Scituate Reservoir Source Water Assessment and Protection Plan

Providence Water

Providence, Rhode Island

August 2023

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Project No. 2003272.E20

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1 Introduction

In September of 2017, Fuss & O'Neill prepared a Source Water Assessment Program Plan (SWAPP) for the Scituate Reservoir watershed on behalf of the Providence Water Supply Board (hereafter 'Providence Water'), which supplies water to over 600,000 people, or approximately 60% of the population of Rhode Island. The goal of the SWAPP is to better protect drinking water supplies at their source by evaluating threats to future water quality.

A guidance document was created in 2010 for the purpose of updating SWAPPs that were completed in 2003 (RIDOH, 2010). The Rhode Island Department of Health (RIDOH) and Rhode Island Nonpoint Education for Municipal Officials (RINEMO) developed the guidance document to simplify updating assessments, making it more straightforward and accessible to various water suppliers when compared to the 2003 Pollution Risk Rating System used for the original SWAPP. The guidance document identifies the major risk factors regarding source water protection for surface waters. It also outlines the procedures water suppliers should follow in order to identify various risks and compare progress in mitigating those risks with previous assessments.

In January of 2022, Fuss & O'Neill drafted the Climate Change Adaptation Plan (CCAP) for the Providence Water Supply Board for the Scituate Reservoir watershed. This report used federal, state, and local Providence Water datasets to evaluate the vulnerability of the Scituate Reservoir watershed to changes in regional temperature, precipitation, and consequently impacts to the surrounding terrestrial and aquatic environment (i.e., forest lands, water quality). The CCAP provides guidelines for the prioritization of actions that increase resilience to climate related hazards while simultaneously working in tandem with the goals outlined by the SWAPP.

Designed for Providence Water, this report summarizes the results of the update to the 2023 SWAPP for Providence Water based on the 2010 guidance document, in tandem with the recommended actions of the CCAP. The overall study area includes the watershed for the Scituate Reservoir which is located all or in part in the towns of Scituate, Foster, Glocester, Johnston, and the City of Cranston, as shown in *Figure 1-1*. The assessment provides a consistent framework for identifying and ranking threats to all public water supplies following four basic steps:

- Inventory and mapping potential sources of pollution within reservoir watersheds;
- Assessing the risk associated with these potential sources of contamination and ranking the susceptibility of the water supply;
- Identifying practical steps that can be taken to reduce pollution risks and make results available;
- Assess broadscale watershed vulnerability to the long-term effects of climate change on water quality and identify actions to mitigate these impacts.

1.1 Assessment Study Areas

Providence Water owns the Scituate Reservoir and five smaller tributary reservoirs located within five Rhode Island municipalities. Providence Water provides water services to residents and businesses including the municipalities of Providence, N. Providence, Cranston, and Johnston, and the Water Departments of Warwick, East Providence, West Cranston, Kent County, East Smithfield, Greenville, and Lincoln. Net available supply from the reservoir is 92 million gallons per day (mgd). In 2023, slight adjustments were made to the watershed boundaries for the Scituate Reservoir based on GIS mapping received from Providence Water. Consequently, there is a small discrepancy between the total watershed area between the previous report (2017) and this updated version.

The Scituate Reservoir study area includes the watersheds for its six (6) reservoirs *(Figure 1-1)*:

- Scituate Reservoir Direct[1]
- Moswansicut Reservoir
- Regulating Reservoir
- Barden Reservoir
- Westconnaug Reservoir
- Ponaganset Reservoir

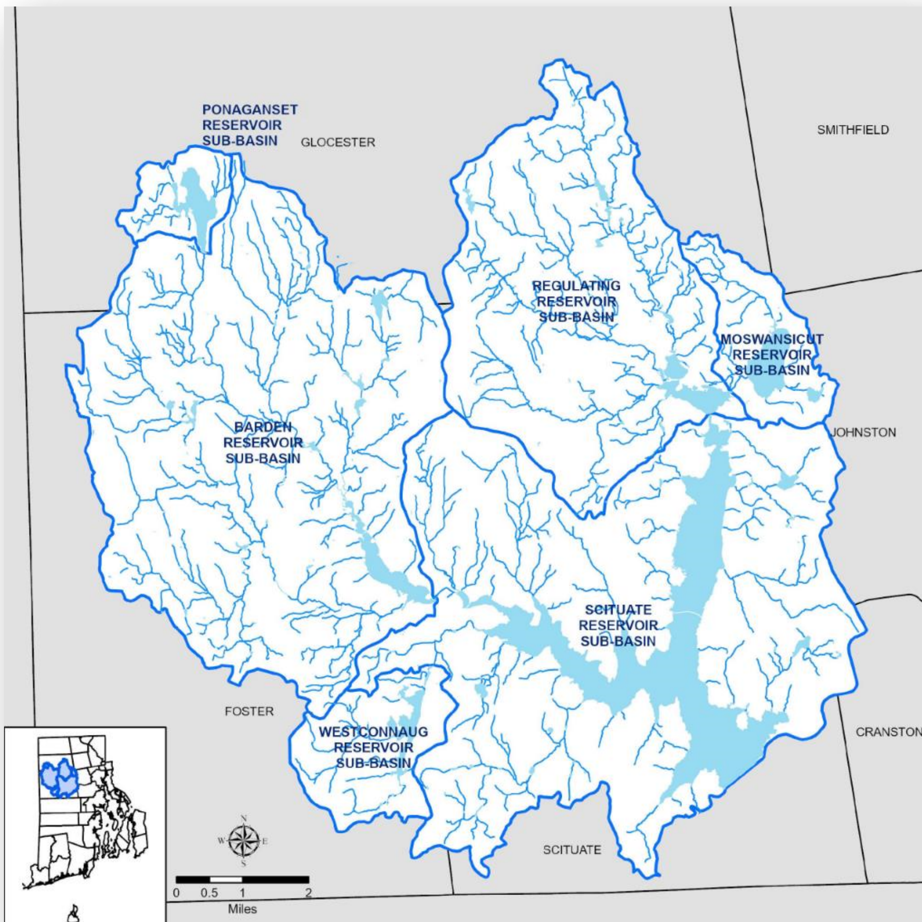


Figure 1-1: Scituate Reservoir watershed Overview

The Scituate Reservoir relies primarily on the Philip J. Holton Water Purification Works for filtration. In service for nearly 100 years, it employs a conventional treatment process, and has a filtration capacity of

[1] Scituate Reservoir Direct includes just those watershed lands draining directly to the Scituate Reservoir. See Section 1.1.6 for further detail.

144 mgd. The distribution system consists of approximately 76,800 service connections, nearly 1,040 miles of mains, and 6,275 hydrants. The majority of dwellings throughout the watershed rely on wells for drinking water and septic systems for wastewater treatment.

1.1.1 Barden Reservoir watershed

The 19,968-acre watershed for the Barden Reservoir lies in the towns of southern Glocester, Foster, and western Scituate (*Figure 1-2*). Providence Water owns much of the land around the perimeter of the reservoir. The land cover in the watershed is primarily forest with some commercial development along Routes 6 and 101 and several small farms scattered throughout.

1.1.2 Ponaganset Reservoir watershed

The Ponaganset Reservoir drains into the Barden watershed from the north and is located in the Town of Glocester (*Figure 1-2*). The watershed for the reservoir encompasses approximately 1,144 acres. Land cover in the watershed is primarily forest with a large amount of medium density residential development along the north and south shores of the reservoir.

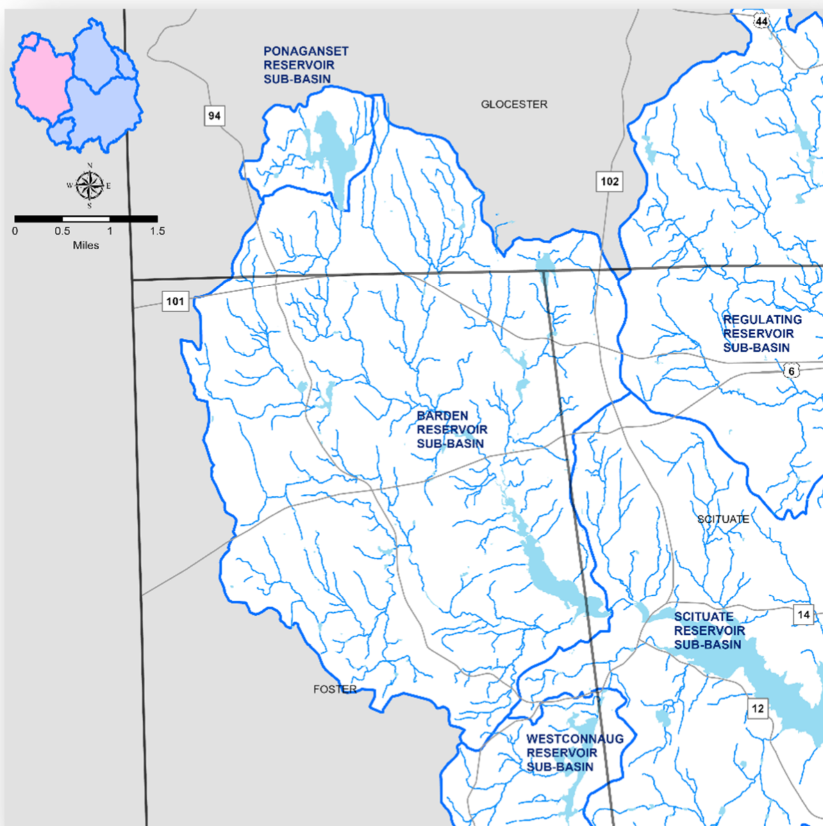


Figure 1-2: Barden and Ponaganset Reservoir Sub-basins

1.1.3 Regulating Reservoir watershed

The 11,929-acre Regulating Reservoir watershed lies almost equally within the Towns of Glocester and Scituate (*Figure 1-3*). It is fed by the Moswansicut Reservoir and several smaller streams, emptying directly into the eastern limb of the Scituate Reservoir. Providence Water owns all the land (1,108 acres) immediately adjacent to the reservoir. Most of the watershed is forested with medium-low density development scattered throughout.

1.1.4 Moswansicut Reservoir watershed

The Moswansicut Reservoir watershed encompasses 2,217 acres in the towns of Scituate, Glocester and Johnston (*Figure 1-3*). It drains to the Regulating reservoir, and ultimately to the eastern limb of the Scituate Reservoir. The majority of the land immediately adjacent to the reservoir is protected and owned by Providence Water. However, this watershed has the largest percentage of commercial and medium density residential development in the Scituate watershed. Furthermore, mapped potential sources of contamination such as underground storage tanks are located in the southern portion of the watershed along Route 6.

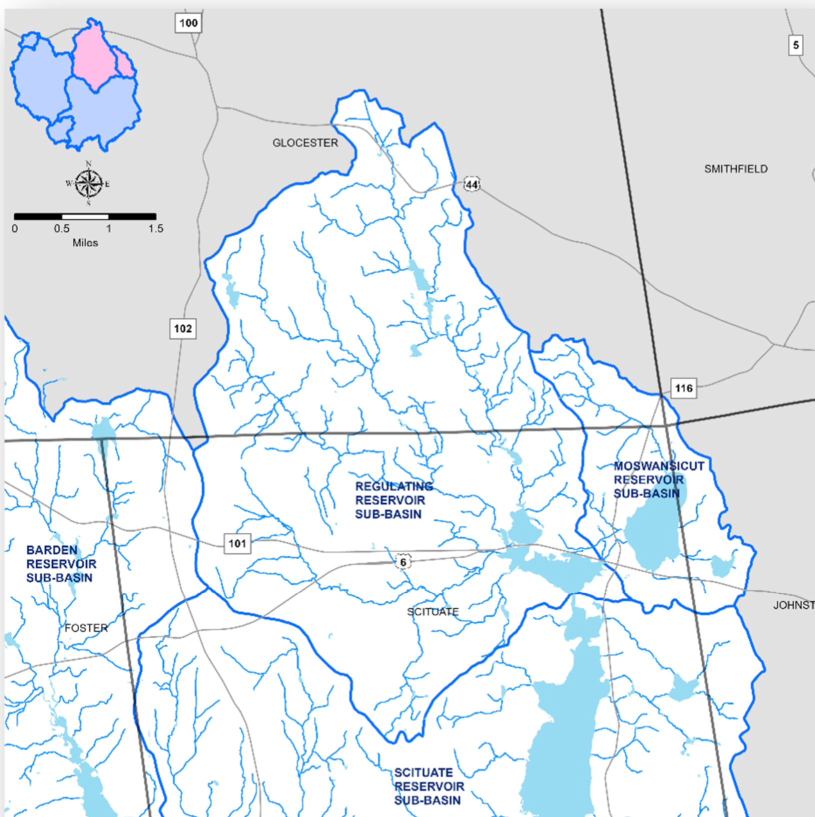


Figure 1-3: Regulating and Moswansicut Reservoir Sub-basins

1.1.5 Westconnaug Reservoir watershed

The 2,580-acre Westconnaug Reservoir watershed is in the Towns of Foster and Scituate and drains into the western limb of the Scituate Reservoir (*Figure 1-4*). All the land immediately surrounding the reservoir is protected and owned by Providence Water. This is one of the least developed of the public water supply watersheds for the Scituate Reservoir; 70 percent of the watershed remains forested. Low-density residential development is prevalent in the central watershed while medium-low density residential is common along the northern and southern basin perimeter.

1.1.6 Scituate Reservoir Direct Drainage watershed

The 22,389-acre direct drainage watershed for the Scituate Reservoir lies primarily in the Town of Scituate, with its far western portion in the Town of Foster, and its easternmost extent in the Town of Johnston and City of Cranston (*Figure 1-4*). The watershed is largely undeveloped; Providence Water owns a buffer around the entire reservoir that averages 0.5 miles wide and comprises 35 percent of the watershed. Residential and commercial development account for just over 10 percent of land use activity in the area.

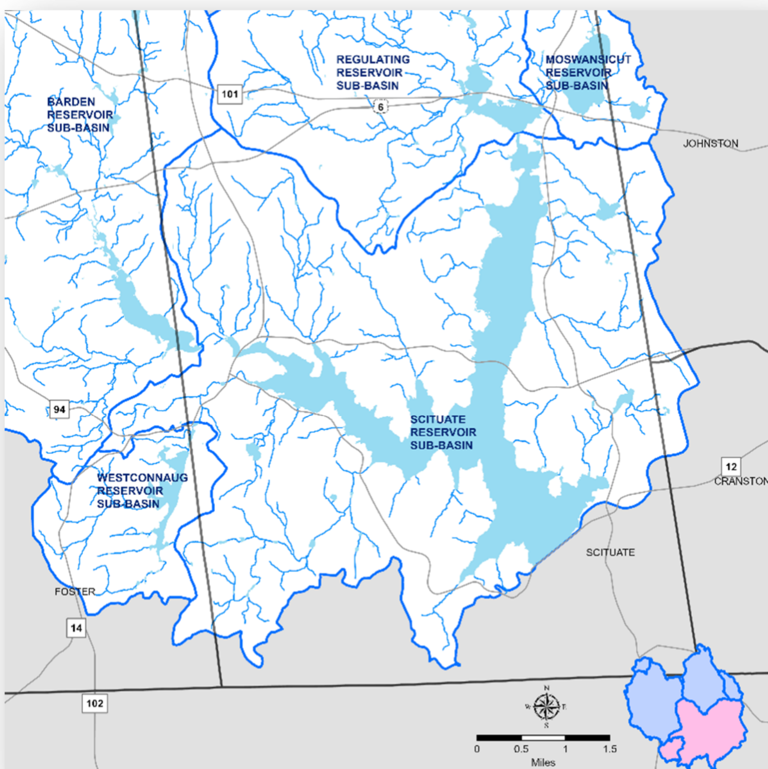


Figure 1-4: Scituate Reservoir Direct and Westconnaug Reservoir Sub-basins

1.2 Summary of Existing Conditions

A review of existing, readily available information on water quality concerns, pollution sources, and existing management practices is the first step in evaluating potential pollution sources. This overview has several objectives:

- To ensure that the assessments build on existing information;
- To highlight the most valuable or vulnerable water resources;
- To provide a basis for refining water supply system management plans, wellhead protection plans and municipal water resource protection goals and priorities;
- To provide a baseline for reviewing progress in water resource protection efforts and for establishing new watershed management strategies. This summary is drawn from information sources such as water supply system management plans, municipal plans and ordinances, and water quality monitoring data.

Input from state and municipal officials, water suppliers, and others participating in this assessment process is also included. This overview is not intended to be a comprehensive synthesis, and it may not include all available data.

Water Quality Goals and Water Resource Protection Strategies

In 1990, the Rhode Island State Planning Council adopted the Scituate Reservoir Watershed Management Plan. This plan concluded that the primary challenges facing the Scituate Reservoir watershed are rapid growth and changing land use patterns. With this in mind, the plan makes recommendations to control existing pollution sources within the watershed; to strengthen the state's water quality protection programs; to continue local programs to prevent new sources of contamination through innovative land use planning; and to provide the necessary funding and strategies to implement the plan. As part of this plan, the Scituate Reservoir watershed Zoning Project was developed to assist the towns of Foster, Glocester and Scituate with the development and implementation of "flexible zoning" to achieve two mutually compatible goals: the preservation of rural character and the prevention of new pollution sources affecting water quality. To date, the Town of Glocester has adopted flexible zoning and Foster and Scituate have considered similar zoning for future adoption.

In the early 2000's, watershed communities worked with the Rhode Island Department of Environmental Management (RIDEM) in development of a Conservation Development manual that provides step-by-step guidance in designing more flexible, compact developments to reduce site disturbance and preserve open space.

Providence Water maintains an active watershed management program focusing on forest management, security, and watershed management. Providence Water currently owns and protects perimeter buffers around the Scituate Reservoir and most of the satellite reservoirs feeding it. With ~28 percent of the watershed protected, continued acquisition of land for conservation and protection purposes remains a top priority for Providence Water. Providence Water has purchased over 1,800 acres since 2003, 320 of which have been acquired since the last update.

Providence Water also conducts an extensive water quality monitoring program. Thirty-eight locations in the watershed are sampled either monthly or quarterly for a full suite of biological and chemical parameters. Watershed managers maintain an inventory of potential pollution sources. Further sampling has also been done for *Cryptosporidium/Giardia*, road salt, and other site-specific needs such as automobile accidents and Harmful Algal Blooms (HABs).

Providence Water staff also review and comment on local development plans to minimize impacts of new development. They also collaborate with the Northern Rhode Island Conservation District to conduct watershed education programs for students and their teachers, homeowners, farmers, business owners, and forest landowners.

Pollution Sources, Concerns and Issues

During the initial assessment process in 2003 a number of local water quality concerns and issues were identified. These concerns and issues have been evaluated over the years so that necessary programmatic alterations could be implemented keeping assessment and protection programs as up to date as possible. This plan is an extension of these efforts, continuing to identify watershed risks and aiding in formulating protection strategies moving forward. As a follow-up to the source water assessment, Providence Water and state agencies should work together to address issues pertaining to these drinking water supply reservoirs and their watersheds.

2 Risk Indicators

Providence Water draws source water entirely from surface water and therefore the assessment of risk factors will follow the procedure for surface water supplies (*RIDOH, 2010*). The surface water supply reservoir risk factors include:

1. High intensity land use (HILU) throughout the watershed or subwatershed.
2. Pollution sources within a 200 ft. buffer to the reservoir and tributaries.
3. Pollution sources per acre throughout the watershed, including the 200 ft. buffer to the reservoir and tributaries.
4. Reservoir nutrient enrichment status.
5. Compliance with water quality criteria.
6. History of contaminant detects within last 5 years.

The following sections describe the methodology used to evaluate and characterize the water supply watersheds and describe the results for each of the six risk factors. Results for each risk factor were then combined and entered into the Surface Water Reservoir Risk Rating table to obtain the overall rating for the water supply watershed (*Appendix A*). A summary of the overall ranking will be included in *Section 3-1*.

2.1 High Intensity Land Use (Risk 1)

The SWAPP Guidance document identifies sixteen types of high intensity land use (HILU; *Table 2-1*) that pose an elevated risk of contamination to surface water supplies. This SWAPP updates HILU mapping based on the most recent Land Use data available.

Table 2-1: High Intensity Land Uses in Scituate Reservoir Watershed.

Land Use Type	Land Use Sub-type
Residential	High Density Residential (1/8 ac lots) Medium-High Density Residential (1/4 - 1/8 ac lots)
Commercial	Commercial (sale of products and services)
Industrial	Industrial (manufacturing, design, assembly, etc.)
Transportation	Roads (divided highways > 200' plus related facilities)
Waste Disposal	Waste Disposal (landfills, junkyards, etc.)
Institutional Land	Institutional (schools, hospitals, churches, etc.)
Cropland	Cropland (tillable), Confined Feeding Operations Orchards, Groves, and Nurseries

2.1.1 Assessment Method

The SWAPP Guidance document specifies which land use data sources should be used to evaluate this risk. Because it was published in 2010, the Guidance document specifies using the then-current 2003 Land Use data from RIGIS. The first SWAPP, published in 2003, was published before the 2003 data was available requiring that the analysis be based on Land Use data from 1995, which is not directly comparable to more recent datasets because of data processing differences. The 2011 and 2020 RIGIS Land Use data sets were developed using updated state-wide Land Use data and the same data processing steps used in the 2003 version. This allows for equitable comparisons of Land Use datasets from 2011 and 2020. However, the 2020 update recoded marinas from "Other transportation and developed recreation" to "Commercial", to more accurately fit the classification system. Additionally, two new classes were added: (1) Ground-mounted Solar Energy Systems and (2) Wind Energy Systems.

Data used in this analysis originated from RIGIS, including Lakes and Ponds (1:5000), Streams (1:5000), Land Cover and Land Use versions for 2011 and 2020. *Figure 2-1* depicts the 2020 Land Use/Land Cover throughout the entire Scituate watershed. Individual watersheds were characterized into Land Use categories as well in order to potentially parse out any smaller scale trends in land use over time within the watershed. *Table 2-2* characterizes the ranking derived from the percentage of HILU as specified in the 2010 guidance document.

Table 2-2: Surface Reservoir Risk Ranking for High Intensity Land Use by Percentage.

Surface Water Reservoir Risk Indicator	Low	Medium	High	Extreme
High Intensity Land Use (HILU)	<10%	10-14 %	15-25%	>25%

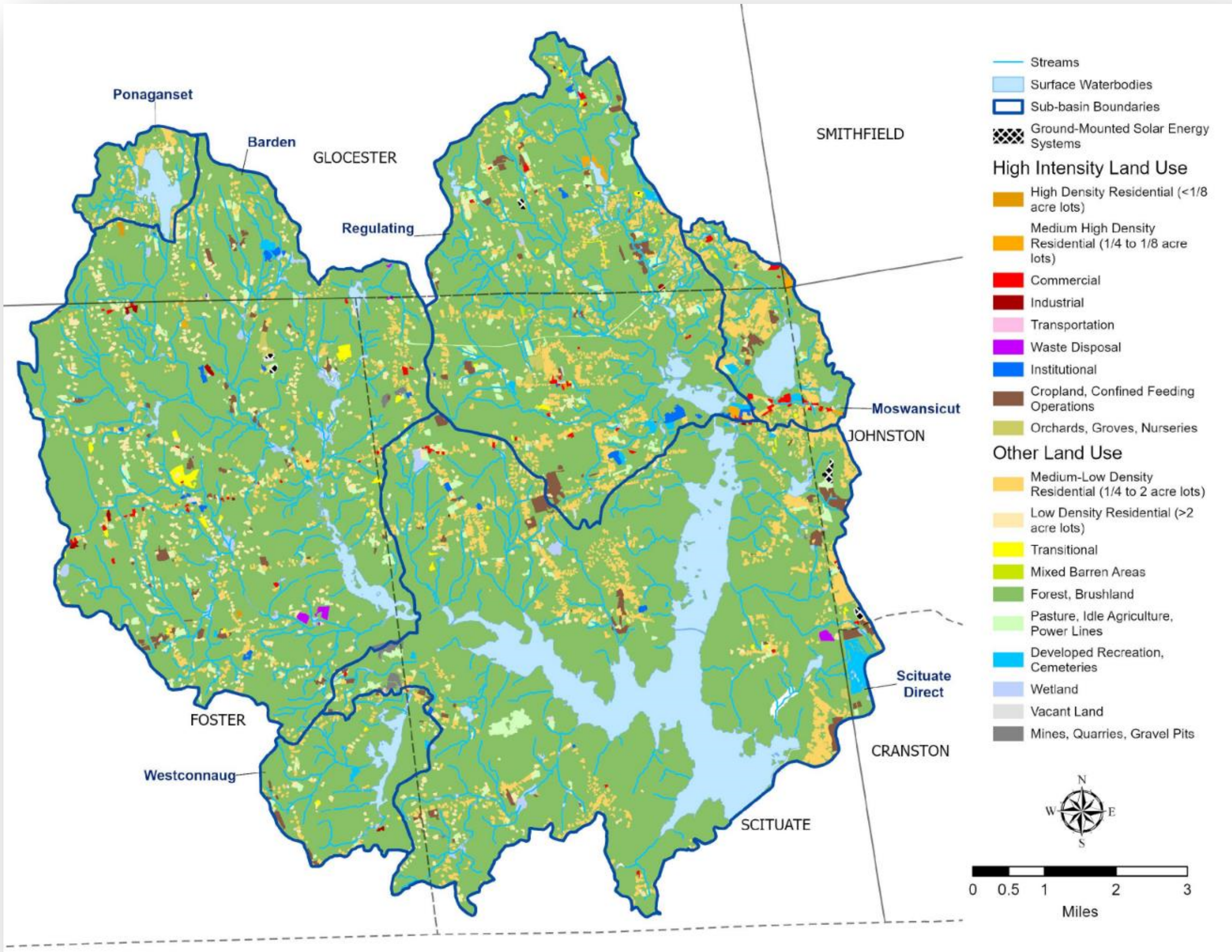


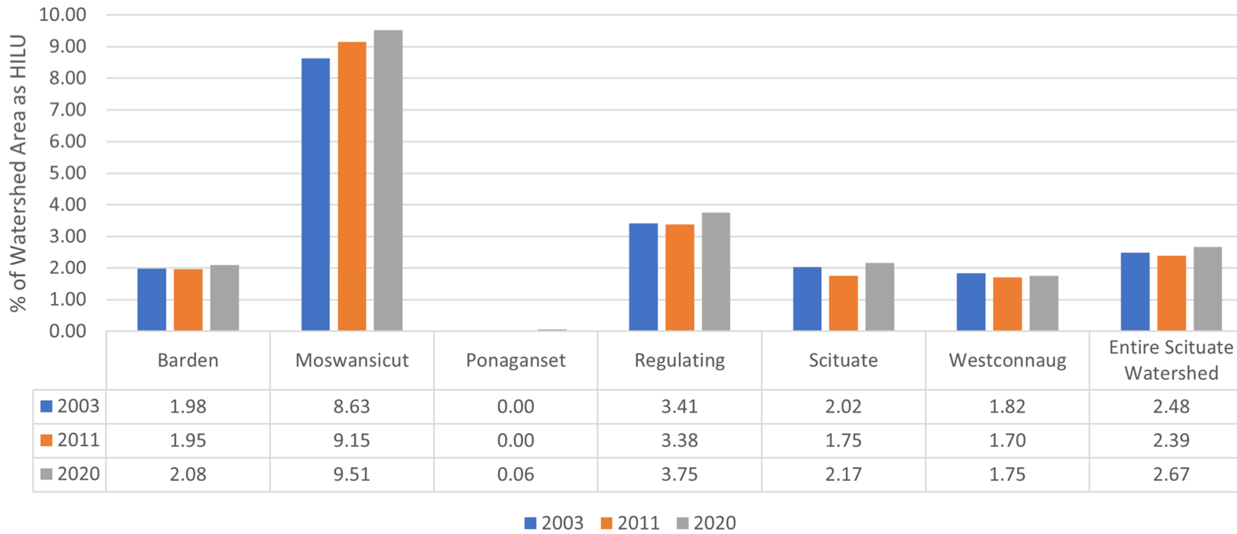
Figure 2-1: 2020 Land Use/Land Cover in the Scituate Water Supply Watersheds.

2.1.2 Pollution Risk Results

The Scituate Reservoir watershed is rural and characterized by forest cover and low-density residential land use. Where HILU exists, it did not exceed 10% of watershed land area in any sub-basin according to the 2003, 2011 or 2020 data sets. Each watershed was therefore assigned a score of 0 as it is characterized as low risk, shown in *Table 2-2*. While the risk category for HILU in the Scituate Reservoir is Low, hotspots of HILU do occur.

As reported in the recent SWAPP update, the highest 2003 HILU percentage was 8.63% in the Moswansicut Reservoir watershed (*Figure 2-2*). This equates to 164 acres, which is the second lowest area in the watershed. Since it is also the second smallest sub-basin, it has the highest concentration of HILU. Conversely, the lowest HILU percentage was in the Ponaganset Reservoir watershed, which did not contain any HILU. The other four sub-basins each contained between 1.75 and 3.50% HILU. Between 2003 and 2011, the trends in HILU remain largely unchanged with the Moswansicut Reservoir still having the highest HILU percentage at 9.15% (174 acres) and a continued absence of HILU in the Ponaganset Reservoir. The 2011 HILU values for the other four sub-basins ranged from 1.70 to 3.38%. See *Appendix B* for Land Use/Land Cover data from 2003, 2011 and 2020, originating from RIGIS.

A review of longer-term changes in the watershed, between 2003 and 2020, reveals that the Scituate Reservoir watershed has changed from a total of 1369 acres of HILU to 1470.8 acres, an increase of 101.8 acres of HILU. However, this only equates to an increase of 0.18% of the total watershed area converted to HILU. In the last ~20 years, the largest proportional change in HILU can be observed in the Moswansicut Reservoir sub-basin, which increased by 0.87%. The Regulating Reservoir has experienced the next largest change with 0.34% of the sub-basin area changed into HILU since 2003.



	Barden	Moswansicut	Ponaganset	Regulating	Scituate	Westconnaug	Entire Scituate Watershed
2003	1.98	8.63	0.00	3.41	2.02	1.82	2.48
2011	1.95	9.15	0.00	3.38	1.75	1.70	2.39
2020	2.08	9.51	0.06	3.75	2.17	1.75	2.67

Figure 2-2: Comparison of the Percent Watershed Area of High Intensity Land Use (HILU) in 2003, 2011, and 2020.

The HILU trends continued in the 2020 Land Use/Land Cover data, with the highest percentage of HILU (9.51%, or 180.7 acres) observed in the Moswansicut Reservoir sub-basin (*Figure 2-2*). This percentage approaches the 10% threshold that would necessitate a Medium risk rating. No other sub-basin exceeded 3.75% HILU. In 2020, HILU was observed in the Ponaganset Reservoir for the first-time due to the conversion of a medium density residential property to a heating oil supplier and classifying 0.05% of the sub-basin area as HILU (*Figure 2-3*). The remaining four sub-basins have HILU ranging from 1.75 to 3.75%.

As in previous years, the most extensive HILU category in the Scituate Reservoir watershed is cropland (tillable), representing more than 30% of the total HILU area in all sub-basins except for the Ponaganset Reservoir. The category with the least HILU is high-density residential which is absent from the Ponaganset, Westconnaug, and Scituate Reservoirs altogether. The Barden and Moswansicut Reservoirs have the highest values of high-density residential housing at 3.20% and 3.43%, respectively. When compared to forested or undeveloped areas, high-density (and medium-high density) residential land use introduces increased risk of water quality issues to the Scituate Reservoir watershed. This is due to increases in impervious area and subsequent increases in stormwater runoff and associated pollutants.

Ground-mounted solar energy systems were a new category in the 2020 Land Use and Land Cover dataset and were not mapped in 2011. Between 2011 and 2020, six solar farms were installed across the entire Scituate Reservoir watershed and one additional solar farm falls on the eastern boundary of the Scituate Direct Reservoir watershed, accounting for a total of 54 acres of new solar installations. Of this, roughly 10 acres (0.05%) of land previously classified as HILU in 2011, mostly cropland and orchards, has been converted into solar farms. Though the reduction in fertilizer and nutrient pollution from this land use conversion is advantageous, stormwater infiltration capabilities will be reduced if the ground cover is bare or non-vegetated.

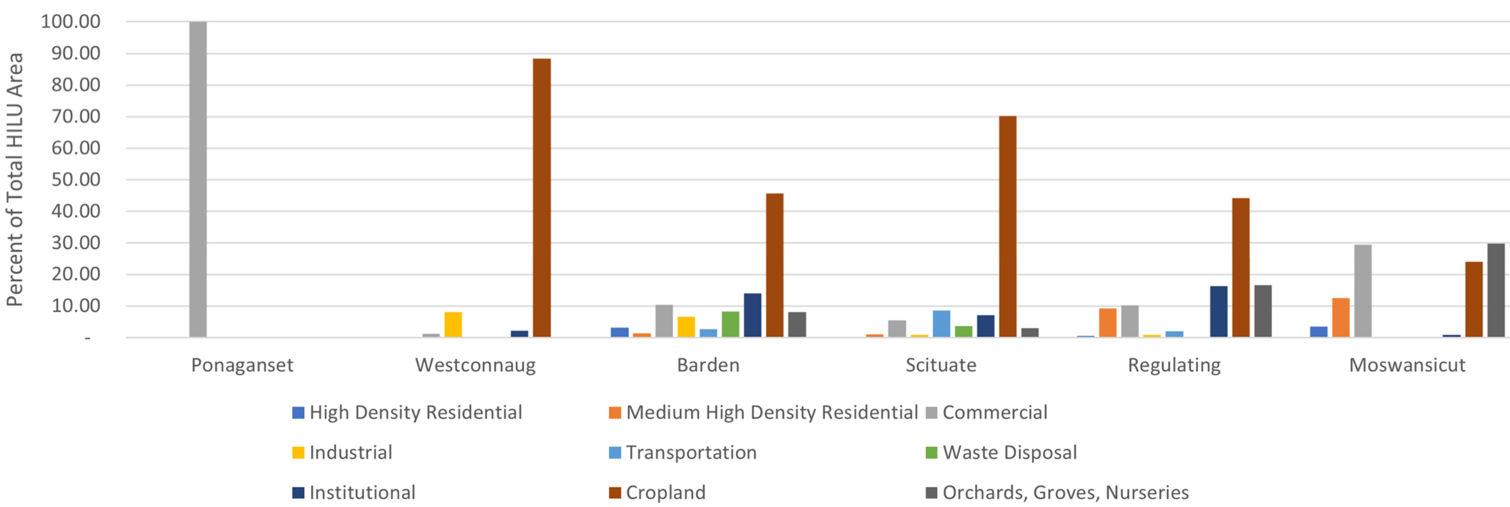


Figure 2-3: Proportions (%) of the 2020 HILU Land Area Distinguished by Category for Each Sub-basin in the Scituate Reservoir watershed.

When comparing changes from 2011 to 2020, total HILU grew in all sub-basins in the Scituate Reservoir watershed. The single sub-basin with the greatest proportional increase in HILU was the Scituate Reservoir Direct, which increased total HILU by 0.41% (77.4 acres). This increase largely stems from a significant increase in cropland and confined feeding operations (35.2 acres; *Figure 2-3*). The sub-basins with the second highest HILU increase were the Regulating and Moswansicut Reservoirs, both increasing by 0.36% in watershed area classified as HILU. In the Regulating Reservoir sub-basin, this increase was driven the expansion of orchards, groves, and nurseries while the Moswansicut experienced increased development of commercial properties. Overall, the Scituate Reservoir watershed increased from 1317.6 to 1470.8 acres of HILU, equating to the total watershed areas defined as HILU increasing from 2.39% to 2.67%. Despite the general increase in HILU area, some HILU categories experienced a decrease in acreage. The largest of which occurred in the Barden Reservoir, with orchards, groves, and nurseries decreasing from 42.4 to 32.5 acres, which represents a 2.45% decrease in this category. In *Appendix B, Table B-4* summarizes HILU changes between 2011 and 2020.

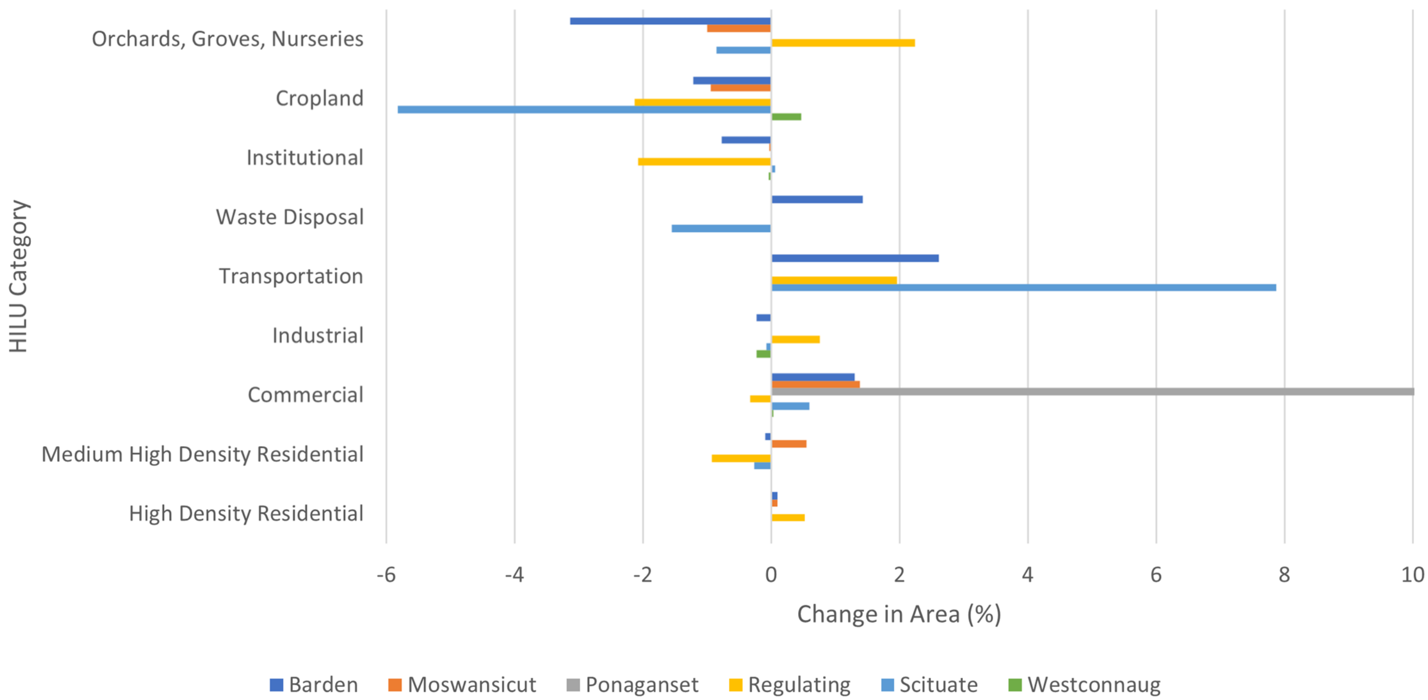


Figure 2-4: Change in the Distribution of HILU Area (%) by Category Between 2011 and 2020 for each Sub-basin in the Scituate Reservoir watershed.

Across the Scituate Reservoir watershed, the HILU category that saw the most growth between 2011 and 2020 was cropland (tillable) and confined feeding operations at 3.7% increase in HILU area (*Figure 2-4*). Generally speaking, land that was forestland, brushland, idle agriculture, and low density residential in 2011 became cropland and confined feeding operations by 2020. The increase in cropland and confined feeding operations can cause water quality impacts including increased nutrient pollution and sediment loading. The next highest increase was observed in the transportation category, due to the introduction of ground-mounted solar energy systems. In 2011, divided highways (> 200 ft) and related facilities represented 0.17% of all HILU area and increased to 3.5% in 2020. The expansion of impervious surfaces can increase the load of sediment and metals from stormwater runoff unless suitable treatment measures are installed.

2.2 Mapped Pollution Sources: within 200 feet of the drinking water reservoir (Risk 2) and tributaries and throughout watershed (Risk 3)

While broad land use categories are an indicator of potential pollution on a watershed scale, there are also individual activities which have a more localized risk of contributing pollutants. Typically mapped and monitored on a smaller, parcel scale these sources may either produce or store pollutants such as volatile and/or synthetic organic compounds (VOCs and SOCs), bacteria, nutrients, or pesticides. When these sources are close to a surface water body there is an elevated risk of these pollutants being released into the environment and making their way to the Scituate Reservoir either directly or transported via groundwater or stormwater. To avoid this situation, administrative and engineering control measures can be implemented to mitigate these elevated risks. *Table 2-3* shows the ranking parameters for Risks 2 and 3.

Table 2-3: Surface Water Reservoir Pollution Risk Rating for Mapped Pollution Sources Within the Watershed and Within 200 feet of Reservoirs and Tributaries.

Surface Water Reservoir Risk Indicator	Low	Medium	High	Extreme
Mapped pollution sources within 200 ft. of reservoir and tributaries (Risk 2)	None			Presence of One or More
Mapped pollution sources per acre (x10) throughout watershed including the 200ft. buffer to reservoir and tributaries (Risk 3)	<0.1	0.1-0.5	0.5-1.0	>1.0

2.2.1 Assessment Method

There are 28 potential pollution source types that were identified and divided into 5 broad categories: agriculture, automotive, medical facilities, other commercial, and industrial and manufacturing sources (*Appendix C*). The first SWAPP from 2003 catalogued these sources as discrete point locations. This data was updated based on the list of 28 source types and a desktop analysis of the watershed using a combination of 2022 aerial imagery and business directories. The most-detailed hydrography available, delineated by RIGIS at a scale of 1:5000, was used to create a 200-foot buffer to streams, lakes, and ponds. Those sources within the buffer were then defined. Within sub-basins, the density of pollution sources was calculated as the ratio of pollution sources per 10 acres of sub-basin. This unit of area is used for consistency with the previous SWAPP version to allow direct comparability.

Identification, tracking, and mapping of all potential sources of pollution are conducted using the ArcGIS mapping software. Potential sources are digitized as point data, meaning that an area of concern is delineated by a singular point. Consequently, potential pollutant sources located within the 200-foot buffer area may have their mapped point outside of this buffer. Points that were physically located within the buffer, but not originally mapped as such, were each evaluated. If necessary, points were moved as close to the actual source location as possible, based on aerial photography, to ensure they were reflected properly and counted in the buffer. However, it is still possible that the number of sources in the 200-foot buffer reported here may be an underestimate.

2.2.2 Pollution Risk Results

All sub-basins draining to the Scituate Reservoir have at least one potential pollution source within the 200-foot buffer area, which places them in the Extreme Risk category (*Figure 2-5).* Across the watershed, all broad categories of potential pollution sources are present. Sub-basins vary, however, in the number and composition of potential contaminant sources. This variation and the mix of potential pollution sources within a sub-basin impacts the type and magnitude of risk to surface and drinking waters.

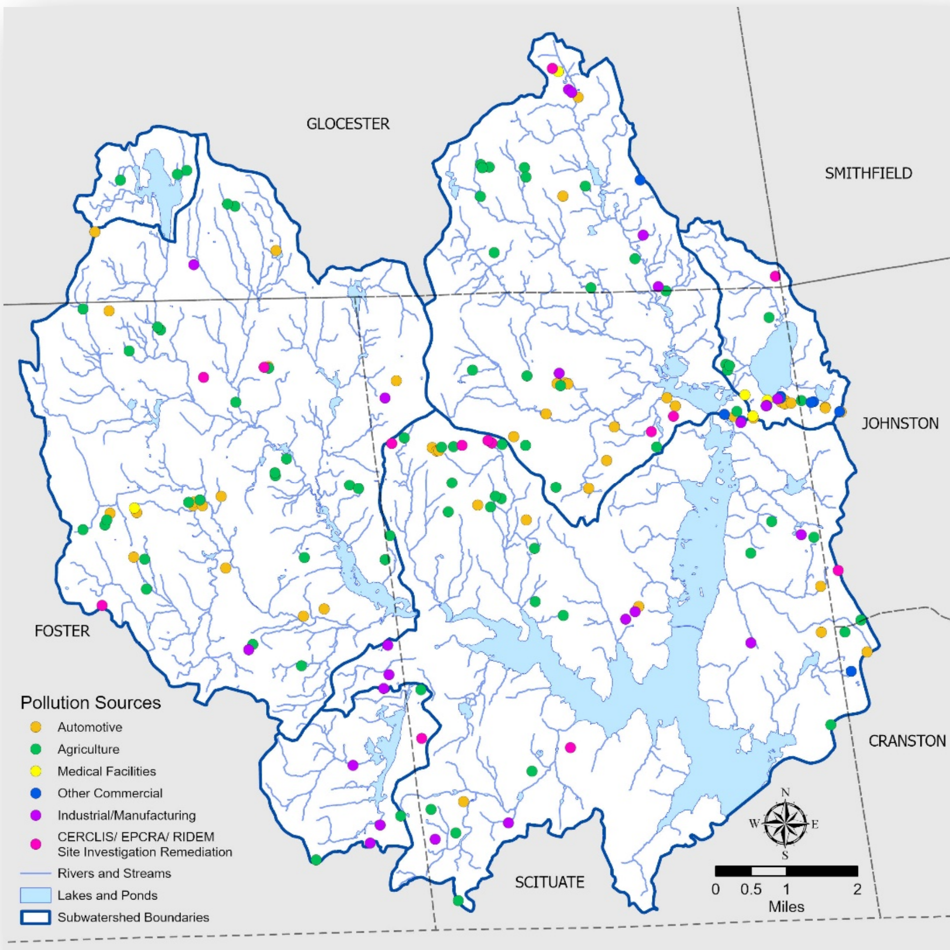


Figure 2-5: Potential Pollution Sources Throughout the Scituate Reservoir Watershed, Including Those Sources Within 200 feet of Reservoirs and Tributaries.

In the Scituate Reservoir watershed there were 87 potential sources of pollution identified within 200 feet of a surface waterbody *(Table 2-4).* The Barden Reservoir sub-basin had the greatest number of these potential pollution sources (36) followed by Regulating Reservoir (24). The remaining sub-basins had twelve or fewer each.

The most-common pollutant source category is agricultural, comprising nearly three-quarters of the identified pollution sources in the 200-foot buffer of reservoirs and their tributaries. These pollution sources were almost entirely made up of livestock, either in residential backyards or larger farms. Backyard livestock pose a risk to water quality as a source of bacteria and excess nutrients from their waste products, which can be introduced into local surface water bodies via precipitation runoff if these are not appropriately managed. Additionally, greenhouses can also act as a source of nutrients, sediment, and pesticides when subjected to significant rainfall.

The second largest source category was automotive, which contains an even mix of underground storage tanks, auto parts or repair businesses, and current or former gas stations, and one junkyard. Auto operations represent a potential source of solvents, metals, and VOCs from fuel and other automotive wastes. Active Underground Storage Tanks (UST) and active Leaking Underground Storage Tanks (LUST), classified by RIDEM, are also included within the automotive category. These fuel storage tanks present a risk to local water supplies by contamination of surface and groundwater with VOCs from leaking stored fuel.

Table 2-4: Potential Sources of Pollution (PSOP) Within 200 feet of a Lake or Surface Water Body.

PSOP Category	Barden Reservoir	Moswansicut Reservoir	Ponaganset Reservoir	Regulating Reservoir	Scituate Reservoir Direct	Westconnaug Reservoir	Entire Scituate watershed
Agriculture	34	4	3	15	7	2	65
Automotive	2	5	N/A	5	1	N/A	13
CERCLIS/EPCRA	N/A	N/A	N/A	1	N/A	N/A	1
Industrial/Manufacturing	N/A	N/A	N/A	3	3	1	7
Medical	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other Commercial	N/A	N/A	N/A	N/A	1	N/A	1
Grand Total	**36**	**9**	**3**	**24**	**12**	**3**	**87**

Other potential sources of pollution within the 200-foot buffer include the former North Scituate dump (CERCLIS/EPCRA), the Alpine Country Club golf course (commercial), and several sand and gravel operations (industrial/manufacturing). A 2018 desktop investigation of suspected sand and gravel operations within the watershed revealed 8 suspected locations of current or former sand and gravel operations. A subsequent review of all RIDEM files related to each of the identified properties revealed five confirmed sand and gravel operations in the buffer area. However, coordination with local town and city officials highlighted that soil and gravel permitting is under municipal jurisdiction in some towns and cities, and thus the RIDEM files may not accurately reflect all potential sources. The CERCLIS site identified within the 200-foot buffer area is a site known to RIDEM and has been the subject of site investigations and ongoing monitoring as part of the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS).

The potential extent of contamination by some pollution sources may reach the buffer area or may be immediately hydrologically up-gradient of the 200-foot buffer. In which case, these points may impact water quality in the Scituate Reservoir watershed, despite not being located within the 200-ft buffer area. Specifically, there are 53 potential contaminant sources that are within 200 to 400 feet of a surface water body. While the risk from these sources may be slightly less than more proximal sources, conducting site visits could provide detail on the specific risk of a potential source beyond what can be captured by a desktop analysis.

A desktop analysis of the number of potential pollution sources for the entire Scituate watershed, not just those within 200-feet of a reservoir or tributary, identified 401 potential sources of pollution (*Table 2-5*). The Ponaganset and Westconnaug sub-basins had the fewest potential sources, with 9 and 16, respectively. The Barden Reservoir sub-basin had the greatest number of potential sources at 157, followed by the Scituate Reservoir Direct at 96. Although the Barden Reservoir had the greatest number of pollution sources, the Moswansicut had the greatest density of potential pollution sources at 0.19 sources per 10 acres of sub-basin area, excluding surface water bodies. Most of the other sub-basins have more diffuse development and are larger than Moswansicut. No other sub-basin exceeded a value of 0.10 sources per 10 acres. Across the Scituate Reservoir watershed as a whole, there were 0.07 potential sources per 10 acres *(Table 2-6)*.

Table 2-5: Potential Sources of Pollution (PSOP) Throughout the Sub-basins, Including the Entire Watershed Area.

PSOP Category	Barden Reservoir	Moswansicut Reservoir	Ponaganset Reservoir	Regulating Reservoir	Scituate Reservoir Direct	Westconnaug Reservoir	Entire Scituate watershed
Agriculture	136	16	8	61	68	12	301
Automotive	14	8	1	14	10	N/A	47
CERCLIS/ EPCRA/ RIDEM Site Investigation Remediation	3	1	N/A	3	6	1	14
Industrial/Manufacturing	3	2	N/A	5	10	3	23
Medical	1	4	N/A	1	N/A	N/A	6
Other Commercial	N/A	6	N/A	2	2	N/A	10
Grand Total	**157**	**37**	**9**	**86**	**96**	**16**	**401**

Table 2-6: Density of Potential Sources of Pollution per 10 Acres, for the Entire Scituate Watershed.

Sub-basin	PSOP Density
Barden Reservoir	0.08
Moswansicut Reservoir	0.19
Ponaganset Reservoir	0.10
Regulating Reservoir	0.07
Scituate Reservoir Direct	0.05
Westconnaug Reservoir	0.07
Entire watershed	**0.07**

Most of the pollutant sources identified within the entire Scituate watershed area were deemed agricultural at 75%; this is similar to the distribution of pollution sources within the 200-foot buffer area described above. Pollutant sources included livestock, equestrian centers, feed and supply stores, and greenhouses. Livestock, either in residential backyards or farms, made up 93% of the agriculture category. The second largest category of potential pollution sources is automotive at nearly 12%. This category included auto parts, auto repair, former gas stations, fuel storage, gas stations, junkyards, and salvage yards.

There are six other CERCLIS sites across the watershed, beyond the CERCLIS site previously identified within the 200-foot buffer. Of these six, two are other capped municipal landfills, two are related to an abandoned military installation, and two are owned by private entities. Other sites identified under the Emergency Preparedness and Community Right-to-Know Act (EPCRA) are included here. These EPCRA sites store a sufficiently large quantity of one or more chemicals deemed hazardous by the EPA. The three EPCRA sites in the watershed are related to communications and electrical utilities. The four active RIDEM Site Investigation Remediation Sites within the greater Scituate watershed are also included in this analysis.

2.2.3 Management Measures

Providence Water continues to manage drinking water quality through educational and outreach efforts and coordination with municipalities and state agencies. The measures appropriate for each potential pollution source vary based on the specific pollutant associated with a source. A summary of current management measures and recommendations is included in *Table 2-7*.

Table 2-7: Summary of Management Measures in Place in the Scituate Reservoir Watershed.

Potential Sources of Pollution	Management measures ongoing or recommended
Agriculture – VOCs, SOCs, Microbes, Nutrients, Pesticides	
1. Feed & Supply Stores 2. Greenhouses 3. Dairy and Poultry Farms, Equestrian Centers, Other Livestock Farms 4. Backyard Livestock (Horses, Fowl, etc. in Residential Areas)	Collaboration with municipalities and farmers/business owners to ensure proper waste management, reduce fertilizer/pesticide use
Automotive - VOCs, SOCs, Solvents, USTs	
5. Gas & Service Stations	Coordination with DEM to monitor USTs
6. Fuel Storage	Coordination with municipalities and DEM to inspect, remove, replace USTs. Applies to all facilities (commercial, industrial, municipal, institutional, etc.) with an above ground or underground storage tank
7. Auto Repair 8. Auto Parts & Machine Shops 9. Body Shops 10. Car Washes 11. Rust Proofers	Coordination with municipalities and DEM to ensure proper waste disposal, spill prevention (e.g., not to storm system)
12. Junkyards & Salvage Yards	Existing municipal zoning restrictions. Encouragement of BMPs and compliance with DEM regulations pertaining to junkyards
Medical Facilities -VOCs, SOCs, Microbes, Nutrients	
13. Walk-in & Emergency Clinics, Hospitals 14. Dental Offices	Outreach to business owners to ensure proper chemical storage and chem/waste disposal
15. Veterinary Clinics	Outreach to business owners to ensure proper chemical storage and disposal, proper animal waste disposal
Other Commercial -VOCs, SOCs, Solvents, Nutrients, Pesticides	
16. Beauty Salons 17. Dry Cleaners/Laundromats 18. Paint Shops 19. Printing Shops 20. Photographic Processors	Existing HAZMAT and emergency response plans are in place and periodically updated. Facility audits to evaluate waste management practices. Outreach to business owners to ensure proper chemical storage and disposal
21. Golf Courses	Work with golf courses to reduce fertilizer/pesticide use
Industrial/Manufacturing – VOCs, SOCs, Solvents	
22. Asphalt, Coal, Tar & Concrete Companies 23. Chemical Manufacturers & Textile Manufacturers 24. Laboratories 25. Other Industrial Manufacturers	Existing HAZMAT and emergency response plans are in place and periodically updated. Facility audits to evaluate waste management practices. Outreach to business owners to ensure proper chemical storage and disposal
26. Road Salt Storage	Education efforts with municipal officials and employees (especially DPW) to ensure compliance with RIPDES MS4, and other water quality protection measures, such as SWPPPs, SWMPPs
27. Sand & Gravel Mining Operations 28. Logging Operations	Work with identified S&G sites to confirm existence of permits and soil and erosion control plans, inquire about recent inspections, and evaluate wetlands near site locations for possible past alterations. Work with Towns to ensure soil erosion and sediment control ordinances are sufficient to address pollution issues arising from these operations.

2.3 Reservoir Nutrient Enrichment Status (Risk 4)

Phosphorus is the key nutrient responsible for algal and plant growth in freshwater lakes and ponds. Although phosphorus is essential to algal and aquatic plant primary productivity, even minute increases in the amount of phosphorus can trigger tremendous increases in growth. For example, the natural background concentration of phosphorus in Rhode Island waters is only 5 to 10 parts per billion (ppb). The RIDEM maximum average total phosphorus standard for freshwater lakes and reservoirs is 25 ppb.

The degree of nutrient enrichment in a lake or pond is measured by the amount of aquatic plants and algae, and phosphorus concentrations. Although eutrophication is a natural process where nutrients, sedimentation, and aquatic plant productivity increase as a lake or pond ages, phosphorus inputs from human activities can greatly accelerate this process. Managing phosphorus inputs to surface drinking water supplies is particularly important for man-made reservoirs as they tend to become eutrophic more rapidly than naturally formed lakes.

In drinking water reservoirs, nutrient enrichment is a problem as algae, accumulating sediment from runoff, and decaying aquatic plants all increase organic matter and suspended solids. These can affect the taste and odor of drinking water. While organic matter is not necessarily a health hazard, it reacts with chlorine in the disinfection process to create trihalomethanes. These byproducts are considered a health hazard and EPA has recently reduced the maximum allowable level of these byproducts from 100 to 80 ppb. One way to reduce disinfection byproducts is to reduce excessive organic matter in drinking water supplies by controlling nutrient inputs. Phosphorus's tendency to attach to sediment makes controlling erosion and sedimentation from farming, construction sites, highways and other sources and protecting shoreline buffers effective control measures.

As the sole source of drinking water for Providence Water, protecting against nutrient loading and conditions favorable for Harmful Algal Blooms (HABs) is imperative. Providence Water is subject to the Algal Toxin Rule for public water systems, under the Rhode Island Department of Health, which went into effect in May of 2019. In compliance with the Algal Toxin Rule, Providence Water performs routine monitoring on 17 locations throughout the Scituate Reservoir to identify visual, chemical, or physical signs of HABs. Monitoring began in 2015 and occurs monthly, at a minimum, or more often as deemed necessary by Providence Water. Additionally, Providence Water performs daily visual inspections, in accordance with Rhode Island Regulations 1.6.10, of Gainer Dam, Horseshoe Dam, and the entry point to the Western Branch of the Scituate Reservoir (from May to October).

2.3.1 Assessment Method

A measure of the nutrient enrichment status of a lake is Carlson's Trophic State Index, which combines information on Secchi depth, or the clarity of a water body, total phosphorus concentration, and chlorophyll-*a* concentration, a proxy for algal growth (*Carlson, 1977*). Providence Water has conducted limnological assessments of the six reservoirs in the Scituate Reservoir watershed, the data from which form the basis of this enrichment status analysis.

Carlson's Trophic Status Index is based on three equations that link Secchi depth, total phosphorus, and chlorophyll-*a* to the trophic state of the waterbody. Seasonally averaged values for these three parameters are compared to index values (*Table 2-8*) to determine whether a lake is oligotrophic (low algal production), mesotrophic (moderate algal production), or eutrophic (high algal production).

Data for total phosphorus and chlorophyll-*a* were occasionally reported as less than the detection limit. In such instances, to be conservative, the detection limit was used in the calculation of the index.

Table 2-8: Carlson's Trophic State Index.

Parameter	Trophic State		
	Oligotrophic	**Mesotrophic**	**Eutrophic**
Secchi Depth (meters)	>4	2-4	<2
Total Phosphorus (ppb[1])	<12	12-24	>24
Chlorophyll- *a* (ppb)	<2.6	2.6-7.2	>7.2

[1]ppb: parts per billion

2.3.2 Pollution Risk Results

Seasonal average values for each parameter in all sub-basins are summarized in *Table 2-9*. Regulating Reservoir had the shallowest Secchi depth, while Scituate Reservoir had the deepest. Total phosphorus ranged from 15.0 ppb in Ponaganset Reservoir to 22.0 ppb in Regulating Reservoir. Chlorophyll-*a* concentrations were lowest in Westconnaug Reservoir and highest in Scituate Reservoir. Most reservoirs fell in the Mesotrophic category, except the Moswansicut and Scituate Reservoirs which can be classified as Oligotrophic *(Table 2-10).* The trophic state did not change in Barden, Regulating, Scituate, or Westconnaug Reservoirs and even improved from mesotrophic to oligotrophic in Moswansicut Reservoir. It is worth noting that while the overall Carlson Trophic State classification for Regulating Reservoir did not change from 2013 to 2019, the index value for Secchi disk depth improved from values in the eutrophic range to mesotrophic range. Conversely, conditions in Ponaganset Reservoir declined from oligotrophic to mesotrophic since 2013, reflected by decreased Secchi depth and increased total phosphorus values. Monitoring should continue at Ponaganset Reservoir to determine whether this pattern is indicative of a longer-term trend toward eutrophication. The Scituate Reservoir is oligotrophic overall, due to low chlorophyll-*a* concentrations and deep light penetration, however high values of total phosphorus warrant a mesotrophic designation for this specific variable. Overall, the average rating for the entire Scituate Reservoir watershed is low to medium risk.

Table 2-9: Seasonally Averaged Values Used in Carlson's Trophic State Index.

Reservoir	Secchi depth (m)	Total Phosphorus (ppb)	Chlorophyll a (ppb)	Available Data Years
Barden	2.5	21.0	3.2	2018-2019
Moswansicut	4.5	17.0	2.0	2018-2019
Ponaganset	3.5	18.5	1.6	2018-2019
Regulating	2.4	22.0	3.3	2018-2019
Scituate	**5.4**	**17.1**	**2.0**	**2016**
Westconnaug	3.8	15.0	1.1	2018-2019

Table 2-10: Carlson's Trophic State Index Results for all Reservoirs.

Reservoir	Secchi depth (m)	Total Phosphorus (ppb)	Chlorophyll *a* (ppb)	Average (majority)
Barden	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Moswansicut	Oligotrophic	Mesotrophic	Oligotrophic	Oligotrophic
Ponaganset	Mesotrophic	Mesotrophic	Oligotrophic	Mesotrophic
Regulating	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
Scituate	**Oligotrophic**	**Mesotrophic**	**Oligotrophic**	**Oligotrophic**
Westconnaug	Mesotrophic	Mesotrophic	Oligotrophic	Mesotrophic

2.4 Listed on RIDEM 303d List (Risk 5)

Long-term water quality monitoring is the best way to identify trends in the health of lakes and rivers, and to spot the signal of contaminants and pollutants before they rise to the level of threatening human health. RIDEM is responsible for ensuring compliance with the Clean Water Act (1972) by analyzing data from water quality monitoring stations and reporting on the status of impaired and unimpaired waters. Since 2008, RIDEM has submitted an Integrated Water Quality Monitoring and Assessment (IWQMA) report every two years, which combines the 303d and 305b lists.

2.4.1 Assessment Method

At the time of this writing, the 2022 IWQMA report has been published online for review. However, digital versions of the data in GIS format are not available for any of the IWQMA since 2012. For this analysis the 2012 IWQMA report results, which have been digitized and were obtained from RIGIS, were augmented using information taken directly from the 2014, 2016, 2018-2020, and 2022 IWQMA reports. These comparisons allow for integration of any waterbodies which have been listed as impaired for the first time, or delisted, since 2012. Using the most up to date list of impaired water bodies, the data was analyzed for connectivity within the stream network to assess the risk to the drinking water supply. If no impairments are noted in the watershed, the risk category is Low. Otherwise, the greater the degree of separation between an impaired water body and a water supply, the lower the risk rating *(Table 2-11)*.

Table 2-11: Surface Water Reservoir Risk Indicator Rating Based on 305(b) and 303(d) Listed Water Bodies within the Drinking Water Reservoir Watershed.

Surface Water Reservoir Risk Indicator	Low	Medium	High	Extreme
Compliance with water quality criteria. Based on the 305(b) an assessment for drinking water, aquatic life, and swimming.	No Impairment	Impaired tributary draining ***indirectly*** into reservoir	Impaired tributary draining ***directly*** into reservoir	Not fully supporting for drinking water

2.4.2 Pollution Risk Results

According to the 2022 IWQMA report, there is one impaired water body that discharges directly to the main Scituate Reservoir, the Wilbur Hollow Brook, and its tributaries (*Figure 2-6*). This impaired waterbody discharges directly into the western branch of the Scituate Reservoir and has been listed for a bacterial impairment (i.e., enterococcus) since 2016. Additionally, there are five other stream segments, one pond, and one reservoir in four sub-basins across the Scituate Reservoir watershed listed as impaired *(Table 2-12)*. Impairments fall into two categories: bacteria and non-native plants. A bacterial impairment can require development of a TMDL, but non-native plants do not have that same requirement. For these reasons, the Direct Scituate Reservoir and overall ranking for this risk indicator is considered High.

The IWQMA Integrated Report designates each surface waterbody of the state into one of five water quality assessment categories, indicating the extent of impairment. The methodology for this categorization is based on the *Rhode Island Consolidated Assessment and Listing Methodology (CALM) for Section 305(B) and 303(D) Integrated Water Quality Monitoring and Assessment Reporting,* which was updated as recently as January 2023 (at the time of this report). Waterbodies which retain all, or some, of the designated uses are placed into categories 1 and 2, respectively. Category 3 applies to waterbodies where there is insufficient or a lack of data to assess if the designated use is impaired. Category 4 applies to waterbodies which are impaired, but do not require a TMDL either because a TMDL has already been completed (Category 4A), other pollution control requirements are in place and expected to achieve water quality goals (Category 4B), or the impairment is not due to a pollutant (Category 4C). Finally, waterbodies that are impaired, or threaten one or more designated uses by a pollutant, and require a TMDL are assessed as Category 5.

Table 2-12: Impaired Waters in the Scituate Reservoir Watershed.

Waterbody	ID	Impairment	Direct to DWS?	Watershed	IQWMA Category
Winsor Brook & Tribs	RI0006015R-30	Enterococcus	No	Barden	4A
Shippee Brook & Tribs	RI0006015R-23	Enterococcus	No	Barden	5
Shippee Saw Mill Pond	RI0006015L-05	Non-native plants	No	Barden	4C
Huntinghouse Brook	RI0006015R-11	Enterococcus	Yes	Regulating	4A
Regulating Reservoir	RI0006015L-01	Non-native plants	Yes	Regulating	4C
Rush Brook & Tribs	RI0006015R-22	Enterococcus	Yes	Regulating	5
Westconnaug Brook & Tribs	RI0006015R-27	Enterococcus	Yes	Westconnaug	5
Wilbur Hollow Brook & Tribs	RI0006015R-29	Enterococcus	Yes	Scituate	5

Within the Barden Reservoir sub-basin, Winsor Brook and Shippee Brook and their associated tributaries were listed as impaired for bacteria, specifically enterococcus. Shippee Saw Mill Pond was recently listed as an impaired water body in 2022, impaired for non-native plants. As these waterbodies are separated from the Barden Reservoir by the unimpaired Ponaganset River, the resulting risk assessment is Medium for the Barden Reservoir.

In the Westconnaug and Regulating sub-basins, impaired waters discharge directly to the reservoir and thus illicit a risk assessment of High. The Westconnaug Reservoir receives discharge from the Westconnaug Brook and associated tributaries, which is listed as impaired by bacteria (i.e., enterococcus). Two impaired segments empty into the Regulating Reservoir, Huntinghouse Brook and Rush Brook and tributaries, both of which are listed for enterococcus impairments. The Regulating Reservoir itself is also an impaired water body with an impairment due to non-native plants. The impairment for non-native plants is more a concern for fish and wildlife habitat, rather than drinking water quality. However, the potential risk from multiple impairments, from both bacterial and non-native plants, with direct impacts to the reservoir itself supports an Extreme risk rating for the Regulating Reservoir sub-basin. The bacterial impairments may indicate the impact of failing onsite wastewater treatment systems (OWTS) or stormwater runoff from areas of increased development.

Overall, the entire Scituate Reservoir watershed receives a High ranking due to the discharge of impaired waters from the Regulating Reservoir to the Scituate Reservoir, plus direct discharge from the Wilbur Hollow Brook and tributaries, impacting the water supply reservoir.

Table 2-13 lists the impaired waters risk indicators for sub-basins and the entire drinking water supply watershed.

Table 2-13: Impaired Waters Risk Indicator Rating for Sub-basins and the Entire Drinking Water Supply Watershed.

Sub-basin	Risk Result
Barden Reservoir	Medium
Moswansicut Reservoir	Low
Ponaganset Reservoir	Low
Regulating Reservoir	Extreme
Scituate Reservoir Direct	High
Westconnaug Reservoir	High
Overall watershed	**High**

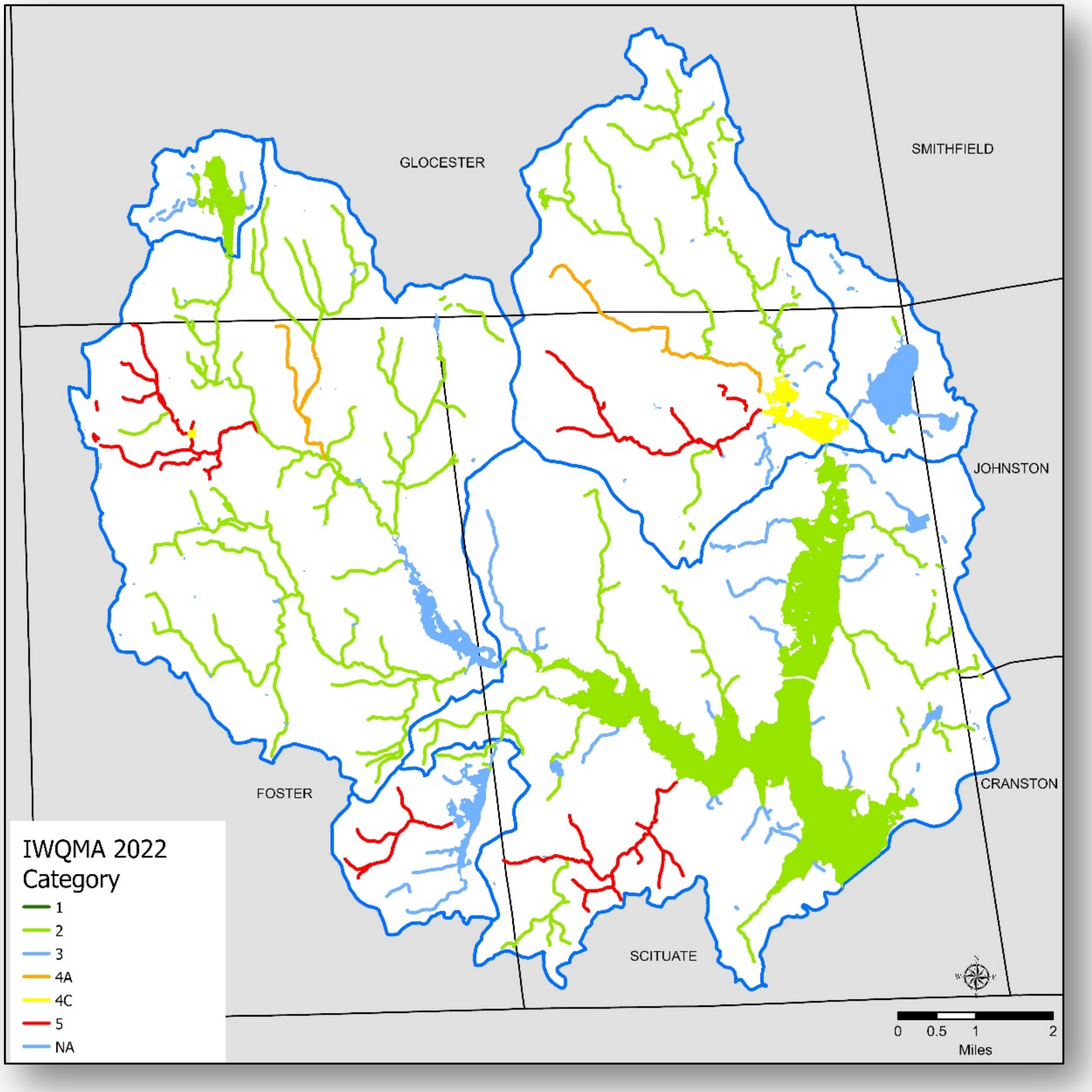


Figure 2-6: Water Body Impairment Status from 2022 IWQMA Report.

2.5 History of Contaminant Detects (Risk 6)

2.5.1 Assessment Method

Regular water quality sampling occurs at the Providence Water intake at Scituate Reservoir. The frequency of monitoring varies based on the category of contaminant of concern. For example, alkalinity and total carbon are monitored monthly, but SOCs and VOCs are monitored annually. Monitoring results are publicly available via a Rhode Island Department of Health (RIDOH) web page. The Scituate Reservoir has a Water System Number of RI1592024 and samples collected from the intake are labelled as IN001. Analysis for the SWAPP requires analysis of the previous five years of water quality sampling data. Results for all samples collected between January 2018 and January 2023 were included for examination. Any contaminant detects were noted and compared to the maximum contaminant limit

(MCL) for the contaminant of concern. Risk ratings were assigned based on the amount of contaminant detected relative to its maximum contaminant limit, which is set by EPA *(Table 2-14).*

Table 2-14: Surface Water Reservoir Risk Indicator and Ranking for the History of Contaminant Detects.

Surface Water Reservoir Risk Indicator	Low	Medium	High	Extreme
History of contaminant detects within last 5 years at outflow sampling station	Trace[2]	≤50% MCL	>50% MCL	Violation

[2] Trace = Less than 10% of contaminant MCL

2.5.2 Pollution Risk Results

Seven contaminants were detected from samples collected at the Providence Water intake since January 2017. Of these, the most noteworthy was the detection of SOCs (2018 and 2020) and PAHs (2019). Di-(2-ethylhexyl) phthalate (DEHP, CAS 117-81-7) is a SOC that is used in the production of vinyl chlorides, added to provide flexibility, and was detected at 1 ug/L in 2018 and then again in 2020 at 2 ug/L. Both measured values were below the MCL of 6 ug/L for SOCs. The PAH compound, Benzo(k)fluoranthene, was detected only once in 2019 at 0.1 ug/L, which is below the MCL of 0.2 mg/L.

E. coli was not detected in any samples collected between January 2018 and January 2023. Because the MCL for *E. coli* is a 0 count (i.e., absent from samples), results for *E. coli* sampling are in a binary presence-absence format. Drinking water standards require that no more than 5% of samples contain coliform bacteria. Treatment of raw water by filtration and disinfection removes these microbes prior to their entering the distribution system.

Trace levels of barium have been regularly detected in annual samples for inorganic compounds, but these levels have not exceeded 10% of the MCL for barium. Barium is a naturally occurring element found in igneous rocks such as the granitic bedrock that underlies much of the Scituate Reservoir watershed (WHO, 2004). Similarly, trace levels of nitrate and fluoride were detected during annual sampling. Like barium, trace amounts of fluoride occur naturally in groundwater resources within Rhode Island (Trench, 1991), in the Scituate Reservoir trace amounts were only detected once at levels not exceeding 10% of the MCL (4 mg/L). In the last 5 years, nitrate has been detected once in 2019 and once in 2022 with measured values at 0.06 mg/L, which is well below the MCL of 10 mg/L. Although nitrate has many uses, and is a common contaminant in water sources, the most common application is in agriculture as a fertilizer. Trace amounts of nitrate may result from the few agricultural sites distributed throughout the Scituate watershed, representing ~1.5% of the total land area.

Sodium, another naturally occurring element that can also enter the water supply through road salt application, has also been regularly detected in monthly sampling. While not a regulated substance, its presence and concentration can adversely impact the taste of drinking water and can point to an over-application of road salt. Sampling occurs during the winter and a composite value of all sample results in a winter season is calculated. Sodium concentrations were highest in 2018 and have remained steady since then, ranging from ~12.8 to 14.9 mg/L (*Figure 2-7*). These values approach the MCL of 20 mg/L.

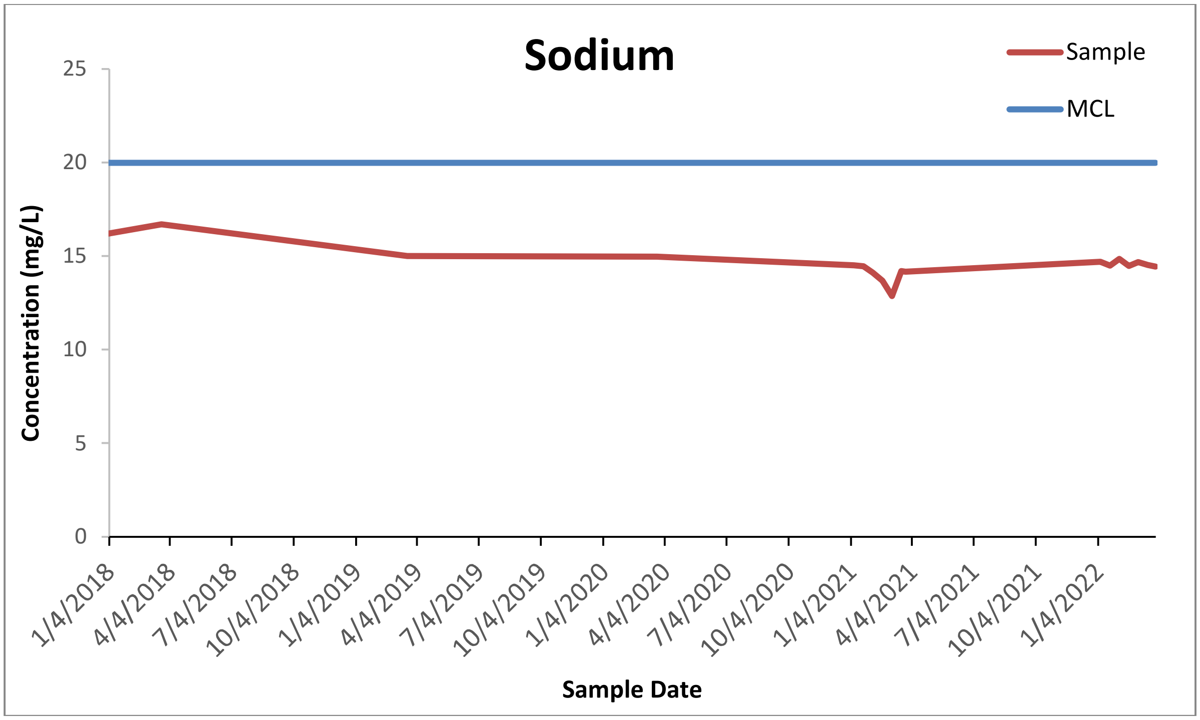


Figure 2-7: Sodium Concentrations at the Providence Water Supply Intake in the Scituate Reservoir

Turbidity, a measure of the opacity of water, increases when suspended sediments, bacteria, and algae are present in water, and typically reflects the quality of stormwater runoff from the watershed. Turbidity may not exceed 5 nephelometric turbidity units (NTU) prior to filtration, per RIDOH drinking water quality regulations. As per EPA surface water treatment rules, conventional filtration systems such as Providence Water cannot exceed turbidity levels of 1 NTU, and samples must not exceed 0.3 NTUs in at least 95% of the samples collected within one month. Between 2018 and 2023, there were three instances where turbidity values exceeded 0.3 NTUs, but did not exceed the 95% occurrence rule. Generally, most samples were below the detection limit or contained 0 NTUs.

3 Total Rating

3.1 Overall and Sub-Basin Risk Rating

For the overall risk rating each sub-basin had rankings assigned according to criteria described in *Tables 2-2, 2-3, 2-8, 2-11, and 2-14*. Sub-basins were assigned risk ratings according to these tables and the results were compiled in a comprehensive table and compared to the 2003 results. *Table 3-1* lists the Risk Rating for each sub-basin as well as the entire watershed. Ratings are detailed in *Appendix A*. Overall, there is a medium risk to the water supply watershed when all of the factors are taken into account. The main driver is the number of potential pollution sources located within the 200 foot buffer of either the reservoir or its tributaries. This alone garners an "Extreme" rating and accounts for over half of the overall score to the watershed. Absent this result the watershed would garner a "Low" risk rating.

Table 3-1: Overall Risk Rating for the Entire Scituate Reservoir Watershed and all Sub-basins for 2003, 2017, and 2023.

Watershed/Sub-Basin	Overall Ranking 2003	Overall Ranking 2017	Overall Ranking 2023
Barden Reservoir	Medium	Medium	Medium
Ponaganset Reservoir	Low	Medium	Medium
Regulating Reservoir	Medium	Medium	Medium
Moswansicut Reservoir	Medium	Medium	Medium
Scituate Reservoir Direct	Medium	Medium	Medium
Westconnaug Reservoir	Low	Medium	Medium
Entire Scituate Reservoir Ranking	**Medium**	**Medium**	**Medium**

Based on the requirements of the SWAPP Guidelines, and the parameters assessed in this report, the entire Scituate Reservoir watershed garners a medium risk rating. However, it is worth noting that the assessment methods outlined in the 2006 updated version of the guidance document may lead to underestimating the potential threats to water quality. This is largely due to the increasingly dense concentration of residential developments on land parcels bordering surface water reservoirs. For example, the Moswansicut Reservoir sub-basin has seen several large houses built along the reservoir. Considering the near 20 years since the last revisions to the SWAPP Guidelines, updates to the evaluation methods used may lead to improved assessments of threats to water quality within the Scituate Reservoir Direct watershed.

4 Additional Assessments

4.1 Property Acquisition

Land protection of buffer areas around surface waters and their tributaries is one of the most effective means to protect the quality of a water supply. Acquisition methods such as strategic purchasing of land parcels, or development rights are key protection mechanisms which can prevent the transport of contaminants from developed areas to the water supply. Especially when located on steep slopes, near tributaries, and in areas with shallow depth to groundwater. Further, land acquisition provides opportunities for evaluating, and mitigating, risks to future climate hazards. As regional temperatures and precipitation patterns are projected to change, prudent land acquisition by Providence Water may protect against threats (e.g., flooding events, decreased water quality, increased pests of disease) to the long-term health and management of forested areas in the Scituate Reservoir watershed.

In the Scituate Reservoir, Providence Water has prioritized specific parcels for protection and continues to purchase parcels through fee sample acquisition, purchase of development rights through a conservation easement, or through the Forest Legacy Program in partnership with the USDA, Forest Service, and the Rhode Island Department of Environmental Management (DEM). Since 2003, Providence Water has invested more than $17.5 million to conserve approximately 1,820 acres of undeveloped land bordering the tributaries to the six reservoirs. Combined, these areas cover nearly 15,000 acres of land area or 27% of the Scituate Reservoir watershed.

The existing Strategic Lands Inventory Checklist used by Providence Water evaluates acquisition opportunities based on criteria concerning current environmental conditions and threats to water quality. However, it fails to take into consideration the anticipated threats of climate change and regional implications regarding temperature and precipitation, and the result impacts to ecosystem health. Updating the Inventory Checklist to incorporate information on climate-related hazard vulnerability as a consideration for land acquisition/protection will improve long-term climate resilience.

Other conservation organizations active in the watershed, such as the Foster, Glocester, and Scituate Land Trusts, the Audubon Society, as well as the municipalities themselves and the State have purchased development rights and parcels outright. Although the mission of these organizations does not explicitly include water supply protection, their land acquisition and protection actions conserve land and limit development. That protection often coincides with land within a buffer around tributaries, to the benefit of the water supply. Where feasible, coordination and cooperation among Providence Water, federal, state, and local conservation organizations in acquiring and protecting land, is encouraged to continue.

Figure 4-1 shows the areas throughout the watershed that are conserved, both through direct ownership by Providence Water as well as other conservation entities, and local municipalities.

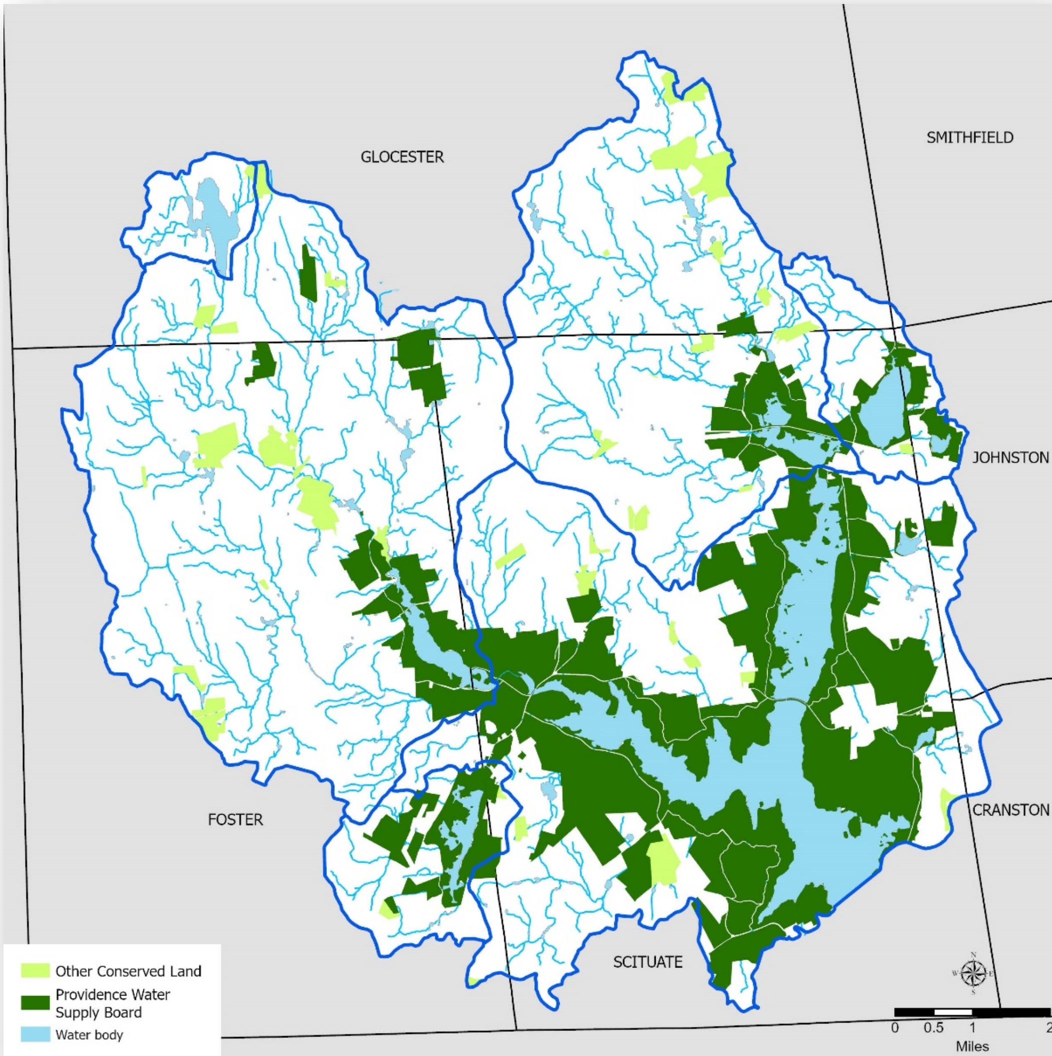


Figure 4-1: Conserved Land Throughout the Scituate Reservoir Watershed.

4.2 Calculate Impervious Coverage

Impervious cover is a catchall term for pavement, rooftops, and other impermeable surfaces that prevent rainwater from infiltrating into the ground. Paved areas provide a surface for accumulation of pollutants and create an express route for delivery of pollutants to waterways. Just as importantly, impervious cover alters the natural hydrologic function of the landscape by dramatically increasing the rate and volume of runoff and reducing groundwater recharge.

Numerous studies have linked the extent of impervious surfaces to declining aquatic habitat quality in streams and wetlands (*Schueler, Fraley-McNeal, & Cappiella, 2009*). According to these reports, stream and wetland habitat quality is often impaired as watershed impervious levels exceed 10 percent, with as little as 4 to 8 percent affecting sensitive wetlands and trout waters (*Azous & Homer, 2000*). At greater than

25-30 percent imperviousness, the extent of flooding and stream water quality impacts can become severe.

4.3 Assessment Methods and Results

RIGIS has developed a statewide raster dataset of impervious cover based on spring 2020 imagery. This dataset is finely resolved, capturing impervious surfaces with a footprint greater than two feet by two feet. The total impervious area as a percentage of sub-basin area, without surface water bodies, is presented in *Table 4-1*.

Each sub-basin experienced some increase in impervious cover between 2017 and 2020, though the largest change was recorded in the Westconnaug Reservoir with an increase from 0.67% to 0.73%. Overall, the Scituate Reservoir watershed increased in impervious cover by 9.01%, from 1.11 to 1.21%. While no sub-basin has more than 5% impervious cover, the areas identified previously for elevated densities of pollution sources and high intensity land use also show locally higher amounts of impervious cover. These concentrated areas of imperviousness could be a focus for stormwater management.

Table 4-1: Impervious Cover by Sub-basin

Sub-basin	2017 Percent IC	2020 Percent IC	Percent Change
Barden Reservoir	0.85	0.90	+ 5.88%
Moswansicut Reservoir	2.95	3.04	+ 3.05%
Ponaganset Reservoir	1.74	1.80	+ 3.45%
Regulating Reservoir	1.42	1.48	+ 4.23%
Scituate Reservoir Direct	1.04	1.08	+ 3.85%
Westconnaug Reservoir	0.67	0.73	+ 8.96%
Entire Scituate Reservoir watershed	**1.11**	**1.21**	**+ 9.01%**

Figure 4-2 depicts the impervious cover throughout the Scituate Reservoir watershed observed in 2020. Isolated areas of imperviousness are viewable throughout the watershed however they seem to be more localized to the northeastern portion of the watershed.

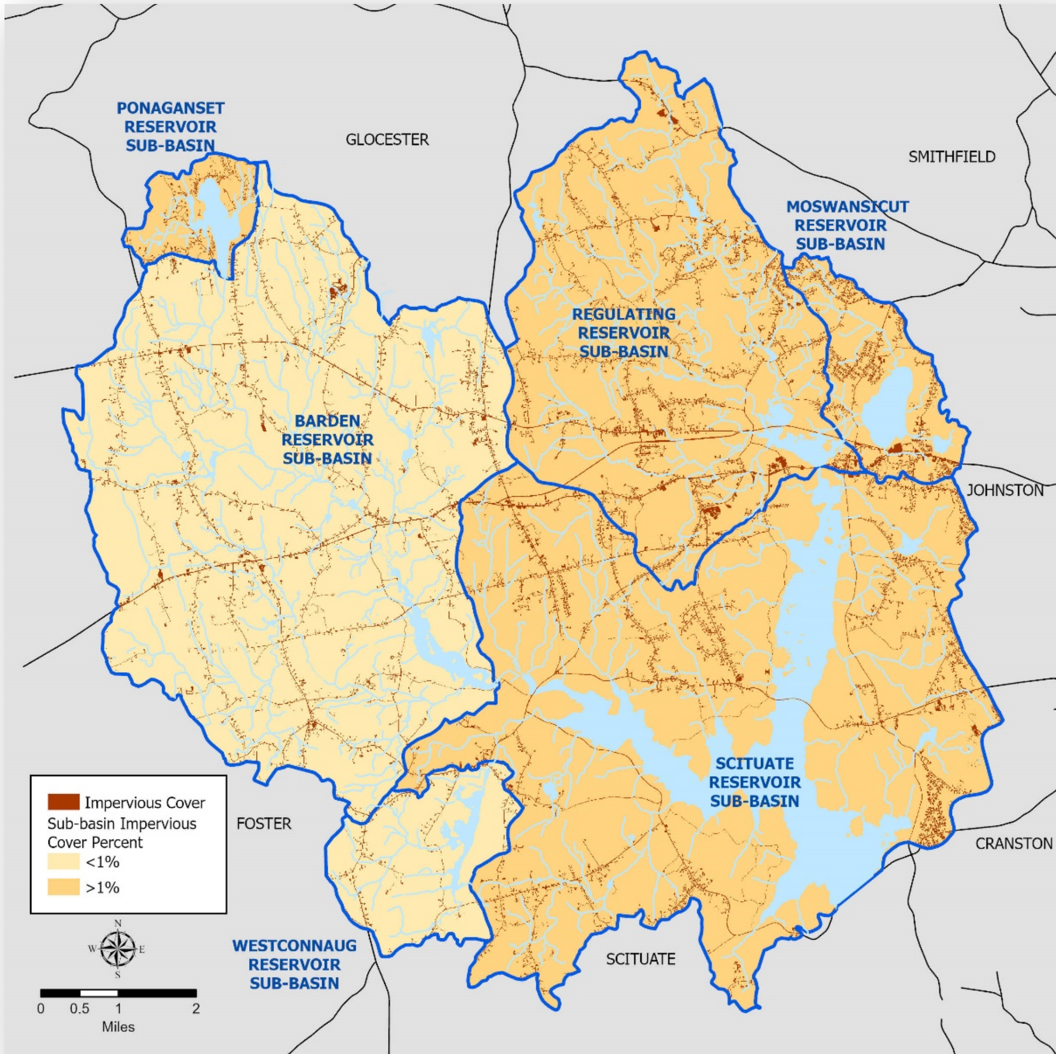


Figure 4-2: Impervious Coverage in Each Sub-basin. Note the Concentration of Impervious Cover Around Regulating, Moswansicut, Scituate, and Ponaganset Reservoirs.

5 Works Cited

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Appendix A

Final Ranking for the Scituate Water Supply Watershed and all Sub-Basins

Table A-1: Final Scituate Water Supply Reservoir Overall Ranking

Surface Water Reservoir Risk Indicator	Overall Scituate Water Supply Reservoir Ranking					
	2003		2011		Update	
	Input	Rating	Input	Rating	Input	Rating
Watershed Land Use						
1. High intensity land use	2.3%	0	2.2%	0	2.7%	0
Existing or Potential Pollution Sources						
2. Pollution sources within the 200 ft buffer to reservoir and tributaries	1	25	138	25	176	25
3. Pollution sources per acre throughout watershed (multiply by 10)	0.02	0	0.03	0	0.03	0
Water quality						
4. Reservoir nutrient enrichment status (clarity, phosphorus, dissolved oxygen).	Oligotrophic	0	Oligotrophic	0	Mesotrophic	5
5. Compliance with water quality criteria. Based on 305b and 303d lists.	Impaired tributary draining directly to reservoir	0	Impaired tributary draining directly to reservoir	10	Impaired tributary draining directly to reservoir	10
6. History of contaminant detects within last 5 years at outflow sampling station	<50% MCL	5	<50% MCL	5	<50% MCL	5
Overall Ranking - Sum of all Risk Rankings	**40**	**Medium**	**40**	**Medium**	**45**	**Medium**

Table A-2: Scituate Water Supply Reservoir Watershed Ranking by Sub-Basin

	Barden Reservoir						Moswansicut Reservoir					
Surface Water Reservoir Risk Indicator	**2003**		**2017 Update**		**2023 Update**		**2003**		**2017 Update**		**2023 Update**	
	Input	**Rating**	**Input**	**Rating**	**Input**	**Rating**	**Input**	**Rating**	**Input**	**Rating**	**Input**	**Rating**
Watershed Land Use												
1. High intensity land use	1.98%	0	1.95%	0	2.08%	0	8.63%	0	9.16%	0	9.51%	0
Existing or Potential Pollution Sources												
2. Pollution sources within the 200 ft buffer to reservoir and tributaries	1	25	5	25	36	25	1	25	7	25	9	25
3. Pollution sources per acre throughout watershed (multiply by 10)	0.01	0	0.02	0	0.08	0	0.01	5	0.15	5	0.19	5
Water Quality												
4. Reservoir nutrient enrichment status (clarity, phosphorus, dissolved oxygen).	Oligotrophic	0	Mesotrophic	5	Mesotrophic	5	Mesotrophic	5	Mesotrophic	5	Oligotrophic	0
5. Compliance with water quality criteria. Based on 305b and 303d lists.		5	Impaired tributary draining indirectly to reservoir	5	Impaired tributary draining indirectly to reservoir	5		5	Impaired tributary draining indirectly to reservoir	5	No impairment	0
6. History of contaminant detects within last 5 years at outflow sampling station	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	
Overall Ranking - Sum of All Risk Rankings	**35**	**Medium**	**40**	**Medium**	**40**	**Medium**	**45**	**Medium**	**45**	**Medium**	**35**	**Medium**

[1]Ratings for each risk indicator are designated in the 2006 revised Source Water Assessment Guidance document, using the Surface Water Reservoir Pollution Risk Rating table on page 24.

Table A-2: Scituate Water Supply Reservoir Watershed Ranking by Sub-Basin, con't.

	Ponaganset Reservoir						Regulating Reservoir					
Surface Water Reservoir Risk Indicator	**2003**		**2017 Update**		**2023 Update**		**2003**		**2017 Update**		**2023 Update**	
	Input	**Rating**	**Input**	**Rating**	**Input**	**Rating**	**Input**	**Rating**	**Input**	**Rating**	**Input**	**Rating**
Watershed Land Use												
1. High intensity land use	0.00%	0	0.00%	0	0.05%	0	3.41%	0	3.38%	0	2.17%	0
Existing or Potential Pollution Sources												
2. Pollution sources within the 200 ft buffer to reservoir and tributaries	0	0	1	25	3	25	1	25	10	25	24	25
3. Pollution sources per acre throughout watershed (multiply by 10)	0	0	0.01	0	0.1	0	0.02	0	0.03	0	0.07	0
Water Quality												
4. Reservoir nutrient enrichment status (clarity, phosphorus, dissolved oxygen).	Oligotrophic	0	Oligotrophic	0	Mesotrophic	5	Oligotrophic	0	Mesotrophic	5	Oligotrophic	0
5. Compliance with water quality criteria. Based on 305b and 303d lists.	No impairment	0	No impairment	0	No impairment	0	Impaired tributary draining indirectly to reservoir	5	Impaired tributary draining indirectly to reservoir	5	Impaired tributary draining directly to reservoir	10
6. History of contaminant detects within last 5 years at outflow sampling station	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5
Overall Ranking - Sum of All Risk Rankings	**5**	**Low**	**30**	**Medium**	**35**	**Medium**	**35**	**Medium**	**40**	**Medium**	**40**	**Medium**

[1]Ratings for each risk indicator are designated in the 2006 revised Source Water Assessment Guidance document, using the Surface Water Reservoir Pollution Risk Rating table on page 24.

Table A-2: Scituate Water Supply Reservoir Watershed Ranking by Sub-Basin, con't.

Surface Water Reservoir Risk Indicator	Scituate Reservoir Direct						Westconnaug Reservoir					
	2003		2017 Update		2023 Update		2003		2017 Update		2023 Update	
	Input	Rating	Input	Rating	Input	Rating	Input	Rating	Input	Rating	Input	Rating
Watershed Land Use												
1. High intensity land use	2.02%	0	1.75%	0	3.75%	0	1.82%	0	1.70%	0	1.75%	0
Existing or Potential Pollution Sources												
2. Pollution sources within the 200 ft buffer to reservoir and tributaries	1	25	3	25	12	25	0	0	1	25	3	25
3. Pollution sources per acre throughout watershed (multiply by 10)	0.01	0	0.02	0	0.05	0	0.01	0	0.02	0	0.07	0
Water quality												
4. Reservoir nutrient enrichment status (clarity, phosphorus, dissolved oxygen).	Oligotrophic	0	Oligotrophic	0	Mesotrophic	5	Oligotrophic	0	Mesotrophic	5	Mesotrophic	5
5. Compliance with water quality criteria. Based on 305b and 303d lists.	No impairment	0	No impairment	0	Impaired tributary draining directly to reservoir	10	No impairment	0	No impairment	0	Impaired tributary draining directly to reservoir	10
6. History of contaminant detects within last 5 years at outflow sampling station	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5	<50% MCL	5
Overall Ranking - Sum of all Risk Rankings	**30**	**Medium**	**30**	**Medium**	**45**	**Medium**	**5**	**Low**	**35**	**Medium**	**45**	**Medium**

[1]Ratings for each risk indicator are designated in the 2006 revised Source Water Assessment Guidance document, using the Surface Water Reservoir Pollution Risk Rating table on page 24.

Appendix B

HILU Data and Percent Change Comparisons

Table B-1: HILU area and composition in 2003 by sub-basin. Percent area is calculated based on the entire watershed area.

Land Use	Barden Reservoir		Moswansicut Reservoir		Ponaganset Reservoir		Regulating Reservoir		Scituate Reservoir Direct		Westconnaug Reservoir		Entire Scituate watershed	
	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%
High Density Residential (<1/8 acre lots)	11.7	0.06	5.8	0.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17.5	0.0
Medium High Density Residential (1/4 to 1/8 acre lots)	5.2	0.03	20.5	1.08	N/A	N/A	37.7	0.33	5.0	0.03	N/A	N/A	68.5	0.1
Commercial (sale of products and services)	33.5	0.17	50.7	2.67	N/A	N/A	36.6	0.32	11.7	0.06	0.5	0.02	133.0	0.2
Industrial (manufacturing, design, assembly, etc.)	28.5	0.15	N/A	N/A	N/A	N/A	0.6	0.01	3.0	0.02	2.5	0.10	34.6	0.1
Transportation (roads)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.3	0.01	0.0	0.00	2.3	0.0
Waste Disposal (landfills, junkyards, etc.)	25.7	0.13	N/A	N/A	N/A	N/A	N/A	N/A	17.5	0.09	N/A	N/A	43.2	0.1
Institutional (schools, hospitals, churches, etc.)	55.0	0.28	1.6	0.08	N/A	N/A	67.1	0.58	23.3	0.12	0.9	0.04	147.9	0.2
Cropland (tillable), Confined Feeding Operations	186.9	0.96	45.0	2.37	N/A	N/A	194.9	1.68	305.5	1.62	39.8	1.66	772.1	1.3
Orchards, Groves, Nurseries	38.9	0.20	40.5	2.13	N/A	N/A	57.8	0.50	12.6	0.07	N/A	N/A	149.8	0.2
Total HILU	**385.5**	**1.98**	**164.1**	**8.63**	**N/A**	**N/A**	**394.8**	**3.41**	**381.0**	**2.02**	**43.7**	**1.82**	**1,369.0**	**2.3**

Table B-2: HILU area and composition in 2011 by sub-basin. Percent area is calculated based on the entire watershed area.

Land Use	Barden Reservoir		Moswansicut Reservoir		Ponaganset Reservoir		Regulating Reservoir		Scituate Reservoir Direct		Westconnaug Reservoir		Entire Scituate watershed	
	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%
High Density Residential (<1/8 acre lots)	11.8	0.06	5.8	0.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17.6	0.2
Medium High Density Residential (1/4 to 1/8 acre lots)	5.7	0.03	20.8	1.10	N/A	N/A	39.7	0.34	4.1	0.02	N/A	N/A	70.4	1.1
Commercial (sale of products and services)	34.4	0.18	48.8	2.57	N/A	N/A	41.4	0.36	15.9	0.08	0.5	0.02	141.1	0.0
Industrial (manufacturing, design, assembly, etc.)	26.3	0.13	N/A	N/A	N/A	N/A	0.6	0.01	3.1	0.02	3.4	0.14	33.5	0.1
Transportation (roads)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.3	0.01	0.0	0.00	2.3	0.3
Waste Disposal (landfills, junkyards, etc.)	25.7	0.13	N/A	N/A	N/A	N/A	N/A	N/A	17.5	0.09	N/A	N/A	43.2	0.1
Institutional (schools, hospitals, churches, etc.)	55.9	0.29	1.6	0.08	N/A	N/A	71.9	0.62	23.2	0.12	0.9	0.04	153.5	0.3
Cropland (tillable), Confined Feeding Operations	178.5	0.91	43.3	2.28	N/A	N/A	181.8	1.57	251.5	1.33	35.8	1.49	690.8	0.0
Orchards, Groves, Nurseries	42.4	0.22	53.6	2.82	N/A	N/A	56.3	0.49	12.9	0.07	N/A	N/A	165.2	0.1
Total HILU	**380.7**	**1.95**	**174.0**	**9.16**	**N/A**	**N/A**	**391.8**	**3.38**	**330.4**	**1.75**	**40.7**	**1.70**	**1,317.6**	**2.2**

Table B-3: HILU area and composition in 2020 by sub-basin. Percent area is calculated based on the entire watershed area.

Land Use	Barden Reservoir		Moswansicut Reservoir		Ponaganset Reservoir		Regulating Reservoir		Scituate Reservoir Direct		Westconnaug Reservoir		Entire Scituate watershed	
	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%
High Density Residential (<1/8 acre lots)	13.0	0.07	6.2	0.33	N/A	N/A	2.3	0.02	N/A	N/A	N/A	N/A	21.4	0.0
Medium High Density Residential (1/4 to 1/8 acre lots)	5.7	0.03	22.6	1.19	N/A	N/A	40.0	0.35	4.0	0.02	N/A	N/A	72.2	0.1
Commercial (sale of products and services)	41.9	0.21	53.2	2.80	0.49	0.05	44.5	0.38	22.1	0.12	0.5	0.02	162.6	0.3
Industrial (manufacturing, design, assembly, etc.)	27.1	0.14	N/A	N/A	N/A	N/A	4.0	0.03	3.5	0.02	3.4	0.14	38.0	0.1
Transportation (roads)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.3	0.01	0.0	0.00	2.3	0.0
Ground-mounted Solar Energy Systems	10.6	0.05	N/A	N/A	N/A	N/A	8.5	0.07	32.7	0.17	N/A	N/A	51.8	0.1
Waste Disposal (landfills, junkyards, etc.)	33.2	0.17	N/A	N/A	N/A	N/A	N/A	N/A	15.3	0.08	N/A	N/A	48.4	0.1
Institutional (schools, hospitals, churches, etc.)	56.4	0.29	1.6	0.09	N/A	N/A	70.7	0.61	28.9	0.15	0.9	0.04	158.5	0.3
Cropland (tillable), Confined Feeding Operations	185.2	0.95	43.3	2.28	N/A	N/A	192.3	1.66	286.7	1.52	37.1	1.55	744.6	1.4
Orchards, Groves, Nurseries	32.5	0.17	53.9	2.84	N/A	N/A	72.1	0.62	12.5	0.07	N/A	N/A	170.9	0.3
Total HILU	**405.6**	**2.08**	**180.7**	**9.51**	**0.49**	**0.05**	**434.2**	**3.75**	**407.8**	**2.17**	**42.0**	**1.75**	**1,470.8**	**2.7**

Table B-4: HILU percent change between 2011 and 2020 by sub-basin.

Land Use	Barden Reservoir	Moswansicut Reservoir	Ponaganset Reservoir	Regulating Reservoir	Scituate Reservoir Direct	Westconnaug Reservoir	Entire Scituate watershed
High Density Residential (<1/8 acre lots)	0.29	0.22	N/A	0.53	N/A	N/A	0.27
Medium High Density Residential (1/4 to 1/8 acre lots)	0.00	0.96	N/A	0.05	-0.02	N/A	0.13
Commercial (sale of products and services)	1.90	2.41	100.00	0.71	1.63	0.00	1.52
Industrial (manufacturing, design, assembly, etc.)	0.20	N/A	N/A	0.79	0.10	0.00	0.32
Transportation (roads)	N/A	N/A	N/A	N/A	0.00	0.00	0.00
Waste Disposal (landfills, junkyards, etc.)	1.89	N/A	N/A	N/A	-0.59	N/A	0.37
Institutional (schools, hospitals, churches, etc.)	0.13	0.00	N/A	-0.29	1.52	-0.07	0.35
Cropland (tillable), Confined Feeding Operations	1.72	-0.03	N/A	2.45	9.39	3.23	3.79
Orchards, Groves, Nurseries	-2.51	0.13	N/A	3.72	-0.11	N/A	0.40
HILU Overall Percent Change	**3.62**	**3.69**	**100.00**	**7.96**	**11.92**	**3.15**	**7.14**

Table B-5: Percent of HILU percent change between 2003 and 2020 by sub-basin.

Land Use	Barden Reservoir	Moswansicut Reservoir	Ponaganset Reservoir	Regulating Reservoir	Scituate Reservoir Direct	Westconnaug Reservoir	Entire Scituate watershed
High Density Residential (<1/8 acre lots)	0.32	0.22	N/A	0.53	N/A	N/A	0.27
Medium High Density Residential (1/4 to 1/8 acre lots)	0.11	1.16	N/A	0.53	-0.28	N/A	0.26
Commercial (sale of products and services)	2.13	1.36	100.00	1.85	2.77	0.00	2.09
Industrial (manufacturing, design, assembly, etc.)	-0.35	N/A	N/A	0.79	0.13	2.22	0.24
Transportation (roads)	N/A	N/A	N/A	N/A	0.00	0.00	0.00
Waste Disposal (landfills, junkyards, etc.)	1.89	N/A	N/A	N/A	-0.59	N/A	0.37
Institutional (schools, hospitals, churches, etc.)	0.37	0.00	N/A	0.84	1.48	-0.07	0.74
Cropland (tillable), Confined Feeding Operations	-0.41	-0.95	N/A	-0.63	-5.02	-6.35	-1.94
Orchards, Groves, Nurseries	-1.64	7.42	N/A	3.35	-0.04	N/A	1.49
HILU Overall Percent Change	**2.42**	**9.20**	**100.00**	**7.27**	**-1.55**	**-4.21**	**3.53**

Appendix C

List of Potential Sources of Pollution

Table C-1: Potential Pollution Source List.

Potential Sources of Pollution

Agriculture – VOCs, SOCs, Microbes, Nutrients, Pesticides

1. Feed & Supply Stores
2. Greenhouses
3. Dairy and Poultry Farms, Equestrian Centers, Other Livestock Farms
4. Backyard Livestock (Horses, Fowl, etc. in Residential Areas)

Automotive - VOCs, SOCs, Solvents, USTs

5. Gas & Service Stations
6. Fuel Storage
7. Auto Repair
8. Auto Parts & Machine Shops
9. Body Shops
10. Car Washes
11. Rust Proofers
12. Junkyards & Salvage Yards

Medical Facilities -VOCs, SOCs, Microbes, Nutrients

13. Walk-in & Emergency Clinics, Hospitals
14. Dental Offices
15. Veterinary Clinics

Other Commercial -VOCs, SOCs, Solvents, Nutrients, Pesticides

16. Beauty Salons
17. Dry Cleaners/Laundromats
18. Paint Shops
19. Printing Shops
20. Photographic Processors
21. Golf Courses

Industrial/Manufacturing – VOCs, SOCs, Solvents

22. Asphalt, Coal, Tar & Concrete Companies
23. Chemical Manufacturers & Textile Manufacturers
24. Laboratories
25. Other Industrial Manufacturers
26. Road Salt Storage (Sodium, Calcium, Chloride)
27. Sand & Gravel Mining Operations
28. Logging Operations

Definitions

VOCs – Volatile Organic Compounds (from fuel, industrial or chemical factories)

SOCs – Synthetic Organic Compounds (from pesticides and herbicides)

USTs – Underground Storage Tanks (store fuel or heating oil)