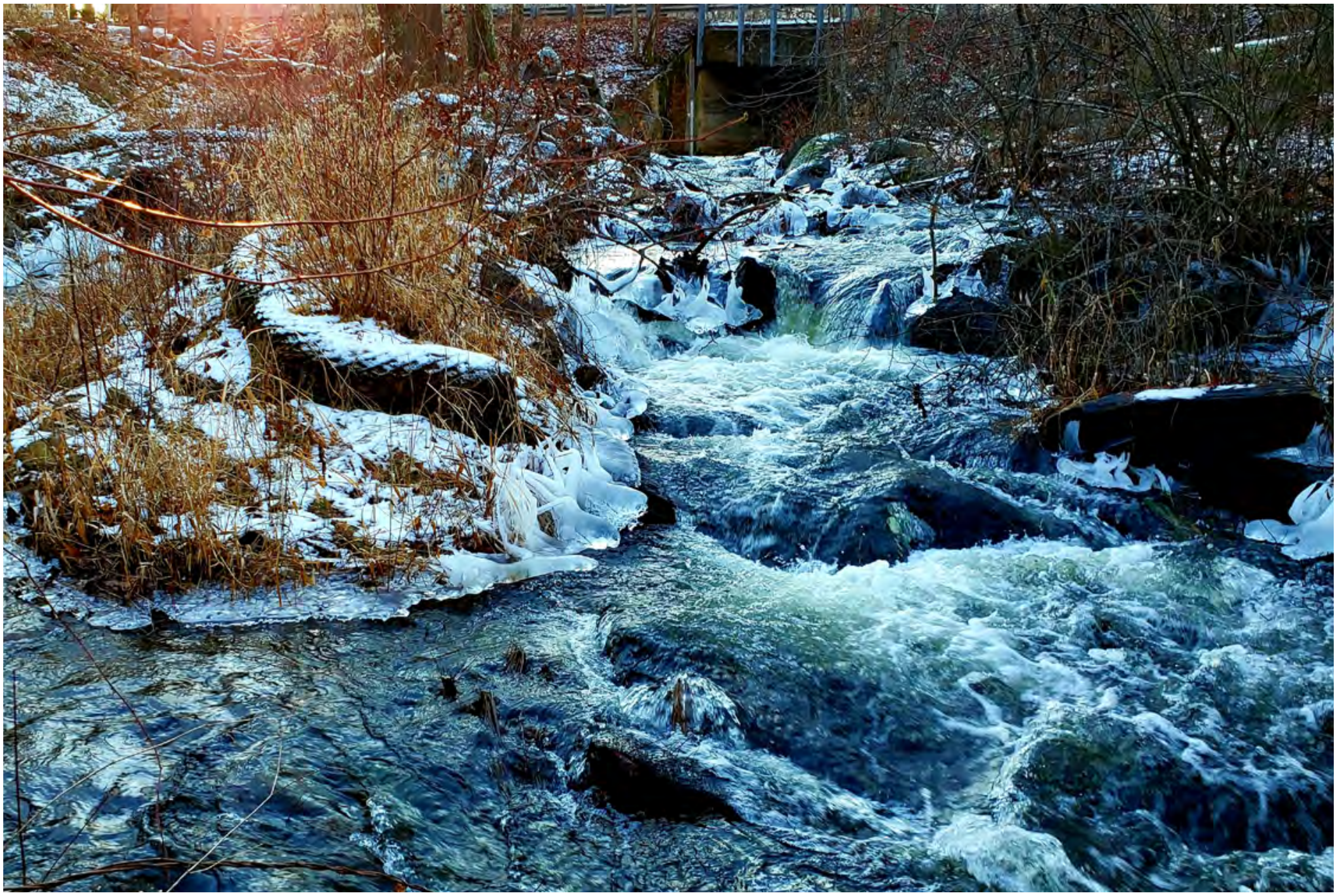
Prepared in cooperation with the Providence Water Supply Board

Streamflow, Water Quality, and Constituent Loads and Yields, Scituate Reservoir Drainage Area, Rhode Island, Water Year 2019



Data Report 1145

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

Cover. U.S. Geological Survey streamgage at Westconnaug Stream at Plainfield Pike, Rhode Island; photograph by the U.S. Geological Survey.

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
ton, short (2,000 lb)	0.9072	metric ton (t)

Datum

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

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

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

Supplemental Information

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

Loads of constituents in water are given in kilograms (kg), and daily loads are given in grams per day (g/d), kilograms per day (kg/d), kilograms per year (kg/yr), metric tons per year (t/yr), or million colony forming units per day ($CFU\times10^6/d$).

Yields are given in grams per day per square mile ($g/d/mi^2$), kilograms per day per square mile ($kg/d/mi^2$), kilograms per year per square mile ($kg/yr/mi^2$), metric tons per year per square mile ($t/yr/mi^2$), or million colony forming units per day per square mile ($CFU\times10^6/d/mi^2$).

Abbreviations

E. coli	*Escherichia coli*
MOVE.1	Maintenance of Variance Extension type 1
NWIS	National Water Information System
PWSB	Providence Water Supply Board
USGS	U.S. Geological Survey
WY	water year

Streamflow, Water Quality, and Constituent Loads and Yields, Scituate Reservoir Drainage Area, Rhode Island, Water Year 2019

By Kirk P. Smith

Abstract

As part of a long-term cooperative program to monitor water quality within the Scituate Reservoir drainage area, the U.S. Geological Survey in cooperation with the Providence Water Supply Board collected streamflow and water-quality data at the Scituate Reservoir and tributaries. Streamflow and concentrations of chloride and sodium estimated from records of specific conductance were used to calculate loads of chloride and sodium during water year 2019 (October 1, 2018, through September 30, 2019) for tributaries to the Scituate Reservoir, Rhode Island. Streamflow was measured or estimated by the U.S. Geological Survey following standard methods at 23 streamgages; 14 of these streamgages are equipped with instrumentation capable of continuously monitoring water level, specific conductance, and water temperature. Water-quality samples were collected by the Providence Water Supply Board at 37 sampling stations, which also include the 14 continuous-record streamgages maintained by the U.S. Geological Survey, during water year 2019 as part of a long-term sampling program; all stations are in the Scituate Reservoir drainage area. Water-quality data collected by the Providence Water Supply Board 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 water year 2019.

The largest tributary to the reservoir, the Ponaganset River, which was monitored by the U.S. Geological Survey, contributed a mean streamflow of 40 cubic feet per second to the reservoir during water year 2019. For the same period, annual mean streamflows measured (or estimated) for the other monitoring stations in this study ranged from about 0.55 to about 26 cubic feet per second. Together, tributaries equipped with instrumentation capable of continuously monitoring specific conductance transported about 3,500 metric tons of chloride and 2,100 metric tons of sodium to the Scituate Reservoir during water year 2019; annual chloride yields for the tributaries ranged from 20 to 180 metric tons per square mile, and annual sodium yields ranged from 14 to 100 metric tons per square mile.

At the stations where water-quality samples were collected by the Providence Water Supply Board, the medians of the median concentrations were 25.1 milligrams per liter for chloride, 0.001 milligram per liter as nitrogen for nitrite, 0.08 milligram per liter as nitrogen for nitrate, 0.03 milligram per liter as phosphate for orthophosphate, 1,000 colony forming units per 100 milliliters for total coliform bacteria, and 10 colony forming units per 100 milliliters for *Escherichia coli* (*E. coli*). The medians of the median daily loads of chloride, nitrite, nitrate, orthophosphate, total coliform, and *E. coli* bacteria were 340 kilograms per day, 18 grams per day, 1,000 grams per day, 410 grams per day, 81,000 million colony forming units per day, and less than 1,800 million colony forming units per day, respectively. The medians of the median yields of chloride, nitrite, nitrate, orthophosphate, total coliform, and *E. coli* bacteria were 140 kilograms per day per square mile, 6.8 grams per day per square mile, 440 grams per day per square mile, 140 grams per day per square mile, 32,000 million colony forming units per day per square mile, and 660 million colony forming units per day per square mile, respectively.

Introduction

The Scituate Reservoir is the primary source of drinking water for more than 60 percent of the population of Rhode Island. The Scituate Reservoir drainage area consists of six subbasins and covers an area of about 94 square miles in parts of the towns of Cranston, Foster, Glocester, Johnston, and Scituate, Rhode Island (fig. 1). Information about the water quality of the reservoir and its tributaries is important for management of the water supply and for the protection of human health. The Providence Water Supply Board (PWSB), which is 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 60 years.

Since 1993, the U.S. Geological Survey (USGS) has been cooperating with the PWSB and the Rhode Island Department of Environmental Management to measure streamflow in

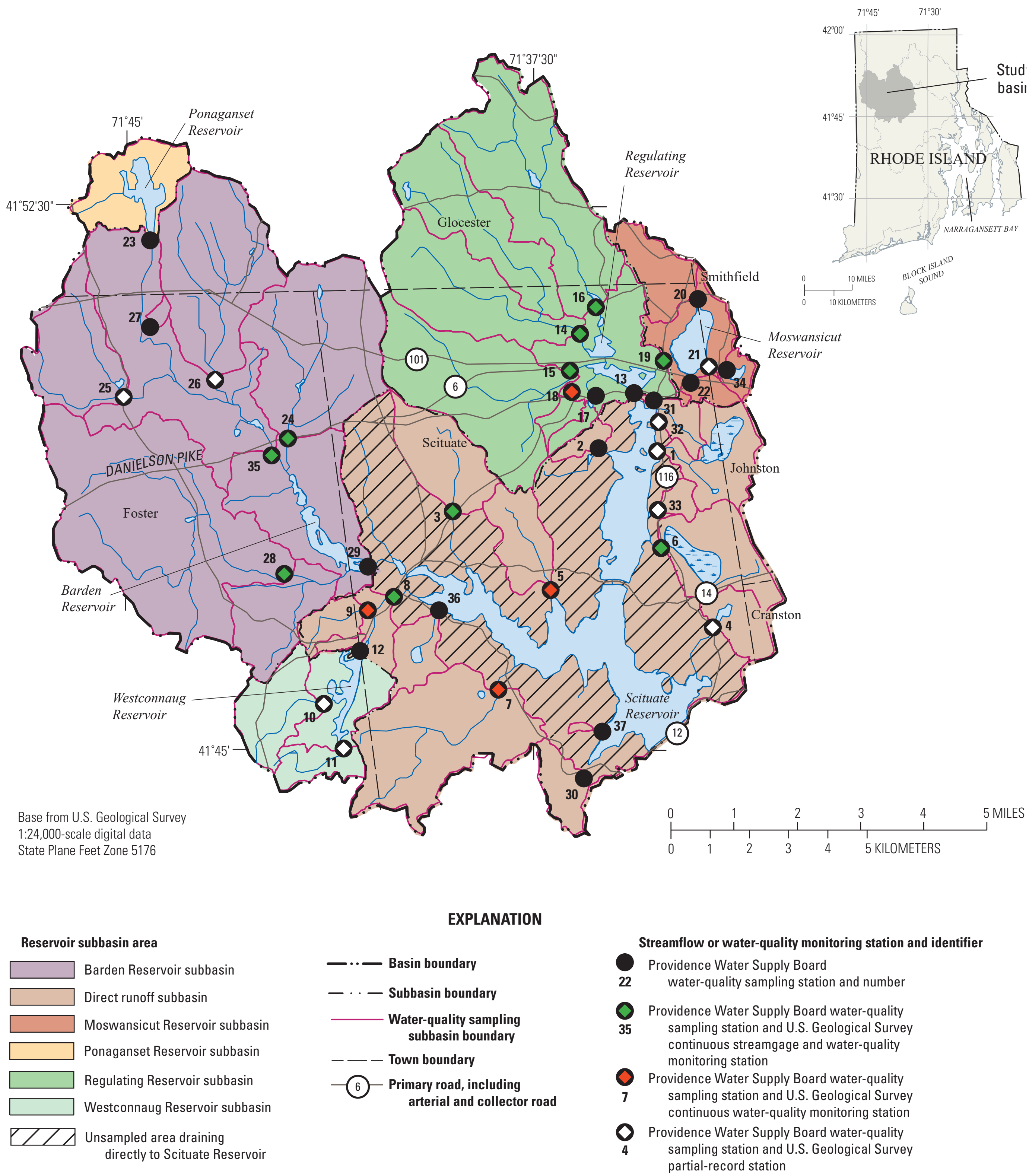

Figure 1. Locations of tributary-reservoir subbasins and stations in the Scituate Reservoir drainage area, Rhode Island, in water year 2019.

tributaries to the Scituate Reservoir. Streamflow has been continuously measured at 10 streamgages in the drainage area (table 1) since 2009 by the USGS. Streamflow also was continuously measured at four streamgages from 2009 to 2014 and periodically measured at nine additional streamgages on tributaries in the drainage area. At the 13 streamgages without continuous flow data, daily mean streamflow has been estimated by using methods developed by the USGS (table 1; Hirsch, 1982). The USGS also has been continuously measuring specific conductance at 14 monitoring stations since 2009 (table 1). Equations that relate specific conductance to concentrations of chloride and sodium in stream water were developed as part of previous cooperative studies of the USGS and the PWSB (Nimiroski and Waldron, 2002; Smith, 2015b, 2018a, 2021a). These equations, used together with measured (or estimated) streamflows, allow for nearly continuous estimation of chloride and sodium loads to the reservoir.

In 2019, the PWSB regularly, either monthly or quarterly, visited fixed sites on 37 tributaries within the Scituate Reservoir drainage area and collected water-quality samples. Compiled and tabulated streamflow (measured or estimated by the USGS) and water-quality data (collected by the PWSB) have been published in Breault and others (2000), Nimiroski and others (2008), Breault (2010), Breault and Campbell (2010a–d), Breault and Smith (2010), Smith and Breault (2011), and Smith (2013, 2014, 2015a, b, 2016, 2018a–d, 2019a, b, 2021a, b).

This report presents data on streamflow, water quality, and loads and yields of selected constituents for water year (WY)[1] 2019 in the Scituate Reservoir drainage area. These data were collected as part of studies done by the USGS in cooperation with the PWSB and the Rhode Island Department of Environmental Management. A summary of measured and estimated streamflows is presented for the 10 continuous-record and 13 partial-record streamgages in the drainage area. Estimated monthly and annual loads and yields of chloride and sodium are presented for the 14 streamgages at which specific conductance is continuously monitored by the USGS. Summary statistics for water-quality data collected by the PWSB for 37 sampling stations (table 1) during WY 2019 also are presented, and these data were used to calculate loads and yields of selected water-quality constituents where flow data were available.

[1]A water year is the period between October 1 and September 30 and is designated by the year in which it ends.

Streamflow Data Collection and Estimation

Streamflow was measured or estimated by the USGS at 23 streamgages (table 1). Measured and estimated streamflows are necessary to estimate water volume and water-quality constituent loads and yields from tributary basins. Stream stage was measured every 10 minutes at most continuous-record streamgages. Streamflow was computed with a stage-discharge relation (known as a rating), which was developed on the basis of periodic manual measurements of streamflow. Daily mean streamflow at a streamgage was calculated by dividing the total volume of water that passed the streamgage each day by 86,400 (the number of seconds in a day). Periodic manual streamflow measurements at partial-record streamgages were used concurrently with continuous-record measurements from streamgages in nearby hydrologically similar drainage areas to estimate a continuous daily record at the partial-record streamgages. Specifically, daily streamflow records for the 13 partial-record sites in the Scituate Reservoir drainage area (table 1) were estimated by using the Maintenance of Variance Extension type 1 (MOVE.1) method, as described by Ries and Friesz (2000) and Smith (2015b); data needed to estimate streamflows at partial-record sites were retrieved from the USGS National Water Information System (NWIS; U.S. Geological Survey, 2020). The upper and lower 90-percent confidence limits for the estimated mean annual streamflows, as described by Tasker and Driver (1988), are listed in table 2. These data indicate that there is a 90-percent chance that the estimated mean annual streamflow is between the upper and lower 90-percent confidence limits.

Continuous-record streamgages were operated and maintained by the USGS during WY 2019 in cooperation with the PWSB (fig. 1; table 1). Streamflow data for these streamgages were collected at 10- or 15-minute intervals (near-real-time streamflow data), were updated at 1-hour intervals on the internet, and are available through the NWIS web interface (U.S. Geological Survey, 2020). Error associated with measured streamflows was generally within about 15 percent as noted in the annual water year summary for each USGS streamgage.

Table 1. Providence Water Supply Board water-quality sampling stations, water-quality samples, and available streamflow and specific conductance monitoring in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, to September 30, 2019.

[Alternate station names given in parenthesis for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown in figure 1. USGS, U.S. Geological Survey; mi², square mile; QW, water quality; M, monthly; Q, quarterly; Y, yes; N, no; Na, sodium; Cl, chloride; —, none]

PWSB station number	USGS station number	Station name	Drainage area (mi²)	Frequency of QW sample collection by PWSB	Number of samples collected by PWSB[1]	Daily estimated Na and Cl loads	Streamflow availability	Specific conductance availability
				Barden Reservoir subbasin				
24	01115190	Dolly Cole Brook	4.90	M	12	Y	Continuous	Continuous
25	01115200	Shippee Brook	2.37	Q	4	N	Estimated	None
26	01115185	Windsor Brook	4.33	Q	4	N	Estimated	None
27	011151845	Unnamed tributary to Ponaganset River (unnamed brook B, unnamed brook west of Windsor Brook)	0.10	Q	3	N	None	None
28	01115265	Barden Reservoir (Hemlock Brook)	8.72	M	12	Y	Continuous	Continuous
29	01115271	Ponaganset River (Barden Stream)	33	M	12	N	None	None
35	01115187	Ponaganset River	14.0	M	12	Y	Continuous	Continuous
				Direct runoff subbasin				
1	01115180	Brandy Brook	1.57	M	10	N	Estimated	None
2	01115181	Unnamed tributary 2 to Scituate Reservoir (unnamed brook nnorth of Bullhead Brook)	0.22	Q	3	N	None	None
3	01115280	Cork Brook	1.87	M	12	Y	Continuous	Continuous
4	01115400	Kent Brook (Betty Pond Stream)	0.85	M	12	N	Estimated	None
5	01115184	Spruce Brook	1.26	Q	4	Y	Estimated	Continuous
6	01115183	Quonapaug Brook	1.96	M	12	Y	Continuous	Continuous
7	01115297	Wilbur Hollow Brook	4.33	M	12	Y	Estimated	Continuous
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	5.18	M	12	Y	Continuous	Continuous
9	01115275	Bear Tree Brook	0.62	Q	4	Y	Estimated	Continuous
30	01115350	Unnamed tributary 4 to Scituate Reservoir (Coventry Brook, Knight Brook)	0.79	Q	4	N	None	None
31	01115177	Toad Pond	0.03	Q	1	N	None	None
32	01115178	Unnamed tributary 1 to Scituate Reservoir (Pine Swamp Brook)	0.45	Q	3	N	Estimated	None
33	01115182	Unnamed tributary 3 to Scituate Reservoir (Halls Estate Brook)	0.28	Q	4	N	Estimated	None
36	—	Outflow from King Pond	0.76	Q	4	N	None	None
37	—	Fire Tower Stream	0.03	Q	4	N	None	None

Table 1. Providence Water Supply Board water-quality sampling stations, water-quality samples, and available streamflow and specific conductance monitoring in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, to September 30, 2019.—Continued

[Alternate station names given in parenthesis for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown in figure 1. USGS, U.S. Geological Survey; mi^2, square mile; QW, water quality; M, monthly; Q, quarterly; Y, yes; N, no; Na, sodium; Cl, chloride; —, none]

PWSB station number	USGS station number	Station name	Drainage area (mi^2)	Frequency of QW sample collection by PWSB	Number of samples collected by PWSB[1]	Daily estimated Na and Cl loads	Streamflow availability	Specific conductance availability
		Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	3.25	M	12	Y	Continuous	Continuous
20	01115160	Unnamed tributary 1 to Moswansicut Reservoir (Blanchard Brook)	1.18	M	11	N	None	None
21	01115165	Unnamed tributary 2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	0.30	Q	2	N	Estimated	None
22	01115167	Moswansicut Reservoir (Moswansicut Stream south)	0.10	M	12	N	None	None
34	01115164	Kimball Stream	0.27	Q	4	N	None	None
		Ponaganset Reservoir subbasin						
23	011151843	Ponaganset Reservoir	1.92	M	11	N	None	None
		Regulating Reservoir subbasin						
13	01115176	Regulating Reservoir	22.1	M	11	N	None	None
14	01115110	Huntinghouse Brook	6.29	M	12	Y	Continuous	Continuous
15	01115114	Rush Brook	4.70	M	12	Y	Continuous	Continuous
16	01115098	Peeptoad Brook (Harrisdale Brook)	4.97	M	12	Y	Continuous	Continuous
17	01115119	Dexter Pond (Paine Pond)	0.22	Q	4	N	None	None
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	0.28	Q	4	Y	Estimated	Continuous
		Westconnaug Reservoir subbasin						
10	01115274	Westconnaug Brook	1.48	M	12	N	Estimated	None
11	01115273	Unnamed tributary to Westconnaug Reservoir (unnamed brook ssouth of Westconnaug Reservoir)	0.72	Q	4	N	Estimated	None
12	011152745	Unnamed tributary to Westconnaug Brook (unnamed brook nnorth of Westconnaug reservoir)	0.16	Q	3	N	None	None

[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, from October 1, 2018, through September 30, 2019.

[Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; ft³/s, cubic foot per second; ft³/s/mi², cubic foot per second per square mile]

PWSB station number	USGS station number	Station name	Annual mean streamflow (ft³/s)	Upper 90-percent confidence interval (ft³/s)	Lower 90-percent confidence interval (ft³/s)	Annual mean streamflow yield (ft³/s/mi²)
		Barden Reservoir subbasin				
24	01115190	Dolly Cole Brook	15	17	14	3.1
25	01115200	Shippee Brook	12	39	3.7	5.0
26	01115185	Windsor Brook	16	35	7.0	3.6
28	01115265	Barden Reservoir (Hemlock Brook)	26	28	24	2.9
35	01115187	Ponaganset River	40	44	36	2.8
		Direct runoff subbasin				
1	01115180	Brandy Brook	3.8	8.1	1.8	2.4
3	01115280	Cork Brook	5.0	5.6	4.4	2.7
4	01115400	Kent Brook (Betty Pond Stream)	2.3	10	0.52	2.7
5	01115184	Spruce Brook	3.4	7.6	1.5	2.7
6	01115183	Quonapaug Brook	5.9	6.4	5.4	3.0
7	01115297	Wilbur Hollow Brook	12	24	5.7	2.7
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	13	14	12	2.5
9	01115275	Bear Tree Brook	2.3	4.0	1.4	3.8
32	01115178	Unnamed tributary 1 to Scituate Reservoir (Pine Swamp Brook)	0.93	1.7	0.50	2.1
33	01115182	Unnamed tributary 3 to Scituate Reservoir (Halls Estate Brook)	0.55	1.3	0.24	1.9
		Moswansicut Reservoir subbasin				
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	8.8	9.4	8.2	2.7
21	01115165	Unnamed tributary 2 to Moswansicut Reservoir (Blanchard Brook)	0.81	1.7	0.38	2.7
		Regulating Reservoir subbasin				
14	01115110	Huntinghouse Brook	17	19	15	2.7
15	01115114	Rush Brook	12	14	11	2.7
16	01115098	Peeptoad Brook (Harrisdale Brook)	13	15	12	2.7
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	1.1	4.6	0.24	3.8
		Westconnaug Reservoir subbasin				
10	01115274	Westconnaug Brook	5.1	12	2.1	3.5
11	01115273	Unnamed tributary to Westconnaug Reservoir (unnamed brook south of Westconnaug Reservoir)	2.9	7.6	1.1	4.0

Water-Quality Data Collection and Analysis

Water-quality data were collected by the USGS and the PWSB. Concentrations of sodium and chloride were estimated by the USGS from continuous records of specific conductance from 14 of the 23 streamgages. Water-quality samples were collected monthly or quarterly at 37 sampling stations in the Scituate Reservoir drainage area by the PWSB during WY 2019 as part of a long-term sampling program (table 1).

Data Collected by the U.S. Geological Survey

Three or more water-quality samples were collected by the USGS from 14 tributaries equipped with continuous specific conductance monitors in the Scituate Reservoir drainage area during water year 2019 (table 1). Samples were collected in the centroid of the streams during the fall, winter, and summer months. Water samples were processed in the USGS New England Water Science Center laboratory in Northborough, Massachusetts, at the conclusion of scheduled sampling. After the processing, the samples were packed in ice and shipped overnight to the USGS National Water Quality Laboratory in Lakewood, Colorado. Analytical results for the USGS water-quality samples are available through the NWIS web interface (U.S. Geological Survey, 2020).

The USGS collected and analyzed continuous-record specific conductance data at 14 streamgages (fig. 1; table 1). Measurements of specific conductance were recorded automatically at 10- or 15-minute intervals at each streamgage. Measurements were made by using an instream probe and standard USGS methods for continuous water-quality monitoring at streams (Wagner and others, 2006). The specific conductance measurement data are available through the NWIS web interface (U.S. Geological Survey, 2020).

Concentrations of chloride and sodium were estimated from continuous measurements of specific conductance by using equations that were developed by the USGS to relate specific conductance to concentrations of chloride and sodium, as follows:

$$C_{Cl}=SPC^{m}\times b \text{ and} \tag{1}$$

$$C_{Na}=SPC^{m}\times b, \tag{2}$$

where

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

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

SPC is the specific conductance, in microsiemens per centimeter;

m is the slope from the MOVE.1 analysis (table 3); and

b is the intercept from the MOVE.1 analysis (table 3).

These regression equations were developed by using the MOVE.1 method (also known as the line of organic correlation; Helsel and Hirsch, 2002) on the basis of concurrent measurements of specific conductance (USGS parameter code 90095) along with chloride (USGS parameter code 00940) and sodium (USGS parameter code 00930) concentrations measured in water-quality samples collected by the USGS from tributaries in the Scituate Reservoir drainage area during WY 2000, WY 2005, and WY 2009–20 (table 3; U.S. Geological Survey, 2020).

MOVE.1 was chosen for regression analysis to maintain variance (Hirsch and Gilroy, 1984). Under some circumstances, specific conductance records were unavailable because a sensor malfunctioned, was affected by debris, fouling, or ice, or was not submerged during low flow. In these cases, values of specific conductance were estimated by proportional distribution between recorded values. In general, the period of specific conductance record that was unavailable for each USGS station represents a small fraction of the record period for WY 2019 (table 3).

Data Collected by the Providence Water Supply Board

Water-quality samples were collected by the PWSB at 37 fixed stations on tributaries draining to the Scituate Reservoir during WY 2019. Sampling visits typically are conducted monthly at 19 stations and quarterly at another 18 stations (table 1).

Water-quality samples were not collected during specific weather conditions; instead, a 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 tributaries at the sampling stations were dry or frozen. When possible, water-quality samples were collected by dipping the sample bottle into the tributary at the center of flow (Richard Blodgett, PWSB, written commun., 2005). Samples were transported on ice to the PWSB water-quality laboratory at the P.J. Holton Water Purification Plant in Scituate. Water-quality properties and constituent concentrations were measured by using unfiltered water samples. These water-quality properties included pH, alkalinity, color, turbidity, and concentrations of chloride, nitrite, nitrate, orthophosphate, and bacteria (*Escherichia coli* [*E. coli*] and total coliform); these data collected by the PWSB are published in Smith (2021b). Analytical methods used for the determination of values or concentrations of pH, color, turbidity, alkalinity, and chloride are documented by Baird and others (2018). Concentrations of nitrite were determined by U.S. Environmental Protection Agency method 353.2 (U.S. Environmental Protection Agency, 1993). Concentrations of nitrate were determined by Standard Method 4500–NO_3 (Holm and others, 2018). Concentrations of orthophosphate were determined by the Hach PhosVer Method (Hach Method

Table 3. Regression equation coefficients used to estimate concentrations of chloride and sodium from values of specific conductance for U.S. Geological Survey streamgage stations in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.

[Constituent concentrations and continuous specific conductance available in National Water Information System (U.S. Geological Survey, 2020). Locations of stations are shown in figure 1. U.S. Geological Survey (USGS) parameter codes: specific conductance, 90095; chloride, 00940; sodium, 00930. PWSB, Providence Water Supply Board; <, less than]

PWSB station number	USGS station number	Samples used in analyses		Chloride			Sodium			Amount of specific conductance record unavailable where discharge is greater than zero (percent)
		Sample date range (month/day/year)	Sample count	Slope	Intercept	Standard error of regressions (percent)	Slope	Intercept	Standard error of regressions (percent)	
24	01115190	03/08/2000; 03/29/2005; 01/22/2009 to 01/29/2020	33	1.2568	0.06927	2.3	1.2341	0.04747	4.6	<0.1
28	01115265	03/28/2001; 03/30/2005; 01/22/2009 to 01/29/2020	34	1.2272	0.07969	3.4	1.1145	0.08224	5.7	0.5
35	01115187	03/28/2001; 03/29/2005; 01/22/2009 to 01/14/2020	33	1.0644	0.16539	4.3	1.1690	0.06355	5.4	<0.1
3	01115280	03/08/2000; 03/30/2005; 01/22/2009 to 01/14/2020	33	1.2248	0.07611	3.0	1.1018	0.08370	5.0	<0.1
5	01115184	03/05/2009 to 01/29/2020	30	1.2604	0.06112	4.0	1.0811	0.08487	4.4	<0.1
6	01115183	03/08/2000; 03/30/2005; 01/22/2009 to 01/28/2020	43	1.1794	0.08455	4.2	1.2057	0.04413	5.9	<0.1
7	01115297	03/28/2001; 03/30/2005; 01/22/2009 to 01/14/2020	33	1.0728	0.12410	4.1	0.88661	0.17736	5.8	<0.1
8	01115276	01/22/2009 to 01/29/2020	30	1.0995	0.13738	2.9	1.0392	0.11477	3.8	<0.1
9	01115275	03/08/2000; 03/30/2005; 01/22/2009 to 01/29/2020	32	1.0585	0.17773	2.5	1.0720	0.09770	3.4	<0.1
19	01115170	03/08/2000; 03/29/2005; 01/22/2009 to 01/14/2020	39	1.2116	0.07599	2.6	1.2080	0.04599	2.8	2.2
14	01115110	03/28/2001; 03/29/2005; 01/22/2009 to 01/14/2020	41	1.1225	0.10393	7.1	1.0317	0.09412	7.7	2.1
15	01115114	01/22/2009 to 01/28/2020	47	1.1441	0.11191	2.9	1.0839	0.09260	5.2	3.1
16	01115098	03/28/2001; 03/29/2005; 01/22/2009 to 01/14/2020	34	1.2598	0.05894	4.3	1.0895	0.08335	6.3	<0.1
18	01115120	01/22/2009 to 01/14/2020	26	1.1633	0.09758	2.8	1.1463	0.06160	3.4	<0.1

8048; Hach Company, 2000). Standard Method 9223 was used for the determination of concentrations of bacteria (Best and others, 2018).

Water-quality samples were collected by the PWSB during a wide range of flow conditions. The daily mean flow-duration curves for the Rush Brook near Elmdale Road at north Scituate (01115114; PWSB station 15) and Shippee Brook Tributary at north Foster, Rhode Island (01115200; PWSB station 25), USGS streamgages for WY 2019 are shown in figure 2. The curves represent the percentage of time that each flow duration was equaled or exceeded at the respective stations; the flows at each station on days when water-quality samples were collected are represented by the plotted points superimposed on the curves. At Rush Brook, samples were collected at flow durations ranging from the 18.8th percentile to the 92.7th percentile; this range indicates that with exception of high-end flows, the water-quality samples collected in WY 2019 generally represented most of the flow conditions during that water year. Samples collected only on a quarterly schedule at Shippee Brook encompassed about half of the range of flow conditions (from the 13.3th percentile to the 66.1th percentile) at this station during WY 2019 (fig. 2), excluding the highest flow conditions and much of low-flow range.

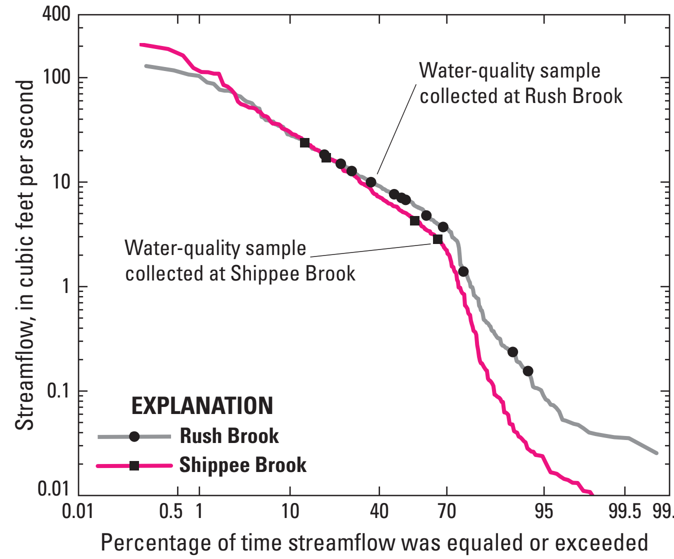

Figure 2. Flow-duration curves and streamflow on the dates (represented by points) when water-quality samples were collected by the Providence Water Supply Board for the U.S. Geological Survey continuous streamgages on Rush Brook near Elmdale Road at north Scituate (01115114) and Shippee Brook Tributary at north Foster, Rhode Island (01115200), for water year 2019. Locations of stations are shown on figure 1.

Estimating Daily, Monthly, and Annual Loads and Yields

Daily, monthly, and annual chloride and sodium loads (in kilograms) were estimated for all streamgages for which continuous-streamflow and specific-conductance data were available for WY 2019. Daily flow-weighted concentrations of chloride and sodium were calculated by multiplying instantaneous flows by concurrent concentrations of chloride and sodium (estimated from measurements of specific conductance) for each day and dividing the sum by the total flow for that day. At the four instrumented monitoring stations, where continuous flow was unavailable (table 1), daily mean concentrations of chloride and sodium were calculated from the daily mean value of specific conductance for each day. The latter method may result in less accurate concentrations because instantaneous measurements of specific conductance may change (decrease or increase) with surface-water runoff; however, the variability of instantaneous measurements of specific conductance at these streamgages was generally small and daily mean values did not differ substantially from daily flow-weighted values estimated during prior water years when instantaneous flow data were available. Daily loads of chloride and sodium were estimated by multiplying daily flow-weighted concentrations of chloride and sodium (in milligrams per liter) by daily discharge (in liters per day). Daily data were summed to estimate monthly or annual loads.

Daily loads of water-quality constituents (in samples collected by the PWSB) were calculated for all sampling dates during WY 2019 (table 4, in back of report) for which periodic- or continuous-streamflow data were available (table 1). These loads were calculated by multiplying constituent concentrations (in milligrams or colony forming units per liter) in single samples by the daily discharge (in liters per day) for the day on which each sample was collected. The flows, which in some cases were estimates, were assumed to be representative of the flow at the time of the sample collection. Loads (in million colony forming units per day, kilograms per day, or grams per day) and yields (in million colony forming units per day per square mile, kilograms per day per square mile, or grams per day per square mile) were calculated for bacteria, chloride, nitrite, nitrate, and orthophosphate. Censored data (concentrations reported as less than method detection limits) were replaced with concentrations equal to one-half the method detection limit.

Streamflow

Monitoring streamflow is a necessary step 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 annual streamflow at the streamgage on the Ponaganset River (01115187, PWSB station 35) for the entire period of its operation (mean of the annual mean streamflows for the period of record, WYs 1994–2018) before WY 2019 was about 29 cubic feet per second (ft^3/s; U.S. Geological Survey, 2020). During WY 2019, the annual mean streamflow of 40 ft^3/s was substantially greater (within the 95th percentile of all annual mean streamflows; fig. 3) than the long-term mean annual streamflows for the period of record and slightly less than that highest annual mean streamflow recorded for WY 2006 (41.5 ft^3/s; U.S. Geological Survey, 2020). The daily mean streamflow was greater than the median streamflows for much of WY 2019 and greater than the 90th percentile of the daily mean streamflows for the period of record (fig. 3) for many days in October, November, December, January, April, May, and August.

The mean annual streamflow at the Peeptoad Brook streamgage (01115098; PWSB station 16), the other long-term continuous-record streamgage in the Scituate Reservoir drainage area, for the period of record (WYs 1994–2018) before WY 2019 was 10.4 ft^3/s (U.S. Geological Survey, 2020). The annual mean streamflow at the Peeptoad Brook streamgage during WY 2019 also was greater than the mean annual streamflow for its period of record at 13 ft^3/s.

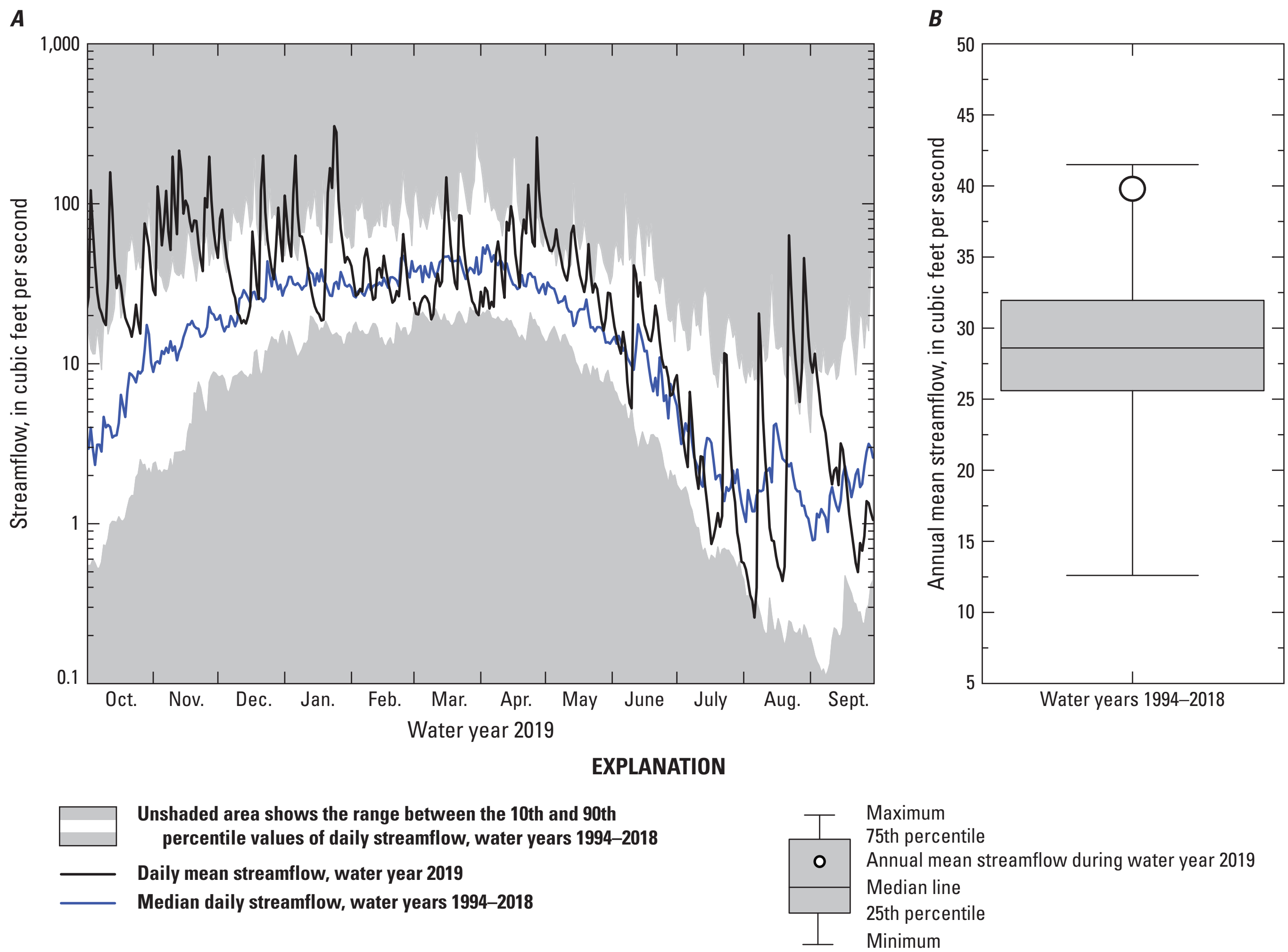

Figure 3. Hydrologic data taken at the U.S. Geological Survey continuous-record streamgage on the Ponaganset river at south Foster (01115187), in the Scituate Reservoir drainage area, Rhode Island; *A*, graph showing measured daily mean streamflow for October 1, 2018, through September 30, 2019, and the 10th percentile, median, and 90th percentile values of daily streamflow for October 1, 1994, through September 30, 2018; and *B*, box plot showing annual mean streamflow during water year 2019 and the distribution of mean annual streamflows for water years 1994–2018. Location of station is shown on figure 1.

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, constituent concentrations, and estimated constituent loads and yields. Loads and yields measure the rates at which masses of constituents are transferred to the reservoir by tributaries. Tributaries with high flows tend to have high loads because the greater volume of water can carry more of the constituent to the reservoir per unit time than tributaries with low flows. Yield represents the constituent load per unit of drainage area and is calculated by dividing the load estimated for a streamgage by the drainage area for the monitoring station. Yields are useful for comparison among streamgages that have different drainage areas because the basin size and therefore total streamflow volume are normalized. Yields also are useful for examining potential differences among basin properties that may contribute to water quality in the reservoir.

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 loads of chloride and sodium (estimated from measurements of specific conductance), datasets that include a large number of values, are better summarized in terms of means because large datasets are more resistant to the effects of outliers than small datasets. Mean values also are particularly appropriate for measuring loads because outlier values, which typically represent large flows, are important to include in estimates of constituent masses delivered to receiving waters.

Uncertainties associated with measuring streamflow and specific conductance and with chloride and sodium sample collection, preservation, and analysis produce uncertainties in load and yield estimates. The load and yield estimates presented in the text and tables are the most likely values for chloride and sodium inputs from tributaries or their drainage basins, based on the available data and analysis methods. It may be best to discuss loads and yields in terms of a range within which the true values lie; however, the most likely 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 the available information. The uncertainties associated with streamflow are commonly assumed to affect load and yield calculations more than the errors associated with measuring specific conductance or chemical analysis, and the uncertainties associated with estimated streamflow are greater than those associated with measured streamflow. The most likely values of loads and yields presented in the tables and text are sufficient for planning-level analysis of water quality in tributaries and their drainage basins.

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

Chloride and sodium 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 Route 116 parallels the eastern limb (fig. 1). Nimiroski and Waldron (2002) indicated that tributaries in basins with State-maintained roads had substantially higher concentrations of chloride and sodium than tributaries in basins with low road density, presumably because of deicing activities. In addition, sodium is a constituent of potential concern for human health; some persons on restricted diets might need to limit intake of sodium.

Estimated monthly mean[2] chloride concentrations in tributaries of the Scituate Reservoir drainage area ranged from 7.9 to 83 milligrams per liter (mg/L), and estimated monthly mean sodium concentrations ranged from 5.4 to 47 mg/L (table 5). The highest monthly mean concentrations of chloride and sodium were estimated to be 83 and 47 mg/L, respectively, at unnamed tributary to Regulating Reservoir (unnamed brook A; 01115120; PWSB station 18) in July 2019. The estimated monthly mean concentrations at most stations were greater during the months of July and August compared with the estimated monthly mean concentrations during the winter months. Peak estimated monthly mean concentrations for Cork Brook and Huntinghouse Brook (01115280 and 01115110, respectively; PWSB stations 3 and 14, respectively) occurred in September, and estimated monthly mean concentrations for Peeptoad Brook (01115098; PWSB station 16), Moswansicut Reservoir (01115170; PWSB station 19), and Dolly Cole Brook (01115190; PWSB station 24) peaked in the beginning of the WY in October 2019. The highest annual mean[3] concentrations of chloride and sodium were estimated to be 59 and 35 mg/L, respectively, at the Moswansicut Reservoir (table 6). The relatively high annual mean concentrations of chloride and sodium at Bear Tree Brook (01115275; PWSB station 9; 48 and 28 mg/L, respectively) are the result of residual chloride and sodium leaching to groundwater from a formerly uncovered salt storage pile (Nimiroski and Waldron, 2002) and comparatively small surface-water flows. Annual mean concentrations of chloride and sodium, ranging from 32 to 52 mg/L and 20 to 30 mg/L, respectively, estimated at the unnamed tributary to the Regulating Reservoir (unnamed brook A; 01115120; PWSB station 18) and Peeptoad Brook also were relatively high (table 6). These stations are in the more developed, northeastern part of the Scituate Reservoir drainage area (fig. 1), which also includes the Moswansicut Reservoir.

During WY 2019, the Scituate Reservoir received about 3,500 metric tons (t; about 3,800 short tons) of chloride and 2,100 t (about 2,300 short tons) of sodium from tributaries that are equipped with instrumentation capable of continuously monitoring specific conductance (table 6). The highest annual chloride and sodium loads in the drainage area during WY 2019 were estimated to be 620 and 380 t, respectively, at the Ponaganset River station (table 6). Monthly estimated chloride and sodium loads were highest in November (table 7), corresponding to some of the highest sustained flows during this monitoring period (fig. 3). The monthly estimated chloride and sodium loads for this month accounted for between 14 and 22 percent of the annual load at each station. From January through April, the winter period when surface-water runoff often contains elevated concentrations of roadway deicing compounds, the sum of the monthly loads of chloride and sodium at each station accounted for between 41 and 54 percent of the annual load at each station and about 45 percent of the annual load for the monitored area in the Scituate Reservoir drainage area. The highest annual chloride and sodium yields were 180 and 100 metric tons per square mile, respectively, measured at unnamed tributary to Regulating Reservoir (unnamed brook A; 01115120; PWSB station 18; table 6). Chloride and sodium yields also were comparatively high at Bear Tree Brook (PWSB station 9) at 150 and 89 metric tons per square mile, respectively. During WY 2019, estimated annual loads of chloride and sodium at the continuous monitoring stations were greater than the median annual loads for WYs 2009–18 at all stations, and for 9 of the 14 stations, the annual loads were greater than the maximum annual loads for WYs 2009–18 (fig. 4). Estimated annual loads of chloride and sodium for the monitored area in the Scituate Reservoir drainage area during WY 2019 were greater

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

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

than loads estimated during the previous water year (Smith, 2019a). The estimated annual loads for the last three consecutive WYs were the highest for the period of record since WY 2009 (fig. 5).

The estimated annual mean yields of chloride and sodium for the drainage areas upstream from the 14 USGS continuous-record streamgages, which represent nearly 66 percent of the Scituate Reservoir drainage area, were 56 and 34 metric tons per year per square mile (t/y/mi^2), respectively. These estimated annual mean yields of chloride and sodium for WY 2019 were greater than the yields in WY 2018 (49 and 30 t/y/mi^2, respectively; Smith, 2019a) and higher than those previously estimated since WY 2009 (fig. 5).

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, and color, were routinely measured to determine water quality in each of the six subbasins in the Scituate Reservoir drainage area (table 8) by the PWSB. 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 tributaries in the Scituate Reservoir drainage area ranged from 5.8 to 7.0; the median of the medians for all stations was 6.4. Median values of color ranged from 18 to 180 platinum cobalt units; the median for all stations was 50 platinum cobalt units. Median values of turbidity ranged from 0.17 to 1.5 nephelometric turbidity units; the median for all stations was 0.59 nephelometric turbidity units. Median alkalinity values in tributaries were low, ranging from 3.1 to 20 mg/L as calcium carbonate ($CaCO_3$); the median for all stations was 5.9 mg/L as $CaCO_3$ (table 8).

Constituent Concentrations and Daily Loads and Yields

Fecal indicator bacteria, chloride, and nutrients such as nitrogen and phosphorus are commonly detected in natural water; at elevated concentrations, these constituents can cause or contribute to water-quality impairments. 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 stream water from precipitation, weathering, or human activities such as waste disposal, use of septic systems, and road deicing. Sources of nutrients in tributary stream water include atmospheric deposition, leaching of naturally occurring organic material, discharge of groundwater that is enriched with nutrients from septic-system leachate, and runoff contaminated with fertilizer or animal waste. The ultimate intended use of water in the tributaries is drinking water, which must meet specific water-quality standards. For this reason, the PWSB closely monitors concentrations of these constituents in tributaries. Median concentrations, loads, and yields of water-quality constituents are listed in tables 8, 9 and 10.

Bacteria

Median concentrations of total coliform bacteria were above the detection limit (1 colony forming unit per 100 milliliters [CFU/100 mL]) at all sites (table 8). Median concentrations of *E. coli* were equal to or greater than a detection limit of 10 CFU/100 mL (highest detection limit of median values) at 25 of the 37 stations; however, censored median concentrations of *E. coli* less than 10 CFU/100 mL were available at 12 stations. Total coliform bacteria concentrations were greater than *E. coli* concentrations (as expected because total coliform is more inclusive than *E. coli*); the medians of median concentrations for all sites in the drainage area were 1,000 CFU/100 mL for total coliform bacteria and 10 CFU/100 mL for *E. coli* (table 8). The highest median concentration of total coliform bacteria, 7,500 CFU/100 mL, was at unnamed tributary #2 to Moswansicut Reservoir (01115165; PWSB station 21) in the Moswansicut Reservoir subbasin. Median concentrations of total coliform bacteria exceeded 2,000 CFU/100 mL at five other stations including Spruce Brook (01115184; PWSB station 5), Bear Tree Brook (01115275; PWSB station 9), unnamed tributary #4 to Scituate Reservoir (01115350; PWSB station 30), and unnamed tributary to Regulating Reservoir (01115120; PWSB station 18). Median concentrations of total coliform bacteria were lowest at Moswansicut Reservoir (01115170; PWSB station 19).

Median daily loads and yields of total coliform bacteria and *E. coli* varied by about two orders of magnitude (tables 9 and 10). The median daily loads of total coliform bacteria for all subbasins in the Scituate Reservoir drainage area ranged from 11,000 to 600,000 million colony forming units per day (CFU×10^6/d), and yields ranged from 8,600 to 230,000 million colony forming units per day per square mile (CFU×10^6/d/mi^2); *E. coli* loads ranged from 130 to 12,000 CFU×10^6/d/, and yields ranged from 260 to 3,700 CFU×10^6/d/mi^2 (table 9). The highest median daily yield of total coliform bacteria at 230,000 CFU×10^6/d/mi^2 was at Ponaganset River (01115187; PWSB station 35), and the highest median daily yield of *E. coli* of 3,700 CFU×10^6/d/mi^2 occurred at the unnamed tributary to Regulating Reservoir (PWSB station 18; table 10). Although relatively high for sampling stations in the Scituate Reservoir subbasin, median daily bacteria yields at these stations were low to moderate for yields of indicator bacteria in sewage-contaminated stream water or stream water affected by stormwater runoff in an urban environment (Breault and others, 2002).

Table 5. Monthly mean concentrations of chloride and sodium estimated from continuous measurements of specific conductance in the Scituate Reservoir drainage area, Rhode Island, October 1, 2018, through September 30, 2019.

[Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown on figure 1. Monthly mean concentrations were calculated by dividing the monthly load by the total discharge for the month. USGS, U.S. Geological Survey; Cl, chloride; Na, sodium; mg/L, milligram per liter; —, not applicable]

PWSB station number	USGS station number	Station name	October		November		December		January		February		March	
			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)
24	01115190	Dolly Cole Brook	28	17	21	13	20	13	18	11	23	14	24	15
28	01115265	Barden Reservoir (Hemock Brook)	20	12	15	9.5	17	11	17	11	22	13	21	13
35	01115187	Ponaganset River	21	13	16	9.5	16	10	15	8.9	19	12	19	11
3	01115280	Cork Brook	33	20	24	15	23	14	21	13	34	20	40	23
5	01115184	Spruce Brook	20	12	16	10	16	10	16	10	18	11	19	12
6	01115183	Quonapaug Brook	30	18	21	12	23	14	23	14	29	17	28	17
7	01115297	Wilbur Hollow Brook	9.1	6.2	8.0	5.5	8.7	5.9	7.9	5.5	9.1	6.2	9.0	6.1
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	19	12	17	11	18	11	17	11	20	12	19	12
9	01115275	Bear Tree Brook	51	30	42	25	46	27	45	27	49	29	48	28
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	65	39	61	36	59	35	57	34	57	34	58	35
14	01115110	Huntinghouse Brook	12	7.6	9.8	6.1	9.6	6.0	8.5	5.4	13	7.8	12	7.3
15	01115114	Regulating Reservoir (Rush Brook)	34	21	24	15	26	16	26	16	45	27	42	25
16	01115098	Peeptoad Brook (Harrisdale Brook)	45	26	29	17	27	17	28	17	36	22	39	23
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	57	33	45	26	43	25	45	26	68	39	73	42
—	—	Mean	32	19	25	15	25	15	25	15	32	19	32	19

Table 5. Monthly mean concentrations of chloride and sodium estimated from continuous measurements of specific conductance in the Scituate Reservoir drainage area, Rhode Island, October 1, 2018, through September 30, 2019.—Continued

[Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown on figure 1. Monthly mean concentrations were calculated by dividing the monthly load by the total discharge for the month. USGS, U.S. Geological Survey; Cl, chloride; Na, sodium; mg/L, milligram per liter; —, not applicable]

PWSB station number	USGS station number	Station name	April		May		June		July		August		September	
			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)
24	01115190	Dolly Cole Brook	22	13	21	13	24	15	26	16	28	17	28	17
28	01115265	Barden Reservoir (Hemock Brook)	18	11	19	12	25	15	33	20	36	21	35	21
35	01115187	Ponaganset River	18	11	19	12	22	14	24	15	21	13	22	14
3	01115280	Cork Brook	31	18	29	18	33	20	37	22	43	25	55	31
5	01115184	Spruce Brook	18	11	19	12	21	13	28	16	40	22	39	22
6	01115183	Quonapaug Brook	26	15	25	15	31	18	39	24	52	31	47	28
7	01115297	Wilbur Hollow Brook	8.5	5.8	8.9	6.1	9.5	6.4	10	6.7	12	7.9	11	7.4
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	17	11	19	12	22	14	26	16	29	18	26	16
9	01115275	Bear Tree Brook	44	26	49	29	54	32	65	39	67	40	67	40
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	56	33	56	33	57	34	58	34	57	34	57	34
14	01115110	Huntinghouse Brook	10	6.3	12	7.3	13	7.9	15	9.2	13	8.2	16	9.5
15	01115114	Regulating Reservoir (Rush Brook)	31	19	38	23	49	29	68	40	53	32	65	38
16	01115098	Peeptoad Brook (Harrisdale Brook)	34	20	33	20	39	23	43	25	41	24	43	25
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	60	35	69	39	70	40	83	47	51	29	68	39
—	—	Mean	28	17	30	18	33	20	40	24	39	23	41	24

Table 6. Annual mean chloride and sodium concentrations, loads, and yields for sampling stations in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.

[Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown on figure 1. Annual mean concentrations were calculated by dividing the annual load by the total discharge for the year; annual mean yields were calculated by dividing the sum of individual loads by the sum of the drainage area. USGS, U.S. Geological Survey; Cl, chloride; Na, sodium; mg/L, milligram per liter; t/yr, metric tons per year; t/yr/mi², metric tons per year per square mile; —, not applicable]

PWSB station number	USGS station number	Station name	Concentration		Load		Yield	
			Cl (mg/L)	Na (mg/L)	Cl (t/yr)	Na (t/yr)	Cl (t/yr/mi²)	Na (t/yr/mi²)
		Barden Reservoir subbasin						
24	01115190	Dolly Cole Brook	22	13	300	180	61	38
28	01115265	Barden Reservoir (Hemlock Brook)	18	11	420	260	48	30
35	01115187	Ponaganset River	17	11	620	380	44	27
		Direct runoff subbasin						
3	01115280	Cork Brook	28	17	130	76	67	41
5	01115184	Spruce Brook	19	12	49	30	39	24
6	01115183	Quonapaug Brook	25	15	130	79	68	40
7	01115297	Wilbur Hollow Brook	8.6	5.9	88	60	20	14
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	19	12	220	140	42	27
9	01115275	Bear Tree Brook	48	28	93	55	150	89
		Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir, (Moswansicut Stream north, Moswansicut Pond)	59	35	460	270	140	84
		Regulating Reservoir subbasin						
14	01115110	Huntinghouse Brook	11	6.5	160	100	26	16
15	01115114	Rush Brook	32	20	360	220	76	46
16	01115098	Peeptoad Brook (Harrisdale Brook)	33	20	390	240	79	48
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	52	30	50	29	180	100
		Scituate Reservoir drainage area						
—	—	Mean concentration or yield	28	17	—	—	56	34
—	—	Total load	—	—	3,500	2,100	—	—

Chloride and Sodium

Median chloride concentrations among the PWSB stations ranged from 7.2 to 170 mg/L; the highest concentration was measured in Toad Pond (PWSB station 31; table 8). The median of median concentrations for all sites in the drainage area was 25.1 mg/L (table 8). Median daily chloride loads and yields estimated from samples collected by the PWSB varied among monitoring stations in the drainage area (tables 9 and 10). Ponaganset River (01115187; PWSB station 35) had the largest median daily chloride load at 1,900 kilograms per day (table 9). The largest median daily chloride yield was determined to be 540 kg/d/mi^2 at Bear Tree Brook (01115275; PWSB station 9; table 10). The median daily chloride yield for monitored areas within the drainage area was 140 kilograms per day per square mile (kg/d/mi^2).

Nutrients

Median concentrations of nitrite and nitrate (table 8) were 0.001 and 0.08 mg/L as nitrogen (N), respectively. The highest median concentration of nitrite was 0.004 mg/L as N measured in a sample collected at unnamed tributary to Regulating Reservoir (01115120; PWSB station 18). The highest median concentration of nitrate (0.85 mg/L as N) was measured in a sample collected at the Moswansicut Reservoir (Moswansicut Stream south; 01115167; PWSB station 22). The median concentration of orthophosphate for the entire study area (table 8) was 0.03 mg/L as phosphate (PO_4). The maximum median concentration of orthophosphate was 0.11 mg/L as PO_4 measured in a sample collected at unnamed tributary #1 to Moswansicut Reservoir (01115160; PWSB station 20). Median daily nitrite loads were largest at Ponaganset River (01115187; PWSB station 35) at 93 grams per day (g/d; table 9). Median daily nitrate loads were largest at Bear Tree Brook (01115275; PWSB station 9) at 3,000 g/d as N. Despite the relatively small flows at Bear Tree Brook, the median nitrate concentration for samples collected at this station was high (0.49 mg/L as N) compared to other PWSB stations (table 8). Median daily orthophosphate loads were largest (2,900 g/d as PO_4) at Barden Reservoir (01115165; PWSB station 28; table 10). The largest median daily yields for nitrite and nitrate were 17 grams per day per square mile (g/d/mi^2) as N and 4,800 g/d/mi^2 as N, respectively, at Bear Tree Brook; and the largest median daily yield for orthophosphate was 560 g/d/mi^2 as PO_4 at unnamed brook south of Westconnaug Reservoir (01115273; PWSB station 11; table 10). The medians of median daily loads and yields were 18 g/d and 6.8 g/d/mi^2 for nitrite as N, 1,000 g/d and 440 g/d/mi^2 for nitrate as N, and 410 g/d and 140 g/d/mi^2 for orthophosphate as PO_4, respectively.

Table 7. Monthly estimated chloride and sodium loads by sampling station, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2018, through September 30, 2019.

[Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; Cl, chloride; Na, sodium; t, metric ton; —, not applicable]

PWSB station number	USGS station number	Station name	October		November		December		January		February		March	
			Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)
24	01115190	Dolly Cole Brook	37	22	61	38	36	22	50	31	20	13	26	16
28	01115265	Barden Reservoir (Hemock Brook)	48	30	71	46	60	38	52	33	39	24	48	29
35	01115187	Ponaganset River	64	39	110	64	63	38	92	55	45	28	57	35
3	01115280	Cork Brook	15	9.1	24	15	13	8.3	14	8.8	9.1	5.4	15	8.9
5	01115184	Spruce Brook	4.9	2.9	6.8	4.3	5.0	3.1	5.7	3.6	4.1	2.5	5.1	3.1
6	01115183	Quonapaug Brook	15	8.7	24	14	15	8.8	18	10	12	7.1	15	8.6
7	01115297	Wilbur Hollow Brook	8.8	6.0	16	11	11	7.3	11	7.7	7.6	5.2	9.2	6.3
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	17	11	33	21	25	16	28	18	18	11	20	12
9	01115275	Bear Tree Brook	7.6	4.5	14	8.2	11	6.3	12	7.2	7.5	4.4	8.3	4.9
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	38	22	88	52	60	36	66	39	39	23	44	26
14	01115110	Huntinghouse Brook	16	9.8	31	19	18	11	22	14	14	8.5	17	10
15	01115114	Regulating Reservoir (Rush Brook)	37	23	55	34	34	21	41	26	31	19	47	29
16	01115098	Peeptoad Brook (Harrisdale Brook)	37	21	61	37	29	18	51	31	38	22	52	31
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	3.9	2.3	11	6.2	5.2	3.0	9.8	5.7	3.0	1.7	5.2	3.0
—	—	Total	350	210	610	370	390	240	150	87	290	170	370	220

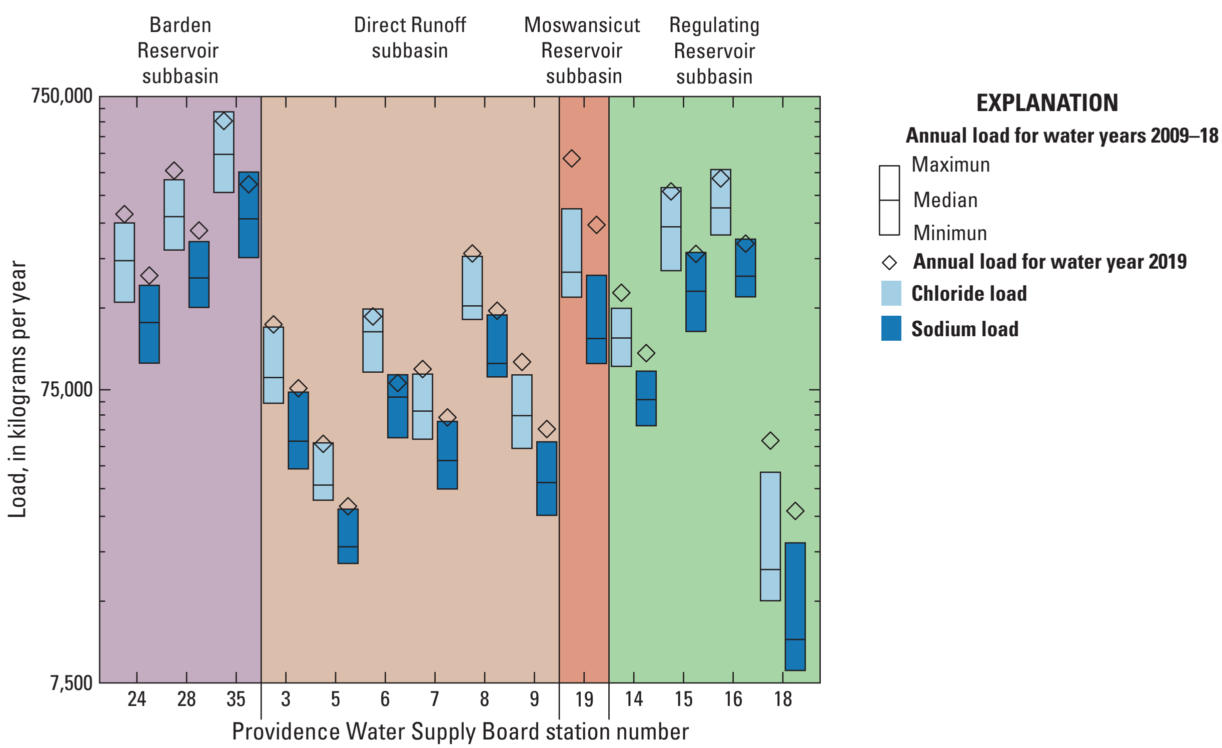

Figure 4. Annual loads of chloride and sodium estimated from streamflow and specific conductance data for water year 2019 and associated minimum, maximum, and median annual loads for water years 2009–18 at 14 Providence Water Supply Board sampling stations in the Scituate Reservoir drainage area, Rhode Island. Locations of continuous water-quality monitoring stations shown on figure 1.

Table 7. Monthly estimated chloride and sodium loads by sampling station, in the Scituate Reservoir drainage area, Rhode Island, October 1, 2018, through September 30, 2019.—Continued

[Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the Providence Water Supply Board (PWSB). Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; Cl, chloride; Na, sodium; t, metric ton; —, not applicable]

PWSB station number	USGS station number	Station name	April		May		June		July		August		September	
			Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)	Cl (t)	Na (t)
24	01115190	Dolly Cole Brook	35	22	17	11	7.3	4.5	2.8	1.7	2.6	1.6	1.4	0.85
28	01115265	Barden Reservoir (Hemock Brook)	49	31	28	17	11	6.5	5.6	3.3	4.3	2.5	2.9	1.7
35	01115187	Ponaganset River	82	50	60	37	26	16	5.6	3.5	14	8.9	5.0	3.1
3	01115280	Cork Brook	19	11	8.2	5.0	4.2	2.5	1.1	0.64	1.2	0.73	0.54	0.30
5	01115184	Spruce Brook	6.0	3.7	4.2	2.6	2.4	1.4	1.1	0.65	2.6	1.4	1.4	0.77
6	01115183	Quonapaug Brook	16	9.5	9.4	5.6	6.1	3.7	1.4	0.86	1.2	0.71	1.5	0.90
7	01115297	Wilbur Hollow Brook	10	7.1	7.1	4.8	4.2	2.8	0.99	0.66	0.75	0.49	0.98	0.64
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	25	16	21	13	12	7.8	7.8	4.9	6.7	4.2	6.0	3.8
9	01115275	Bear Tree Brook	10	6.2	8.8	5.2	5.1	3.0	3.3	2.0	2.6	1.6	2.7	1.6
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	56	33	37	22	21	12	5.4	3.2	4.4	2.6	3.7	2.2
14	01115110	Huntinghouse Brook	22	14	12	7.4	4.4	2.7	0.96	0.58	2.8	1.7	0.84	0.51
15	01115114	Regulating Reservoir (Rush Brook)	53	33	28	17	17	10	4.5	2.7	5.2	3.1	1.9	1.1
16	01115098	Peeptoad Brook (Harrisdale Brook)	56	33	36	21	17	9.8	6.0	3.5	9.9	5.8	3.0	1.7
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	9.1	5.2	2.6	1.5	0.55	0.31	0.029	0.017	0.099	0.057	0.011	0.0064
—	—	Total	450	270	280	170	140	83	47	28	58	35	32	19

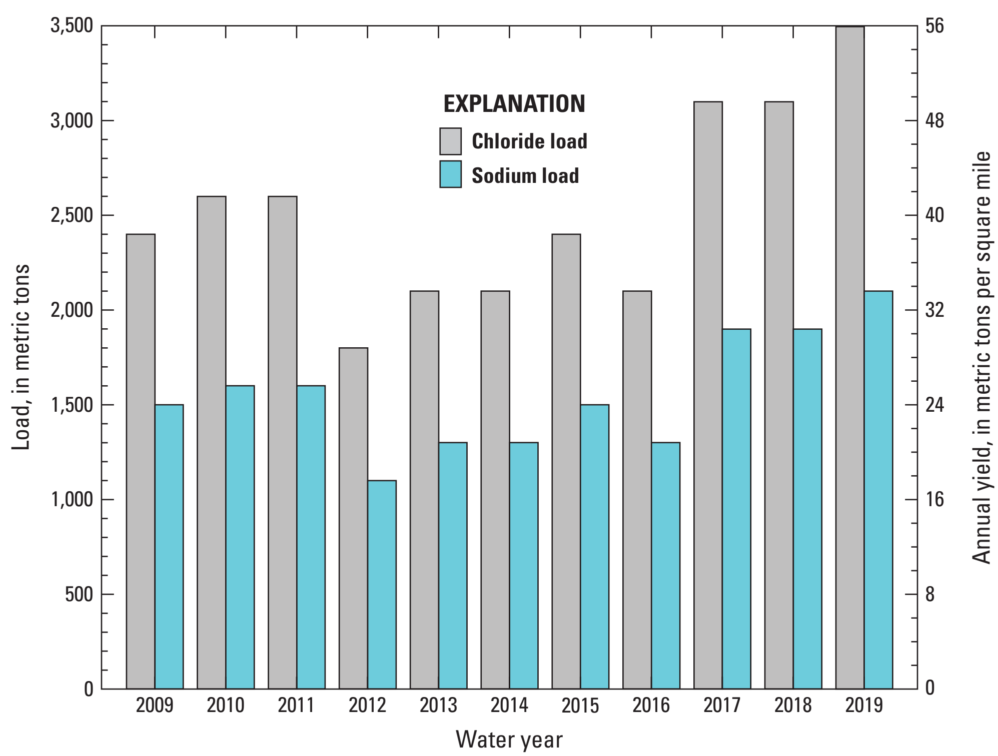

Figure 5. Annual loads and annual yields of chloride and sodium estimated from continuous measurements of flow and specific conductance for water years 2009–19 for the area upstream from 14 Providence Water Supply Board sampling stations in the Scituate Reservoir drainage area, Rhode Island. Locations of continuous water-quality monitoring stations shown on figure 1.

Table 8. Median values for water-quality data collected at Providence Water Supply Board stations in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; PCU, platinum cobalt unit; NTU, nephelometric turbidity unit; CFU/100 mL, colony forming unit per 100 milliliters; *E. coli*, *Escherichia coli*; mg/L, milligram per liter; $CaCO_3$, calcium carbonate; N, nitrogen; PO_4, phosphate; <, less than; —, no data]

PWSB station number	USGS station number	Station name	Properties			Constituents						
			pH	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 PO_4)
Barden Reservoir subbasin												
24	01115190	Dolly Cole Brook	6.4	62	0.57	1,400	10	4.7	26.0	0.001	0.07	0.03
25	01115200	Shippee Brook	6.1	73	0.59	1,300	60	3.9	13.1	0.002	<0.05	0.04
26	01115185	Windsor Brook	6.2	63	0.39	830	<10	3.9	26.0	0.001	<0.05	0.03
27	011151845	Unnamed tributary to Ponaganset River (unnamed brook B, unnamed brook west of Windsor Brook)	6.1	24	0.19	1,100	10	4.1	16.1	0.001	<0.05	0.02
28	01115265	Barden Reservoir (Hemlock Brook)	6.1	100	0.60	1,100	20	3.8	25.1	0.002	0.08	0.05
29	01115271	Ponaganset River (Barden Stream)	6.3	50	0.59	410	<10	4.2	22.1	0.001	<0.05	0.03
35	01115187	Ponaganset River	6.4	51	0.66	1,400	10	4.2	22.9	0.002	0.07	0.03
Direct runoff subbasin												
1	01115180	Brandy Brook	6.9	78	1.5	1,300	20	10	15.0	0.003	0.20	0.05
2	01115181	Unnamed tributary #2 to Scituate Reservoir (unnamed brook north of Bullhead Brook)	6.3	20	0.33	1,900	74	6.0	75.3	0.001	0.15	0.02
3	01115280	Cork Brook	6.5	37	0.32	910	10	5.2	40.1	0.001	0.19	0.04
4	01115400	Kent Brook (Betty Pond Stream)	6.2	28	0.51	1,100	<10	6.7	7.20	0.001	<0.05	0.01
5	01115184	Spruce Brook	6.3	54	0.63	2,100	21	4.8	19.9	0.002	0.28	0.03
6	01115183	Quonapaug Brook	6.6	100	0.59	1,100	20	10	31.7	0.003	0.19	0.05
7	01115297	Wilbur Hollow Brook	6.3	60	0.51	1,100	31	5.9	11.1	0.002	<0.05	0.03
8	01115276	Westconnaug Brook (Westconnaug Reservoir)	6.3	20	0.49	220	<10	3.7	13.6	0.001	<0.05	0.02
9	01115275	Bear Tree Brook	6.4	59	0.93	2,600	36	6.3	51.1	0.002	0.49	0.04

Table 8. Median values for water-quality data collected at Providence Water Supply Board stations in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; PCU, platinum cobalt unit; NTU, nephelometric turbidity unit; CFU/100 mL, colony forming unit per 100 milliliters; *E. coli*, *Escherichia coli*; mg/L, milligram per liter; $CaCO_3$, calcium carbonate; N, nitrogen; PO_4, phosphate; <, less than; —, no data]

PWSB station number	USGS station number	Station name	Properties					Constituents				
			pH	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 PO_4)
Direct runoff subbasin—Continued												
30	01115350	Unnamed tributary #4 to Scituate Reservoir (Coventry Brook, Knight Brook)	6.0	73	0.78	2,800	10	4.2	33.7	0.001	0.10	0.06
31	01115177	Toad Pond	6.5	40	0.60	130	<10	20	170	0.003	0.81	0.04
32	01115178	Unnamed tributary #1 to Scituate Reservoir (Pine Swamp Brook)	6.6	100	0.92	960	<10	9.5	13.5	0.002	0.26	0.07
33	01115182	Unnamed tributary #3 to Scituate Reservoir (Hall's Estate Brook)	6.2	38	0.31	740	20	5.5	13.1	0.001	0.19	0.05
36	—	Outflow from King Pond	6.6	37	0.28	1,000	25	4.9	7.80	0.001	0.06	0.03
37	—	Fire Tower Stream	5.9	28	0.17	900	<10	3.6	8.45	<0.001	<0.05	0.02
Moswansicut Reservoir subbasin												
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	7.0	20	0.6	81	<10	9.6	59.1	0.001	0.12	0.02
20	01115160	Unnamed tributary #1 to Moswansicut Reservoir (Blanchard Brook)	6.4	180	0.54	530	10	7.1	70.6	0.003	0.22	0.11
21	01115165	Unnamed tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	6.5	43	1.10	7,500	15	15	44.8	0.004	0.40	0.06
22	01115167	Moswansicut Reservoir (Moswansicut Stream south)	6.7	25	1.10	1,500	36	14	55.1	0.004	0.85	0.04
34	01115164	Kimball Stream	6.5	65	0.95	540	<10	11	37.8	0.003	0.17	0.06

Table 8. Median values for water-quality data collected at Providence Water Supply Board stations in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; PCU, platinum cobalt unit; NTU, nephelometric turbidity unit; CFU/100 mL, colony forming unit per 100 milliliters; *E. coli*, *Escherichia coli*; mg/L, milligram per liter; $CaCO_3$, calcium carbonate; N, nitrogen; PO_4, phosphate; <, less than; —, no data]

PWSB station number	USGS station number	Station name	Properties					Constituents				
			pH	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 PO_4)
Ponaganset Reservoir subbasin												
23	011151843	Ponaganset Reservoir	6.2	18	0.62	280	<10	3.2	19.5	0.001	<0.05	0.03
Regulating Reservoir subbasin												
13	01115176	Regulating Reservoir	6.7	35	0.82	260	<10	8.7	43	0.001	<0.05	0.02
14	01115110	Huntinghouse Brook	6.6	41	0.56	880	31	7.1	15.2	0.001	0.11	0.03
15	01115114	Rush Brook	6.8	58	0.67	770	26	9.7	53.9	0.001	0.11	0.04
16	01115098	Peeptoad Brook (Harrisdale Brook)	6.6	40	0.82	720	10	10	44.6	0.001	0.08	0.03
17	01115119	Dexter Pond (Paine Pond)	6.1	85	0.74	1,700	48	8.7	38.7	0.002	<0.05	0.03
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	6.4	90	1.0	2,400	88	10	66.6	0.004	0.25	0.07
Westconnaug Reservoir subbasin												
10	01115274	Westconnaug Brook	5.8	30	0.31	1,600	10	3.1	23.9	0.001	<0.05	0.03
11	01115273	Unnamed tributary to Westconnaug Reservoir (unnamed brook south of Westconnaug Reservoir)	5.8	80	0.53	890	10	4.0	8.20	0.002	<0.05	0.04
12	011152745	Unnamed tributary to Westconnaug Brook (unnamed brook north of Westconnaug reservoir)	6.2	25	0.47	510	<10	4.8	17.1	0.001	<0.05	0.03
Scituate Reservoir drainage area												
—	—	Minimum	5.8	18	0.17	81	<10	3.1	7.2	<0.001	<0.05	0.01
		Median	6.4	50	0.59	1,000	10	5.9	25.1	0.001	0.08	0.03
		Maximum	7.0	180	1.5	7,500	88	20	170	0.004	0.85	0.11

Table 9. Median daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; CFU×10⁶/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, grams per day; N, nitrogen; PO_4, phosphate; —, not applicable]

PWSB station number	USGS station number	Station name	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 PO_4)
		Barden Reservoir subbasin						
24	01115190	Dolly Cole Brook	160,000	[1]1,900	660	33	[1]1,900	670
25	01115200	Shippee Brook	150,000	5,500	280	24	[1]1,400	550
26	01115185	Windsor Brook	150,000	[1]2,700	680	31	[1]1,400	1,100
28	01115265	Barden Reservoir	210,000	9,200	1,500	78	2,700	2,600
35	01115187	Ponaganset River	600,000	[1]7,100	1,900	93	[1]1,400	1,700
		Direct runoff subbasin						
1	01115180	Brandy Brook	49,000	[1]1,000	110	11	1,200	210
3	01115280	Cork Brook	60,000	[1]490	380	7.5	940	240
4	01115400	Kent Brook	12,000	[1]260	22	3.5	[1]87	52
5	01115184	Spruce Brook	150,000	[1]2,200	200	12	2,200	180
6	01115183	Quonapaug Brook	57,000	2,300	470	23	930	490
7	01115297	Wilbur Hollow Brook	110,000	5,500	320	32	[1]780	620
8	01115276	Westconnaug Brook	81,000	[1]1,800	450	35	[1]880	680
9	01115275	Bear Tree Brook	91,000	[1]700	340	11	3,000	180
32	01115178	Unnamed tributary #1 to Scituate Reservoir (Pine Swamp Brook)	17,000	[1]140	25	2.7	320	55
33	01115182	Unnamed tributary #3 to Scituate Reservoir (Halls Estate Brook)	11,000	[1]420	29	1.6	[1]480	81
		Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	28,000	[1]1,200	1,400	25	[1]3,400	260
21	01115165	Unnamed tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	70,000	[1]130	65	4.1	620	58
		Regulating Reservoir subbasin						
14	01115110	Huntinghouse Brook	260,000	12,000	350	31	[1]1,600	740
15	01115114	Regulating Reservoir (Rush Brook)	110,000	3,400	820	18	1,600	510
16	01115098	Peeptoad Brook (Harrisdale Brook)	150,000	1,800	770	26	[1]2,200	480
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	37,000	1,000	75	4.9	220	74

Table 9. Median daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations are shown on figure 1. USGS, U.S. Geological Survey; CFU×10⁶/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, grams per day; N, nitrogen; PO_4, phosphate; —, not applicable]

PWSB station number	USGS station number	Station name	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 PO_4)
		Westconnaug Reservoir subbasin						
10	01115274	Westconnaug Brook	40,000	[1]500	200	8.3	[1]220	210
11	01115273	Unnamed tributary to Westconnaug Reservoir (unnamed brook south of Westconnaug Reservoir)	20,000	[1]940	41	6.5	[1]120	410
		Scituate Reservoir drainage area						
—	—	Minimum	11,000	[1]130	22	1.6	[1]87	52
		Median	81,000	[1]1,800	340	18	1,000	410
		Maximum	600,000	12,000	1,900	93	3,000	2,600

[1]The concentrations used to calculate the loads were censored as one-half the method detection limit.

Table 10. Median daily yields of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.

[Water-quality data are from samples collected and analyzed by Providence Water Supply Board (PWSB). Locations of stations shown on figure 1. USGS, U.S. Geological Survey; CFU×10⁶/d/mi²; millions of colony forming units per day per square mile; *E. coli*, *Escherichia coli*; N, nitrogen; PO_4, phosphate; kg/d/mi², kilogram per day per square mile; g/d/mi², gram per day per square mile; —, none]

PWSB station number	USGS station number	Station name	Total coliform bacteria (CFU×10⁶/mi²)	*E. coli* (CFU×10⁶/mi²)	Chloride (kg/d/mi²)	Nitrite (g/d/mi² as N)	Nitrate (g/d/mi² as N)	Orthophosphate (g/d/mi² as PO_4)
		Barden Reservoir subbasin						
24	01115190	Dolly Cole Brook	33,000	[1]390	130	6.6	[1]390	140
25	01115200	Shippee Brook	61,000	2,300	120	10	[1]570	230
26	01115185	Windsor Brook	35,000	[1]620	160	7.0	[1]310	250
28	01115265	Barden Reservoir	24,000	1,100	170	8.9	310	290
35	01115187	Ponaganset River	43,000	[1]500	130	6.6	[1]250	120
		Direct runoff subbasin						
1	01115180	Brandy Brook	31,000	660	73	6.8	730	130
3	01115280	Cork Brook	32,000	260	200	4.0	500	130
4	01115400	Kent Brook	14,000	310	26	4.1	100	61
5	01115184	Spruce Brook	120,000	1,700	150	9.5	1,700	140
6	01115183	Quonapaug Brook	29,000	1,200	240	12	470	250
7	01115297	Wilbur Hollow Brook	26,000	1,300	74	7.4	180	140
8	01115276	Westconnaug Brook	16,000	340	87	6.8	170	130
9	01115275	Bear Tree Brook	150,000	1,100	540	17	4,800	280
32	01115178	Unnamed tributary #1 to Scituate Reservoir (Pine Swamp Brook)	38,000	310	56	6.0	710	120
33	01115182	Unnamed tributary #3 to Scituate Reservoir (Halls Estate Brook)	38,000	1,500	100	5.5	1,700	290
		Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	8,600	370	420	7.5	1000	80
21	01115165	Unnamed tributary #2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	230,000	430	220	14	2,100	190
		Regulating Reservoir subbasin						
14	01115110	Huntinghouse Brook	41,000	1,800	55	4.9	250	120

Table 10. Median daily yields of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by Providence Water Supply Board (PWSB). Locations of stations shown on figure 1. USGS, U.S. Geological Survey; CFU×10⁶/d/mi²; millions of colony forming units per day per square mile; *E. coli*, *Escherichia coli*; N, nitrogen; PO_4, phosphate; kg/d/mi², kilogram per day per square mile; g/d/mi², gram per day per square mile; —, none]

PWSB station number	USGS station number	Station name	Total coliform bacteria (CFU×10^6/mi^2)	*E. coli* (CFU×10^6/mi^2)	Chloride (kg/d/mi^2)	Nitrite (g/d/mi^2 as N)	Nitrate (g/d/mi^2 as N)	Orthophosphate (g/d/mi^2 as PO_4)
		Regulating Reservoir subbasin—Continued						
15	01115114	Regulating Reservoir (Rush Brook)	22,000	710	170	3.7	340	110
16	01115098	Peeptoad Brook (Harrisdale Brook)	30,000	360	150	5.2	440	96
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	130,000	3,700	270	17	790	260
		Westconnaug Reservoir subbasin						
10	01115274	Westconnaug Brook	27,000	340	140	5.6	150	140
11	01115273	Unnamed tributary to Westconnaug Reservoir (unnamed brook south of Westconnaug Reservoir)	28,000	1,300	56	9.0	170	560
		Scituate Reservoir drainage area						
—	—	Minimum	8,600	260	26	3.70	100	61
		Median	32,000	660	140	6.8	440	140
		Maximum	230,000	3,700	540	17	4,800	560

[1]The concentrations used to calculate the yields were censored as one-half the method detection limit.

References Cited

Baird, R.B., Eaton, A.D., and Rice, E.W., eds., 2018, Standard methods for the examination of water and wastewater (23d ed.): American Public Health Association, American Water Works Association, and Water Environment Federation, [variously paged], accessed October 4, 2018, at https://www.standardmethods.org/.

Best, J., Cockerel, B.L., Jr., Dichter, G., and Hall, N.H., northeimer, W.W., Reynolds, V., and Solo-Gabriele, H., 2018, 9223—Enzyme substrate coliform test, *in* Baird, R.B., Eaton, A.D., and Rice, E.W., eds., Standard methods for the examination of water and wastewater (23d ed.): American Public Health Association, American Water Works Association, and Water Environment Federation, 4 p., accessed October 4, 2018, at https://www.standardmethods.org/doi/10.2105/SMWW.2882.194.

Breault, R.F., 2010, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2002: U.S. Geological Survey Open-File Report 2009–1041, 25 p. [Also available at https://doi.org/10.3133/ofr20091041.]

Breault, R.F., and Campbell, J.P., 2010a, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2003: U.S. Geological Survey Open-File Report 2010–1043, 24 p. [Also available at https://doi.org/10.3133/ofr20101043.]

Breault, R.F., and Campbell, J.P., 2010b, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2004: U.S. Geological Survey Open-File Report 2010–1044, 24 p. [Also available at https://doi.org/10.3133/ofr20101044.]

Breault, R.F., and Campbell, J.P., 2010c, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2005: U.S. Geological Survey Open-File Report 2010–1045, 24 p. [Also available at https://doi.org/10.3133/ofr20101045.]

Breault, R.F., and Campbell, J.P., 2010d, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2006: U.S. Geological Survey Open-File Report 2010–1046, 25 p. [Also available at https://doi.org/10.3133/ofr20101046.]

Breault, R.F., and Smith, K.P., 2010, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2009: U.S. Geological Survey Open-File Report 2010–1275, 24 p. [Also available at https://doi.org/10.3133/ofr20101275.]

Breault, R.F., Sorenson, J.R., and Weiskel, P.K., 2002, Streamflow, water quality, and contaminant loads in the lower Charles River watershed, Massachusetts, 1999–2000: U.S. Geological Survey Water-Resources Investigations Report 2002–4137, 131 p. [Also available at https://doi.org/10.3133/wri024137.]

Breault, R.F., Waldron, M.C., Barlow, L.K., and Dickerman, D.C., 2000, Water-quality conditions in relation to drainage basin characteristics in the Scituate Reservoir basin, Rhode Island, 1982–95: U.S. Geological Survey Water-Resources Investigations Report 2000–4086, 46 p. [Also available at https://doi.org/10.3133/wri004086.]

Hach Company, 2000, DR/2010 spectrophotometer procedures manual, rev. 2: Loveland, Colo., Hach Company, 657 p.

Helsel, D.R., and Hirsch, R.M., 2002, Statistical methods in water resources: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. A3, 522 p. [Also available at https://doi.org/10.3133/twri04A3.]

Hirsch, R.M., 1982, A comparison of four streamflow record extension techniques: Water Resources Research, v. 18, no. 4, p. 1081–1088. [Also available at https://doi.org/10.1029/WR018i004p01081.]

Hirsch, R.M., and Gilroy, E.J., 1984, Methods of fitting a straight line to data—Examples in water resources: Water Resources Bulletin, v. 20, no. 5, p. 705–711. [Also available at https://doi.org/10.1111/j.1752-1688.1984.tb04753.x.]

Holm, T.R., Bennett, J., Blakesley, R., Gleichauf, G.K., Jagessar, P.K., Lipps, W.C., Vilissova, N., and Woodall, M.A., 2018, 4500-NO_3^-—Nitrogen (nitrate), *in* Baird, R.B., Eaton, A.D., and Rice, E.W., eds., Standard methods for the examination of water and wastewater (23d ed.): American Public Health Association, American Water Works Association, and Water Environment Federation, 13 p., accessed October 4, 2018, at https://www.standardmethods.org/doi/10.2105/SMWW.2882.089.

Nimiroski, M.T., DeSimone, L.A., and Waldron, M.C., 2008, Water-quality conditions and constituent loads, 1996–2002, and water-quality trends, 1983–2002, in the Scituate Reservoir drainage area, Rhode Island: U.S. Geological Survey Scientific Investigations Report 2008–5060, 55 p. [Also available at https://doi.org/10.3133/sir20085060.]

Nimiroski, M.T., and Waldron, M.C., 2002, Sources of sodium and chloride in the Scituate Reservoir drainage basin, Rhode Island: U.S. Geological Survey Water-Resources Investigations Report 2002–4149, 16 p. [Also available at https://doi.org/10.3133/wri024149.]

Ries, K.G., III, and Friesz, P.J., 2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water-Resources Investigations Report 2000–4135, 81 p. [Also available at https://doi.org/10.3133/wri004135.]

Smith, K.P., 2013, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2011: U.S. Geological Survey Open-File Report 2013–1127, 32 p. [Also available at https://doi.org/10.3133/ofr20131127.]

Smith, K.P., 2014, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2012: U.S. Geological Survey Open-File Report 2013–1274, 30 p. [Also available at https://doi.org/10.3133/ofr20131274.]

Smith, K.P., 2015a, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2013: U.S. Geological Survey Open-File Report 2015–1082, 31 p., accessed June 3, 2015, at https://doi.org/10.3133/ofr20151082.

Smith, K.P., 2015b, Water-quality trends in the Scituate reservoir drainage area, Rhode Island, 1983–2012: U.S. Geological Survey Scientific Investigations Report 2015–5058, 57 p. [Also available at https://doi.org/10.3133/sir20155058.]

Smith, K.P., 2016, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2014: U.S. Geological Survey Open-File Report 2016–1051, 31 p. [Also available at https://doi.org/10.3133/ofr20161051.]

Smith, K.P., 2018a, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2015: U.S. Geological Survey Open-File Report 2018–1065, 28 p. [Also available at https://doi.org/10.3133/ofr20181065.]

Smith, K.P., 2018b, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2016: U.S. Geological Survey Open-File Report 2018–1065, 32 p. [Also available at https://doi.org/10.3133/ofr20181084.]

Smith, K.P., 2018c, Water quality data from the Providence Water Supply Board for tributary streams to the Scituate Reservoir, water year 2015: U.S. Geological Survey data release, https://doi.org/10.5066/F7FJ2FR5.

Smith, K.P., 2018d, Water quality data from the Providence Water Supply Board for tributary streams to the Scituate Reservoir, water year 2016: U.S. Geological Survey data release, https://doi.org/10.5066/F7Z60NC5.

Smith, K.P., 2019a, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2017: U.S. Geological Survey Open-File Report 2018–1039, 33 p. [Also available at https://doi.org/10.3133/ofr20191039.]

Smith, K.P., 2019b, Water quality data from the Providence Water Supply Board for tributary streams to the Scituate Reservoir, water year 2017: U.S. Geological Survey data release, https://doi.org/10.5066/P9PPAKP6.

Smith, K.P., 2021a, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2018: U.S. Geological Survey Data Report 1144, 36 p., https://doi.org/10.3133/dr1144.

Smith, K.P., 2021b, Water quality data from the Providence Water Supply Board for tributary streams to the Scituate Reservoir, water year 2018–19: U.S. Geological Survey data release, https://doi.org/10.5066/P9WK8N0F.

Smith, K.P., and Breault, R.F., 2011, Streamflow, water quality, and constituent loads and yields, Scituate Reservoir drainage area, Rhode Island, water year 2010: U.S. Geological Survey Open-File Report 2011–1076, 26 p. [Also available at https://doi.org/10.3133/ofr20111076.]

Tasker, G.D., and Driver, N.E., 1988, Nationwide regression models for predicting urban runoff water quality at unmonitored sites: Water Resources Bulletin, v. 24, no. 5, p. 1091–1101. [Also available at https://doi.org/10.1111/j.1752-1688.1988.tb03026.x.]

U.S. Environmental Protection Agency, 1993, Method 353.2, revision 2.0—Determination of nitrate-nitrite nitrogen by automated colorimetry: U.S. Environmental Protection Agency, [variously paged], accessed June 10, 2016, at https://www.epa.gov/sites/production/files/2015-8/documents/method_353-2_1993.pdf.

U.S. Geological Survey, 2020, USGS water data for the nation: U.S. Geological Survey National Water Information System database, accessed May 28, 2020, at https://doi.org/10.5066/F7P55KJN.

Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods, book 1, chap. D3, 8 attachments, accessed April 10, 2006, at https://doi.org/10.3133/tm1D3.

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic foot per second; CFU×10^6/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, gram per day; N, nitrogen; PO_4, phosphate; <, less than; >, greater than]

PWSB station number	USGS station number	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 PO_4)
				Barden Reservoir subbasin						
24	01115190	Dolly Cole Brook	10/12/18	52	>31,000,000	1,500,000	3,000	380	[1]3,200	3,800
			11/12/18	30	1,000,000	7,400	2,200	74	[1]1,800	3,700
			12/07/18	15	190,000	[1]1,900	850	38	2,300	1,100
			01/04/19	22	170,000	5,400	1,100	54	3,500	540
			02/19/19	11	81,000	[1]1,400	710	28	2,400	830
			03/26/19	15	140,000	[1]1,900	930	37	2,300	370
			04/05/19	8.6	150,000	[1]1,100	580	21	1,400	2,700
			05/22/19	11	580,000	2,700	610	53	[1]670	800
			06/07/19	2.4	97,000	1,200	150	12	690	230
			07/12/19	1.7	630,000	41,000	140	16	850	120
			08/02/19	0.75	48,000	370	51	3.7	260	55
			09/06/19	1.1	38,000	[1]130	68	2.6	2,000	52
25	01115200	Shippee Brook	11/30/18	14	140,000	3,400	370	34	1700	680
			02/21/19	4.3	27,000	1,000	180	10	2000	420
			05/29/19	2.8	150,000	7,600	87	14	[1]170	280
			08/22/19	17	8,300,000	720,000	560	130	[1]1,000	1,700
26	01115185	Windsor Brook	11/30/18	19	170,000	4,600	960	46	[1]1,200	1,900
			02/21/19	6.2	48,000	[1]760	400	15	1,500	450
			05/29/19	4.2	130,000	[1]510	290	10	[1]260	200
			08/22/19	23	>14,000,000	4,300,000	1,400	170	3,500	1,700
28	01115265	Barden Reservoir (Hemlock Brook)	10/05/18	36	3,900,000	150,000	1,800	270	[1]2,200	3,600
			11/13/18	75	5,000,000	850,000	2,800	550	11,000	29,000
			12/11/18	36	260,000	[1]4,400	2,300	170	8,700	4,400
			01/15/19	22	100,000	[1]2,700	1,500	55	6,800	550
			02/11/19	21	75,000	[1]2,500	1,200	50	4,400	1,500
			03/12/19	29	150,000	14,000	2,200	70	8,400	1,400
			04/16/19	53	1,900,000	39,000	2,800	390	[1]3,200	9,000
			05/14/19	28	2,300,000	130,000	1,500	130	[1]1,700	4,700
			06/11/19	8.7	1,500,000	380,000	500	85	1,100	3,600
			07/16/19	1.7	54,000	420	120	8.3	510	42
			08/13/19	1.4	31,000	680	130	10	380	240
			09/10/19	1.1	24,000	540	98	5.4	190	140

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic foot per second; CFU×10^6/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, gram per day; N, nitrogen; PO_4, phosphate; <, less than; >, greater than]

PWSB station number	USGS station number	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 PO_4)
Barden Reservoir subbasin—Continued										
35	01115187	Ponaganset River	10/12/18	160	66,000,000	6,900,000	8,700	1100	[1]9,600	11,000
			11/12/18	65	2,100,000	[1]7,900	4,000	160	[1]4,000	7,900
			12/07/18	34	670,000	[1]4,100	1,700	83	7,100	1,700
			01/04/19	47	580,000	[1]5,700	2,000	110	9,200	1,100
			02/01/19	41	340,000	10,000	2,100	100	14,000	2,000
			03/26/19	35	250,000	[1]4,200	2,100	85	8,800	1,700
			04/05/19	22	310,000	[1]2,700	1,200	55	3,100	1,600
			05/22/19	37	1,300,000	9,100	2,100	180	[1]2,300	1,800
			06/07/19	14	1,200,000	37,000	720	100	2,200	3,000
			07/12/19	2.6	620,000	17,000	180	13	920	64
			08/02/19	0.52	62,000	2,000	37	2.5	160	38
			09/06/19	4.9	370,000	6,200	300	24	[1]300	360
Direct runoff subbasin										
1	01115180	Brandy Brook	10/15/18	3.5	120,000	1,700	130	26	730	340
			11/05/18	5.4	510,000	210,000	170	53	1,100	1,100
			02/05/19	3.5	41,000	[1]420	130	8.5	2,800	170
			03/05/19	3.1	37,000	1,500	130	[1]3.8	2,700	150
			04/02/19	2.9	55,000	1,400	98	7.1	1,400	430
			05/07/19	5.4	160,000	[1]660	180	26	1,300	660
			06/04/19	1.9	38,000	[1]240	59	14	1,200	240
			07/09/19	0.64	43,000	160	24	4.7	330	110
			08/15/19	0.26	27,000	130	10	1.3	180	38
			09/03/19	1.8	490,000	36,000	80	13	630	170
3	01115280	Cork Brook	10/11/18	6.3	300,000	1,500	740	31	1,900	1,700
			11/01/18	4.2	59,000	5,300	420	10	810	410
			12/06/18	4.4	77,000	[1]540	370	11	1,800	440
			01/03/19	6.2	120,000	16,000	430	15	2,300	300
			02/07/19	5.7	150,000	13,000	430	14	3,100	420
			03/07/19	2.1	7,000	[1]250	220	5.0	1,000	150
			04/04/19	3.5	61,000	[1]430	420	[1]4.3	1,200	170
			05/02/19	4.2	130,000	2,100	390	10	880	620
			06/06/19	0.99	11,000	[1]120	93	2.4	580	48
			07/11/19	0.16	5,500	[1]19	13	0.39	160	16
			08/01/19	0.081	3,300	20	8.7	0.20	82	12
			09/05/19	0.20	6,700	260	30	0.50	110	9.9

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic foot per second; CFU×10^6/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, gram per day; N, nitrogen; PO_4, phosphate; <, less than; >, greater than]

PWSB station number	USGS station number	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 PO_4)
				Direct runoff subbasin—Continued						
4	01115400	Kent Brook	10/15/18	1.4	69,000	350	26	3.5	[1]88	70
			11/05/18	3.1	22,000	[1]370	67	7.5	[1]190	450
			12/04/18	3.5	8,200	850	71	8.5	[1]210	170
			01/30/19	2.5	5,200	[1]300	49	6.1	[1]150	180
			02/05/19	1.4	2,600	[1]170	18	3.4	[1]86	34
			03/22/19	4.9	3,600	[1]600	91	12	[1]300	120
			04/02/19	1.0	7,300	[1]130	18	2.5	[1]63	25
			05/07/19	3.1	180,000	3,100	53	7.5	[1]190	150
			06/04/19	0.51	54,000	[1]62	7.7	1.2	[1]31	12
			07/09/19	0.07	16,000	36	1.2	0.18	[1]4.5	1.8
			08/19/19	0.01	1,500	[1]0.89	0.09	0.036	[1]0.45	[1]0.089
			09/03/19	0.44	42,000	220	5.9	1.1	[1]27	11
5	01115184	Spruce Brook	12/26/18	5.0	130,000	[1]610	230	12	3,500	240
			03/22/19	4.9	170,000	3,700	230	12	3,700	120
			05/21/19	3.1	210,000	6,600	160	15	890	390
			08/20/19	0.30	26,000	72	31	1.4	190	29
6	01115183	Quonapaug Brook	10/15/18	5.5	240,000	17,000	460	40	[1]340	400
			11/05/18	10	230,000	15,000	640	75	[1]620	5,000
			12/04/18	9.7	58,000	2,400	600	24	4,200	1,400
			01/30/19	8.9	56,000	2,200	670	22	7,500	650
			02/05/19	6.4	36,000	3,100	470	16	5,200	310
			03/22/19	14	59,000	3,400	1,000	69	8,000	2,100
			04/02/19	4.5	39,000	[1]550	360	11	2,300	550
			05/07/19	6.7	250,000	[1]820	500	33	880	2,000
			06/04/19	1.6	50,000	790	140	12	970	200
			07/09/19	0.25	42,000	660	26	4.8	230	30
			08/06/19	0.013	2,200	130	2.0	0.18	4.9	1.8
			09/03/19	4.3	2,500,000	1,500,000	420	42	610	420

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic foot per second; $CFU \times 10^6/d$; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, gram per day; N, nitrogen; PO_4, phosphate; <, less than; >, greater than]

PWSB station number	USGS station number	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria ($CFU \times 10^6/d$)	*E. coli* ($CFU \times 10^6/d$)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as PO_4)
					Direct runoff subbasin—Continued					
7	01115297	Wilbur Hollow Brook	10/11/18	8.8	930,000	24,000	240	64	[1]540	640
			11/01/18	12	270,000	41,000	330	56	[1]700	1,400
			12/06/18	14	97,000	7,000	470	35	4,100	1,000
			01/03/19	17	91,000	4,200	400	42	4,700	420
			02/07/19	17	94,000	4,100	440	41	8,700	810
			03/07/19	8.4	17,000	[1]1,000	320	21	6,000	830
			04/04/19	12	280,000	[1]1,500	340	30	1,500	600
			05/02/19	14	420,000	6,800	320	34	[1]850	2,700
			06/06/19	3.5	400,000	14,000	100	26	[1]220	86
			07/11/19	0.47	37,000	470	11	3.4	[1]29	23
			08/01/19	0.15	17,000	390	3.7	1.1	[1]9.0	11
			09/05/19	1.4	130,000	6,800	37	10	[1]87	69
8	01115276	Westconnaug Brook	10/05/18	14	450,000	3,500	510	35	[1]880	[1]<180
			11/19/18	25	62,000	6,200	850	62	3,200	2500
			12/28/18	20	20,000	[1]2,400	590	49	3,300	970
			01/28/19	25	74,000	6,200	840	62	[1]1,500	1800
			02/15/19	14	3,300	[1]1,700	410	33	[1]830	660
			03/15/19	15	[1]1,800	[1]1,800	450	36	[1]910	730
			04/19/19	15	110,000	[1]1,900	500	38	[1]950	760
			05/17/19	14	52,000	[1]1,700	450	35	[1]870	700
			06/18/19	7.2	220,000	[1]890	240	18	[1]440	350
			07/26/19	4.7	630,000	[1]580	160	12	[1]290	230
			08/16/19	2.3	87,000	[1]280	78	5.6	[1]140	500
			09/20/19	2.2	130,000	[1]270	73	5.4	[1]130	54
9	01115275	Bear Tree Brook	12/26/18	3.3	110,000	[1]400	430	8.1	4,500	160
			03/22/19	3.6	71,000	[1]440	350	17	3,700	1,000
			05/21/19	2.6	390,000	4,000	320	13	2,200	190
			08/20/19	0.46	43,000	950	78	2.2	910	45
32	01115178	Unnamed tributary 1 to Scituate Reservoir (Pine Swamp Brook)	10/25/18	0.55	13,000	[1]68	25	2.7	320	140
			03/11/19	1.1	17,000	[1]140	37	2.7	1,300	55
			06/28/19	0.24	30,000	1,400	6.4	3.5	150	41

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations shown on figure 1. USGS, U.S. Geological Survey; ft³/s, cubic foot per second; CFU×10⁶/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, gram per day; N, nitrogen; PO_4, phosphate; <, less than; >, greater than]

PWSB station number	USGS station number	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria ($CFU \times 10^6/d$)	*E. coli* ($CFU \times 10^6/d$)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as PO_4)
				Direct runoff subbasin—Continued						
33	01115182	Unnamed tributary 3 to Scituate Reservoir (Halls Estate Brook)	11/26/18	1.3	15,000	660	37	[1]1.6	640	130
			03/19/19	0.63	6,500	1,800	20	1.5	540	31
			04/24/19	1.4	35,000	[1]170	45	3.5	410	210
			09/25/19	0.0040	400	2.1	0.72	0.032	1.9	0.53
				Moswansicut Reservoir subbasin						
19	01115170	Moswansicut Reservoir (Moswansicut Stream north, Moswansicut Pond)	10/18/18	4.6	49,000	[1]560	740	11	[1]280	110
			11/08/18	16	44,000	4,000.0	2,500	40	3,000	790
			12/20/18	10	7,400	2,400.0	1,400	24	3,700	480
			01/10/19	14	11,000	3,500.0	2,000	35	6,700	710
			02/14/19	11	2,800	[1]1,400	1,600	28	6,400	280
			03/14/19	8.4	[1]1,000	[1]1,000	1,300	21	5,600	210
			04/11/19	10	[1]1,200	[1]1,200	1,500	25	6,400	500
			05/16/19	10	12,000	[1]1,200	1,600	48	4,600	240
			06/13/19	9.6	150,000	[1]1,200	1,300	47	[1]590	470
			07/25/19	3.1	220,000	[1]380	410	7.6	[1]190	76
			08/08/19	1.1	110,000	[1]140	160	2.7	[1]68	55
			09/12/19	0.71	140,000	170.0	100	1.7	[1]43	17
21	01115165	Unnamed tributary 2 to Moswansicut Reservoir (Brook from Kimball Reservoir)	03/28/19	0.84	19,000	[1]100	92	4.1	1,000	41
			06/25/19	0.33	120,000	160	37	4.1	240	74
				Regulating Reservoir subbasin						
14	01115110	Huntinghouse Brook	10/19/18	6.2	170,000	13,000	290	15	[1]380	600
			11/09/18	22	340,000	11,000	780	54	[1]1,300	2,200
			12/18/18	21	450,000	26,000	730	51	4,700	1,000
			01/11/19	16	320,000	12,000	490	39	4,800	1,200
			02/08/19	26	200,000	19,000	840	63	8,400	1,300
			03/08/19	7.0	23,000	[1]860	320	17	3,100	340
			04/18/19	15	320,000	7,300	590	37	1,900	730
			05/10/19	10	190,000	4,900	370	25	[1]610	740
			06/20/19	5.6	2,700,000	290,000	230	55	2,200	960
			07/31/19	0.28	25,000	870	9.8	1.3	96	20
			08/09/19	2.7	1,600,000	57,000	99	13	730	260
			09/17/19	0.65	26,000	160	30	1.6	180	64

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

[Water-quality data are from samples collected and analyzed by the Providence Water Supply Board (PWSB). Alternate station names are listed in parentheses for stations where different historical names were used for the same sampling location by the PWSB. Locations of stations shown on figure 1. USGS, U.S. Geological Survey; ft^3/s, cubic foot per second; CFU×10^6/d; millions of colony forming units per day; *E. coli*, *Escherichia coli*; kg/d, kilogram per day; g/d, gram per day; N, nitrogen; PO_4, phosphate; <, less than; >, greater than]

PWSB station number	USGS station number	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 PO_4)
Regulating Reservoir subbasin—Continued										
15	01115114	Rush Brook	10/19/18	3.7	100,000	[1]450	520	18	640	550
			11/09/18	15	280,000	3,600	1,500	73	1,800	2,900
			12/18/18	13	240,000	3,100	950	31	3,200	620
			01/11/19	7.1	62,000	[1]870	600	17	2,900	520
			02/08/19	18	120,000	18,000	1,700	45	6,200	1,300
			03/08/19	4.8	13,000	[1]590	810	12	3,100	120
			04/18/19	10	92,000	4,900	1,200	24	1,400	490
			05/10/19	6.8	110,000	23,000	820	17	1,100	330
			06/20/19	7.6	3,700,000	250,000	1,200	110	3,300	1,300
			07/31/19	0.23	24,000	750	40	0.57	87	23
			08/09/19	1.4	670,000	17,000	210	6.8	340	140
			09/17/19	0.15	9,000	120	35	0.38	40	15
16	01115098	Peeptoad Brook (Harrisdale Brook)	10/19/18	4.3	48,000	2,100	520	21	800	420
			11/09/18	14	110,000	3,300	1,300	67	2,100	330
			12/18/18	11	170,000	7,900	800	26	5,000	790
			01/11/19	12	130,000	28,000	730	29	6,100	860
			02/08/19	20	180,000	9,900	1,800	50	12,000	1,500
			03/08/19	8.9	44,000	[1]1,100	980	22	6,100	430
			04/18/19	11	200,000	2,600	1,200	26	2,200	520
			05/10/19	12	270,000	[1]1,500	1,200	59	2,300	890
			06/20/19	6.3	180,000	[1]770	680	31	1,700	310
			07/31/19	0.88	130,000	430	100	2.1	[1]54	210
			08/09/19	3.7	390,000	[1]450	400	8.9	[1]220	710
			09/17/19	0.74	18,000	[1]91	88	1.8	[1]45	36
18	01115120	Unnamed tributary to Regulating Reservoir (unnamed brook A)	10/30/18	1.8	56,000	1,400	270	13	[1]110	660
			02/28/19	0.28	670	69	58	0.69	710	14
			05/31/19	0.19	17,000	690	33	2.4	170	38
			08/29/19	0.75	>440,000	140,000	92	7.3	270	110

Table 4. Daily loads of bacteria, chloride, nitrite, nitrate, and orthophosphate in the Scituate Reservoir drainage area, Rhode Island, from October 1, 2018, through September 30, 2019.—Continued

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PWSB station number	USGS station number	Station name	Date	Daily mean streamflow (ft^3/s)	Total coliform bacteria ($CFU\times10^6/d$)	*E. coli* ($CFU\times10^6/d$)	Chloride (kg/d)	Nitrite (g/d as N)	Nitrate (g/d as N)	Orthophosphate (g/d as PO_4)
Westconnaug Reservoir subbasin										
10	01115274	Westconnaug Brook	10/05/18	5.0	450,000	5,000	310	12	[1]310	240
			11/13/18	35	2,200,000	64,000	1,500	170	[1]2,100	34,000
			12/11/18	2.0	24,000	490	120	4.9	[1]120	98
			01/15/19	2.3	31,000	[1]290	130	[1]2.9	[1]140	170
			02/11/19	2.6	32,000	[1]320	140	6.5	[1]160	130
			03/12/19	4.2	47,000	[1]510	260	10	640	310
			04/16/19	11	380,000	[1]1,400	670	300	[1]680	1,100
			05/14/19	9.6	810,000	2,300	580	23	[1]590	940
			06/11/19	4.5	850,000	170,000	280	22	[1]280	780
			07/16/19	0.06	7,300	28	2.7	0.14	[1]3.5	4.2
			08/26/19	0.66	19,000	160	22	1.6	[1]40	32
			09/20/19	0.05	2,200	24	2.6	[1]0.06	[1]3.0	4.8
11	01115273	Unnamed tributary to Westconnaug Reservoir (unnamed brook south of Westconnaug Reservoir)	10/23/18	1.1	17,000	270	22	5.5	[1]68	82
			01/29/19	3.0	11,000	[1]370	59	7.4	[1]180	1,300
			04/23/19	10	280,000	2,400	210	24	[1]610	730
			09/24/19	0.04	23,000	1,500	1.1	1.1	[1]2.4	3.8

[1]Values were censored and are reported as one-half the method detection limit.

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