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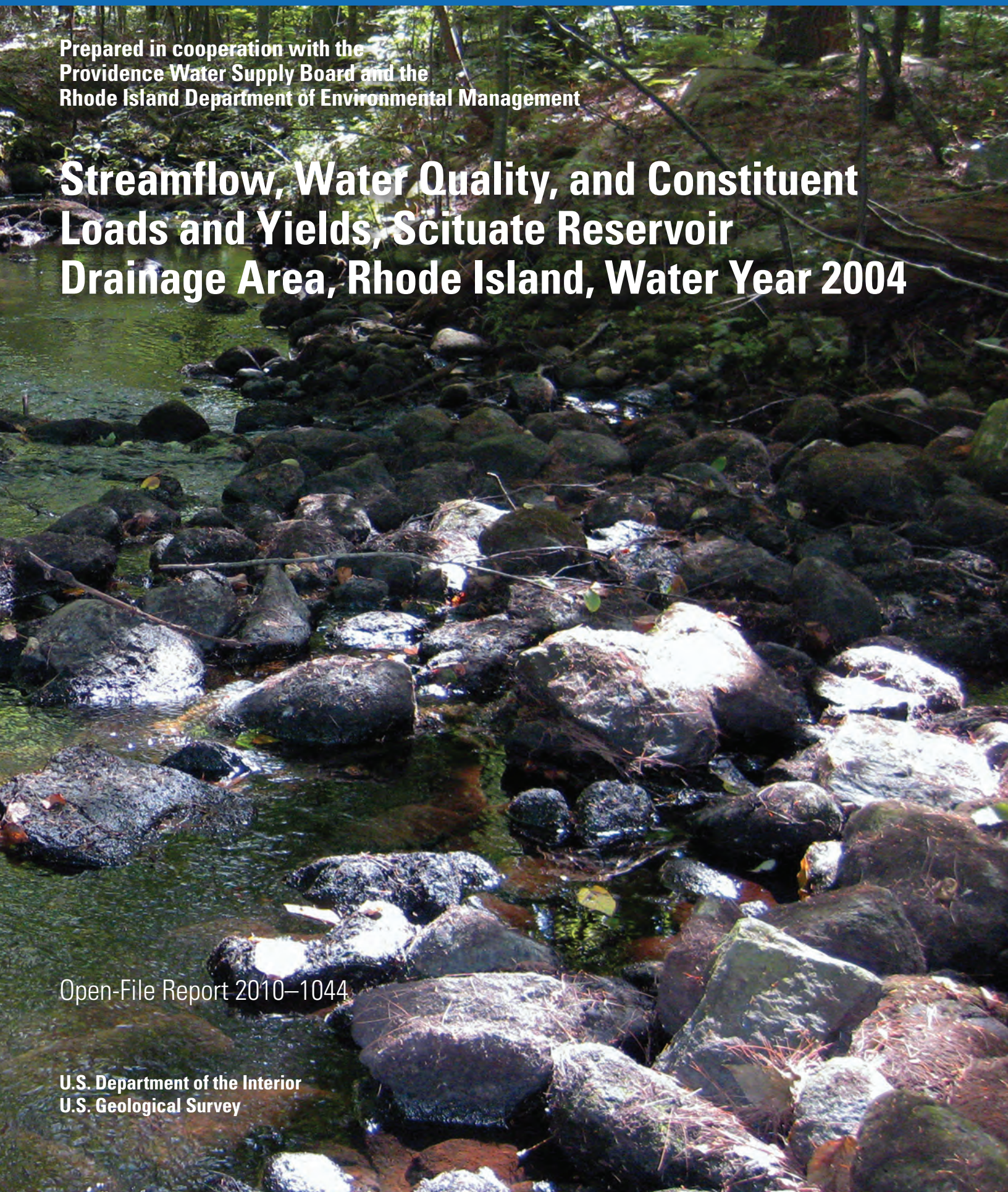
Streamflow, Water Quality, and Constituent Loads and Yields, Scituate Reservoir Drainage Area, Rhode Island, Water Year 2004



Open-File Report 2010–1044

U.S. Department of the Interior
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Cover. Photograph shows Peaptoad Brook.

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By Robert F. Breault and Jean P. Campbell

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

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Conversion Factors

Multiply	By	To obtain
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Mass	
ton, short (2,000 lb)	907.2	kilogram (kg)
ton, short (2,000 lb)	907,200	gram (kg)

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or colony forming units per 100 milliliters (CFU/100 mL).

Loads of chemical constituents in water are given either in grams or kilograms (or millions of colony forming units for bacteria) per day, month, or year and yields in grams or kilograms (or millions of colony forming units for bacteria) per day, month, or year per square mile.

Streamflow, Water Quality, and Constituent Loads and Yields, Scituate Reservoir Drainage Area, Rhode Island, Water Year 2004

By Robert F. Breault and Jean P. Campbell

Abstract

Streamflow and water-quality data were collected by the U.S. Geological Survey (USGS) or the Providence Water Supply Board, Rhode Island's largest drinking-water supplier. Streamflow was measured or estimated by the USGS following standard methods at 23 streamgage stations; 10 of these stations were also equipped with instrumentation capable of continuously monitoring specific conductance. Streamflow and concentrations of sodium and chloride estimated from records of specific conductance were used to calculate instantaneous (15-minute) loads of sodium and chloride during water year (WY) 2004 (October 1, 2003, to September 30, 2004). Water-quality samples were also collected at 37 sampling stations in the Scituate Reservoir drainage area by the Providence Water Supply Board during WY 2004 as part of a long-term sampling program. Water-quality data are summarized by using values of central tendency and are used, in combination with measured (or estimated) streamflows, to calculate loads and yields (loads per unit area) of selected water-quality constituents for WY 2004.

The largest tributary to the reservoir (the Ponaganset River, which was monitored by the USGS) contributed about 27 cubic feet per second (ft^3/s) to the reservoir during WY 2004. For the same time period, annual mean[1] streamflows measured (or estimated) for the other monitoring stations in this study ranged from about 0.42 to 19 ft^3/s. Together, tributary streams (equipped with instrumentation capable of continuously monitoring specific conductance) transported about 1,100,000 kilograms (kg) of sodium and 1,700,000 kg of chloride to the Scituate Reservoir during WY 2004; sodium and chloride yields for the tributaries ranged from 12,000 to 61,000 kilograms per square mile (kg/mi^2) and from 17,000 to 100,000 kg/mi^2, respectively.

At the stations where water-quality samples were collected by the Providence Water Supply Board, the median of the median chloride concentrations was 24.8 milligrams per liter (mg/L), median nitrite concentration was 0.001 mg/L as N, median nitrate concentration was 0.03 mg/L as N, median orthophosphate concentration was 0.07 mg/L as P, and median concentrations of total coliform and *Escherichia coli (E. coli)* bacteria were 33 and 23 colony forming units per 100 milliliters (CFU/100 mL), respectively. The medians of the median daily loads (and yields) of chloride, nitrite, nitrate, orthophosphate, and total coliform and *E. coli* bacteria were 160 kg/d (81 $kg/d/mi^2$), 9.1 g/d (5.2 $g/d/mi^2$), 280 g/d (110 $g/d/mi^2$), 760 g/d (340 $g/d/mi^2$), and 4,700 million colony forming units per day (CFU 10^6/d) (1,700 CFU $10^6/d/mi^2$) and 1,900 CFU 10^6/d (520 CFU $10^6/d/mi^2$), respectively.

[1] The arithmetic mean of the individual daily mean discharges for the year noted or for the designated period.

Introduction

The Scituate Reservoir is the primary source of drinking water for more than 60 percent of the population of Rhode Island. It covers about 94 mi^2 in parts of the towns of Cranston, Foster, Glocester, Johnston, and Scituate, R.I. (fig. 1). Information about the water quality of the reservoir and its tributary streams is important for management of the water supply and for the protection of human health. The Providence Water Supply Board (Providence Water), the agency responsible for the management and distribution of the Scituate Reservoir water supply, has been monitoring and assessing water quality in the reservoir and reservoir drainage area for more than 50 years.

Since 1993, the U.S. Geological Survey (USGS) has been cooperating with Providence Water and the Rhode Island Department of Environmental Management (RIDEM) to measure streamflow in tributaries to the Scituate Reservoir. Streamflow has been continuously measured at 2 streamgage stations in the drainage area and has been periodically measured at 21 additional stations on tributaries in the drainage area. At these 21 partial-record stations, continuous streamflow records have been estimated by using methods developed by the USGS (Hirsch, 1982). More recently (since 2000), the USGS also has been continuously measuring specific conductance at 10 monitoring stations. Equations that relate specific conductance to concentrations of sodium and chloride in streamwater also were developed as part of a previous USGS/Providence Water cooperative study (Nimiroski and Waldron, 2002). These equations, updated here and used together with measured (or estimated) streamflows, allow for nearly continuous estimation of sodium and chloride loads to the reservoir (Nimiroski and Waldron, 2002).

Currently (2009), Providence Water regularly collects water-quality samples from 37 tributary streams, either monthly or quarterly. Occasionally, samples are collected from other streams or stations as needed. Water-quality results are summarized by monitoring station and constituent or parameter in annual reports published by Providence Water. In addition, over the past 10 years, USGS reports have compiled and tabulated streamflow (measured or estimated by USGS) and water-quality data (collected by Providence Water; Breault and others, 2000; Nimiroski and others, 2008).

This report presents data on streamflow, water quality, and loads and yields of selected constituents for water year[2] (WY) 2004 in the Scituate Reservoir drainage area. These data were collected as part of studies done by the USGS in cooperation with Providence Water and the RIDEM. A summary of measured and estimated streamflows is presented for the 2 continuous-record and 21 partial-record streamgage stations in the drainage area. Estimated monthly loads and annual loads (and yields) of sodium and chloride are presented for the 10 stations at which specific conductance is continuously monitored by the USGS. Summary statistics for water-quality data collected by Providence Water at 37 sampling stations during WY 2004 also are presented, and these data were used to calculate loads and yields of selected water-quality constituents (table 1).

[2] October 1, 2003, to September 30, 2004.

Streamflow Data Collection and Estimation

Streamflow and water-quality data were collected by the USGS or Providence Water. Streamflow was measured or estimated by the USGS at 23 streamgage stations. Measured and estimated streamflows are necessary to estimate water volume and water-quality constituent loads and yields from tributary basins. At continuous-record streamgage stations, stream stage is measured every 15 minutes. Streamflow is computed with a stage-discharge relation (or rating), which is developed on the basis of periodic manual measurements. Daily mean streamflow at a station is calculated by dividing the total volume of water that passes the station each day by 86,400, the number of seconds in a day. Periodic manual streamflow measurements at partial-record gaging stations are used with concurrent continuous-record measurements from stations in hydrologically similar drainage areas to estimate a continuous record at the partial-record site. Specifically, continuous streamflow records for the 21 partial-record sites in the Scituate Reservoir drainage area were estimated by using the Maintenance of Variance Extension type 1 (MOVE.1) method, as described by Ries and Friesz (2000); data needed to estimate streamflows at partial-record sites were retrieved from the USGS National Water Inventory System (NWIS; http://waterdata.usgs.gov/nwis/) and formatted. Streamflows were estimated by MOVE.1 method by using a suite of USGS-developed computer programs (Granato, 2008). Errors for estimated streamflows are expressed as the upper and lower 90-percent confidence limits, as described by Tasker and Driver (1988) (table 2); there is a 90-percent chance that streamflow is somewhere between the upper and lower 90-percent confidence limits.

Continuous-record streamgage stations were operated and maintained by the USGS during WY 2004 on Peeptoad Brook (USGS station number 01115098 and Providence Water station number 16, in cooperation with RIDEM) and on the Ponaganset River (USGS station number 01115187 and Providence Water station number 35, in cooperation with Providence Water; fig. 1 and table 1). Streamflow data for these two gaging stations were collected at 15-minute intervals (near-real-time streamflow data), were updated at 2-hour intervals on the World Wide Web (WWW), and are available through the NWIS Web Interface (NWIS Web; U.S. Geological Survey, 2006). Error associated with measured streamflows in Peeptoad Brook and Ponaganset River was generally within about 15 percent (Socolow and others, 2004); upper and lower 90-percent confidence limits calculated by methods described by the National Institute of Standards and

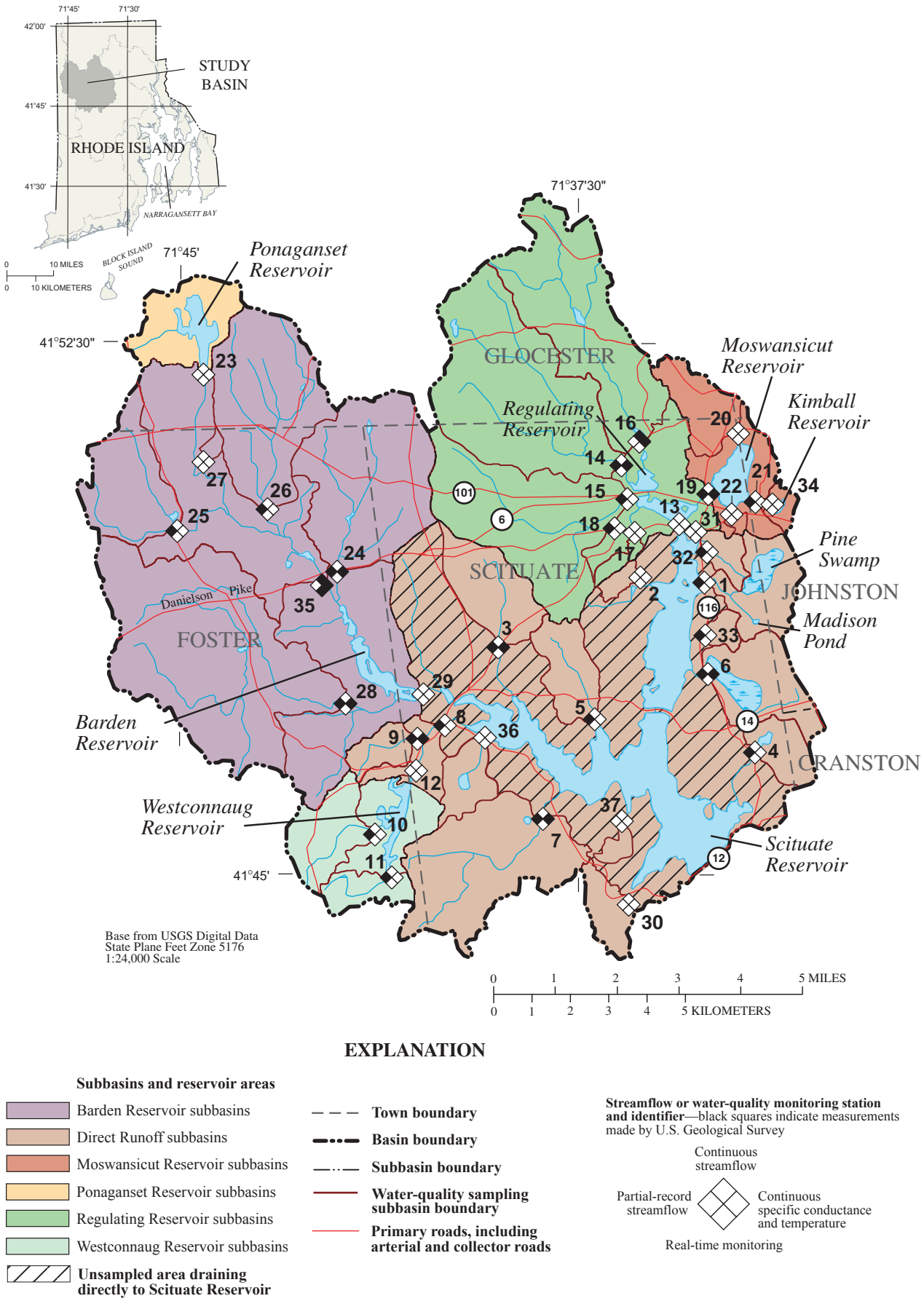

Figure 1. Locations of tributary-reservoir subbasins and streamgage and water-quality monitoring stations in the Scituate Reservoir drainage area, Rhode Island.

Table 1. Providence Water Supply Board water-quality sampling stations, water-quality samples, and available streamflow and continuous monitoring stations by tributary reservoir subbasin, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, to September 30, 2004.

[PW, Providence Water; USGS, U.S. Geological Survey; no., number; mi^2, square miles; QW, water quality; M, monthly; Q, quarterly;Y, yes; N, no; Na, sodium; Cl, chloride; --, none; Alternate station names given for stations where different historical names were used for the same sampling location by Providence Water.]

PW station no.	USGS station no.	Station name	Drainage area (mi^2)	Station active during study period	Frequency of QW sample collection	Number of samples collected by Providence Water[1]	Daily estimated Na and Cl loads	Estimated streamflow calculated
		Barden Reservior subbasin						
24	01115190	Dolly Cole Brook	4.90	Y	M	12	Y	Y
25	01115200	Shippee Brook	2.35	Y	Q	3	N	Y
26	01115185	Windsor Brook	4.32	Y	Q	3	N	Y
27	011151845	Unnamed Tributary to Ponaganset River (Unnamed Brook B, Unnamed Brook West of Windsor Brook)	0.10	Y	Q	1	N	N
28	01115265	Barden Reservoir (Hemlock Brook)	8.72	Y	M	12	Y	Y
29	01115271	Ponaganset River (Barden Stream)	33.0	Y	M	11	N	N
35	01115187	Ponaganset River	14.0	Y	M	11	Y	N
		Direct Runoff subbasin						
1	01115180	Brandy Brook	1.57	Y	M	12	N	Y
2	01115181	Unnamed Tributary #2 to Scituate Reservoir (Unnamed Brook North of Bullhead Brook)	0.15	Y	Q	2	N	N
3	01115280	Cork Brook	1.79	Y	M	12	Y	Y
4	01115400	Kent Brook (Betty Pond Stream)	0.85	Y	M	12	N	Y
5	01115184	Spruce Brook	1.22	Y	Q	3	N	Y
6	01115183	Quonapaug Brook	1.96	Y	M	9	Y	Y
7	01115297	Wilbur Hollow Brook	4.32	Y	M	12	Y	Y
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	5.18	Y	M	1	N	Y
9	01115275	Bear Tree Brook	0.62	Y	Q	4	Y	Y
30	01115350	Unnamed Tributary #4 to Scituate Reservoir (Coventry Brook, Knight Brook)	0.78	Y	Q	4	N	N
31	01115177	Toad Pond	0.04	Y	Q	1	N	N
32	01115178	Unnamed Tributary #1 to Scituate Reservoir (Pine Swamp Brook)	0.45	Y	Q	3	N	Y
33	01115182	Unnamed Tributary #3 to Scituate Reservoir (Hall's Estate Brook)	0.28	Y	Q	3	N	Y
36	--	Outflow from King Pond	0.77	Y	Q	3	N	N
37	--	Fire Tower Stream	0.15	Y	Q	3	N	N

Table 1. Providence Water Supply Board water-quality sampling stations, water-quality samples, and available streamflow and continuous monitoring stations by tributary reservoir subbasin, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, to September 30, 2004.—Continued

[PW, Providence Water; USGS, U.S. Geological Survey; no., number; mi^2, square miles; QW, water quality; M, monthly; Q, quarterly;Y, yes; N, no; Na, sodium; Cl, chloride; --, none; Alternate station names given for stations where different historical names were used for the same sampling location by Providence Water.]

PW station no.	USGS station no.	Station name	Drainage area (mi^2)	Station active during study period	Frequency of QW sample collection	Number of samples collected by Providence Water[1]	Daily estimated Na and Cl loads	Estimated streamflow calculated
		Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	3.25	Y	M	6	Y	Y
20	01115160	Unnamed Tributary #1 to Moswansicut Reservoir (Blanchard Brook)	1.18	Y	M	10	N	N
21	01115165	Unnamed Tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	0.29	Y	Q	3	N	Y
22	01115167	Moswansicut Reservoir (Moswansicut Stream South)	0.22	Y	M	9	N	N
34	01115164	Kimball Stream	0.27	Y	Q	3	N	N
		Ponaganset Reservoir subbasin						
23	011151843	Ponaganset Reservoir	1.92	Y	M	12	N	N
		Regulating Reservoir subbasin						
13	01115176	Regulating Reservoir	22.1	Y	M	12	N	N
14	01115110	Huntinghouse Brook	6.23	Y	M	12	Y	Y
15	01115114	Regulating Reservoir (Rush Brook)	4.70	Y	M	12	N	Y
16	01115098	Peeptoad Brook (Harrisdale Brook)	4.96	Y	M	12	Y	N
17	01115119	Dexter Pond (Paine Pond)	0.22	Y	Q	2	N	N
18	01115120	Unnamed Tributary to Regulating Reservoir (Unnamed Brook A)	0.28	Y	Q	1	N	Y
		Westconnaug Reservoir subbasin						
10	01115274	Westconnaug Brook	1.48	Y	M	10	N	Y
11	01115273	Unnamed Tributary to Westconnaug Reservoir (Unnamed Brook south of Westconnaug Reservoir)	0.72	Y	Q	2	N	Y
12	011152745	Unnamed Tributary to Westconnaug Brook (Unnamed Brook north of Westconnaug Reservoir)	0.16	Y	Q	1	N	N

[1] Not all samples were analyzed for all water-quality properties or constituents.

Table 2. Measured or estimated annual mean streamflow for tributary streams in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[USGS, U.S. Geological Survey; PW, Providence Water; no., number; ft^3/s, cubic feet per second; $ft^3/s/mi^2$, cubic feet per second per square mile]

PW station no.	USGS station no.	Station name	Annual mean streamflow (ft^3/s)	Upper 90-percent confidence interval (ft^3/s)	Lower 90-percent confidence interval (ft^3/s)	Normalized annual mean streamflow (ft^3/mi^2)
		Barden Reservoir subbasin				
24	01115190	Dolly Cole Brook	11	38	2.9	2.2
25	01115200	Shippee Brook	8.8	30	2.6	3.8
26	01115185	Windsor Brook	9.5	34	2.6	2.2
28	01115265	Barden Reservoir (Hemock Brook)	19	49	7.2	2.1
35	01115187	Ponaganset River	27	30	23	1.9
		Direct Runoff subbasin				
1	01115180	Brandy Brook	3.1	7.2	1.3	2.0
3	01115280	Cork Brook	3.8	9.0	1.6	2.1
4	01115400	Kent Brook (Betty Pond Stream)	2.4	22	0.28	2.9
5	01115184	Spruce Brook	3.5	14	0.85	2.9
6	01115183	Quonapaug Brook	4.9	14	1.7	2.5
7	01115297	Wilbur Hollow Brook	10	42	2.5	2.4
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	7.5	15	3.8	1.4
9	01115275	Bear Tree Brook	1.4	2.6	0.75	2.2
32	01115178	Unnamed Tributary #1 to Scituate Reservoir (Pine Swamp Brook)	0.59	1.1	0.33	1.3
33	01115182	Unnamed Tributary #3 to Scituate Reservoir (Hall's Estate Brook)	0.95	2.5	0.36	3.4
		Moswansicut Reservoir subbasin				
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	6.9	29	1.6	2.1
21	01115165	Unnamed Tributary #2 to Moswansicut Reservoir (Blanchard Brook)	0.70	3.0	0.16	2.4
		Regulating Reservoir subbasin				
14	01115110	Huntinghouse Brook	14	45	4.4	2.3
15	01115115	Regulating Reservoir (Rush Brook)	10	34	3.1	2.2
16	01115098	Peeptoad Brook (Harrisdale Brook)	11	12	9.4	2.1
18	01115120	Unnamed Tributary to Regulating Reservoir	0.42	1.0	0.17	1.5
		Westconnaug Reservoir subbasin				
10	01115274	Westconnaug Brook	4.0	13	1.3	2.7
11	01115273	Unnamed Tributary to Westconnaug Reservoir (Unnamed Brook South of Westconnaug Reservoir)	4.0	13	1.3	5.6

Water-Quality Data Collection and Analysis

Water-quality data were collected by the USGS or Providence Water. Concentrations of sodium and chloride were estimated (by USGS) from continuous records of specific conductance from 10 of the 23 streamgage stations. Water-quality samples were collected monthly or quarterly at 35 of 37 sampling stations in the Scituate Reservoir drainage area by Providence Water during WY 2002, as part of a long-term sampling program. Daily loads of chloride, bacteria, nitrate, nitrite, and orthophosphate were calculated at 23 monitoring stations where streamflow data were collected by USGS and water-quality samples were collected by Providence Water. Yields were calculated by dividing load by drainage area.

Data Collected by the U.S. Geological Survey

Water quality was monitored in a periodic water-quality sampling program that included measurements by automatic specific-conductance probes. The USGS collected and analyzed the specific conductance. Specific conductance was measured by the USGS at 15-minute intervals at the 10 monitoring stations, including the 2 continuous streamgage stations and 8 partial-record sites (fig. 1). Measurements were made by using an instream probe and standard USGS methods for continuous streamwater-quality monitoring (Wagner and others, 2006). Specific conductance data for the 10 monitoring stations were published in the USGS Annual Data Report for WY 2002 (Socolow and others, 2003).

Concentrations of sodium and chloride were estimated from continuous measurements of specific conductance by using equations that were developed by the USGS to relate specific conductance to concentrations of sodium and chloride (equations 1 and 2). These regression equations were developed by the MOVE.1 method (also known as the line of organic correlation; Helsel and Hirsch, 1992) on the basis of concurrent measurements of specific conductance along with sodium and chloride concentrations measured in water-quality samples collected from tributary streams in the Scituate Reservoir drainage area (Marcus Waldron, U.S. Geological Survey, written comm., 2008):

$$C_{Na} = \left(Spc^{1.1794}\right) \quad 0.05240 \text{ and} \tag{1}$$

$$C_{Cl} = \left(Spc^{1.2828}\right) \quad 0.05063, \tag{2}$$

where

C_{Na} is the sodium concentration, in milligrams per liter;

C_{Cl} is the chloride concentration, in milligrams per liter; and

Spc is the specific conductance, in microsiemens per centimeter.

MOVE.1 was chosen for regression analysis to maintain variance (Hirsch and Gilroy, 1984). Some missing values of specific conductance were estimated. In these cases, seasonal (July to October; November to June) averages were used for estimated values of specific conductance.

Data Collected by the Providence Water Supply Board

Water-quality samples were collected at 35 of 37 monitoring stations by Providence Water. Sampling was monthly at 18 monitoring stations and quarterly at another 17 stations (table 1) during WY 2002. Water-quality samples were not collected during specific weather conditions; rather, a strictly periodic water-quality sampling schedule was followed so that water-quality samples would be representative of various weather conditions. However, sometimes samples could not be collected because streams at the sampling stations were dry or frozen. When possible, water-quality samples were collected by dipping the sample bottle into the stream at the center of flow (Richard Blodgett, Providence Water Supply Board, written commun., 2005). Samples were transported on ice to the water-quality laboratory of Providence Water at the P.J. Holton Water Purification Plant in Scituate, R.I. Water-quality properties and constituent concentrations were measured by using unfiltered water samples. These water-quality properties included pH, temperature, acidity, alkalinity, color, turbidity, and concentrations of chloride, nitrite, nitrate, orthophosphate, and bacteria (*Escherichia coli (E. coli)* and total coliform). More information on sample-collection, analytical, and quality-control procedures can be found in the Providence Water Quality Assurance Program Manual (Providence Water Supply Board Water Quality Laboratory, 2003).

Providence Water collected samples during a wide range of flow conditions. The daily mean flow-duration curve for the Ponaganset River at South Foster (USGS station number 01115187) for WY2002 is shown in figure 2. The curve represents the percentage of time that each flow was exceeded at this station. The flows at this station on days when water-quality samples were collected at a representative station (Dolly Cole Brook, fig. 2) are represented by the plotted points superimposed on the curve. Samples were collected at flow durations ranging from the 1st percentile to the 90th percentile; this range indicates that water-quality samples collected in WY 2002 represent a wide range of flow conditions during that water year.

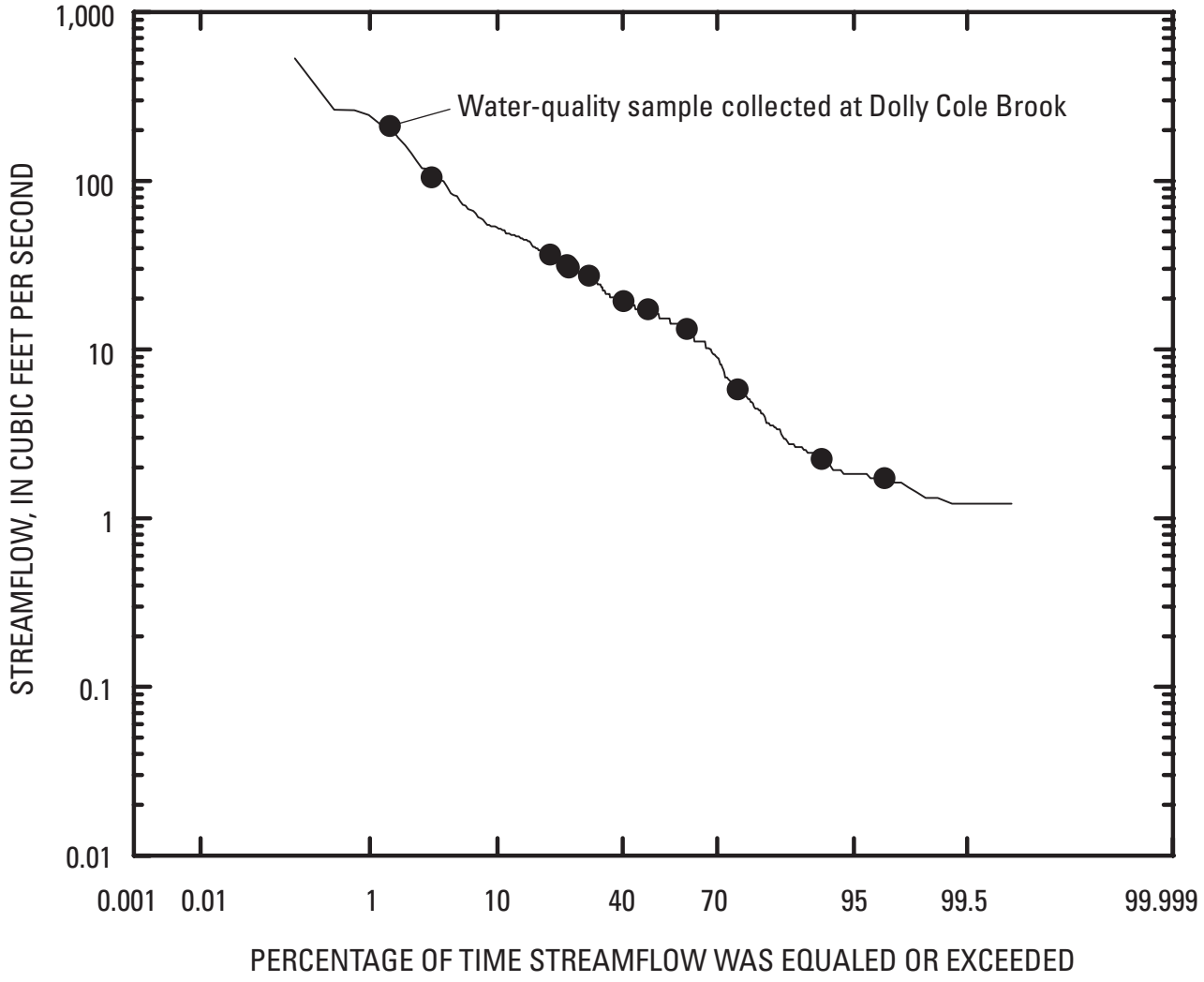

Figure 2. Flow-duration curve for the U.S. Geological Survey continuous streamgage station on Ponaganset River at South Foster (station 01115187) for water year 2004 and streamflow measurements at the Ponaganset River gaging station on the dates when water-quality samples were collected at Dolly Cole Brook (shown as points).

Estimating Daily, Monthly, and Annual Loads and Yields

Daily, monthly, and annual sodium and chloride loads in kilograms were estimated for all sampling sites for which streamflow (periodic or continuous) and continuous specific-conductance data were available during WY 2004. Daily sodium and chloride loads were estimated by multiplying daily (flow-weighted) concentrations of sodium and chloride in milligrams per liter by daily discharge (in liters per day) and added by month or water year. Daily flow-weighted concentrations of sodium and chloride were calculated by multiplying instantaneous flows by concurrent concentrations of sodium and chloride (estimated from measurements of specific conductance) for each day and dividing by the total flow for that day.

Daily loads of water-quality constituents (in samples collected by Providence Water) were calculated for all sampling dates during WY 2004 (table 3, at back of report) for which periodic or continuous streamflow data were available (table 1). These loads were calculated by multiplying constituent concentrations in milligrams per liter or colony forming units (CFU) per 100 milliliters in single samples multiplied by the daily discharge (in liters per day) for the day on which each sample was collected. The flows, which in most cases were estimates, were assumed to be representative of the flow at the time of the sample collection. Loads in grams or kilograms (or millions of CFUs for bacteria) per day and yields in grams or kilograms (or millions of CFUs for bacteria) per day per square mile were calculated for bacteria, chloride, nitrite, nitrate, and orthophosphate from this water-quality data. Censored data (or concentrations reported as less than method detection limits) were replaced with one-half the method detection limit.

Streamflow

Monitoring streamflow is necessary to measure the volume of water and estimate constituent loads to the Scituate Reservoir. The Ponaganset River is the largest monitored tributary to the Scituate Reservoir. Mean streamflow at the gaging station on the Ponaganset River (USGS station number 01115187) for the entire time period of its operation (mean of the daily mean streamflows for the period of record, WY 1994–2008) was 28 ft^3/s (http://waterdata.usgs.gov/nwis). During WY 2004, annual mean streamflow was 27 ft^3/s (fig. 3; Socolow and others, 2004). Mean streamflow in Peeptoad Brook (station number 01115098), the other continuous streamgage station in the Scituate Reservoir drainage area (USGS 01115098), for its period of record (WY 1994–2008) was 10 ft^3/s (http://waterdata.usgs.gov/nwis). Annual mean streamflow in Peeptoad Brook during WY 2004 was 11 ft^3/s (Socolow and others, 2004).

The 15-year periods of record at these two streamgage stations are shorter than time periods typically used to represent long-term average conditions. However, comparison with a nearby station having a period of record from WY 1940–2008 (Quinsigamond River at North Grafton, Mass., USGS station number 01110000) indicates that the distribution of streamflows regionally during the study period with respect to the long-term average flow at that station (42 ft^3/s; wdr.water.usgs.gov/) was similar to the distribution at Ponaganset River and Peeptoad Brook; the annual mean flow in WY 2004 was about average (40 ft^3/s; Socolow and others, 2004). Annual mean streamflows estimated for partial-record monitoring stations are given in table 2. Estimated annual mean streamflows at partial record stations ranged from 0.42 to 19 ft^3/s. Annual mean streamflows normalized by drainage area ranged from 1.3 to 5.6 $ft^3/s/mi^2$ (table 2).

Water Quality and Constituent Loads and Yields

Water-quality conditions in the Scituate Reservoir drainage area are described by summary statistics for water-quality properties and constituent concentrations and estimated constituent loads and yields. Loads and yields characterize the rates at which masses of constituents are transferred to the reservoir by tributary streams. In the case of loads, streams with higher flows tend to have higher loads because the greater volume of water carries more of the constituent to the reservoir per unit time. Yields represent the constituent load per unit drainage area and are calculated by dividing the load estimated for a monitoring station by the drainage area to the station. Yields are useful for comparison among sites of different drainage-area sizes because the effects of basin size and, therefore, total streamflow volume are attenuated. Yields are useful for examining potential differences among basin properties that may contribute to reservoir quality.

Summary statistics include means and medians. For some purposes, median values are more appropriate because they are less likely to be affected by high or low concentrations (or outliers). Medians are especially important to use for summarizing a relatively limited number of values. In contrast, continuously monitored streamflow and sodium and chloride loads (estimated from measurements of specific conductance), which include a large number of values, are better summarized in terms of means because a large data set is more resistant to the effects of outliers. Mean values also are particularly appropriate for characterizing loads because outlier values, which typically represent large flows, are important to include when representing the delivery of constituent masses to receiving waters.

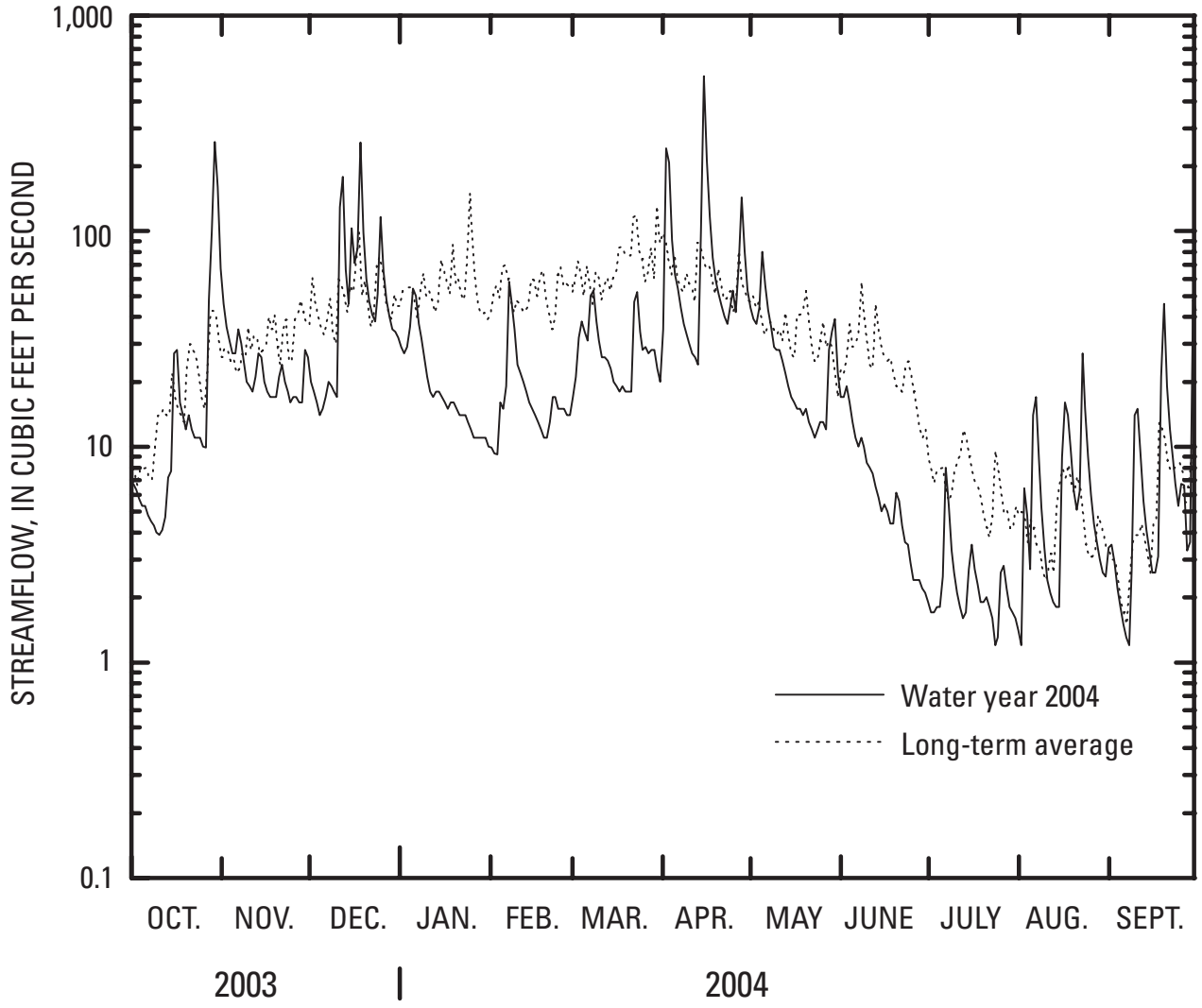

Figure 3. Measured daily mean streamflow for the U.S. Geological Survey continuous-record gaging station on the Ponaganset River at South Foster (station 01115187) in the Scituate Reservoir drainage area, Rhode Island, for October 1, 2003, through September 30, 2004 (solid line), and mean daily streamflow for March 22, 1994, through July 13, 2008 (dotted line).

Sodium and Chloride Loads and Yields Estimated from Specific-Conductance Monitoring Data

Sodium and chloride are constituents of special concern in the Scituate Reservoir drainage area; they are major constituents of road salt used for deicing, and several major roadways cross the drainage basin. State Routes 12 and 14 cut across the main body of the reservoir, and State Route 116 parallels the eastern limb (fig. 1). A recent study by the USGS, in cooperation with Providence Water, indicated that tributary streams in basins with state-maintained roads have substantially higher concentrations of sodium and chloride, presumably because of deicing activities (Nimiroski and Waldron, 2002). In addition, sodium is a constituent of potential concern for human health; some persons on restrictive diets need to limit their intake of sodium.

Estimated monthly mean[3] sodium concentrations in tributary streams of the Scituate Reservoir drainage area ranged from 3.4 to 58.5 mg/L, and estimated monthly mean chloride concentrations ranged from 4.8 to 105 mg/L. The highest monthly mean concentrations of sodium and chloride were measured at station 9 (Bear Tree Brook) in July 2004 (58.5 and 105 mg/L, respectively) (table 4). The highest annual mean[4] concentrations of sodium and chloride were measured at station 9 (Bear Tree Brook) at 30.1 and 51.1 mg/L, respectively (table 5). These high values are not surprising, because the waters that pass this station contain sodium and chloride from a formerly uncovered salt storage pile (Nimiroski and Waldron, 2002).

The Scituate Reservoir received about 1,100,000 kg (about 1,212 tons) of sodium and 1,700,000 kg (about 1,873 tons) of chloride from tributary streams—equipped with instrumentation capable of continuously monitoring specific conductance—during WY 2004. The highest sodium and chloride loads in WY 2004—200,000 kg and 310,000 kg, respectively—were measured at the Ponaganset River station (Providence Water Station Number 35) (table 5). Monthly sodium and chloride loads were highest at all stations in April (table 6). The totals of the April loads of sodium and chloride accounted for about 26 percent of the annual load for each constituent. The highest annual sodium and chloride yields were 61,000 and 100,000 kg/mi^2, respectively, and were measured at Bear Tree Brook (station 9; table 5).

[3] Monthly mean concentrations were calculated by dividing the total monthly load by the total discharge for the month.

[4] Annual mean concentrations were calculated by dividing the total annual load by the total discharge for the year.

Uncertainties associated with measuring streamflow and specific conductance and with sodium and chloride sample collection, preservation, and analysis produce uncertainties in load and yield estimates. The load and yield estimates presented in the text and tables are estimated to be the most likely values for loads and yields of sodium and chloride coming from tributary streams or their drainage basins. It may be best to discuss loads and yields in terms of a range within which the true values lie; however, the most probable values of loads and yields are presented for ease of discussion and presentation. The range within which the true values lie depends on the uncertainties in individual measurements of streamflow and concentration, which are difficult to quantify with available information. It is commonly assumed that the uncertainties associated with estimating streamflow affect load and yield calculations more than the error associated with measuring specific conductance and (or) chemical analysis. The most probable values of loads and yields presented in the tables and text are sufficient for planning-level analysis of water quality in tributary streams and their drainage basins.

Physical and Chemical Properties and Daily Loads and Yields Estimated from Data Collected by the Providence Water Supply Board

Physical and Chemical Properties

Physical and chemical properties including pH, turbidity, alkalinity, specific conductance, and color were routinely measured to characterize water quality from each basin (table 7). Specifically, pH is a measure of the acidity of the water; color can be an indirect measure of the amount of organic carbon dissolved in the water column; turbidity is an indirect measure of suspended particles; and alkalinity is a measure of the acid-neutralizing capacity of water.

The median pH in tributary streams in the Scituate Reservoir drainage area ranged from 5.2 to 6.7; the median of the medians among all stations was 6.1. Median values of color ranged from 12 to 250 platinum cobalt units (PCU); the median among all stations was 44 PCU. Median values of turbidity ranged from 0.2 to 1.8 nephelometric turbidity units (NTU); the median among all stations was 0.6 NTU. Median alkalinity values in tributary streams were low, ranging from 2.1 to 17 mg/L as $CaCO_3$; the median among all stations was 4.9 mg/L as $CaCO_3$ (table 7).

Table 4. Monthly mean concentrations of chloride and sodium estimated from continuous measurements of specific conductance in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[USGS, U.S. Geological Survey; PW, Providence Water; no., number; mg/L, milligrams per liter; Cl, chloride; Na, sodium; the average root mean square error of the regression estimates for sodium and chloride are 1.2 and 0.06, respectively; monthly mean concentrations were calculated by dividing the monthly load by the total discharge for the month]

PW station no.	USGS station no.	Station name	Oct.		Nov.		Dec.		Jan.		Feb.		Mar.	
			Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)
Barden Reservoir subbasin														
24	01115190	Dolly Cole Brook	16.9	10.9	17.7	11.4	16.6	10.7	18.4	11.9	27.9	17.2	24.3	15.3
28	01115265	Barden Reservoir (Hemock Brook)	12.1	8.0	14.6	9.6	10.6	7.1	15.7	10.3	18.7	12.0	15.6	10.2
35	01115187	Ponaganset River	15.4	7.9	12.2	8.0	9.9	6.3	11.3	7.6	14.9	10.4	15.3	10.0
Direct Runoff subbasin														
3	01115280	Cork Brook	21.0	13.3	21.7	13.8	22.3	14.1	24.4	15.3	35.3	21.5	36.5	22.2
6	01115183	Quonapaug Brook	25.1	15.7	27.8	17.3	23.8	15.0	33.3	20.4	51.2	29.8	31.6	19.5
7	01115297	Wilbur Hollow Brook	8.2	5.6	8.4	5.8	7.1	4.9	10.6	7.2	10.8	7.2	9.6	6.5
9	01115275	Bear Tree Brook	48.0	28.4	44.9	26.9	38.3	23.2	42.5	25.6	46.7	27.9	44.7	26.8
Moswansicut Reservoir subbasin														
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	33.0	20.2	34.5	21.1	24.2	14.8	36.1	21.9	61.6	35.3	36.9	22.5
Regulating Reservoir subbasin														
14	01115110	Huntinghouse Brook	5.0	3.5	4.8	3.4	9.0	6.2	13.4	8.8	12.9	8.6	12.6	8.4
16	01115098	Peeptoad Brook (Harrisdale Brook)	31.4	19.4	31.4	19.4	25.2	15.8	27.1	16.9	39.0	23.6	34.3	21.0
Scituate Reservoir basin														
		Average	21.6	13.3	21.8	13.7	18.7	11.8	23.3	14.6	31.9	19.4	26.1	16.2

PW station no.	USGS station no.	Station name	Apr.		May		June		July		Aug.		Sep.	
			Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)	Cl (mg/L)	Na (mg/L)
Barden Reservoir subbasin														
24	01115190	Dolly Cole Brook	20.7	13.2	22.6	14.3	24.2	15.2	24.4	15.3	30.2	18.7	25.3	15.9
28	01115265	Barden Reservoir (Hemock Brook)	14.3	9.4	20.2	12.9	22.9	14.5	28.2	17.5	29.5	18.3	22.1	14.0
35	01115187	Ponaganset River	13.3	7.8	16.6	10.5	19.7	12.2	20.7	13.0	20.6	13.1	19.0	11.5
Direct Runoff subbasin														
3	01115280	Cork Brook	27.4	17.1	28.6	17.8	27.0	16.8	32.9	20.2	32.1	19.7	32.7	20.1
6	01115183	Quonapaug Brook	24.7	15.5	30.4	18.8	35.0	21.4	52.0	30.8	41.5	25.0	28.7	17.7
7	01115297	Wilbur Hollow Brook	8.4	5.8	10.6	7.1	11.3	7.6	13.3	8.8	12.5	8.3	8.7	5.9
9	01115275	Bear Tree Brook	39.3	23.7	57.9	34.0	76.6	43.9	105	58.5	95.2	53.6	81.5	46.3
Moswansicut Reservoir subbasin														
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	35.2	21.5	38.9	23.6	40.4	24.4	41.7	25.1	40.8	24.7	40.9	24.7
Regulating Reservoir subbasin														
14	01115110	Huntinghouse Brook	6.8	4.7	11.7	7.8	11.7	7.8	13.9	9.2	17.2	11.1	13.6	9.0
16	01115098	Peeptoad Brook (Harrisdale Brook)	27.7	17.2	31.3	19.3	34.5	21.1	34.8	21.3	36.6	22.3	39.2	23.8
Scituate Reservoir basin														
		Average	21.8	13.6	26.9	16.6	30.3	18.5	36.6	22.0	35.6	21.5	31.2	18.9

Table 5. Annual mean chloride and sodium concentrations, loads, and yields by sampling station in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[USGS, U.S. Geological Survey; PW, Providence Water; no., number; mg/L, milligrams per liter; kg, kilograms; kg/mi², kilograms per square mile; Cl, chloride; Na, sodium; annual mean concentrations were calculated by dividing the annual load by the total discharge for the year.]

PW station no.	USGS station no.	Station name	Concentration		Load		Yield	
			Cl (mg/L)	Na (mg/L)	Cl (kg)	Na (kg)	Cl (kg/mi²)	Na (kg/mi²)
		Barden Reservoir subbasin						
24	01115190	Dolly Cole Brook	19.9	12.7	190,000	120,000	39,000	25,000
28	01115265	Barden Reservoir (Hemock Brook)	14.7	9.6	250,000	160,000	28,000	18,000
35	01115187	Ponaganset River	12.8	8.5	310,000	200,000	22,000	14,000
		Direct Runoff subbasin						
3	01115280	Cork Brook	26.3	16.4	90,000	56,000	51,000	32,000
6	01115183	Quonapaug Brook	28.5	17.6	120,000	77,000	63,000	39,000
7	01115297	Wilbur Hollow Brook	8.8	6.0	80,000	55,000	19,000	13,000
9	01115275	Bear Tree Brook	51.1	30.1	64,000	38,000	100,000	61,000
		Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir, (Moswansicut Stream North, Moswansicut Pond)	35.1	21.3	220,000	130,000	67,000	40,000
		Regulating Reservoir subbasin						
14	01115110	Huntinghouse Brook	8.6	5.8	110,000	74,000	17,000	12,000
16	01115098	Peeptoad Brook, (Harrisdale Brook)	29.9	18.5	280,000	170,000	57,000	35,000
		Scituate Reservoir basin						
			Average		Total		Average	
			23.6	14.7	1,700,000	1,100,000	46,000	29,000

Table 6. Monthly estimated chloride and sodium loads by sampling station in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[USGS, U.S. Geological Survey; PW, Providence Water; no., number; Cl, chloride; Na, sodium; kg, kilogram]

PW station no.	USGS station no.	Station name	Oct.		Nov.		Dec.		Jan.		Feb.		Mar.	
			Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)
Barden Reservoir subbasin														
24	01115190	Dolly Cole Brook	15,000	9,600	13,000	8,400	37,000	24,000	11,000	6,900	11,000	6,900	17,000	11,000
28	01115265	Barden Reservoir (Hemock Brook)	18,000	12,000	21,000	14,000	39,000	26,000	18,000	12,000	15,000	9,900	22,000	14,000
35	01115187	Ponaganset River	26,000	17,000	20,000	14,000	41,000	28,000	18,000	12,000	21,000	14,000	34,000	22,000
Direct Runoff subbasin														
3	01115280	Cork Brook	6,400	4,100	6,200	3,900	17,000	11,000	5,500	3,500	5,600	3,400	10,000	6,100
6	01115183	Quonapaug Brook	9,300	5,800	11,000	6,700	22,000	14,000	10,000	6,300	12,000	6,800	12,000	7,300
7	01115297	Wilbur Hollow Brook	6,500	4,400	6,700	4,600	14,000	9,700	6,800	4,600	5,000	3,300	7,400	5,000
9	01115275	Bear Tree Brook	4,700	2,800	5,600	3,400	6,800	4,100	4,800	2,900	4,400	2,700	5,700	3,400
Moswansicut Reservoir subbasin														
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	17,000	10,000	20,000	12,000	30,000	19,000	17,000	10,000	21,000	12,000	20,000	12,000
Regulating Reservoir subbasin														
14	01115110	Huntinghouse Brook	6,100	4,300	4,400	3,100	28,000	19,000	9,600	6,300	6,200	4,100	11,000	7,200
16	01115098	Peeptoad Brook (Harrisdale Brook)	25,000	15,000	28,000	17,000	48,000	30,000	19,000	12,000	21,000	13,000	29,000	18,000
Scituate Reservoir basin														
		Total	130,000	85,000	140,000	87,000	280,000	180,000	120,000	76,000	120,000	75,000	170,000	110,000

PW station no.	USGS station no.	Station name	Apr.		May		June		July		Aug.		Sep.	
			Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)	Cl (kg)	Na (kg)
Barden Reservoir subbasin														
24	01115190	Dolly Cole Brook	61,000	39,000	16,000	9,900	2,200	1,400	470	300	2,800	1,700	3,400	2,200
28	01115265	Barden Reservoir (Hemock Brook)	67,000	44,000	27,000	17,000	5,000	3,100	1,700	1,000	6,400	3,900	6,500	4,100
35	01115187	Ponaganset River	77,000	51,000	32,000	21,000	9,600	6,200	3,600	2,300	11,000	6,900	13,000	8,600
Direct Runoff subbasin														
3	01115280	Cork Brook	27,000	17,000	7,600	4,700	1,100	670	330	200	1,300	780	1,800	1,100
6	01115183	Quonapaug Brook	29,000	18,000	11,000	6,800	2,300	1,400	1,000	610	2,600	1,600	2,400	1,500
7	01115297	Wilbur Hollow Brook	21,000	14,000	7,900	5,300	1,400	950	480	320	1,600	1,000	1,500	990
9	01115275	Bear Tree Brook	7,800	4,700	7,000	4,100	4,000	2,300	3,600	2,000	4,900	2,800	4,300	2,400
Moswansicut Reservoir subbasin														
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	55,000	34,000	21,000	13,000	4,400	2,600	1,500	930	4,400	2,600	5,400	3,200
Regulating Reservoir subbasin														
14	01115110	Huntinghouse Brook	28,000	20,000	10,000	6,700	1,100	760	250	160	1,700	1,100	2,200	1,400
16	01115098	Peeptoad Brook (Harrisdale Brook)	66,000	41,000	26,000	16,000	5,700	3,500	2,000	1,200	6,000	3,600	7,900	4,800
Scituate Reservoir basin														
		Total	440,000	280,000	160,000	100,000	37,000	23,000	15,000	9,100	42,000	26,000	49,000	30,000

Constituent Concentrations and Daily Loads and Yields

Fecal indicator bacteria, chloride, and nutrients like phosphorus and nitrogen are commonly detected in natural water; at elevated concentrations, these constituents can render water unfit for the intended use. Fecal indicator bacteria, which are found in the intestines of warm-blooded animals, may indicate impairment from sewage contamination or from livestock or wildlife that defecate in or near the stream margin. Chloride originates in tributary streamwater from precipitation, weathering, or human activities like waste disposal and road deicing. Sources of nutrients in tributary streamwater include atmospheric deposition, leaching of naturally occurring organic material, discharge of groundwater that is enriched in nutrients from septic-system leachate, and runoff contaminated with fertilizer or animal waste. The ultimate intended use of water in the tributary streams is drinking water, which must meet specific water-quality standards. For this reason, Providence Water and the USGS closely monitor concentrations of these constituents in tributary streams. Median concentrations, loads, and yields of water-quality constituents are given in tables 7 and 8.

Bacteria

Median concentrations of total coliform and *E. coli* bacteria were above the detection limit (3 CFU/100 mL) at nearly all sites (table 7). Total coliform bacteria concentrations were in most cases equal to or greater than *E. coli* concentrations (as expected because total coliform is more inclusive); the median concentrations among all sites in the drainage basin were equal to 33 CFU/100 mL for total coliform bacteria and 23 CFU/100 mL for *E. coli* bacteria. Median concentrations of total coliform and *E. coli* bacteria were greatest (2,400 CFU/100 mL) at the Unnamed Tributary Regulating Reservoir (Providence Water Station 18) and Kimball Stream (Providence Water Station 34) (table 7). Concentrations of fecal indicator bacteria in some cases were lowest at monitoring stations immediately downstream from subbasin reservoirs, such as station 23 at the outlet of the Ponaganset Reservoir.

Median daily loads and yields of total coliform and *E. coli* bacteria varied over three orders of magnitude; the highest median daily yields were at station 11 (Unnamed Tributary Westconnaug Reservoir) in the Westconnaug Reservoir subbasin (table 8). Although relatively high for monitoring stations in the Scituate Reservoir subbasin, median daily bacteria yields at this station are low compared to yields of indicator bacteria in sewage-contaminated streamwater or streamwater influenced by stormwater runoff in an urban environment (Breault and others, 2002). The median daily loads of total coliform bacteria for the entire Scituate Reservoir drainage area ranged from 130 to 580,000 CFU 10^6/d, and median daily yields ranged from 290 to 800,000 CFU 10^6/d/mi2. The median daily loads for *E. coli* ranged from 79 to 450,000 CFU 10^6/d, and median daily yields ranged from 200 to 620,000 CFU 10^6/d/mi^2 (table 8).

Chloride

The highest median chloride concentration (111 mg/L) was measured in the Direct Runoff Subbasin at the Toad Pond station (31) (table 7). Median daily chloride loads and yields varied among monitoring stations in the drainage area (table 8); the median chloride yield for the overall drainage area was about 81 kg/d/mi^2. Ponaganset River (35) had the largest median daily chloride load (1,000 kg/d) and Unnamed Tributary to Regulating Reservoir (18) had the largest median daily chloride yield (570 kg/d/mi^2).

Nutrients

Median concentrations of nitrite and nitrate were 0.001 and 0.03 mg/L as N, respectively (table 7). Relatively high concentrations of nitrite and nitrate at some monitoring sites, such as Moswansicut Reservoir (22) in the Moswansicut Reservoir subbasin (0.009 mg/L as N and 0.32 mg/L, respectively), may have been affected by nitrogen-enriched runoff or groundwater (Nimiroski and others, 2008). The median concentration of orthophosphate for the entire study area (table 7) was 0.07 mg/L as P. The maximum median concentration of orthophosphate (0.14 mg/L as P) was measured at Fire Tower Stream (37). Nutrient loadings from the Unnamed Tributary to Westconnaug Reservoir (11) into the Westconnaug Reservoir—nitrite (130 g/d), nitrate (2,400 g/d), and orthophosphate (2,800 g/d)—were among the largest of all the sampled stations. Median daily orthophosphate loads for WY 2004 were larger at only two stations, Ponaganset River (35; 5,300 g/d) and Regulating Reservoir (15; 3,000 g/d). The largest median daily nutrient yields for nitrite (180 g/d/mi^2), nitrate (3,400 g/d/mi^2), and orthophosphate (3,900 g/d/mi^2) were determined for Unnamed Tributary to Westconnaug Reservoir (11); (table 8).

Table 7. Median values for water-quality data collected at Providence Water stations by tributary reservoir subbasin, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[Water-quality data are from samples collected and analyzed by Providence Water (PW); USGS, U.S. Geological Survey; no., number; PCU, platinum cobalt units; NTU, nephelometric turbidity units; CFU/100 mL, colony forming units per 100 milliliters; *E. coli*., *Escherichia coli*; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; N, nitrate; P, phosphorus; --, no data; <, less than]

PW station no.	USGS station no.	Station name	pH (units)	Color (PCU)	Turbidity (NTU)	Total coliform bacteria (CFU/100 mL)	*E. coli* (CFU/100 mL)	Alkalinity (mg/L as $CaCO_3$)	Chloride (mg/L)	Nitrite (mg/L as N)	Nitrate (mg/L as N)	Orthophosphate (mg/L as P)
Barden Reservoir subbasin												
24	01115190	Dolly Cole Brook	6.0	53	0.6	19	12	3.9	25.1	0.002	0.02	0.05
25	01115200	Shippee Brook	5.9	48	0.4	15	15	3.7	9.8	0.001	0.04	0.07
26	01115185	Windsor Brook	6.0	140	0.3	<3	<3	3.7	24.5	0.001	0.06	0.03
27	011151845	Unnamed Tributary to Ponaganset River (Unnamed Brook B, Unnamed Brook West of Windsor Brook)	5.9	--	0.3	4	4	4.4	8.4	0.001	0.03	0.08
28	01115265	Barden Reservoir (Hemlock Brook)	5.9	67	0.5	23	23	3.3	26.7	0.002	0.02	0.09
29	01115271	Ponaganset River (Barden Stream)	5.9	40	0.6	23	7	3.7	19.0	0.001	0.01	0.03
35	01115187	Ponaganset River	6.2	45	0.6	23	23	3.2	17.2	0.001	0.01	0.07
Direct Runoff subbasin												
1	01115180	Brandy Brook	6.7	73	1.8	87	23	9.4	9.9	0.003	0.03	0.09
2	01115181	Unnamed Tributary #2 to Scituate Reservoir (Unnamed Brook North of Bullhead Brook)	6.1	70	0.5	87	49	4.7	--	0.002	0.04	0.04
3	01115280	Cork Brook	6.3	28	0.4	33	19	4.5	32.7	0.001	0.07	0.12
4	01115400	Kent Brook (Betty Pond Stream)	6.4	34	0.6	84	23	6.1	4.5	0.001	0.02	0.05
5	01115184	Spruce Brook	6.1	44	0.4	23	5	3.6	15.5	0.001	0.06	0.12
6	01115183	Quonapaug Brook	6.3	120	1.0	43	23	9.5	34.2	0.003	0.05	0.13
7	01115297	Wilbur Hollow Brook	6.0	100	0.9	23	23	5.1	9.4	0.002	0.01	0.07
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	5.8	20	0.5	23	9	2.9	12.2	0.001	0.02	0.02
9	01115275	Bear Tree Brook	6.3	23	0.4	550	23	6.4	57.9	0.001	0.19	0.11
30	01115350	Unnamed Tributary #4 to Scituate Reservoir (Coventry Brook, Knight Brook)	6.1	29	0.3	38	43	4.3	20.5	0.001	0.04	0.08
31	01115177	Toad Pond	6.7	--	1.0	460	460	17	111	0.009	0.19	0.12
32	01115178	Unnamed Tributary #1 to Scituate Reservoir (Pine Swamp Brook)	5.9	160	1.0	75	75	4.9	7.5	0.002	<0.01	0.11
33	01115182	Unnamed Tributary #3 to Scituate Reservoir (Hall's Estate Brook)	5.9	57	0.3	<3	1,200	4.3	11.8	0.002	0.03	0.06
36	--	Outflow from King Pond	6.5	31	0.3	43	4	5.2	2.5	0.001	0.02	0.09
37	--	Fire Tower Stream	5.8	23	0.2	240	4	3.5	4.1	0.001	0.03	0.14

Table 7. Median values for water-quality data collected at Providence Water stations by tributary reseroir subbasin, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[Water-quality data are from samples collected and analyzed by Providence Water (PW); USGS, U.S. Geological Survey; no., number; PCU, platinum cobalt units; NTU, nephelometric turbidity units; CFU/100 mL, colony forming units per 100 milliliters; *E. coli*., *Escherichia coli*; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; N, nitrate; P, phosphorus; --, no data; <, less than]

PW station no.	USGS station no.	Station name	pH (units)	Color (PCU)	Turbidity (NTU)	Total coliform bacteria (CFU/100 mL)	*E. coli* (CFU/100 mL)	Alkalinity (mg/L as $CaCO_3$)	Chloride (mg/L)	Nitrite (mg/L as N)	Nitrate (mg/L as N)	Orthophosphate (mg/L as P)
Moswansicut Reservoir subbasin												
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	6.7	25	1.1	33	23	8.6	39.1	0.002	0.02	0.06
20	01115160	Unnamed Tributary #1 to Moswansicut Reservoir (Blanchard Brook)	5.9	120	0.6	59	26	5.1	48.2	0.003	0.03	0.07
21	01115165	Unnamed Tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	6.6	80	0.5	23	6	15	47.3	0.004	0.18	0.06
22	01115167	Moswansicut Reservoir (Moswansicut Stream South)	6.5	25	1.6	240	43	14	43.0	0.009	0.32	0.10
34	01115164	Kimball Stream	6.4	77	0.8	2,400	2,400	15	40.5	0.002	<0.01	0.11
Ponaganset Reservoir subbasin												
23	011151843	Ponaganset Reservoir	5.7	12	0.4	14	3	2.2	10.9	0.001	0.02	0.02
Regulating Reservoir subbasin												
13	01115176	Regulating Reservoir	6.5	31	0.7	23	3	8.3	33.3	0.001	0.03	0.09
14	01115110	Huntinghouse Brook	6.5	35	0.6	33	23	6.2	9.2	0.001	0.03	0.10
15	01115115	Regulating Reservoir (Rush Brook)	6.7	48	1.0	43	43	7.4	45.0	0.002	0.03	0.10
16	01115098	Peeptoad Brook (Harrisdale Brook)	6.5	35	1.0	43	23	9.6	33.9	0.002	0.03	0.06
17	01115119	Dexter Pond (Paine Pond)	5.9	42	0.7	12	23	6.4	30.6	0.002	0.01	0.01
18	01115120	Unnamed Tributary to Regulating Reservoir (Unnamed Brook A)	6.4	--	1.7	2,400	2,400	8.4	54.5	0.001	<0.01	0.06
Westconnaug Reservoir subbasin												
10	01115274	Westconnaug Brook	5.2	22	0.2	26	4	2.1	25.7	0.001	0.02	0.11
11	01115273	Unnamed Tributary to Westconnaug Reservoir (Unnamed Brook South of Westconnaug Reservoir)	5.2	250	0.7	1,400	1,200	3.2	4.8	0.003	0.06	0.07
12	011152745	Unnamed Tributary to Westconnaug Brook (Unnamed Brook north of Westconnaug Reservoir)	5.8	--	0.6	23	23	4.0	46.6	0.001	<0.01	0.03
Scituate Reservoir basin												
		Median	6.1	44	0.6	33	23	4.9	24.8	0.001	0.03	0.07

Table 8. Median daily loads and yields of bacteria, chloride, nitrite, nitrate, and orthophosphate, by tributary reservoir subbasin, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[Water-quality data are from samples collected and analyzed by Providence Water (PW); USGS, U.S. Geological Survey; no., number; CFU 10^6/d; millions of colony forming units per day; CFU 10^6/mi^2, millions of colony forming units per square mile; *E. coli*, *Escherichia coli*; kg/d, kilograms per day; kg/d/mi^2, kilograms per day per square mile; g/d, grams per day; g/d/mi^2, grams per day per square mile]

PW station no.	USGS station no.	Station name	Total coliform bacteria		*E. coli*		Chloride		Nitrite (as N)		Nitrate (as N)		Orthophosphate (as P)	
			(CFU 10^6/d)	(CFU 10^6/mi^2)	(CFU 10^6/d)	(CFU 10^6/mi^2)	(kg/d)	(kg/d/mi^2)	(g/d)	(g/d/mi^2)	(g/d)	(g/d/mi^2)	(g/d)	(g/d/mi^2)
Barden Reservoir subbasin														
24	01115190	Dolly Cole Brook	1,400	290	1,000	210	490	99	23	4.7	240	49	760	160
25	01115200	Shippee Brook	1,400	580	1,400	580	130	56	9.1	3.9	720	310	1,500	650
26	01115185	Windsor Brook	1,900	450	1,900	450	300	69	12	2.8	650	150	370	85
28	01115265	Barden Reservoir	28,000	3,300	4,500	520	700	81	46	5.3	280	32	1,600	180
35	01115187	Ponaganset River	17,000	1,200	6,800	490	1,000	73	83	5.9	440	31	5,300	380
Direct Runoff subbasin														
1	01115180	Brandy Brook	6,300	4,000	560	350	52	33	8.2	5.2	60	38	350	220
3	01115280	Cork Brook	1,500	860	1,000	570	140	80	6.4	3.6	230	130	500	280
4	01115400	Kent Brook	720	850	310	370	12	14	2.7	3.2	29	34	100	120
5	01115184	Spruce Brook	1,000	830	240	200	68	56	6.4	5.2	790	650	890	730
6	01115183	Quonapaug Brook	4,100	2,100	3,500	1,800	280	140	15	7.5	340	170	950	490
7	01115297	Wilbur Hollow Brook	2,700	630	1,900	440	150	34	33	7.6	200	47	1,600	370
8	01115276	Westconnaug Brook	6,800	1,300	2,600	510	360	69	29	5.7	590	110	590	110
9	01115275	Bear Tree Brook	5,600	9,000	620	1,000	130	210	2.9	4.7	350	560	170	270
32	01115178	Unnamed Tributary #1 to Scituate Reservoir (Pine Swamp Brook)	4,700	10,000	4,700	10,000	48	110	6.1	14	32	71	670	1,500
33	01115182	Unnamed Tributary #3 to Scituate Reservoir (Hall's Estate Brook)	130	470	20,000	70,000	16	58	3.3	12	120	430	98	350
Moswansicut Reservoir subbasin														
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	6,800	2,100	2,000	610	360	110	8.1	2.5	110	35	200	62

Table 8. Median daily loads and yields of bacteria, chloride, nitrite, nitrate, and orthophosphate, by tributary reservoir subbasin, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.—Continued

[Water-quality data are from samples collected and analyzed by Providence Water (PW); USGS, U.S. Geological Survey; no., number; CFU 10^6/d; millions of colony forming units per day; CFU 10^6/mi^2, millions of colony forming units per square mile; *E. coli*, *Escherichia coli*; kg/d, kilograms per day; kg/d/mi^2, kilograms per day per square mile; g/d, grams per day; g/d/mi^2, grams per day per square mile]

PW station no.	USGS station no.	Station name	Total coliform bacteria		*E. coli*		Chloride		Nitrite (as N)		Nitrate (as N)		Orthophosphate (as P)	
			(CFU 10^6/d)	(CFU 10^6/mi^2)	(CFU 10^6/d)	(CFU 10^6/mi^2)	(kg/d)	(kg/d/mi^2)	(g/d)	(g/d/mi^2)	(g/d)	(g/d/mi^2)	(g/d)	(g/d/mi^2)
Moswansicut Reservoir subbasin—Continued														
21	01115165	Unnamed Tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	530	1,800	79	270	68	230	3.9	13	310	1,100	73	250
Regulating Reservoir subbasin														
14	01115110	Huntinghouse Brook	11,000	1,700	4,400	700	120	19	21	3.4	600	97	2,100	340
15	01115115	Regulating Reservoir (Rush Brook)	5,100	1,100	3,400	720	530	110	18	3.7	210	45	3,000	650
16	01115098	Peeptoad Brook (Harrisdale Brook)	9,100	1,800	1,400	290	720	140	41	8.2	760	150	800	160
18	01115120	Unnamed Tributary to Regulating Reservoir (Unnamed Brook A)	70,000	250,000	70,000	250,000	160	570	2.9	10	15	52	180	630
Westconnaug Reservoir subbasin														
10	01115274	Westconnaug Brook	2,600	1,800	620	420	170	120	7.7	5.2	200	130	810	550
11	01115273	Unnamed Tributary to Westconnaug Reservoir (Unnamed Brook South of Westconnaug Reservoir)	580,000	800,000	450,000	620,000	240	340	130	180	2,400	3,400	2,800	3,900
Scituate Reservoir basin														
		Median	4,700	1,700	1,900	520	160	81	9.1	5.2	280	110	760	340

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Table 3. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate by tributary reservoir subbasin in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.

[Water-quality data are from samples collected and analyzed by Providence Water (PW); USGS, U.S. Geological Survey; no., number; ft^3/s, cubic feet per second; CFU 10^6/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilograms per day; g/d, grams per day; --, no data]

PW station no.	USGS station no.	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria (CFU 10^6/d)	*E. coli* (CFU 10^6/d)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as P)
Barden Reservoir subbasin										
24	01115190	Dolly Cole Brook	10/3/2003	0.81	850	850	48	2.0	40	280
			11/7/2003	13	4,800	4,800	620	64	160	2,500
			12/15/2003	57	640,000	60,000	2,500	140	700	7,000
			1/2/2004	12	1,200	1,200	510	59	880	1,800
			2/6/2004	5.7	210	210	460	14	980	420
			3/5/2004	8.9	2,000	2,000	570	44	870	1,100
			4/2/2004	107	24,000	10,000	7,100	260	5,200	10,000
			5/7/2004	13	480	480	790	32	320	6,400
			6/4/2004	3.0	1,700	1,700	180	15	150	220
			7/1/2004	0.19	200	200	11	0.93	4.6	9.3
			8/6/2004	0.75	3,900	790	59	3.7	37	440
			9/3/2004	0.19	1,100	19	14	0.46	9.3	23
25	01115200	Shippee Brook	10/17/2003	3.7	1,400	1,400	130	9.1	720	1,500
			4/16/2004	52	1,900	1,900	970	250	3,800	8,900
			7/1/2004	0.06	34	34	1.4	0.15	5.9	8.8
26	01115185	Windsor Brook	10/17/2003	5.0	2,800	2,800	300	12	980	370
			4/16/2004	53	1,900	1,900	1,600	260	650	2,600
			7/1/2004	0.12	4.4	4.4	7.5	0.15	18	44
28	01115265	Barden Reservoir	10/14/2003	2.0	1,100	1,100	130	24	24	240
			11/17/2003	14	7,900	7,900	620	68	340	1,400
			12/19/2003	98	36,000	36,000	2,500	480	2,400	22,000
			1/13/2004	13	480	480	800	64	640	3,800
			2/10/2004	16	1,600	590	1,400	120	2,000	2,300
			3/9/2004	20	7,300	730	790	49	2,000	3,900
			4/13/2004	68	38,000	38,000	4,300	170	3,300	10,000
			5/11/2004	18	110,000	110,000	1,200	44	220	1,800
			6/8/2004	4.5	260,000	26,000	300	33	220	990
			7/1/2004	0.61	36,000	36,000	44	3.0	90	210
			8/10/2004	0.67	39,000	380	59	1.6	16	200
			9/14/2004	0.78	21,000	440	61	3.8	9.5	270
35	01115187	Ponaganset River	10/3/2003	5.7	3,200	3,200	270	28	280	980
			11/7/2003	30	17,000	6,600	1,200	150	730	16,000
			12/15/2003	103	2,800,000	58,000	3,700	250	2,500	10,000
			1/2/2004	27	990	990	1,000	66	660	4,000
			3/5/2004	31	6,800	6,800	1,200	230	380	5,300
			4/2/2004	208	46,000	46,000	7,700	510	10,000	51,000
			5/7/2004	36	3,500	3,500	1,500	88	440	26,000
			6/4/2004	13	76,000	24,000	600	32	320	3,800
			7/1/2004	1.7	100,000	100,000	86	12	42	170
			8/6/2004	17	1,000,000	190,000	1,000	83	830	5,800
			9/3/2004	2.2	4,000	1,200	110	5.4	27	220

Table 3. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate by tributary reservoir subbasin in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.—Continued

[Water-quality data are from samples collected and analyzed by Providence Water (PW); USGS, U.S. Geological Survey; no., number; ft^3/s, cubic feet per second; CFU 10^6/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilograms per day; g/d, grams per day; --, no data]

PW station no.	USGS station no.	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria (CFU 10^6/d)	*E. coli* (CFU 10^6/d)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as P)
Direct Runoff subbasin										
1	01115180	Brandy Brook	10/7/2003	0.83	470	470	21	4.1	61	200
			11/4/2003	4.5	17,000	4,700	97	33	55	1,100
			12/2/2003	3.1	680	110	75	23	150	680
			1/6/2004	6.6	650	650	130	8.1	480	1,300
			2/3/2004	1.7	19,000	19,000	46	8.3	42	540
			3/2/2004	3.1	1,700	110	76	7.6	530	230
			4/6/2004	6.6	240	240	52	32	650	160
			5/17/2004	2.4	14,000	14,000	53	18	180	470
			6/1/2004	2.4	140,000	2,500	58	18	59	590
			7/1/2004	0.40	11,000	2,300	9.6	2.9	59	120
			8/3/2004	0.41	24,000	230	12	1.0	5.0	30
			9/7/2004	0.34	190	190	9.4	2.5	25	50
3	01115280	Cork Brook	10/2/2003	0.43	25,000	12,000	37	1.1	63	5.3
			11/6/2003	5.9	35,000	1,300	360	29	140	1,900
			12/4/2003	2.0	730	730	150	4.9	730	590
			1/9/2004	3.5	770	130	270	8.6	1,200	1,000
			2/5/2004	2.0	200	200	140	4.9	680	490
			3/4/2004	3.5	8,000	340	290	8.6	1,300	3,900
			4/1/2004	29	16,000	16,000	2,300	140	2,100	5,700
			5/6/2004	6.3	1,400	1,400	540	31	310	150
			6/3/2004	1.6	1,700	1,700	130	7.8	120	510
			7/1/2004	0.10	180	180	6.4	0.49	17	34
			8/5/2004	0.41	24,000	24,000	43	1.0	10	90
			9/2/2004	0.12	68	68	13	0.29	26	79
4	01115400	Kent Brook	10/7/2003	0.07	37	37	0.48	0.16	13	1.6
			11/4/2003	2.5	4,600	1,400	15	12	31	370
			12/2/2003	1.1	2,500	620	14	2.7	27	160
			1/6/2004	5.8	3,300	3,300	52	7.1	280	990
			2/3/2004	0.33	12	12	4.3	0.81	81	150
			3/2/2004	1.1	40	40	13	2.7	54	54
			4/6/2004	5.8	570	570	60	14	710	570
			5/17/2004	0.65	3,800	3,800	50	4.8	16	170
			6/1/2004	0.66	18,000	1,200	10	6.5	48	16
			7/1/2004	0.01	380	15	0.17	0.34	1.0	0.68
			8/3/2004	0.02	880	8.4	0.04	0.04	0.18	3.7
			9/7/2004	0.01	59	59	0.07	0.02	0.12	0.24
5	01115184	Spruce Brook	10/21/2003	1.3	2,400	290	30	6.4	95	890
			1/20/2004	1.8	1,000	--	68	4.4	880	310
			4/22/2004	5.4	200	200	230	13	790	1,600
6	01115183	Quonapaug Brook	10/7/2003	0.59	3,500	3,500	57	4.3	58	190
			11/4/2003	6.7	180,000	6,400	380	66	82	1,600
			12/2/2003	3.9	4,100	2,200	380	29	670	2,000
			1/6/2004	12	440	440	1,100	15	4,400	3,800
			3/2/2004	3.9	2,200	2,200	280	9.5	1,300	950
			4/6/2004	12	6,200	4,400	850	29	1,500	1,200
			5/17/2004	2.7	1,500	1,500	160	6.6	130	33
			6/1/2004	2.8	160,000	75,000	240	27	340	890
			7/1/2004	0.21	12,000	12,000	18	1.5	15	67

Table 3. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate by tributary reservoir subbasin in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.—Continued

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PW station no.	USGS station no.	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria (CFU 10^6/d)	*E. coli* (CFU 10^6/d)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as P)
Direct Runoff subbasin—Contined										
7	01115297	Wilbur Hollow Brook	10/2/2003	1.4	790	790	33	17	17	240
			11/6/2003	16	94,000	94,000	200	78	200	2,700
			12/4/2003	6.0	2,200	2,200	140	29	2,200	1,800
			1/9/2004	9.8	360	360	220	48	480	1,700
			2/5/2004	5.8	3,300	210	160	28	990	2,100
			3/4/2004	9.8	2,200	2,200	220	48	480	1,900
			4/1/2004	69	39,000	39,000	1,300	340	1,700	10,000
			5/6/2004	17	9,600	1,700	350	1,700	210	420
			6/3/2004	4.9	5,200	5,200	120	36	60	1,600
			7/1/2004	0.38	400	400	11	3.7	28	65
			8/5/2004	1.4	82,000	16,000	32	3.4	17	210
			9/2/2004	0.43	240	240	9.9	6.3	5.3	170
8	01115276	Westconnaug Brook	4/29/2004	12	6,800	2,600	360	29	590	590
9	01115275	Bear Tree Brook	10/21/2003	1.1	30,000	620	170	2.7	240	190
			1/20/2004	1.3	130	--	74	3.2	920	130
			4/22/2004	2.1	77	77	270	5.1	360	820
			7/1/2004	0.41	11,000	11,000	87	1.0	340	150
32	01115178	Unnamed Tributary #1 to Scituate Reservoir (Pine Swamp Brook)	10/30/2003	2.6	4,800	4,800	48	32	32	700
			4/15/2004	2.5	92	92	380	6.1	180	670
			7/1/2004	0.08	4,700	4,700	1.2	0.39	0.98	23
33	01115182	Unnamed Tributary #3 to Scituate Reservoir (Hall's Estate Brook)	10/15/2003	0.67	39,000	39,000	16	3.3	16	98
			1/28/2004	0.15	5.5	--	4.3	1.1	120	22
			4/28/2004	3.6	130	130	550	8.8	260	970
Moswansicut Reservoir subbasin										
19	01115170	Moswansicut Reservoir (Moswansicut Stream North, Moswansicut Pond)	3/11/2004	6.5	6,800	640	600	7.9	640	1,900
			4/8/2004	12	6,800	6,800	1,100	59	2,900	3,800
			5/13/2004	5.8	3,300	3,300	560	28	140	140
			6/10/2004	1.7	100,000	100,000	170	8.3	21	42
			7/1/2004	0.40	23,000	730	39	0.98	9.8	20
			9/9/2004	1.2	680	120	110	5.9	88	260
21	01115165	Unnamed Tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	10/24/2003	0.37	100	100	43	3.6	27	81
			1/23/2004	0.50	530	--	68	12	310	73
			4/26/2004	1.6	900	59	120	3.9	700	39
Regulating Reservoir subbasin										
14	01115110	Huntinghouse Brook	10/6/2003	0.74	420	420	21	3.6	36	520
			11/3/2003	20	11,000	11,000	390	49	3,400	8,300
			12/1/2003	11	6,200	6,200	240	27	810	5,100
			1/5/2004	33	170,000	35,000	690	81	3,200	8,100
			2/17/2004	3.9	140	140	100	9.5	670	48
			3/1/2004	6.1	6,400	220	140	15	1,000	1,000
			4/5/2004	52	5,100	1,900	1,100	130	3,800	6,400
			5/3/2004	22	12,000	12,000	510	160	540	3,200
			6/7/2004	2.4	14,000	2,500	62	12	120	180
			7/1/2004	0.17	10,000	10,000	2.2	0.42	4.2	54
			8/16/2004	8.6	500,000	500,000	74	42	210	8,400
			9/15/2004	0.22	13,000	120	5.1	0.54	16	48

Table 3. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate by tributary reservoir subbasin in the Scituate Reservoir drainage area, Rhode Island, October 1, 2003, through September 30, 2004.—Continued

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PW station no.	USGS station no.	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria (CFU 10^6/d)	*E. coli* (CFU 10^6/d)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as P)
Regulating Reservoir subbasin—Continued										
15	01115115	Regulating Reservoir (Rush Brook)	10/6/2003	0.62	350	350	76	3.0	45	120
			11/3/2003	15	8,400	8,400	1,000	73	1,800	2,900
			12/1/2003	8.2	1,800	1,800	630	20	400	3,200
			1/5/2004	24	88,000	88,000	2,900	120	2,300	6,500
			2/17/2004	3.1	1,700	300	410	15	230	4,400
			3/1/2004	4.7	28,000	4,900	430	11	460	920
			4/5/2004	38	40,000	40,000	3,800	93	7,400	11,000
			5/3/2004	16	17,000	17,000	1,700	78	200	3,100
			6/7/2004	1.9	1,100	1,100	270	14	46	190
			7/1/2004	0.15	1,700	1,700	22	0.37	3.7	33
			8/16/2004	6.6	390,000	390,000	760	48	160	4,700
			9/15/2004	0.19	1,100	350	4.0	0.46	14	56
16	01115098	Peeptoad Brook (Harrisdale Brook)	10/6/2003	1.7	960	960	170	8.3	83	170
			11/3/2003	17	620	620	1,300	83	2,900	7,500
			12/1/2003	11	1,100	1,100	840	54	1,100	4,000
			1/5/2004	24	140,000	14,000	1,600	59	2,900	4,100
			2/17/2004	5.4	1,200	530	490	13	1,200	130
			3/1/2004	7.4	14,000	14,000	680	18	2,200	720
			4/5/2004	33	35,000	19,000	2,900	160	6,500	4,800
			5/3/2004	18	10,000	1,800	1,400	88	440	880
			6/7/2004	3.8	22,000	22,000	320	28	93	370
			7/1/2004	0.61	640	640	48	3.0	30	75
			8/16/2004	9.4	55,000	550,000	760	69	230	8,300
			9/15/2004	0.72	8,100	26	70	1.8	35	230
18	01115120	Unnamed Tributary to Regulating Reservoir (Unnamed Brook A)	4/26/2004	1.2	70,000	70,000	160	2.9	15	180
Westconnaug Reservoir subbasin										
10	01115274	Westconnaug Brook	10/14/2003	0.33	19,000	19,000	21	3.2	16	81
			11/17/2003	2.8	2,900	100	180	6.8	140	820
			12/19/2003	23	2,300	2,300	1,100	56	1,100	6,800
			1/13/2004	2.5	92	92	130	6.1	370	790
			2/10/2004	3.1	680	680	160	15	230	76
			3/9/2004	3.9	140	140	250	9.5	290	1,700
			4/13/2004	15	550	550	1,100	37	370	3,300
			5/11/2004	3.5	3,700	340	250	8.6	170	1,000
			6/8/2004	0.80	9,000	4,700	59	2.0	20	98
			7/1/2004	0.09	5,300	5,300	2.2	4.5	4.5	1.1
11	01115273	Unnamed Tributary to Westconnaug Reservoir (Unnamed Brook South of Westconnaug Reservoir)	10/28/2003	15	880,000	880,000	120	150	3,700	3,300
			4/27/2004	24	270,000	14,000	360	120	1,200	2,300

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