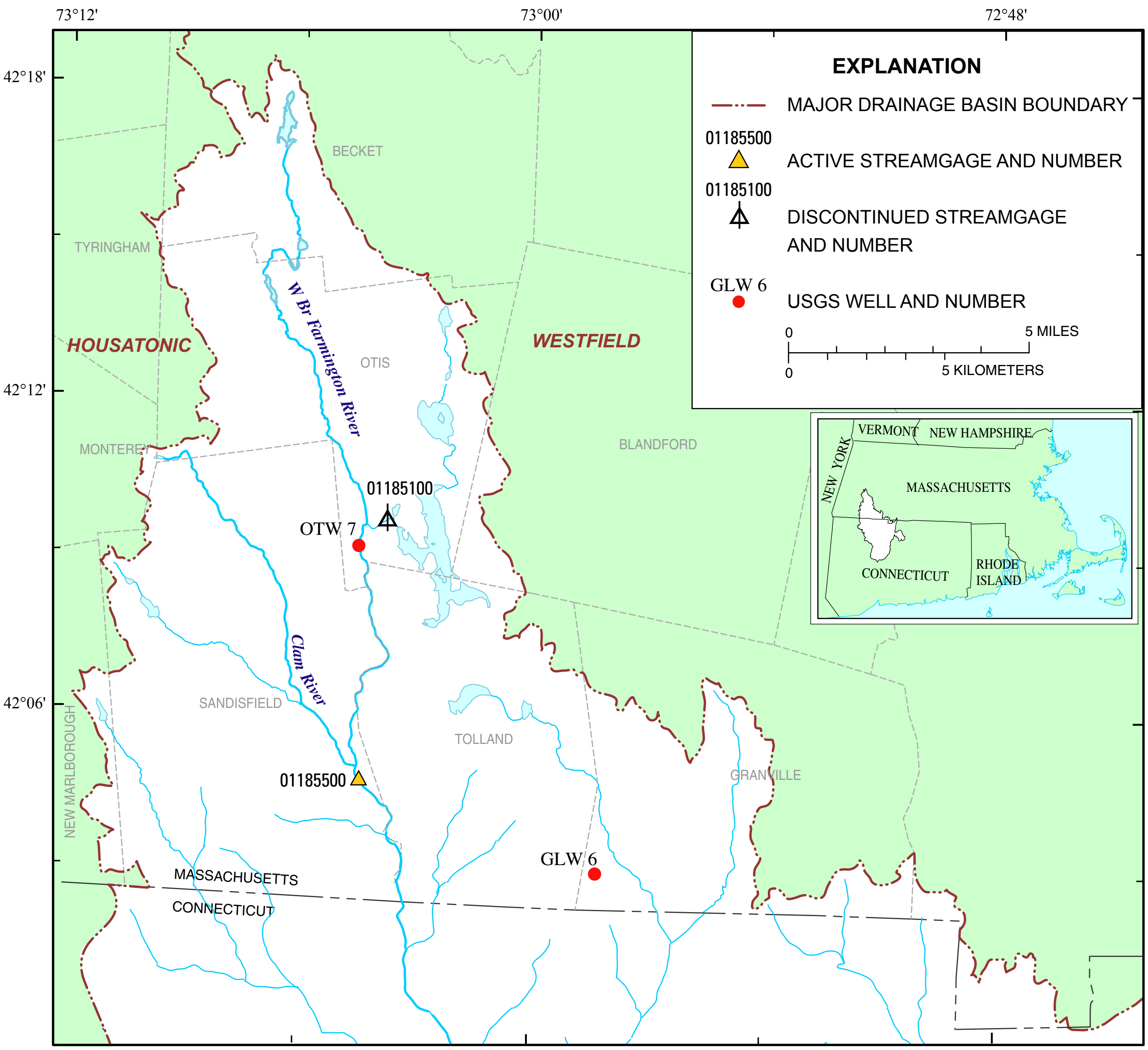
Station number	Station name	Record		Years	Regulation code	Drainage area (mi²)	Region code
		Begin	End				
01168151	Deerfield River near Rowe, MA	1974	1997	24	3	254	CU
01168639	Unnamed Channel to Wilder Brook at Buckland, MA	1993	1995	3	0	.01	CU
01168640	Wilder Brook at Buckland, MA	1993	1995	3	0	.07	CU

Table 1.8C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
CSW 8	Colrain, MA	1965	36	32	S&G	Monthly	Affected by North River stage
DFW 44	Deerfield, MA	1965	36	28	S&G	Monthly	

FARMINGTON RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

FARMINGTON RIVER DRAINAGE BASIN

Table 1.9A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 3, all flows. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01185500	West Branch Farmington River near New Boston, MA	1913	88	3	91.7	WH	1,475	9.3	4.8	4.2	85	0.7	2.2	3.1	4.2

Table 1.9B. Discontinued continuous streamgage stations

[**Regulation code:** 3, all flows. **Region code:** WH, Western Highlands. mi^2, square miles]

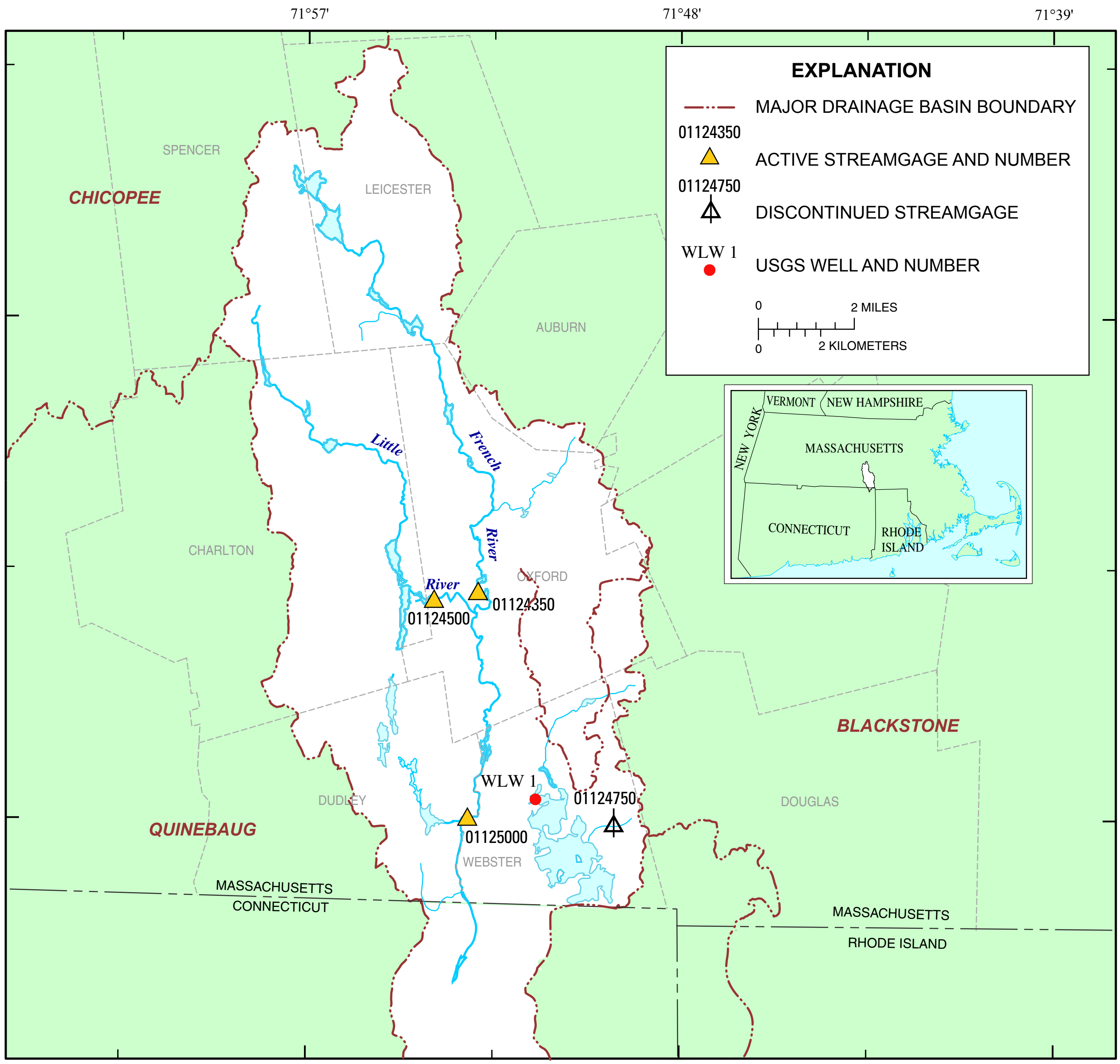
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01185100	Fall River below Otis Reservoir, near Otis, MA	1969	1982	14	3	16.5	WH

Table 1.9C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
GLW 6	Granville, MA	1965	36	21	S&G	Monthly	Affected by Halfway Brook stage
OTW 7	Otis, MA	1965	36	18	S&G	Monthly	Affected by Minor Brook stage

FRENCH RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

FRENCH RIVER DRAINAGE BASIN

Table 1.10A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 3, all flows. **Region code:** CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01124350	French River below Hodges Village Dam at Hodges Village, MA[1]	1962	39	3	31.2	CU	806	6.0	4.6	6.4	65	4.3	8.6	11	12
01124500	Little River near Oxford, MA[1]	1939	62	3	27.4	CU	722	6.5	4.9	6.3	73	1.9	10	3.9	9.4
01125000	French River at Webster, MA[1]	1949	52	3	86	CU	711	6.0	6.5	5.8	64	6.3	8.4	9.0	20

[1]Not published since 1990.

Table 1.10B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CU, Central Uplands. mi^2, square miles]

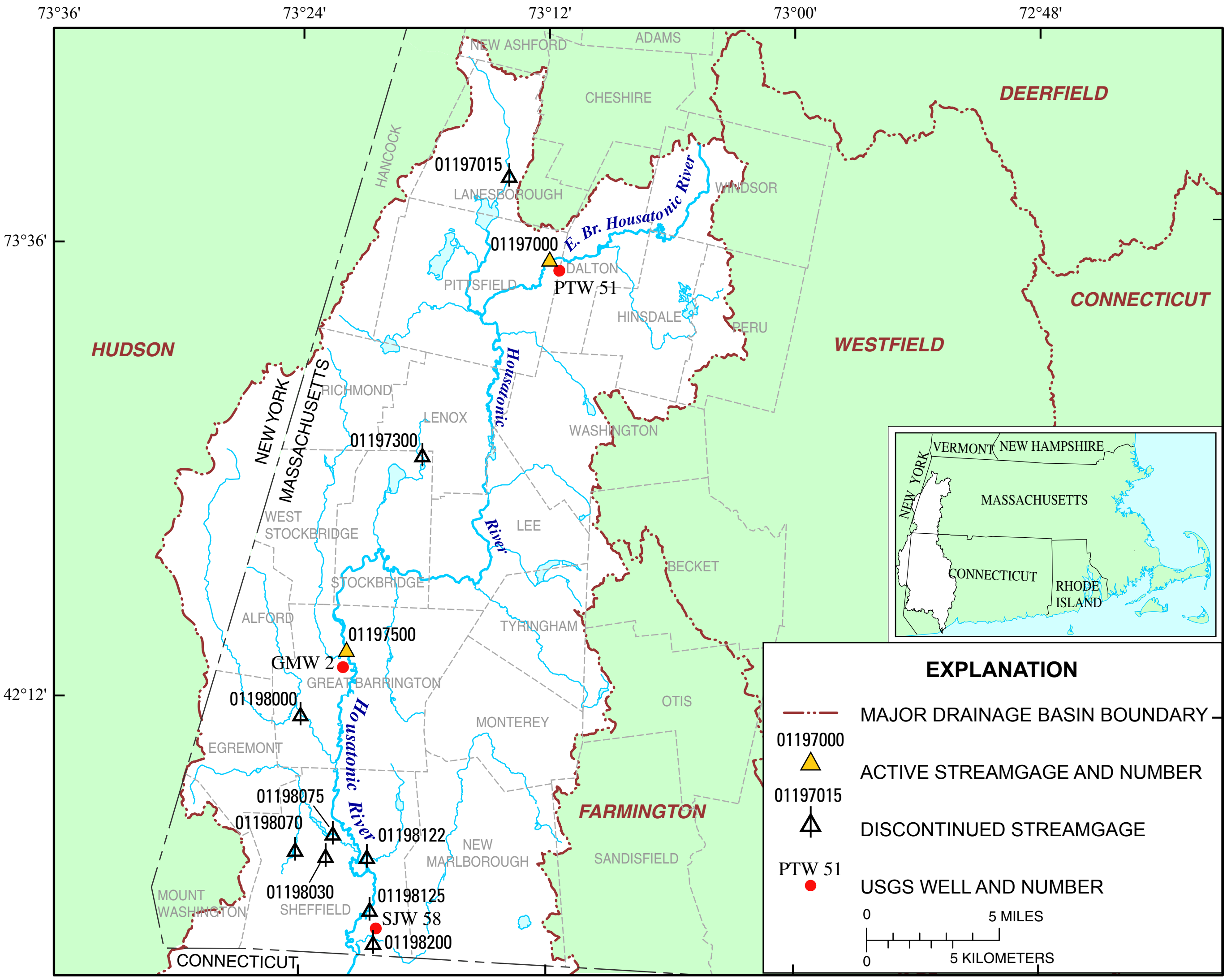
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01124750	Browns Brook near Webster, MA	1963	1977	15	0	0.49	CU

Table 1.10C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
WLW 1	Webster, MA	1958	43	27	S&G	Monthly	

HOUSATONIC RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

HOUSATONIC RIVER DRAINAGE BASIN

Table 1.11A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 3, all flows. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01197000	East Branch Housatonic River at Coltsville, MA	1936	65	3	57.6	WH	1,475	9.30	2.1	2.6	79	2.4	6.0	7.9	14
01197500	Housatonic River near Great Barrington, MA	1913	88	3	282	WH	1,663	8.44	2.6	2.8	70	5.0	8.4	11.2	12

Table 1.11B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01197015	Town Brook at Bridge Street at Lanesborough, MA	1980	1983	4	0	10.6	WH
01197300	Marsh Brook at Lenox, MA	1963	1974	12	0	2.12	WH
01198000	Green River near Great Barrington, MA	1951	1971	[1]24	0	51	WH
01198030	Schenob Brook near Sheffield, MA	1971	1972	2	0	23.3	WH
01198070	Willard Brook near Sheffield, MA	1971	1972	2	1	3.2	WH
01198075	Hubbard Brook at Sheffield, MA	1971	1972	2	1	25.8	WH
01198122	Ironworks Brook, on East Road, at Sheffield, MA	1994	1996	3	0	11.2	WH
01198125	Housatonic River near Ashley Falls, MA	1994	1996	3	0	465	WH
01198200	Konkapot River at Ashley Falls, MA	1994	1996	3	3	61.1	WH

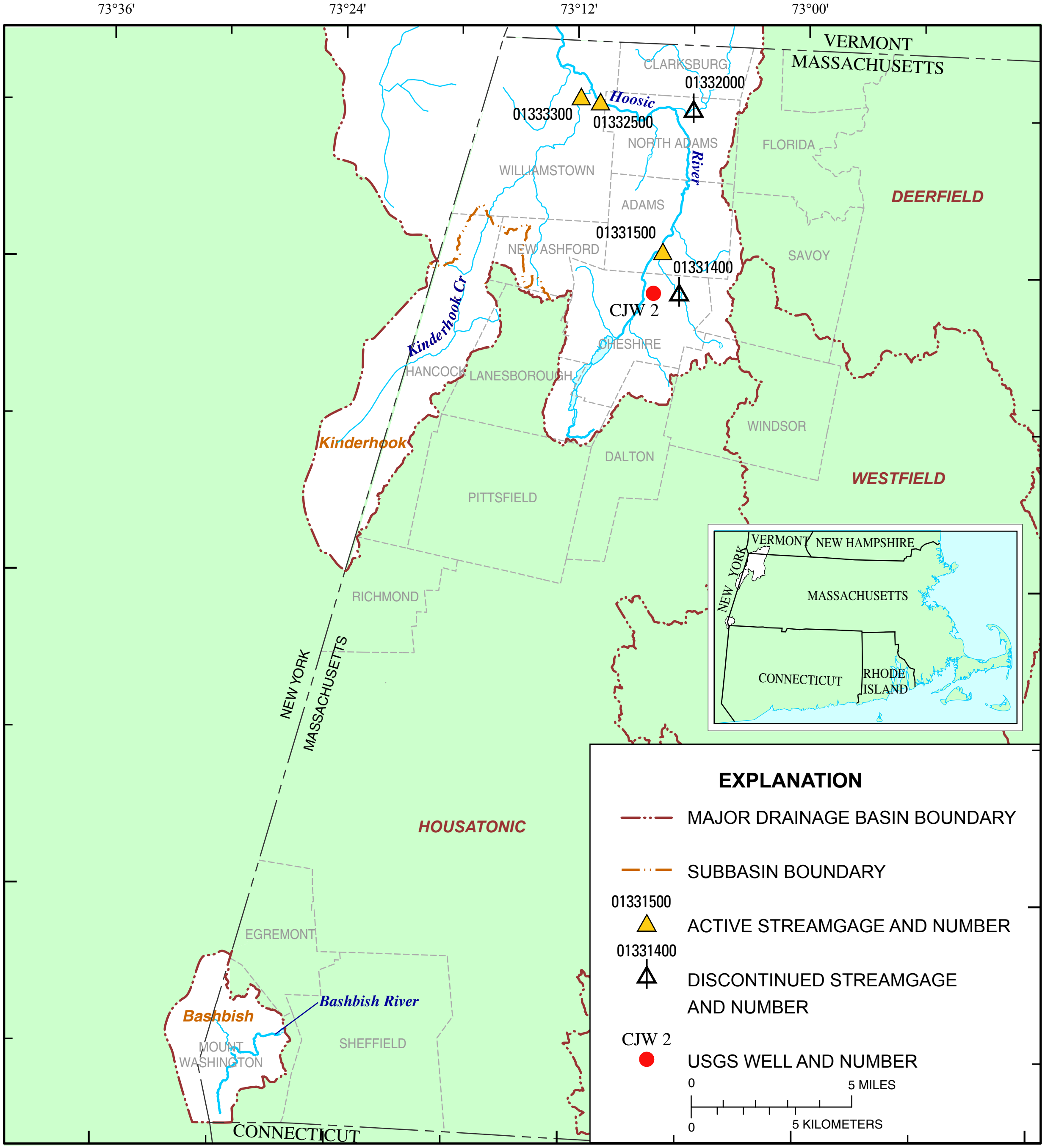
[1]Restarted 1994–96.

Table 1.11C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
GMW 2	Great Barrington, MA	1951	50	16	Till	Monthly	Affected by stream stage
PTW 51	Pittsfield, MA	1963	38	32	S&G	Hourly	Telemetered
SJW 58	Sheffield, MA	1987	14	32	S&G	Monthly	

HUDSON RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

HUDSON RIVER DRAINAGE BASIN

Table 1.12A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only; 3, all flows. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01331500	Hoosic River at Adams, MA	1931	70	3	46.7	WH	1,552	15.0	2.1	0.9	73	0.8	15	8.2	13
01332500	Hoosic River near Williamstown, MA	1940	61	3	126	WH	1,609	16.7	1.0	.5	77	3.1	11	7.4	10
01333000	Green River at Williamstown, MA	1949	52	1	42.6	WH	1,554	23.9	.1	0	79	.5	15	5.4	11

Table 1.12B. Discontinued continuous streamgage stations

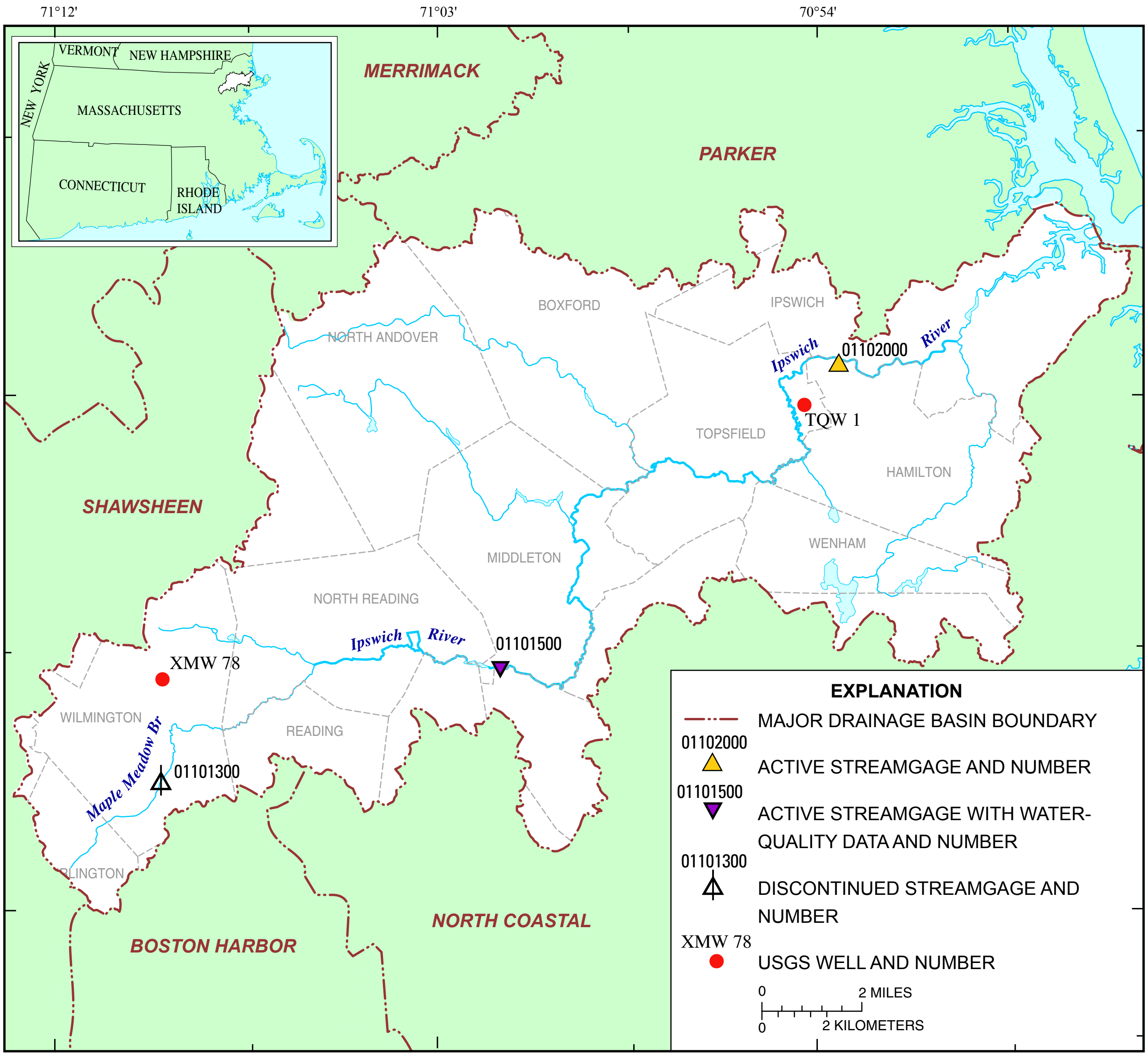
[**Regulation code:** 1, low flow only. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01331400	Dry Brook at Adams, MA	1963	1974	12	unknown	7.67	WH
01332000	North Branch Hoosic River at North Adams, MA	1931	1990	60	1	40.9	WH

Table 1.12C. Observation wells active in the 2000 water year

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
CJW 2	Cheshire, MA	1951	50	22	Till	Monthly	May be affected by pumping in summer

IPSWICH RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

IPSWICH RIVER DRAINAGE BASIN

Table 1.13A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only. **Region code:** CL, Coastal Lowlands. Nmi², square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi²)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01101500	Ipswich River at South Middleton, MA	1938	63	CL	44.5	1	107	3.0	1.7	11	45	6.9	1.4	34	52
01102000	Ipswich River near Ipswich, MA	1930	71	CL	125	1	105	3.6	3.9	10	54	4.8	4.3	23	42

Table 1.13B. Discontinued continuous streamgage stations

[**Regulation code:** 1, low flow only. **Region code:** CL, Coastal Lowlands. mi², square miles]

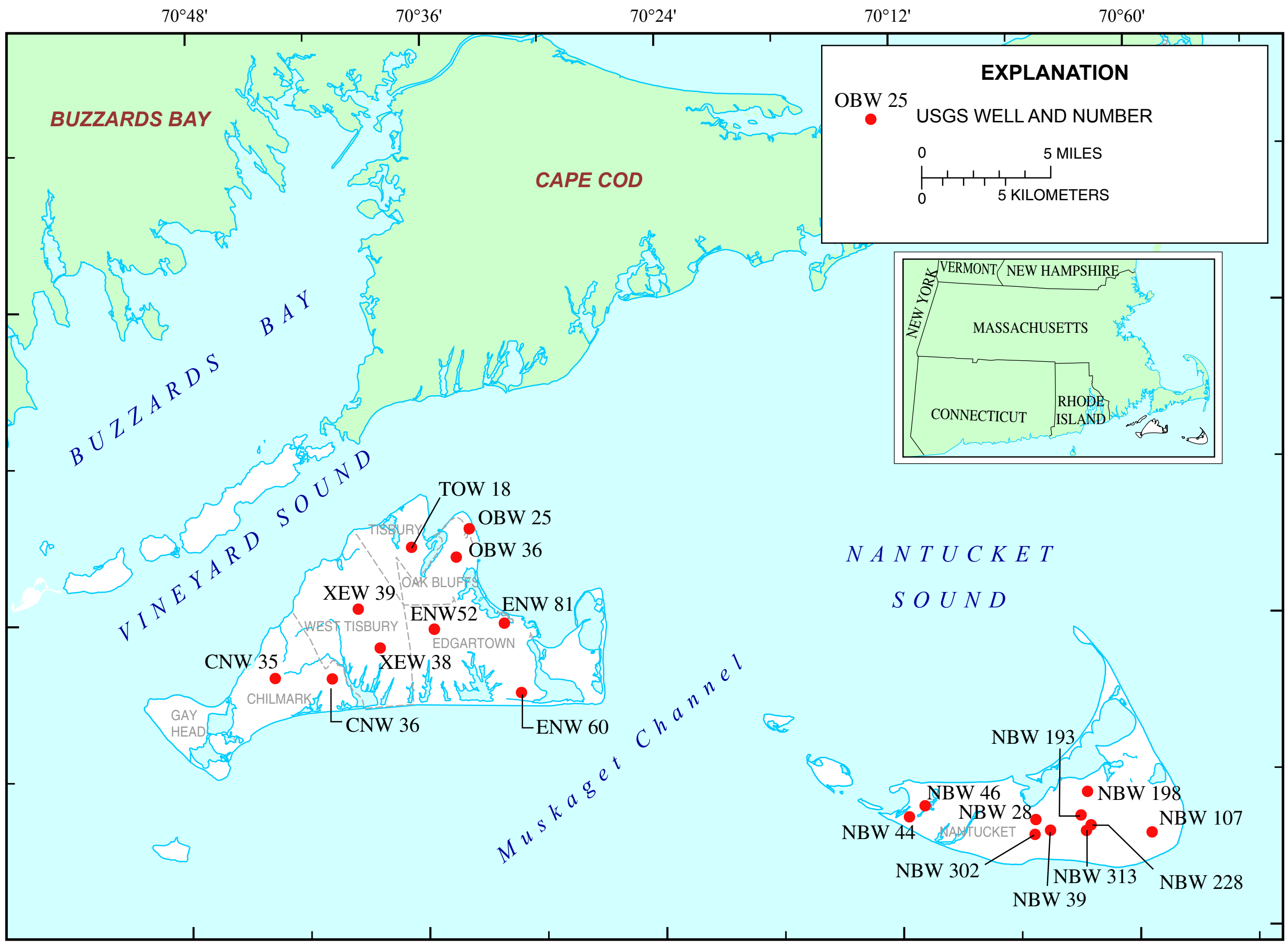
Station number	Station name	Record		Years	Regulation code	Drainage area (mi²)	Region code
		Begin	End				
01101300	Maple Meadow Brook at Wilmington, MA	1963	1974	12	1	4.04	CL

Table 1.13C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
TQW 1	Topsfield, MA	1936	65	22	Till	Monthly	
XMW 78	Wilmington, MA	1951	50	12	S&G	Hourly	Telemetered

ISLANDS DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

ISLANDS DRAINAGE BASIN

Table 1.14A. Continuous streamgage station active during the 2000 water year

None

Table 1.14B. Discontinued continuous streamgage station

None

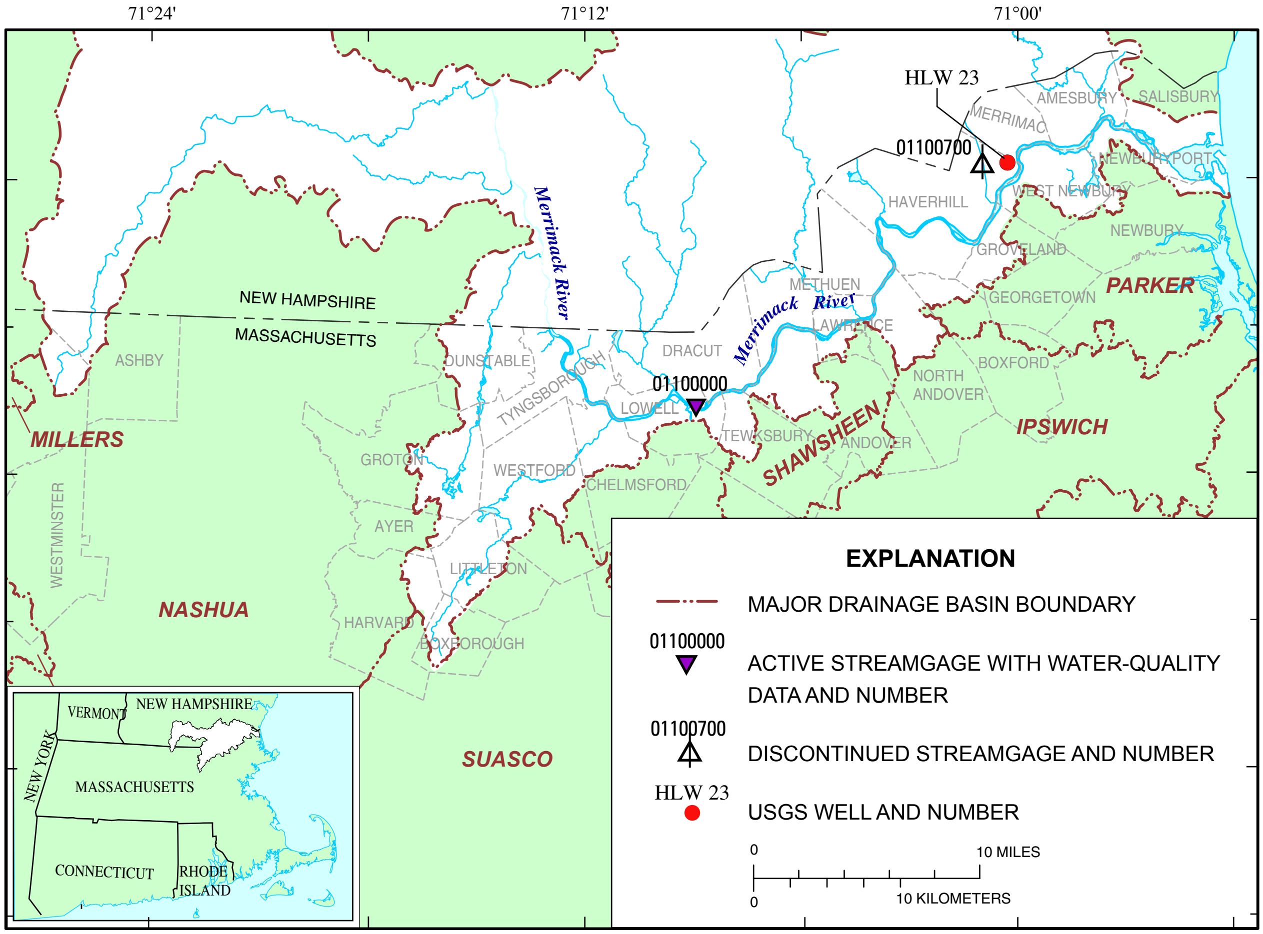
Table 1.14C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel. NWIS, National Water Information System]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
Martha's Vineyard							
CNW 35[1]	Chilmark, MA	1991	10	50	S&G	Monthly	
CNW 36[1]	Chilmark, MA	1991	10	23	S&G	Monthly	
ENW 52	Edgartown, MA	1976	25	64	S&G	Monthly	
ENW 60[1]	Edgartown, MA	1977	24	24	S&G	Monthly	
ENW 81[1]	Edgartown, MA	1991	10	16	S&G	Monthly	
OBW 25[1]	Oak Bluffs, MA	1977	24	20	S&G	Monthly	
OBW 36[1]	Oak Bluffs, MA	1991	10	56	S&G	Monthly	
TOW 18[1]	Tisbury, MA	1991	10	113	S&G	Monthly	
XEW 38[1]	West Tisbury, MA	1991	10	120	S&G	Monthly	
XEW 39[1]	West Tisbury, MA	1991	10	64	S&G	Monthly	
Nantucket							
NBW 28[1]	Nantucket, MA	1982	19	21	S&G	Monthly	
NBW 39[1]	Nantucket, MA	1973	28	52	S&G	Monthly	
NBW 44[1]	Nantucket, MA	1973	28	40	S&G	Monthly	
NBW 46[1]	Nantucket, MA	1973	28	45	S&G	Monthly	
NBW 107[1]	Nantucket, MA	1982	19	25	S&G	Monthly	
NBW 193[1]	Nantucket, MA	1975	26	43	S&G	Monthly	
NBW 198[1]	Nantucket, MA	1975	26	60	S&G	Monthly	
NBW 228	Nantucket, MA	1976	25	36	S&G	Monthly	
NBW 302[1]	Nantucket, MA	1982	19	65	S&G	Monthly	
NBW 313[1]	Nantucket, MA	1982	19	100	S&G	Monthly	

[1]Water-level measurements are stored in the NWIS database, but are not published in the annual data reports.

MERRIMACK RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

MERRIMACK RIVER DRAINAGE BASIN

Table 1.15A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 3, all flows. **Region code:** na, none assigned. mi^2, square miles; --, not determined]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01100000	Merrimack River below Concord River at Lowell, MA	1923	78	3	4,425	na	--	--	--	--	--	--	--	--	--

Table 1.15B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

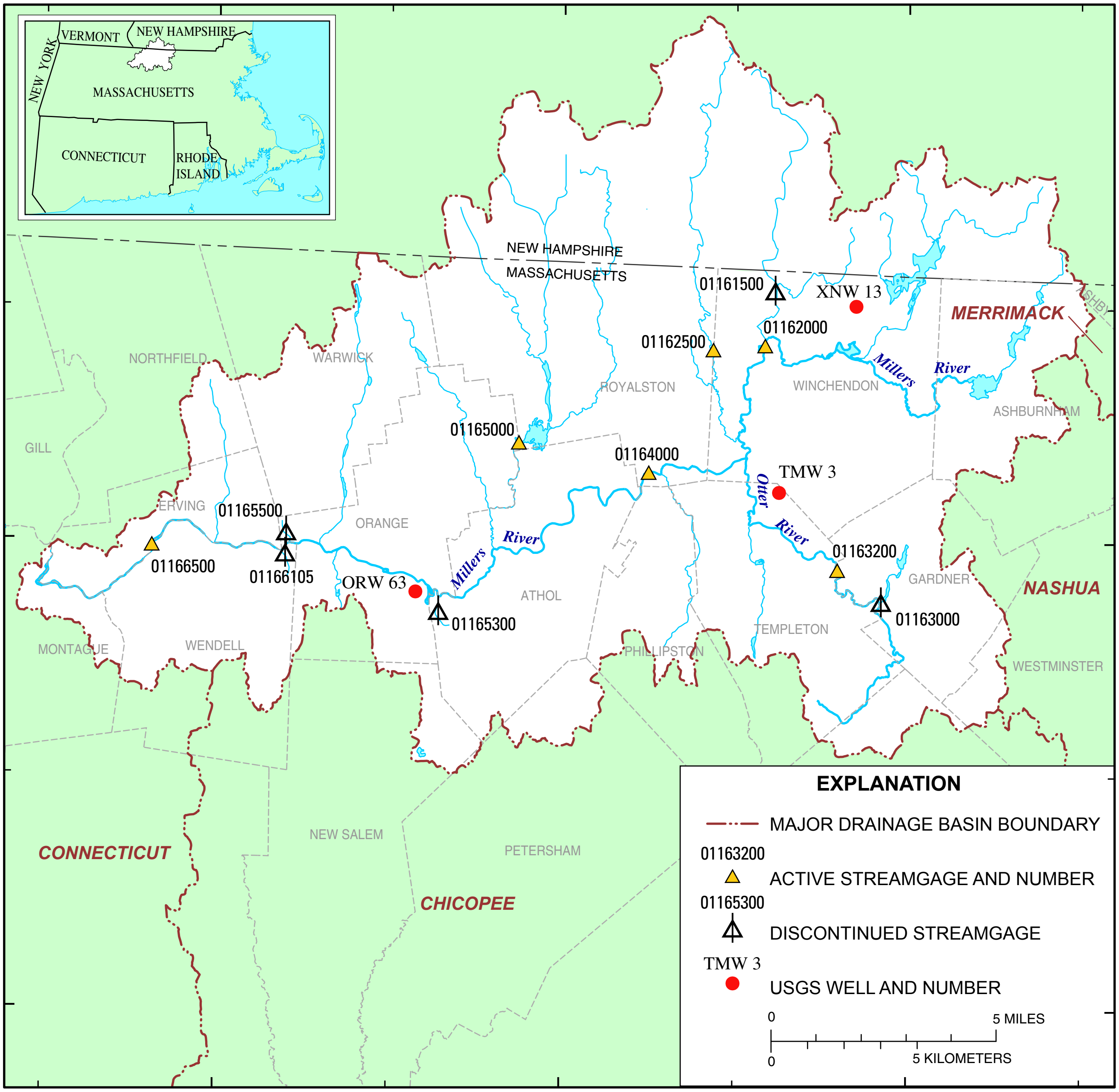
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01100700	East Meadow River near Haverhill, MA	1963	1974	12	0	5.47	CL

Table 1.15C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
HLW 23	Haverhill, MA	1960	41	15	S&G	Hourly	

MILLERS RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

MILLERS RIVER DRAINAGE BASIN

Table 1.16A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 3, all flows; 4 variable flows. **Region code:** CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01162000	Millers River near Winchendon, MA	1916	85	4	81.8	CU	1,114	6.1	5.3	5.1	79	1.7	3.8	5.1	22
01162500	Priest Brook near Winchendon, MA	1916	85	0	19.4	CU	1,095	6.3	1.7	3.0	88	.70	4.3	2.3	10
01163200	Otter River at Otter River, MA	1964	37	1	34.1	CU	1,074	5.7	3.6	5.3	67	9.3	2.8	12.	26
01164000	Millers River at South Royalston, MA	1939	62	3	189	CU	1,067	6.0	3.6	4.6	78	2.9	4.1	6.8	25
01165000	East Branch Tully River at Athol, MA[1]	1916	85	3	50.5	CU	1,034	8.4	2.7	3.5	88	.20	3.5	2.1	17
01166500	Millers River at Erving, MA	1915	86	3	372	CU	979	7.8	3.0	3.5	82	2.1	4.1	5.3	23

[1]Not published since 1990.

Table 1.16B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** CU, Central Uplands. mi^2, square miles]

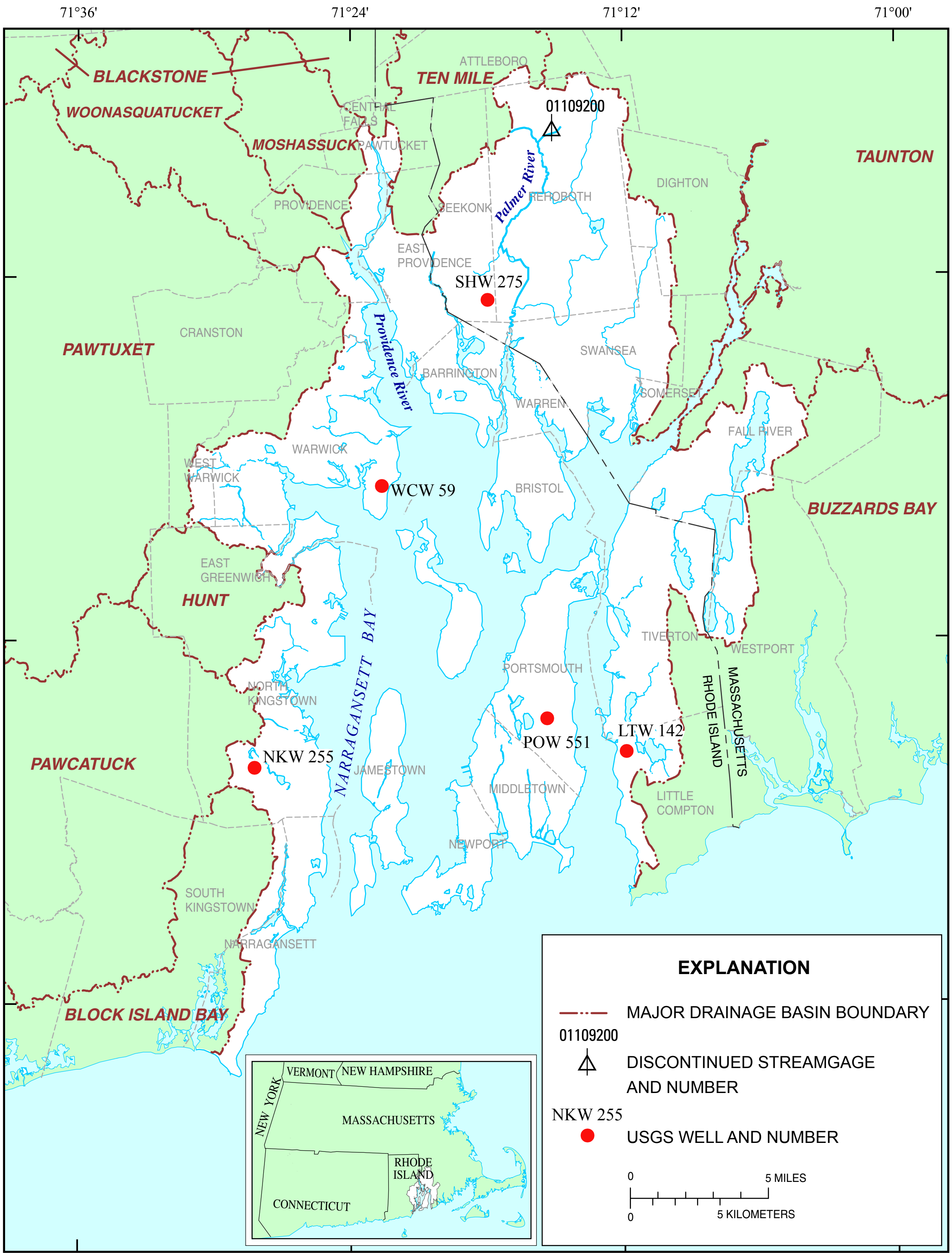
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01161500	Tarbell Brook near Winchendon, MA	1916	1982	67	1	17.8	CU
01163000	Otter River at Gardner Road at Gardner, MA	1916	1917	2	unknown	20	CU
01165300	Lake Rohunta Outlet near Athol, MA	1965	1985	21	3	20.3	CU
01165500	Moss Brook at Wendell Depot, MA	1916	1982	67	0	12.1	CU
01166105	Whetstone Brook at Depot Road at Wendell Depot, MA	1985	1991	7	0	5.22	CU

Table 1.16C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
ORW 63	Orange, MA	1985	16	23	S&G	Monthly	
TMW 3	Templeton, MA	1957	44	14	S&G	Monthly	
XNW 13	Winchendon, MA	1939	62	14	Till	Monthly	

NARRAGANSETT BAY DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

NARRAGANSETT BAY DRAINAGE BASIN

Table 1.17A. Continuous streamgage station active during the 2000 water year.

None

Table 1.17B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record Begin	Record End	Years	Regulation code	Drainage area (mi^2)	Region code
01109200	West Branch Palmer River near Rehoboth, MA	1962	1974	13	0	4.35	CL

Table 1.17C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record Start	Record Years	Well depth (feet)	Material	Measurement frequency	Remarks
LTW 142	Little Compton, RI	1992	9	23	Till	Monthly	
NKW 255	North Kingston, RI	1954	47	14	S&G	Monthly	
POW 551	Portsmouth, RI	1992	9	52	Till	Monthly	
SHW 275	Seekonk, MA	1964	37	14	S&G	Monthly	
WCW 59	Warwick, RI	1991	10	27	Till	Monthly	

NASHUA RIVER DRAINAGE BASIN

Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

NASHUA RIVER DRAINAGE BASIN

Table 1.18A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** CL, Coastal Lowlands; CU, Central Uplands. mi², square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi²)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01094400	North Nashua River at Fitchburg, MA	1972	29	1	64.2	CU	981	8.1	3.6	2.4	71	6.3	5.7	11	21
01094500	North Nashua River near Leominster, MA	1935	66	1	110	CL	843	7.9	3.2	1.8	65	11	6.0	13	23
01095220	Stillwater River near Sterling, MA	1994	7	0	31.6	CL	766	7.7	1.9	2.5	77	1.2	10	7.4	18
01095375	Quinapoxet River at Canada Mills near Holden, MA	1996	5	1	46.3	CL	895	6.6	4.1	3.1	71	2.5	8.3	11	20
01096000	Squannacook River near West Groton, MA	1949	52	0	63.7	CL	622	7.5	.90	2.2	82	1.3	6.0	7.6	27
01096500	Nashua River at East Pepperell, MA	1935	66	3	316	CL	626	6.7	4.3	2.8	66	5.4	8.5	13	32

Table 1.18B. Discontinued continuous streamgage stations

[**Region code:** CL, Coastal Lowlands. mi², square miles]

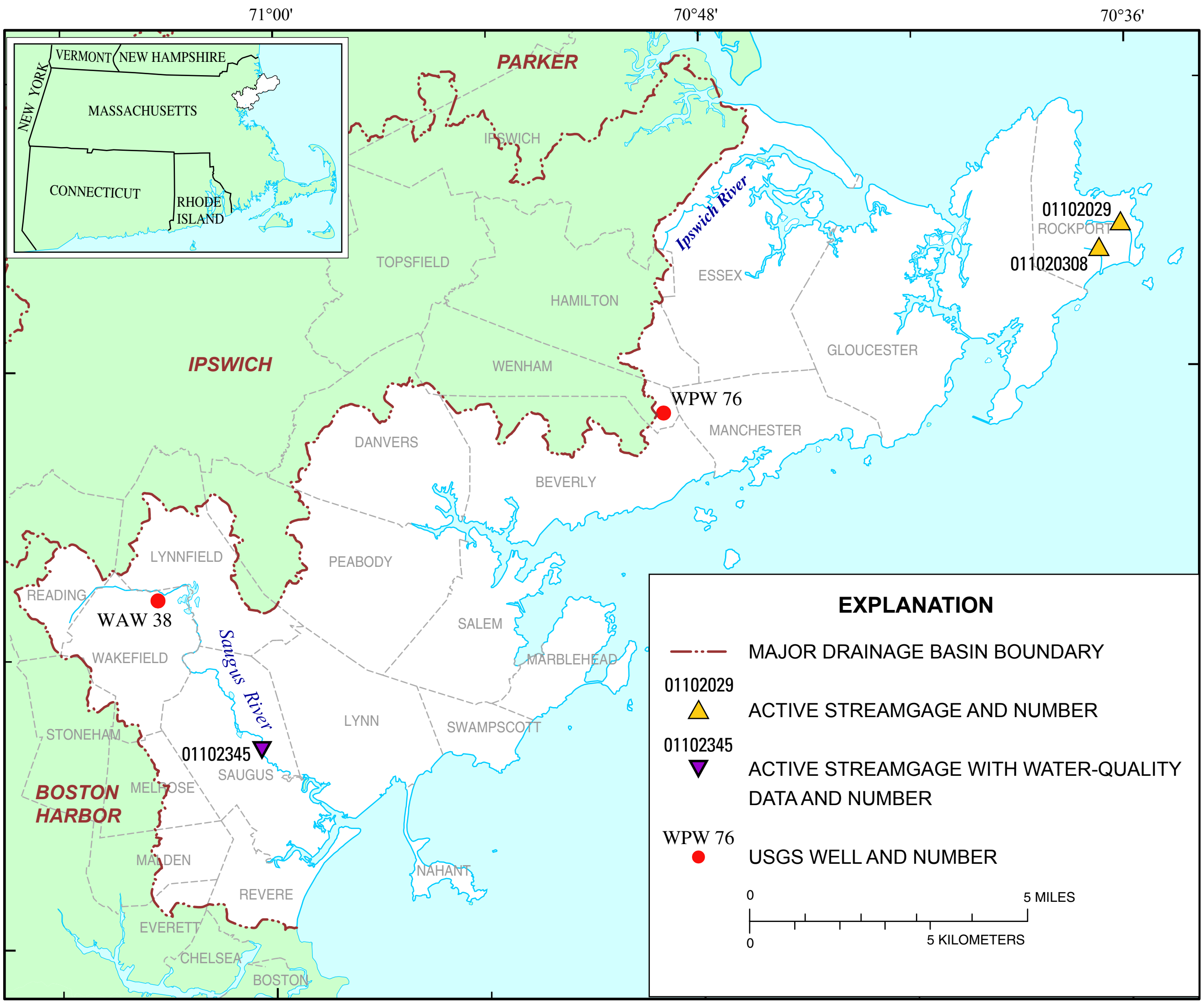
Station number	Station name	Record		Years	Regulation code	Drainage area (mi²)	Region code
		Begin	End				
01095000	Rocky Brook near Sterling, MA	1947	1967	21	Unknown	1.95	CL

Table 1.18C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
BKW 87	Boylston, MA	1995	6	12	Till	Monthly	
HRW 169	Holden, MA	1995	6	10	Till	Monthly	
PYW 64	Princeton, MA	1995	6	22	S&G	Monthly	
SYW 1	Sterling, MA	1947	54	15	Till	Monthly	
SYW 177	Sterling, MA	1995	6	24	Till	Monthly	
TRW 13	Townsend, MA	1965	36	33	S&G	Monthly	
WSW 26	West Boylston, MA	1995	6	17	S&G	Monthly	
WSW 27	West Boylston, MA	1995	6	25	Till	Monthly	
WSW 28	West Boylston, MA	1995	6	29	S&G	Monthly	

NORTH COASTAL DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

NORTH COASTAL RIVER DRAINAGE BASIN

Table 1.19A. Continuous streamgage stations active during the 2000 water year

[**Regulation code**: 0, none; 1, low flow only. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01102029	Mill Brook at Rockport, MA	1998	3	0	0.55	CL	133	5.7	1.0	2.0	68	16	0	13	4.2
011020308	Sawmill River near Rockport, MA	1999	2	1	.53	CL	86	4.1	3.2	1.6	65	2.8	3.4	24	25
01102345	Saugus River at Saugus Ironworks at Saugus, MA	1994	7	1	20.8	CL	100	4.2	7.4	3.2	26	15	0.4	48	42

Table 1.19B. Discontinued continuous streamgage station

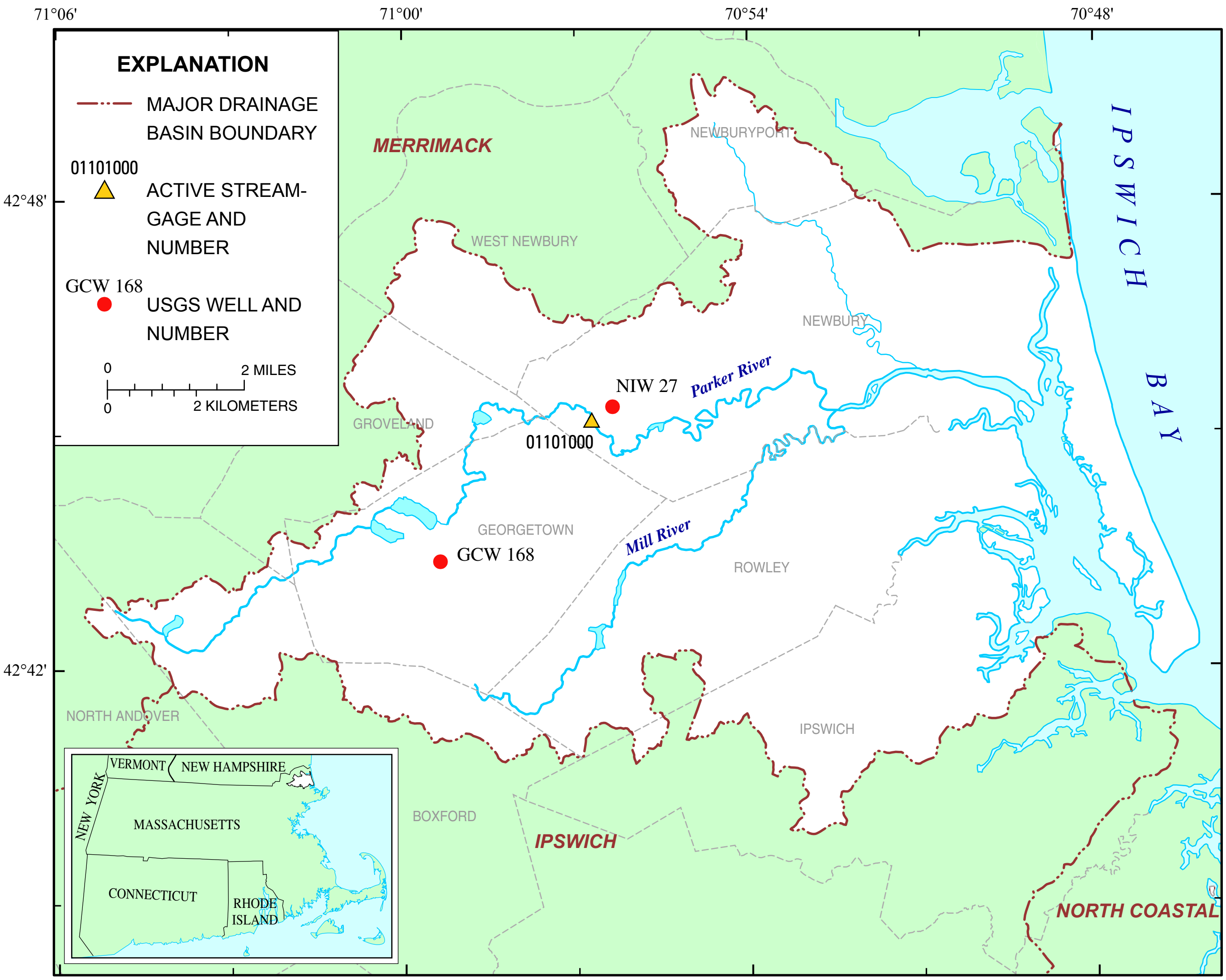
None

Table 1.19C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
WAW 38	Wakefield, MA	1965	36	26	S&G	Hourly	Telemetered
WPW 76	Wenham, MA	1965	36	22	S&G	Monthly	

PARKER RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

PARKER RIVER DRAINAGE BASIN

Table 1.20A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only. **Region code:** CL, Coastal Lowlands. mi^2, square miles; --, not applicable]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean elevation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01101000	Parker River at Byfield, MA	1945	56	1	21.3	CL	116	4.6	2.4	10	58	1.4	8.2	20	43

Table 1.20B. Discontinued continuous streamgage station

None

Table 1.20C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
GCW 168	Georgetown, MA	1965	36	21	S&G	Monthly	
NIW 27	Newbury, MA	1965	36	20	Till	Hourly	

PAWCATUCK RIVER AND BLOCK ISLAND BAY DRAINAGE BASINS

Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

PAWCATUCK RIVER AND BLOCK ISLAND BAY DRAINAGE BASIN

Table 1.21A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 4 variable flows. **Region code:** CL, Coastal Lowlands; CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record Begin	Record Years	Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area: Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01117350	Chipuxet River at West Kingston, RI	1973	28	0	9.59	CL	181	4.3	2.5	13	44	5.5	22	13	41
011173545	Queen River above William Road at Exeter, RI	1999	1	1	3.69	CL	347	5.2	.6	17	67	2.4	3.7	9.3	8.3
01117370	Queen River at Liberty, RI	1998	3	0	19.6	CL	291	4.9	.6	14	61	3.9	11	9.5	32
01117410	Usquepaug River at Route 138 at Usquepaug, RI	1999	1	1	32.8	CL	291	4.9	.9	14	62	3.3	10	9.8	29
01117420	Usquepaug River near Usquepaug, RI	1974	27	0	36.1	CL	277	4.8	.9	15	60	3.3	12	8.8	34
01117468	Beaver River near Usquepaug, RI	1974	27	0	8.87	CL	325	6.2	.9	12	73	2.7	4.2	7.2	25
01117500	Pawcatuck River at Wood River Junction, RI	1940	61	1	100	CL	206	4.1	3.40	18	53	3.8	12	9.8	44
01117800	Wood River near Arcadia, RI	[1]1964	36	0	35.2	CU	396	5.9	1.6	10	80	1.5	4.7	2.2	27
01118000	Wood River at Hope Valley, RI	1941	60	1	72.4	CL	344	5.9	2.6	11	74	3.1	4.8	4.5	25
01118500	Pawcatuck River at Westerly, RI	1940	61	4	295	CL	228	4.8	2.8	15	62	3.4	8.6	8.2	35

[1]Discontinued during the 1982 water year.

Table 1.21B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

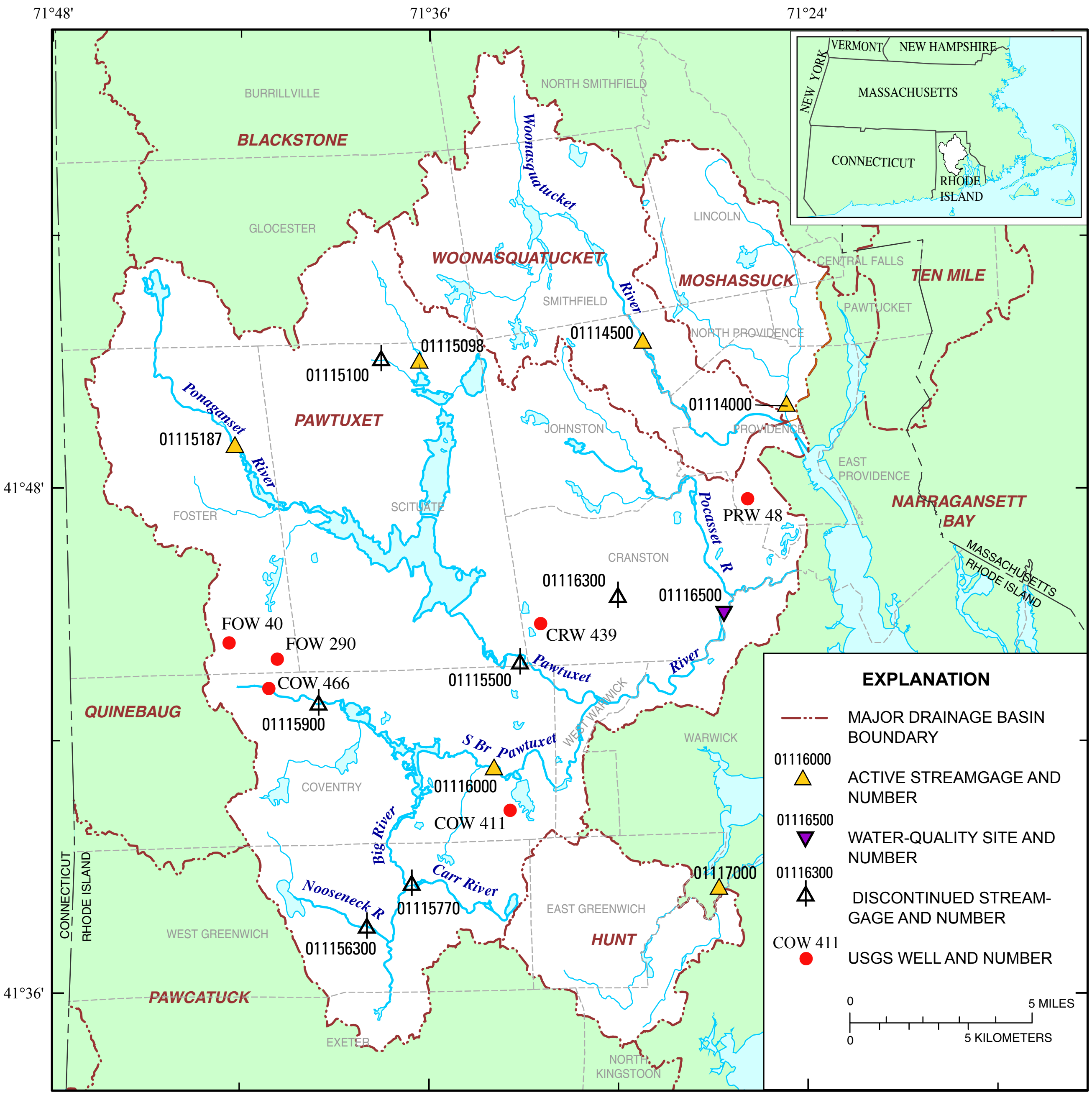
Station number	Station name	Record Begin	Record End	Years	Regulation code	Drainage area (mi^2)	Region code
01117100	Annaquatucket River at Belleville, RI	1961	1964	4	1	6.44	CL
01117472	Beaver River at Kenyon, RI	1975	1979	5	0	11.7	CL
01117600	Meadow Brook near Carolina, RI	1965	1974	10	0	5.53	CL

Table 1.21C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
CHW 586	Charlestown, RI	1992	9	14	Till	Monthly	
CHW 587	Charlestown, RI	1992	9	12	Till	Monthly	
EXW 6	Exeter, RI	1948	53	10	S&G	Monthly	Affected by Wood River stage
EXW 158	Exeter, RI	1991	10	18	Till	Monthly	
EXW 238	Exeter, RI	1991	10	14	Till	Monthly	
EXW 278	Exeter, RI	1991	10	24	Till	Monthly	
EXW 475	Exeter, RI	1981	20	40	S&G	Hourly	
EXW 554	Exeter, RI	1988	13	25	S&G	Monthly	
HOW 67	Hopkinton, RI	1991	10	23	Till	Monthly	
RIW 417	Richmond, RI	1976	25	40	S&G	Hourly	Affected by Beaver River stage
RIW 600	Richmond, RI	1977	24	54	S&G	Hourly	
RIW 785	Richmond, RI	1989	12	40	S&G	Monthly	
SNW 6	South Kingstown, RI	1955	46	34	S&G	Hourly	
SNW 515	South Kingstown, RI	1955	46	30	S&G	Monthly	Destroyed July 2000
WEW 522	Westerly, RI	1969	32	16	S&G	Monthly	
WGW 181	West Greenwich, RI	1969	32	18	S&G	Monthly	
WGW 206	West Greenwich, RI	1991	10	10	Till	Monthly	
Block Island							
CHW 18	Charlestown, RI	1946	55	32	S&G	Monthly	
NHW 258	New Shoreham, RI	1991	10	19	Till	Monthly	

PAWTUXET, WOONASQUATUCKET, MOSHASSUCK, AND HUNT RIVER DRAINAGE BASINS



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

PAWTUXET, WOONASQUATUCKET, MOSHASSUCK, AND HUNT RIVER DRAINAGE BASINS

Table 1.22A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only; 3, all flows. **Region code:** CL, Coastal Lowlands; CU, Central Uplands. mi², square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi²)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01114000	Moshassuck River at Providence, RI	1963	38	1	23.1	CL	199	4.9	2.6	8.0	25	18	3.4	43	28
01114500	Woonasquatucket River at Centerdale, RI	1941	60	1	38.3	CL	358	6.8	4.8	12	44	8.9	6.3	24	22
01115098	Peeptoad Brook at Elmdale Road near North Scituate, RI	1994	7	0	4.96	CU	462	6.5	2.0	10	65	4.3	6.7	12	23
01115187	Ponaganset River near South Foster, RI	1994	7	0	14.4	CU	611	4.6	2.9	11	72	8.0	3.1	3.0	15
01116000	South Branch Pawtuxet River at Washington, RI	1940	61	3	62.8	CU	384	4.8	3.9	14	61	4.8	3.3	13	40
01116500	Pawtuxet River at Cranston, RI	1939	62	3	200	CL	397	4.8	5.6	12	55	6.9	4.5	16	28
01117000	Hunt River near East Greenwich, RI	1940	61	0	22.9	CL	192	3.8	.80	17	37	10	5.2	30	51

Table 1.22B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 3, all flows. **Region code:** CU, Central Uplands. mi², square miles]

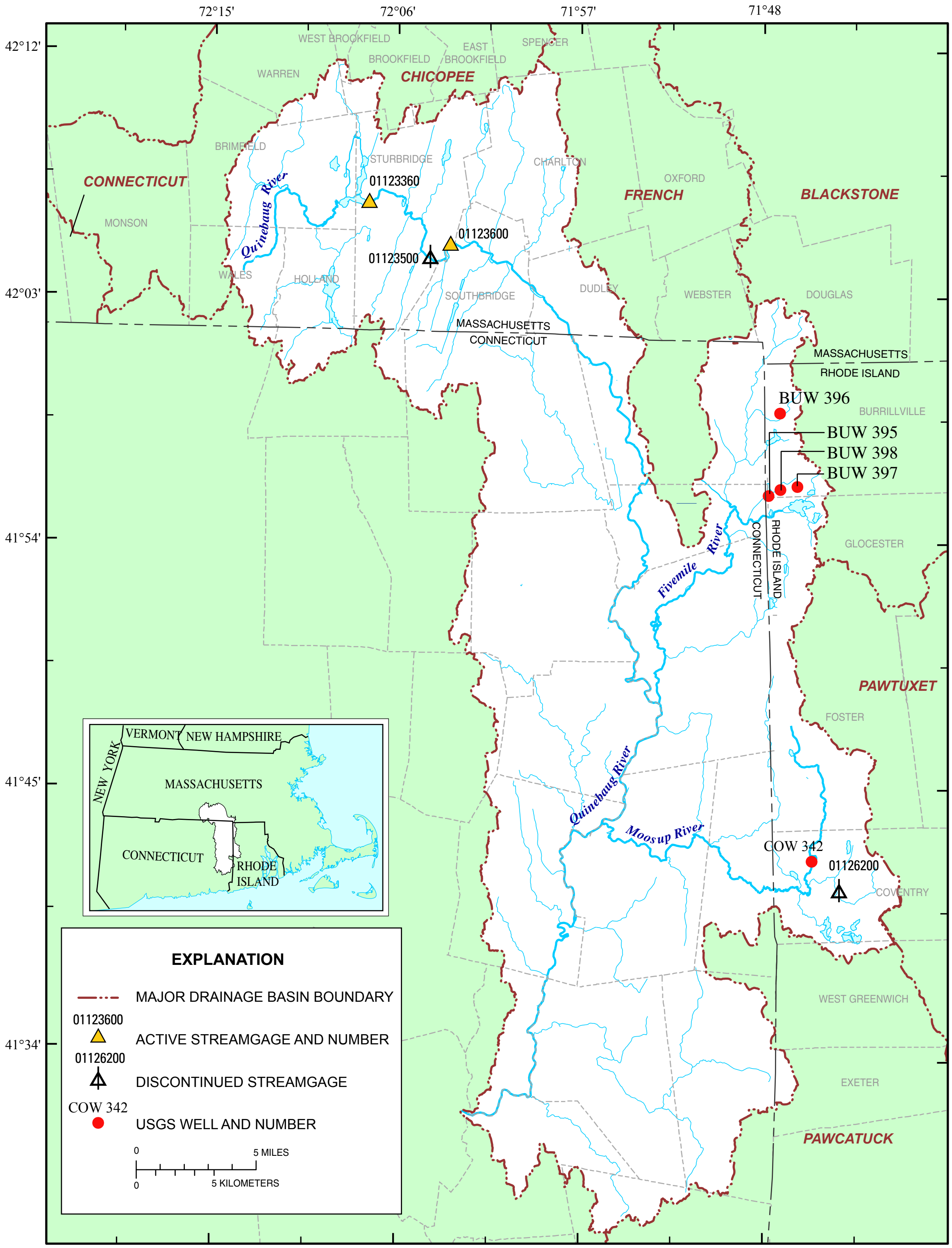
Station number	Station name	Record		Years	Regulation code	Drainage area (mi²)	Region code
		Begin	End				
01115100	Mosquitohawk Brook near North Scituate, RI	1965	1974	10	0	3.06	CU
01115500	Pawtuxet River at Fiskeville, RI	1915	1925	11	3	102	CU
01115630	Nooseneck River at Nooseneck, RI	1964	1981	18	0	8.23	CU
01115770	Carr River near Nooseneck, RI	1964	1980	17	3	6.73	CU
01115900	Flat River near Coventry, RI	1961	1964	4	0	9.13	CU
01116300	Furnace Hill Brook at Cranston, RI	1965	1974	10	0	4.19	CU

Table 1.22C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
COW 411	Coventry, RI	1961	40	26	S&G	Monthly	
CRW 439	Cranston City, RI	1992	9	23	Till	Monthly	
COW 466	Coventry, RI	1992	9	18	Till	Monthly	
FOW 40	Foster, RI	1991	10	15	Till	Monthly	
FOW 290	Foster, RI	1992	9	15	Till	Monthly	
PRW 48	Providence, RI	1944	57	124	S&G	Monthly	Affected by pumping from nearby wells

QUINEBAUG RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

QUINEBAUG RIVER DRAINAGE BASIN

Table 1.23A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 3, all flows. **Region code:** CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01123360	Quinebaug River below East Brimfield Dam near Fiskdale, MA[1]	1973	28	3	62.6	CU	833	9.3	3.7	5.1	80	2.0	5.8	3.4	22
01123600	Quinebaug River below Westville Dam near Southbridge, MA[1]	1963	38	3	94.4	CU	795	8.9	3.8	4.8	79	3.0	4.9	4.5	22

[1]Not published since 1990

Table 1.23B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 3, all flows. **Region code:** CU, Central Uplands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01123500	Quinebaug River at Westville, MA	1940	1962	23	3	93.6	CU
01126200	Bucks Horn Brook at Greene, RI	1965	1974	10	0	5.52	CU

Table 1.23C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
BUW 395	Burrillville, RI	1992	9	18	Till	Monthly	
BUW 396	Burrillville, RI	1992	9	17	Till	Monthly	
BUW 397	Burrillville, RI	1992	9	26	Till	Monthly	
BUW 398	Burrillville, RI	1992	9	14	Till	Monthly	
COW 342	Coventry, RI	1991	10	13	S&G	Monthly	

SHAWSHEEN RIVER DRAINAGE BASIN

Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

SHAWSHEEN RIVER DRAINAGE BASIN

Table 1.24A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01100568	Shawsheen River at Hanscom Field near Bedford, MA	1995	6	0	2.13	CL	149	2.6	0	0	19	48	1.0	32	14
01100600	Shawsheen River near Wilmington, MA	1963	38	0	36.5	CL	159	3.4	.5	4.0	29	24	2.5	40	39

Table 1.24B. Discontinued continuous streamgage station.

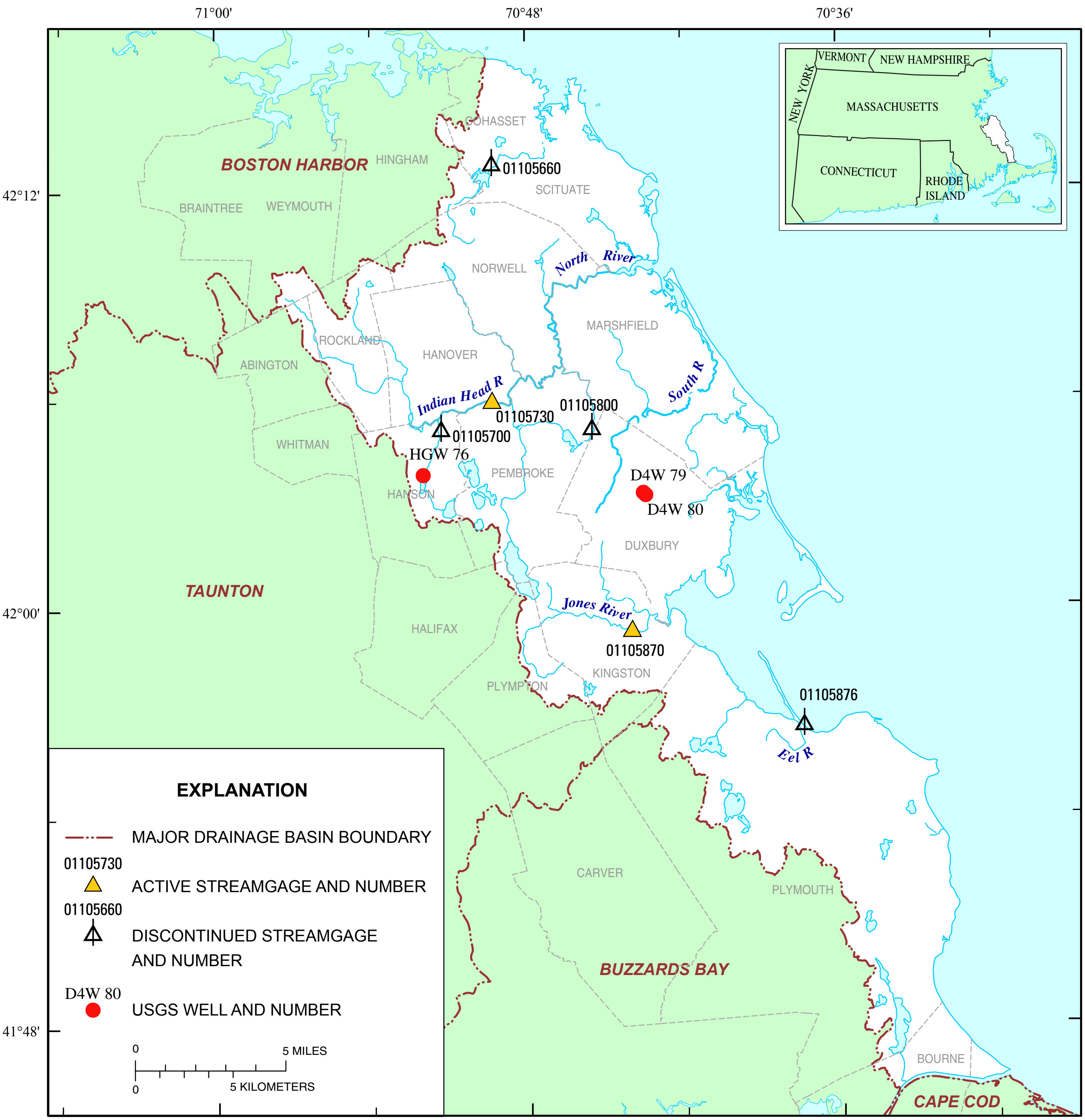
None

Table 1.24C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
AJW 462	Andover, MA	1968	33	32	S&G	Monthly	Affected by construction, January 1993 to January 1995
BCW 363	Billerica, MA	1962	39	16	S&G	Monthly	

SOUTH COASTAL DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

SOUTH COASTAL RIVER DRAINAGE BASIN

Table 1.25A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 4, variable flows. **Region code:** CL, Coastal Lowlands.mi², square miles; --, not applicable]

Station number	Station name	Record		Regu-lation code	Drainage area (mi²)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01105730	Indian Head River at Hanover, MA	1966	35	0	30.3	CL	99	2.0	2.4	11	47	12	2.6	25	69
01105870	Jones River at Kingston, MA	1966	35	4	15.7	CL	78	2.6	7.3	14	55	1.0	7.7	15	96

Table 1.25B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none. **Region code:** CL, Coastal Lowlands. mi², square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi²)	Region code
		Begin	End				
01105660	Bound Brook near Cohasset, MA	1970	1971	2	0	4.86	CL
01105700	Indian Head Brook near Hanson, MA	1958	1960	3	0	4.3	CL
01105800	Pudding Brook at East Pembroke, MA	1958	1962	5	0	1.38	CL
01105876	Eel River near Plymouth, MA	1970	1971	2	0	14.7	CL

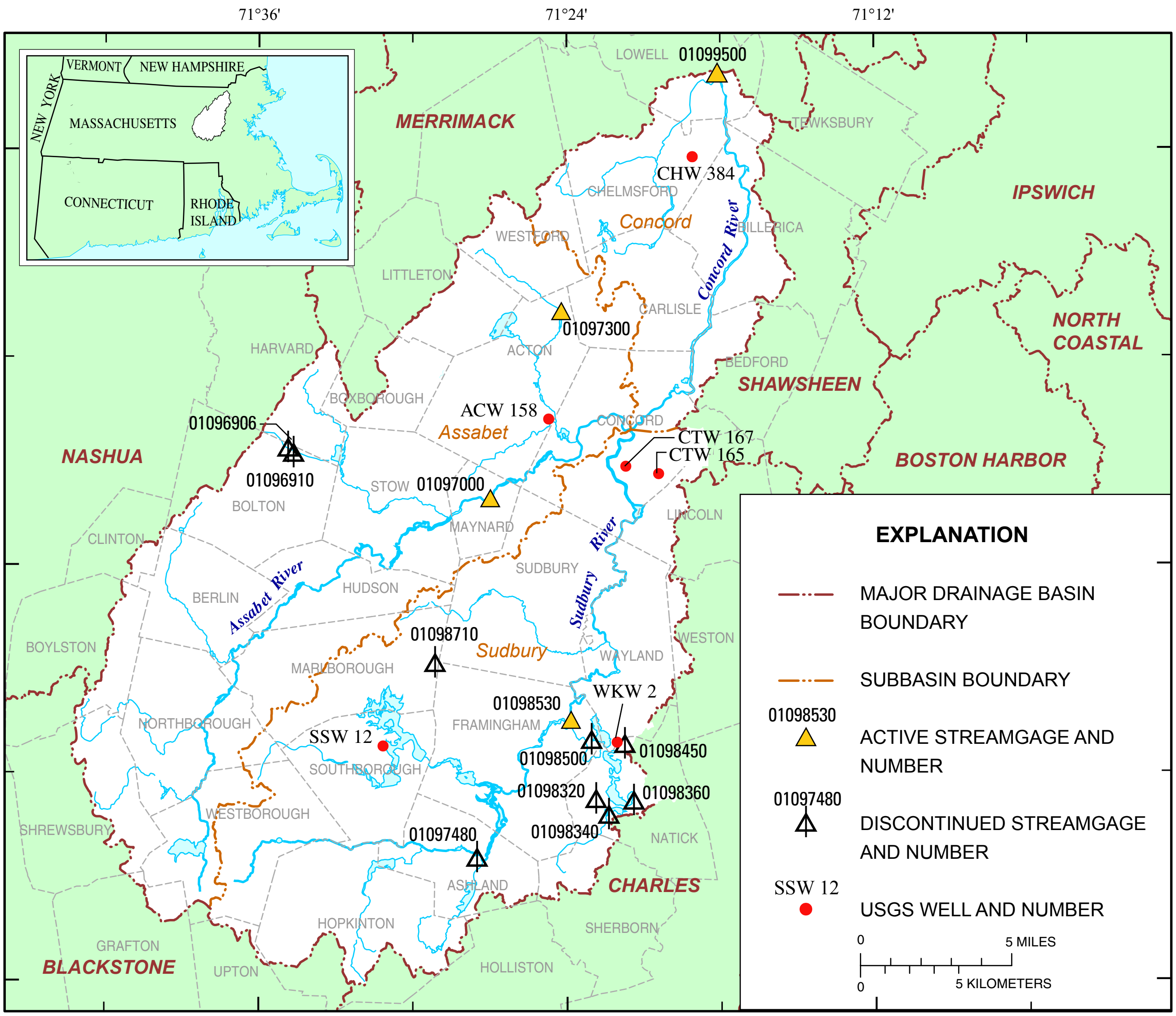
Table 1.25C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
D4W 79	Duxbury, MA	1965	36	24	S&G	Hourly	Telemetered
D4W 80	Duxbury, MA	1965	36	181	Bedrock	Monthly	
HGW 76	Hanson, MA	1964	37	27	S&G	Monthly	Affected by Wampatuck Pond stage

SUASCO DRAINAGE BASIN

Assabet River, Sudbury River, and Concord River Basins



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

SUASCO DRAINAGE BASIN—Assabet River, Sudbury River, Concord River Basins

Table 1.26A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only; 3, all flows; 4, variable flows. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01097000	Assabet River at Maynard, MA	1941	60	1	116	CL	350	5.9	3.0	6.1	52	7.2	9.7	22	39
01097300	Nashoba Brook near Acton, MA	1963	38	4	12.8	CL	231	4.2	.6	7.4	59	6.8	8.2	18	58
01098530	Sudbury River at Saxonville, MA	1979	22	3	106	CL	290	4.9	5.7	5.4	44	15	5.9	24	42
01099500	Concord River below Meadow Brook at Lowell, MA	1936	65	3	307	CL	263	4.8	3.7	6.1	46	9.6	7.6	27	47

Table 1.26B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only; 2, high flow only; 3, all flows; 4 variable flows. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

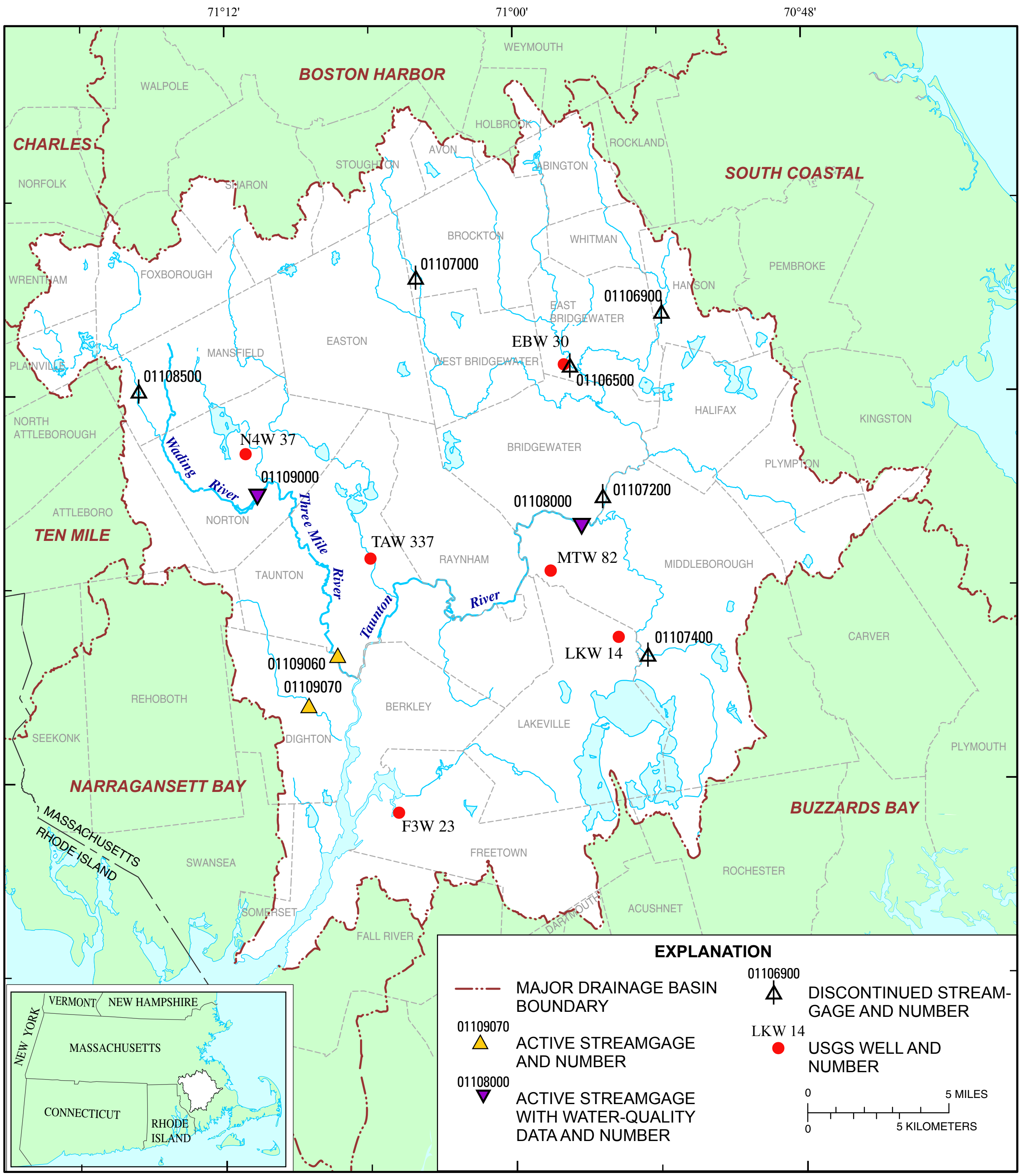
Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01096906	Boulder Brook near East Bolton, MA	1975	1978	4	0	1.32	CL
01096910	Boulder Brook at East Bolton, MA	1972	1981	10	0	1.6	CL
01097480	Sudbury River at Ashland, MA	1994	1995	2	0	35.1	CL
01098320	Beaverdam Brook at Natick, MA	1978	1979	2	unknown	7.27	CL
01098340	Course Brook at Natick, MA	1978	1979	2	unknown	3.44	CL
01098360	Pegan Brook at Natick, MA	1978	1979	2	unknown	0.54	CL
01098450	Snake Brook at Wayland, MA	1978	1979	2	unknown	2.1	CL
01098500	Lake Cochituate Outlet at Framingham, MA	1978	1979	2	3	21.1	CL
01098710	Hager Pond Outlet at Marlborough, MA	1978	1980	3	1	1.8	CL

Table 1.26C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
ACW 158	Acton, MA	1965	36	34	S&G	Hourly	Telemetered
CHW 384	Chelmsford, MA	1987	14	42	S&G	Monthly	
CTW 165	Concord, MA	1965	36	67	S&G	Monthly	
CTW 167	Concord, MA	1965	36	25	S&G	Monthly	
SSW 12	Southborough, MA	1990	11	20	Till	Monthly	
WKW 2	Wayland, MA	1965	36	33	S&G	Monthly	

TAUNTON RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

TAUNTON RIVER DRAINAGE BASIN

Table 1.27A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 1, low flow only. **Region code:** CL, Coastal Lowlands. mi², square miles; --, not applicable]

Station number	Station name	Record		Regu-lation code	Drainage area (mi²)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01108000	Taunton River near Bridgewater, MA	1929	72	0	261	CL	96	2.1	6.1	14	49	7.1	9.8	14	52
01109000	Wading River near Norton, MA	1925	76	0	43.3	CL	179	2.6	2.7	9.2	57	6.7	4.4	20	58
01109060	Threemile River at North Dighton, MA	1966	35	1	84.3	CL	156	2.2	3.1	9.2	56	7.1	4.6	20	64
01109070	Segreganset River near Dighton, MA	1966	35	1	10.6	CL	114	2.2	.4	6.9	75	1.6	6.1	10	16

Table 1.27B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 3, all flows. **Region code:** CL, Coastal Lowlands. mi², square miles]

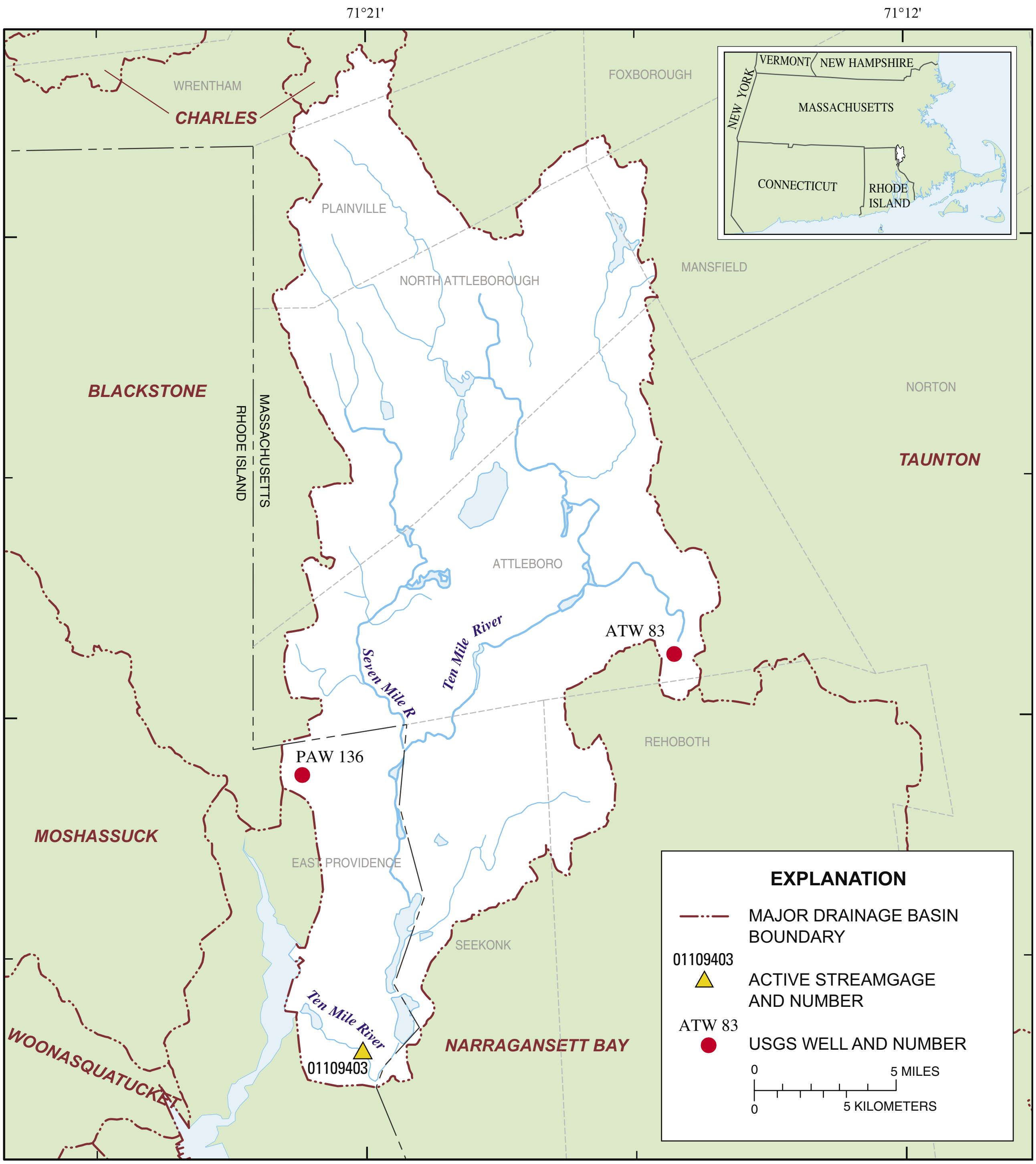
Station number	Station name	Record		Years	Regulation code	Drainage area (mi²)	Region code
		Begin	End				
01106500	Matfield River at Elmwood, MA	1958	1960	3	unknown	40.5	CL
01106900	Poor Meadow Brook at South Hanson, MA	1958	1960	3	unknown	14.6	CL
01107000	Dorchester Brook near Brockton, MA	1963	1974	12	0	4.67	CL
01107200	Taunton River at Titicut, near Brockton, MA	1920	1925	6	unknown	182	CL
01107400	Fall Brook near Middleboro, MA	1967	1968	2	0	9.32	CL
01108500	Wading River at West Mansfield, MA	1954	1986	33	3	19.5	CL

Table 1.27C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
EBW 30	East Bridgewater, MA	1958	43	24	Till	Monthly	
F3W 23	Freetown, MA	1964	37	42	S&G	Monthly	Affected by tide
LKW 14	Lakeville, MA	1964	37	41	S&G	Hourly	Telemetered
MTW 82	Middleborough, MA	1965	36	26	Till	Monthly	
N4W 37	Norton, MA	1964	37	20	S&G	Monthly	
TAW 337	Taunton, MA	1964	37	20	S&G	Monthly	Affected by Mill River

TEN MILE RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conconformal conic projection. 1983 North American datum

TEN MILE RIVER DRAINAGE BASIN

Table 1.28A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 1, low flow only. **Region code:** CL, Coastal Lowlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01109403	Ten Mile River at Pawtucket Avenue at East Providence, RI	1986	15	1	53.1	CL	154	2.5	3.6	4.1	37	13	4.3	38	58

Table 1.28B. Discontinued continuous streamgage station

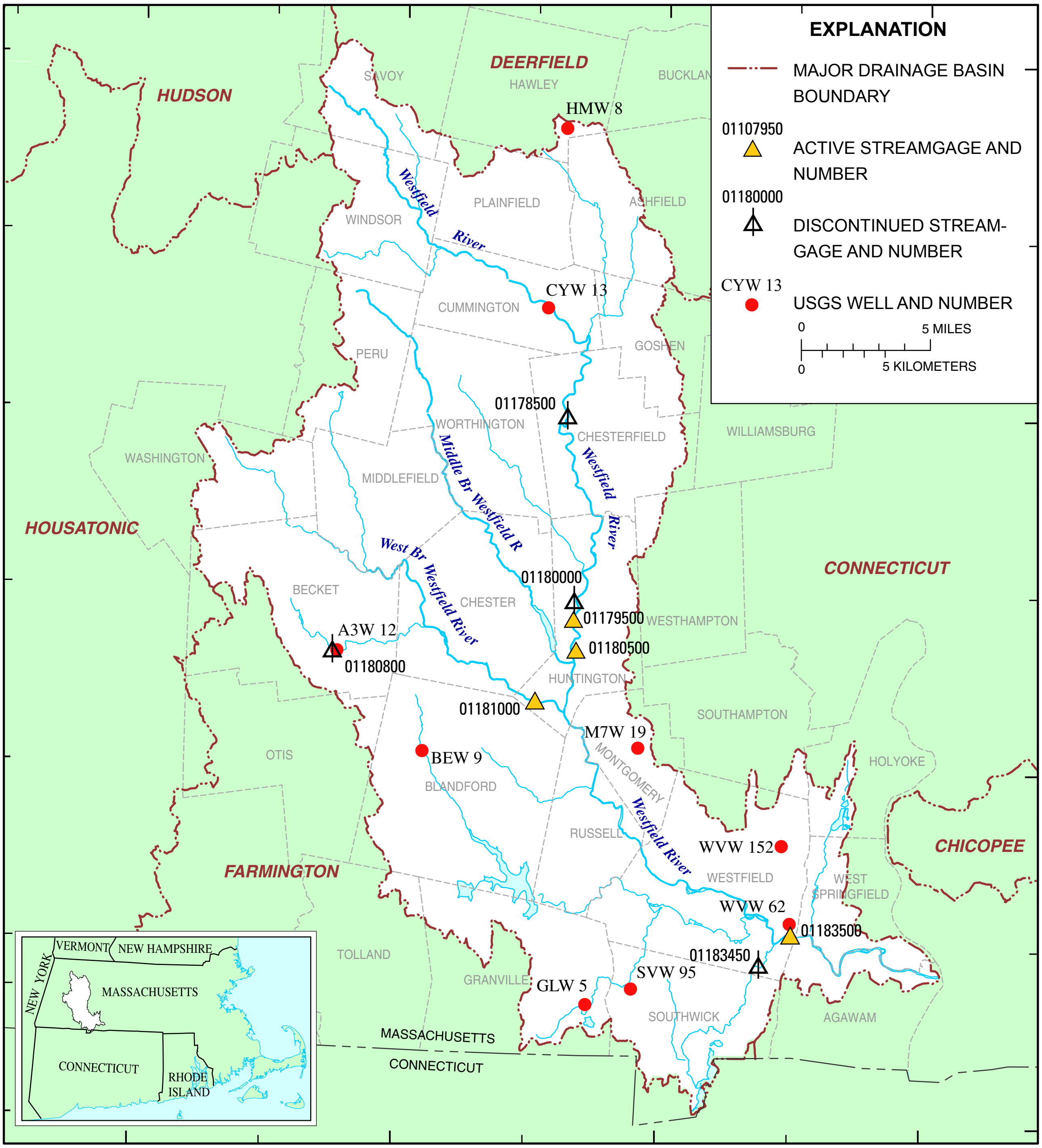
None

Table 1.28C. Observation wells active in the 2000 water year

[**Material**: S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
ATW 83	Attleboro, MA	1964	37	21	S&G	Monthly	
PAW 136	Pawtucket, RI	1962	39	43	S&G	Monthly	Destroyed July 2000

WESTFIELD RIVER DRAINAGE BASIN



Base from U.S. Geological Survey digital data, 1:25,000, 1991,
Lambert conformal conic projection. NAD 83

WESTFIELD RIVER DRAINAGE BASIN

Table 1.29A. Continuous streamgage stations active during the 2000 water year

[**Regulation code:** 0, none; 3, all flows. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Regu-lation code	Drainage area (mi^2)	Region code	Mean el-evation (feet)	Mean slope (percent)	Basin characteristics, percent of basin area						
		Begin	Years						Water	Wet-land	Forest	Urban	Agri-culture	Other	Sand and gravel
01179500	Westfield River at Knightville, MA	1909	92	3	161	WH	1,447	11.0	0.7	1.2	85	0.2	8.2	4.7	2.6
01180500	Middle Branch Westfield River at Goss Heights, MA[1]	1910	91	3	52.7	WH	1,414	13.0	.9	1.0	91	.1	4.3	2.7	2.8
01181000	West Branch Westfield River at Huntington, MA	1935	66	0	94	WH	1,422	13.2	1.3	1.3	91	.4	2.3	3.7	4.0
01183500	Westfield River near Westfield, MA	1914	87	3	497	WH	1,183	11.2	1.7	1.3	82	1.7	7.1	6.2	12

[1]Not published since 1990.

Table 1.29B. Discontinued continuous streamgage stations

[**Regulation code:** 0, none; 1, low flow only. **Region code:** WH, Western Highlands. mi^2, square miles]

Station number	Station name	Record		Years	Regulation code	Drainage area (mi^2)	Region code
		Begin	End				
01178500	Westfield River at West Chesterfield, MA	1946	1951	6	unknown	110	WH
01180000	Sykes Brook at Knightville, MA	1945	1974	30	0	1.73	WH
01180800	Walker Brook near Becket Center, MA	1963	1977	15	0	2.94	WH
01183450	Great Brook near Westfield, MA	1973	1982	10	1	22.6	WH

Table 1.29C. Observation wells active in the 2000 water year

[**Material:** S&G, sand and gravel]

Local well number	Town and State	Record		Well depth (feet)	Material	Measurement frequency	Remarks
		Start	Years				
ATW 83	Attleboro, MA	1964	37	21	S&G	Monthly	
A3W 12	Becket, MA	1986	15	35	S&G	Monthly	
BEW 9	Blandford, MA	1986	15	15	S&G	Monthly	
CYW 13	Cummington, MA	1986	15	39	S&G	Monthly	
GLW 5	Granville, MA	1965	36	68	S&G	Monthly	
HMW 8	Hawley, MA	1986	15	17	Till	Monthly	
M7W 19	Montgomery, MA	1986	15	18	S&G	Monthly	
SVW 95	Southwick, MA	1986	15	37	S&G	Monthly	
WVW 62	Westfield, MA	1957	44	22	S&G	Monthly	Affected by pumping
WVW 152	Westfield, MA	1986	15	16	S&G	Monthly	

Appendix 2: Tables of Correlated Streamgage Stations in Massachusetts and Rhode Island

Table2.1. Streamgage stations correlated with other streamgage (index) stations by mean daily streamflow in Massachusetts and Rhode Island

[Daily values correlated from April 1 through November 30 for the 1997 through 2001 water years unless noted otherwise. StdErr, standard error of estimate, in percent; r^2, correlation coefficient]

Basin and station number	Index station 1			Index station 2			Index station 3			Index station 4			Index station 5		
	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2
Nashua															
01094400	01094500	27.2	94.2	01096000	27.9	93.9	01163200	30.8	92.6	01173000	37.9	88.9	01173500	39.7	87.9
01094500	01094400	22.2	94.0	01096000	22.4	94.0	01096500	31.1	88.5	01163200	32.5	87.5	01097000	32.7	87.3
01095220	01112500	52.1	87.9	01095375	54.7	86.8	01173000	56.6	86.0	01096000	56.6	85.9	01173500	57.6	85.5
01095375	01112500	45.1	91.0	01097000	46.8	90.3	01096000	48.3	89.7	01095220	52.4	88.1	01177000	53.4	87.6
01096000	01094500	24.0	95.2	01094400	25.4	94.6	01163200	36.7	89.1	01097000	37.4	88.7	01173500	38.3	88.2
01096500	01094500	32.8	88.9	01096000	34.3	87.8	01094400	38.0	85.2	01097000	39.7	83.9	01095375	41.2	82.8
SUASCO (Sudbury, Assabet, and Concord)															
01097000	01099500	27.4	93.6	01112500	29.6	92.5	01094500	34.3	90.1	01095375	34.7	89.8	01096000	36.1	89.0
01097300	01102000	60.1	89.1	01101500	66.8	86.8	01110000	67.2	86.6	01173000	70.2	85.5	01101000	71.2	85.2
01098530	01099500	46.6	87.9	01097000	56.4	82.8	01112500	58.3	81.7	01104200	63.8	78.5	01103500	64.2	78.2
01099500	01097000	24.7	94.9	01112500	25.9	94.4	01103500	29.8	92.6	01104200	33.2	91.0	01104500	36.5	89.2
Shawsheen															
01100568	01102500	65.4	57.5	01114000	66.7	55.9	01100600	67.1	55.5	01109403	69.4	52.8	01105500	70.4	51.6
01100600	01102500	40.9	87.8	01103500	47.9	83.6	011055566	50.2	82.1	01109060	50.5	81.9	01112500	53.5	79.8
Parker and Ipswich															
01101000	01102000	63.9	91.2	01097300	76.6	88.0	01176000	82.6	86.3	01101500	84.4	85.8	01099500	100.8	81.0
01101500	01102000	55.2	92.8	01097300	71.8	88.5	01104200	82.2	85.5	01101000	84.8	84.7	01104500	88.9	83.4
01102000	01101500	37.8	93.4	01101000	45.5	90.6	01103500	51.5	88.2	01104200	52.3	87.8	01099500	53.8	87.2
North Coastal															
01102345	01102500	37.8	91.3	01102000	51.8	84.2	01112500	53.1	83.5	011055566	55.9	81.8	01109403	62.3	77.9
01102500	01102345	36.4	89.2	01100600	41.9	85.8	01112500	48.5	81.3	01105500	53.1	77.9	01105000	54.8	76.6
Charles															
01103280[1]	01103500	23.4	96.1	01104200	32.2	92.7	01109060	33.2	92.2	01112500	34.2	91.8	01105000	35.8	91.0
01103500	01104200	17.6	97.5	01104500	21.9	96.2	01109060	26	94.7	011055566	28	93.9	01099500	31.4	92.3
01104200	01104500	18.1	97.4	01103500	20.2	96.8	01109060	32.4	91.9	01109000	35.1	90.5	01099500	36.3	89.8
01104430	01175500	209.8	11.2	01105600	229.6	.85	01100568	231	0	01100600	231	0	01104500	231	0
01104500	01104200	15.9	97.4	01103500	20.7	95.7	01109060	30.5	90.7	01109000	31	90.4	01099500	34.4	88.3
01104480[1]	01162500	249.7	48.8	01185500	251.5	48.4	01162000	255.7	47.5	01101000	276	42.9	01166500	281.5	41.6
Neponset															
01105000	011055566	29.2	93.0	01103500	35.6	89.7	01105500	35.9	89.6	01109060	38.4	88.1	01108000	38.5	88.1
01105500	011055566	27.5	92.8	01105000	34.8	88.6	01108000	35.7	88.1	01105730	38.4	86.2	01109403	42.0	83.6
011055566	01105500	27.2	94.1	01105000	27.7	93.9	01103500	31.7	92.0	01108000	36.4	89.6	01109060	36.9	89.4

Table 2.1. Streamgage stations correlated with other streamgage (index) stations by mean daily streamflow in Massachusetts and Rhode Island—*Continued*

Basin and station number	Index station 1			Index station 2			Index station 3			Index station 4			Index station 5		
	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2
South Coastal															
01105600	01105730	37.9	88.7	01108000	45.3	84.2	01105500	48	82.3	01109403	59.2	74.0	01102500	62.1	71.5
01105730	01105600	29.1	91.1	01108000	29.2	91.1	01105500	37	85.8	01109060	39.1	84.2	01109403	41.4	82.3
01105870	01108000	23.1	90.1	01105730	29.8	83.8	01112500	30.2	83.4	01109403	32	81.3	01117500	35.4	77.3
Buzzards Bay															
01105933	01117000	56.9	83.7	01109060	58	83.1	01118000	59.3	82.4	01118500	60.4	81.8	01109000	61.1	81.4
Taunton															
01108000	01109060	26.4	92.5	01109403	28.8	91.1	01109000	29.9	90.3	011055566	30	90.3	01112500	31.7	89.2
01109000	01109060	20.9	97.4	01109403	31.5	94.1	01103500	35.8	92.4	01112500	39.2	91.0	01108000	40.4	90.4
01109060	01109000	18.3	97.5	01109403	22.1	96.4	01103500	29	93.8	01108000	31.5	92.7		35.9	90.7
01109070	01109000	81.6	82.9	01115187	86.6	81.1	01109060	87.2	80.8	01105933	88.7	80.3	01111300	102	75.2
TenMile															
01109403	01109060	18.3	94.9	01109000	22.1	92.7	01112500	26.3	89.6	01108000	26.9	89.2	01118000	31.3	85.4
Blackstone															
01110000	01097300	71.8	87.3	01102000	86.7	82.5	01099500	90.4	81.2	01101500	91.1	80.9	01173000	92.0	80.6
01110500	01094500	27.5	86.6	01112500	31.9	82.0	01097000	32.4	81.5	01177000	33.1	80.7	01116500	35.4	78.1
01111300	01115187	55.1	87.0	01112500	64.4	85.7	01115098	66.8	84.6	01109000	68.3	84.1	01095220	70.8	83.0
01111500	01112500	34.6	88.7	01115187	42.1	81.4	01109403	47.0	79.8	01115098	47.0	79.8	01109000	47.8	79.2
01112500	01097000	27.4	91.9	01109403	29.2	90.8	01109060	29.3	90.8	01109000	30.5	90.0	01111500	31.7	89.2
01113695[1]	01111300	54.1	86.2	01103500	66.2	80.1	01115098	68.1	79.0	01101500	69.3	78.3	01098530	72.4	76.6
Moshassuck															
01114000	01109403	32.2	87.8	01118000	37.9	83.4	01112500	40.2	81.3	01117000	40.3	81.2	01117420	41.7	79.9
Woonasquatucket															
01114500	01116500	44.6	79.7	01109060	45.8	78.7	01118000	47.0	77.6	01117800	47.3	77.3	01112500	48.0	76.7
Pawtuxet															
01115098	01115187	41.9	90.3	01117800	53.3	87.5	01111300	56.5	86.1	01118000	59.4	84.8	01095220	59.8	84.6
01115187	01115098	53.6	90.7	01109000	63.6	87.3	01111300	63.8	87.2	01109060	68.7	85.4	01112500	73.2	83.7
01116000	01116500	26.8	89.3	01118000	34.5	82.5	01112500	35.7	81.4	01117800	35.8	81.2	01118500	37.4	79.6
01116500	01116000	28.0	88.0	01109403	32.3	84.3	01118000	33.6	82.9	01112500	33.9	82.7	01117800	34.3	82.2
Hunt															
01117000	01118500	25.2	94.2	01117420	27.4	93.2	01118000	27.7	93.0	01117468	27.9	92.9	01117800	31.3	91.1

Table 2.1. Streamgage stations correlated with other streamgage (index) stations by mean daily streamflow in Massachusetts and Rhode Island—*Continued*

Basin and station number	Index station 1			Index station 2			Index station 3			Index station 4			Index station 5		
	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2
Pawcatuck															
01117350	01117500	34.5	87.4	01118500	38.2	84.7	01117468	38.6	84.4	01117420	40.8	82.6	01118000	42.1	81.6
011173545[1]	01117370	19.3	96.8	01117420	23.6	95.2	01117000	23.8	95.2	01117410	23.8	95.1	01117468	29.2	92.7
01117370[1]	01117410	13.2	97.7	01117420	14.6	97.2	011173545	14.6	97.2	01117000	18.1	95.7	01117468	19.5	95.0
01117410[1]	01117420	12.0	97.8	01117370	12.2	97.7	01117000	13.4	97.3	01117468	14.4	96.9	011173545	16.9	95.7
01117420	01117468	21.5	94.1	01118500	21.9	93.9	01117500	22.1	93.8	01117000	22.2	93.7	01118000	23.9	92.8
01117468	01118500	16.9	96.0	01117500	17.8	96.0	01117420	21.2	94.4	01118000	21.7	94.1	01117800	22.8	93.5
01117500	01118500	11.8	98.0	01117468	15.7	96.5	01117000	18.4	95.2	01117420	19.9	94.4	01118000	21.3	93.5
01117800	01118000	16.5	96.6	01117468	23.1	93.5	01117000	25.4	92.2	01118500	25.5	92.1	01117420	26.7	91.4
01118000	01117800	16.6	96.5	01118500	19.1	95.4	01117468	22.3	93.1	01117000	22.7	93.6	01117420	24.5	92.5
01118500	01117500	12.9	97.9	01117468	16.3	96.6	01118000	18.0	95.9	01117000	18.9	95.5	01117420	21.2	94.4
Millers															
01162000	01166500	38.9	89.7	01162500	40.2	89.0	01163200	56.7	79.2	01171500	59.5	77.3	01094400	63.2	74.6
01162500	01166500	46.1	89.8	01162000	48.9	88.6	01183500	66.8	80.0	01174565	69.8	78.3	01163200	75.1	75.3
01163200	01094400	29.8	93.0	01094500	37.2	89.2	01096000	38.6	88.4	01173500	41.9	86.5	01166500	44.7	84.7
01166500	01162500	33.4	89.5	01162000	34.5	88.8	01163200	40.5	84.8	01094400	43.2	82.8	01096000	44.9	81.4
Deerfield															
01168500	01170000	18.0	95.0	01169000	39.2	77.2	01332500	40.0	76.4	01170100	41.5	74.7	01331500	43.1	72.7
01169000	01170100	14.4	98.5	01169900	32.0	92.9	01181000	38.2	90.0	01332500	38.4	89.9	01183500	38.8	89.7
01169900	01171500	32.2	92.9	0116-9000	33.0	92.5	01170100	33.2	92.4	01183500	36.8	90.8	01181000	37.6	90.4
01170000	01168500	17.8	95.7	01169000	30.2	87.8	01170100	32.8	85.7	01183500	36.4	82.5	01169900	36.5	82.4
01170100	01169000	14.8	98.6	01169900	33.1	93.0	01181000	39.6	90.2	01183500	40.5	89.7	01332500	43.1	88.4
Connecticut															
01171500	01169900	32.0	93.0	01183500	35.1	91.6	01181000	36.5	91.0	01174565	40.8	88.8	01169000	45.1	86.5
Ware															
01172500	01173000	40.9	93.0	01173500	51.6	89.2	01094400	53.4	88.5	01163200	58.6	86.4	01176000	63.0	84.5
01173000	01173500	31.9	94.4	01172500	33.0	94.0	01094400	38.3	92.0	01176000	39.9	91.4	01096000	41.9	90.5
01173500	01173000	30.5	93.0	01177000	33.9	91.4	01176000	35.7	90.5	01094400	37.4	89.6	01096000	39.5	88.5

Table 2.1. Streamgage stations correlated with other streamgage (index) stations by mean daily streamflow in Massachusetts and Rhode Island—*Continued*

Basin and station number	Index station 1			Index station 2			Index station 3			Index station 4			Index station 5		
	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2	Station	StdErr	r^2
Chicopee															
01174500	01174565	73.0	80.3	01094400	76.7	78.6	01163200	78.9	77.5	01173500	81.5	76.3	01173000	84.8	74.6
01174565	01171500	41.0	90.7	01183500	49.8	86.5	01181000	52.5	85.1	01094400	57.0	82.7	01173500	58.1	82.1
01175500	01104430	55.8	10.2	01117350	57.4	5.5	01117500	57.7	4.7	01117468	58.5	2.20	01100568	58.9	.77
01175670	01176000	54.6	87.2	01094400	55.8	86.7	01097000	56.8	86.2	01112500	59.5	85.1	01173000	62.9	83.4
01176000	01173000	30.4	93.4	01173500	31.1	93.1	01177000	35.4	91.1	01175670	37.1	90.3	01099500	40.8	88.3
01177000	01173500	24.2	90.8	01176000	27.2	88.5	01096000	28.8	87.1	01173000	29.0	86.9	01112500	29.3	86.6
Westfield															
01179500	01183500	28.7	94.2	01181000	31.8	92.9	01169000	36.9	90.6	01169900	37.1	90.4	01197500	43.4	87.2
01181000	01183500	30.9	94.4	01171500	38.6	91.3	01169900	39.4	91.0	01169000	41.6	90.0	01170100	41.7	90.0
01183500	01179500	24.2	94.7	01181000	24.6	94.5	01171500	29.4	92.2	01169000	33.8	89.8	01197500	35.0	89.1
Housatonic															
01185500	01181000	53.5	84.1	01197500	62.4	78.9	01171500	62.4	78.9	01183500	66.5	76.3	01174565	72.1	72.8
01197000	01197500	25.4	93.2	01331500	28.8	91.2	01332500	29.5	90.8	01181000	33.0	88.6	01169000	36.9	85.8
01197500	01197000	21.2	94.0	01181000	25.2	91.6	01331500	27.3	90.2	01332500	27.7	89.8	01183500	28.9	89.0
Hudson															
01331500	01332500	15.4	96.8	01197000	24.6	91.9	01333000	25.6	91.2	01197500	27.9	89.6	01169000	30.9	87.3
01332500	01331500	15.8	96.6	01333000	25.1	91.6	01197000	25.9	91.1	01169000	28.7	89.1	01197500	29.2	88.8
01333000	01332500	30.6	92.3	01331500	31.6	91.8	01197500	43.2	85.1	01197000	45.3	83.7	01181000	46.2	83.1

[1]Indicates shorter period of record available for regression analysis.